

Can Demand Elasticities Explain Sticky Credit Card Rates?

It has long been recognized that interest rates charged on credit card loans are sticky (that is, they remain high even when the cost of funds drops). Although some studies have blamed market power by issuing banks for the persistently high rates,¹ the credit card market is relatively unconcentrated, with hundreds of issuers nationwide. The explanation for the sticky rates is more likely, therefore, to lie on the demand side. Since consumers could minimize their cost of credit by borrowing at the lowest possible rate,² one would expect banks to drop their rates to attract customers in the competitive market. Yet issuing banks do not appear to be behaving in this way. Do banks maintain high rates because customers' demand for credit card loans does not respond to changes in the rates they charge (that is, because demand for credit cards is inelastic with respect to the interest rates)? Do consumers indeed borrow at high interest rates because they are irrational, as Ausubel (1991) suggested?

Several theories purport to explain credit card rate stickiness.³ Although some studies have speculated whether demand for credit card loans is responsive to interest rates, the only information about demand elasticities comes from consumer survey results.⁴ According to evidence presented in Ausubel (1991), however, consumer survey results consistently underestimate how much consumers actually borrow. When the results of consumer surveys are compared to bank data, it turns out that consumers borrow more and repay less than they report. Therefore, evidence about demand elasticities should come from bank data, yet no study has explicitly estimated demand elasticities for credit card loans with respect to the interest rates charged. Using panel data from credit card plans offered by banks, this study estimates consumers' sensitivity to the various attributes of credit card plans: interest rates, annual fees, grace periods, finance charges, and additional enhancements. In the past, regulatory agencies and research economists have

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focused their analyses of the credit card market almost exclusively on the annual percentage rate of interest (APR). However, customers may be more responsive to other characteristics of the plans. It is worthwhile to find out whether the careful scrutiny the credit card rates have received over the years should be directed at other attributes as well.

Consumers have more credit card plan options today than ever before. Most credit card plans are offered nationwide, and abundant information about them arrives in every day's mail. Each plan is composed of many attributes. Are consumers more likely

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to borrow at a lower interest rate, pay a lower annual fee, or choose more "bells and whistles"?⁵ Consumers may opt for high-APR plans because of their inelastic demand or because those plans compensate them with other features, such as low fees. This article approaches the sticky interest rate puzzle by estimating consumers' demand responsiveness to the various features of credit card plans.

¹ Calem and Mester (1995); Shaffer (1994).

² Approximately two-thirds of credit card holders carry debt on their cards (*American Banker*, 1/4/96, p. 12).

³ Ausubel (1991); Calem and Mester (1995); Shaffer (1994); Woolley (1988). See also Canner and Lueckett (1992) for a review of that literature.

⁴ For example, a 1986 survey of cardholders by Payment Systems, Inc. found that customers would apply for a credit card with a lower annual interest rate if offered. In a recent survey by *American Banker*, 23 percent of the respondents said that they would switch to another plan for a 1 percent drop in the interest rate (*American Banker*, 11/1/95, p. 12). Canner and Lueckett (1992) discuss consumer sensitivity to interest rates based on consumer survey results, but do not provide any numbers.

⁵ For example, some press articles have speculated that consumers may be responsive to enhancements: "Americans are back in love with their credit cards—and not just because the economy has improved . . . by offering airline miles or rebates, [credit card issuers] are providing more incentives to use credit cards in place of cash or checks. . . . Consumers love rebate products" (*BusinessWeek*, 12/12/94, p. 42).

The first section describes the data used in the analysis. Section II addresses the question of whether credit card users are rational. Section III sets up the specification used in this paper, while the following section presents estimation results. Section V examines how a bank's size affects the credit card rates it charges and the demand elasticity it faces. The final section offers a summary and conclusions. The results show that banks face an adverse selection problem: Lowering the APR would attract risky customers or induce existing customers to borrow more than they can handle. As a result, delinquent loans rise at a significantly higher rate than that of loans in general. This induces banks to maintain high interest rates. The adverse selection hypothesis is further supported by the finding that banks' income from credit card fees and interest increases with APR.

I. The Data

This study uses data from a survey on the Terms of Credit Card Plans (TCCP), collected semiannually by the Federal Reserve Board from approximately 200 of the largest issuers of bank credit cards. The survey was conducted each January and July during the 1990–95 period. Smaller banks are not included in the sample. Although they may offer systematically different terms of credit card plans, the sampled banks issue the majority of outstanding credit.⁶

The data include characteristics of each plan, such as annual percentage rates (APR), annual fees, grace periods, minimum finance charges, late payment charges, cash advance fees, and over-the-limit fees, as well as indicators showing whether the plan had additional "enhancements," such as automobile insurance, travel discounts, extended warranty, and the like. The data set was merged with information from bank financial statements filed with the Federal Deposit Insurance Corporation. These Consolidated Reports of Condition and Income (Call Reports) include each bank's deposits and assets, as well as outstanding credit card loans and income from credit card interest and fees. The Call Report data are collected quarterly. Data from March Call Reports were merged with the January TCCP data, and data from September Call Reports were merged with the July

⁶ According to the recent American Bankers Association annual survey, the outstanding credit card credit totaled \$257 billion at the end of 1994 (*American Banker*, 1/4/96, p. 12). The TCCP sample issuers' outstanding credit amounted to \$246 billion in January of 1995, or about 96 percent of the total.

TCCP data.⁷ Panel data constructed from information on the majority of credit card banks over the period of six years permit analysis of customers' sensitivity to features of credit card plans. Table 1 (below) provides descriptive statistics and definitions of the major variables.

Although interest rates on credit card plans have remained high relative to other rates of interest (Figure 1), the average APR has declined over the past few years. Several issuers have also eliminated annual fees, although the average annual fee was approximately constant until 1994.⁸ Figure 2 shows changes in the average APR and annual fee during the 1990–95 period. However, these changes do not necessarily mean that credit has gotten cheaper. As can be seen in Figure 3, issuers have been raising other charges, such as late payment fees and over-the-limit fees. The evidence also shows some regional differences among credit card plans. In particular, New England banks have been offering lower rates of interest, but charge higher annual fees than banks in the rest of the country (Figure 4).⁹

Selecting a credit card has therefore become more complicated over time: Each plan is composed of a vector of various charges and rewards, and more variation exists among them now than in the past. As Figure 5 shows, the variance in both APR and annual fees has increased, even though the sample of issuers has remained fairly stable. The increase in the variance of APR was partly caused by a higher fraction of credit card plans with variable rates of interest (Figure 6). The next two sections of the paper examine the sensitivity of customers to the various options.

II. Are Consumers Rational?

One explanation for high credit card interest rates is consumer irrationality (Ausubel 1991). According to that view, consumers typically do not intend to borrow on their credit cards but end up doing so anyway. These "irrational" consumers presumably do not take APR into account when selecting a plan, since they do

not intend to carry any debt. Banks therefore have no incentive to lower their rates. On the other hand, if consumers behave consistently with their intentions, they are likely to put significant weight on APR when deciding which credit card plan to adopt.¹⁰ Under the "rational" scenario, convenience customers (customers who repay their balance in full) would be more likely to choose a plan with a low fee, a long grace period, and many enhancements, but ignore APR. At the same time, revolvers (customers who carry a

The difference in delinquency rates between no-fee and positive fee plans could indicate either that higher charges create high rates of delinquency or, more likely, that banks offering attractive terms are more selective in their customer approval process.

balance on their cards) would choose low-APR plans, but pay less attention to the other attributes. By the same token, under the rational scenario low-APR plans would have a relatively higher fraction of overdue loans (those on which customers failed to make minimum payments), while low-fee or high-enhancement plans would have a relatively lower fraction of overdue loans.

Casual observation of the data yields no support for the rational scenario. The correlation coefficient between APR and the fraction of overdue loans¹¹ is *positive* (0.23), contrary to the above. High-APR plans have higher rates of delinquency than low-APR plans: The average delinquency rate for plans with APR above 17 percent (the mean) is 3.4 percent, compared to 2.6 percent for plans with APR below 17 percent

⁷ Quarterly flow variables were adjusted to correspond to the appropriate six-month period.

⁸ Carlton and Frankel (1995) show that the average annual fee charged by Visa issuers declined throughout the 1990–95 period (p. 44). Since this study uses a much larger sample than Carlton and Frankel used, the results of this study are more likely to be accurate.

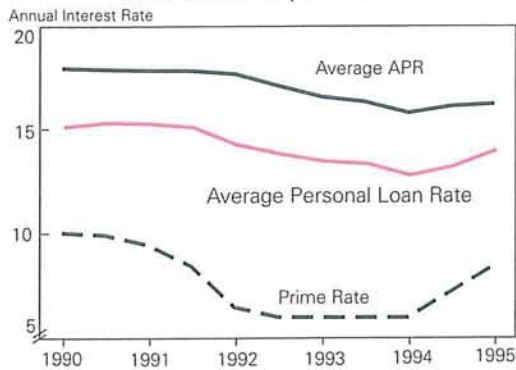
⁹ There is no evidence for a trade-off between APR and annual fee for the overall sample. The correlation coefficient between the two variables is not statistically significantly different from 0.

¹⁰ Even if the one-third of credit card users who pay their balance in full ignored the interest rates on their credit cards, the rate of interest would be a significant factor in credit card borrowing.

¹¹ The amount of overdue loans is from the Call Report and is defined as the amount of credit card loans on which customers have failed to make minimum payments. Although the variable does not include all the loans that accrue interest, the two measures can be expected to be correlated.

Figure 1

APR has remained above the prime rate and rates on personal loans.



(the difference is statistically significant at the 5 percent level). However, no-fee credit card plans tend to have lower delinquency rates than plans with non-zero fees, consistent with the above: The average delinquency rate for no-fee plans is 2.4 percent, as compared to 3.2 percent for plans with positive annual fees (again, the difference is statistically significant at the 5 percent level).

The differences in delinquency rates could indicate either that higher charges create high rates of delinquency or, more likely, that banks offering attractive terms are more selective in their customer approval process. Low-APR banks seem to screen their customers more carefully than high-APR banks to avoid high-risk cardholders. High-APR banks have less of an incentive to screen than low-APR banks do: Since their profit margin is higher, they can afford higher losses. Even if consumers were perfectly rational, low-APR banks might turn down revolvers who intend to borrow (because of their past credit record, for example) and force them to get high-APR cards. If banks screened their customers correctly, then low-APR banks would end up with a lower charge-off rate (a measure of losses) than high-APR banks. The data support this theory: The correlation coefficient between APR and the charge-off rate is positive, although small (0.13).

The positive correlation between APR and the delinquency rate, and between APR and the charge-off rate, provide no evidence in support of the "rational" scenario, namely that customers who do not repay their loans on time borrow at lower rates than convenience customers. The causality is not clear, however: Customers may irrationally ignore the rates in their

Figure 2

The mean APR and annual fee have declined over time.

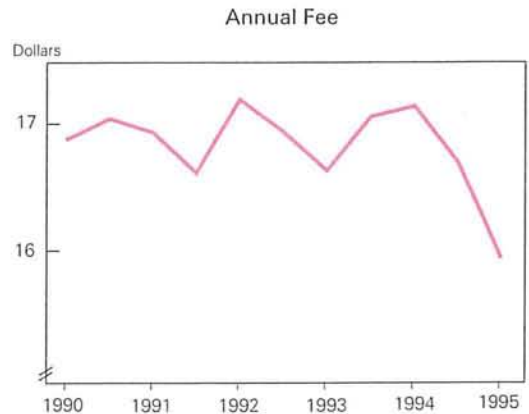
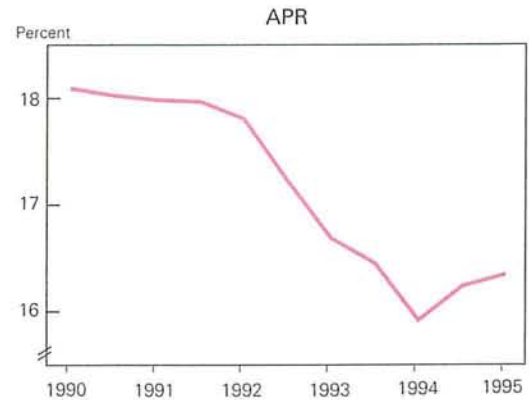


Figure 3

Mean late-payment fees and over-the-limit fees have increased over time.

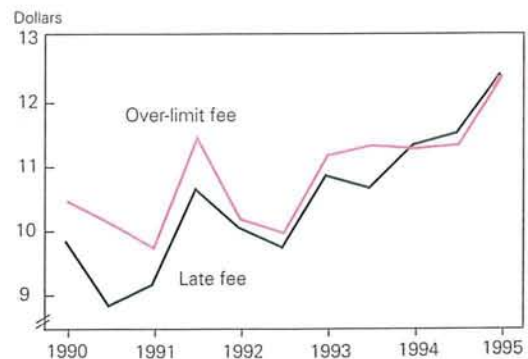


Figure 4

New England banks charge lower APR, but higher annual fee.

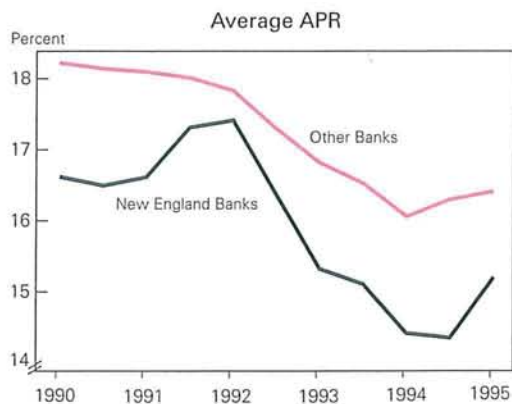


Figure 5

Variance of APR and variance of annual fee have increased over time.

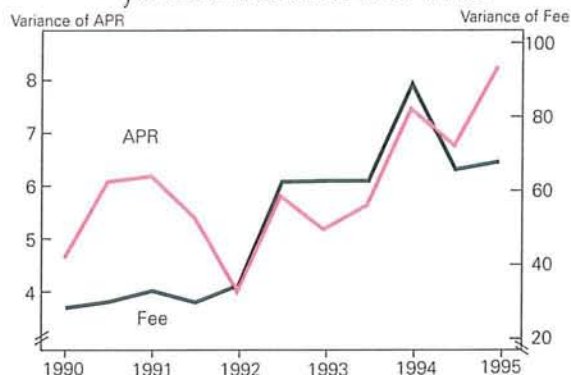
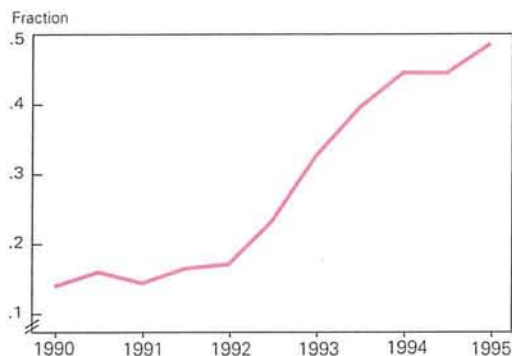


Figure 6

Fraction of plans with variable rate of interest has increased.



borrowing patterns, or banks may successfully steer them away from attractive borrowing options. It is possible that customers respond more strongly to other attributes of credit card plans. The next section uses regression analysis to determine whether consumers' demand for loans responds to the interest rates charged.

III. Consumer Demand for Credit Card Loans

Demand for credit card loans is a two-step process. Consumers first choose a credit card plan, then decide how much money to borrow. However, card selection is not an important determinant of borrowing patterns. Consumers typically own more than one

credit card.¹² A consumer may carry both low- and high-APR cards. The subject of this study is consumers' actual borrowing patterns and not their credit card selections. The study therefore focuses on the amount actually borrowed on each plan and models only the second stage of the two-step demand process.¹³

¹² Estimates of the average number of charge and credit cards per household vary from 3.7 (*Fortune*, 6/27/94, p. 14) to 6 (1989 *Survey of Consumer Finances*, sponsored by the Federal Reserve).

¹³ As the section above shows, banks may screen "good" and "bad" customers, making plan selection endogenous. Simultaneous supply and demand estimation will be used below to test for the endogeneity.

Overall Demand

The amount of credit card loans borrowed on a given plan is regressed on the plan's attributes, as well as on the prevailing interest rate on personal loans. Personal loans are typically the closest substitute for credit card borrowing (both types of loans are unsecured by assets). The specification is as follows:

$$\begin{aligned} \text{CRLOAN}_{it} = & \beta_0 + \beta_1 D_i + \beta_2 D_t \\ & + \beta_3 \text{APR}_{it} + \beta_4 F_{it} \\ & + \beta_{3k} z_{kit} + \beta_4 r_t + \varepsilon_{it} \quad (1) \end{aligned}$$

where CRLOAN_{it} is the total amount outstanding of credit card loans for plan i in period t ; D_i is a dummy for bank i ; D_t is a dummy for period t ; APR_{it} is the annual rate of interest under plan i in period t ; F_{it} is the annual fee; z_{kit} is a vector of k other attributes of the plan;¹⁴ r_t is the prevailing rate of interest for personal loans; ε_{it} is a random error term; β 's are parameters to be estimated. Table 1 lists the variables used in the estimation, as well as their sources.

Revolvers' Demand

The demand for credit card loans by revolvers (customers who carry a balance on their cards) should be more responsive to the rate of interest than the demand for loans by all cardholders. While convenience customers may be indifferent to the rate their issuer charges, at least some revolvers (those who behave consistently with their intentions) are likely to be sensitive to the rates charged. To find out how revolvers respond

¹⁴ The vector of attributes may include grace period, minimum finance charge, late payment fee, and so on, as well as dummies for each plan's additional enhancements, such as automobile insurance, travel discounts, and extended warranty.

Table 1
Descriptive Statistics on Major Variables and Their Sources

Variable	Mean	Standard Deviation	Variable Definition
<i>The Federal Reserve Board Survey on Terms of Credit Card Plans (TCCP):</i>			
APR	17.21	2.43	Annual percentage rate on credit card loans
FEE	16.79	7.79	Annual fee (\$)
GRACE	23.41	7.31	Grace period (days)
MINFIN	.52	1.83	Minimum finance charge (\$)
CASH	2.02	1.93	Transaction fee for cash advance (\$)
LATE	10.46	4.81	Late payment fee (\$)
OVER	10.83	4.52	Over-the-credit-limit fee (\$)
<i>Enhancement Dummies:</i>			
REBATE	.09	.29	Rebates on purchases
WARRANT	.19	.39	Extension of manufacturer's warranty
PROTECT	.20	.40	Purchase protection
ACCID	.62	.49	Travel accident insurance
TRADISC	.20	.40	Travel-related discounts
AUTO	.19	.39	Automobile rental insurance
BUYDISC	.04	.20	Purchase discounts (not travel-related)
REGIS	.19	.39	Credit card registration
OTHER	.28	.45	Other enhancements
<i>Consolidated Reports of Condition and Income (Call Reports):</i>			
CRLOAN	489.0 million	1,250 million	Credit card loans outstanding (\$)
CREDINC	43.6 million	103.0 million	Interest and fee income on credit cards (\$)
CHOFFS	12.5 million	34.8 million	Charge-offs on credit card loans (\$)
OVERDUE	22.1 million	80.4 million	Overdue credit card loans (\$)
DEPOSITS	4,140 million	7,200 million	Deposits in domestic offices (\$)
<i>Federal Reserve Bulletin:</i>			
L1YRTB	5.50	1.76	Interest rate on 1-year U.S. Treasury bill
I_PERSON	14.36	.90	Interest rate on personal loans
<i>U.S. Bureau of Labor Statistics, Employment and Wages: Annual Averages:</i>			
AWWAGE	583.18	147.50	Average weekly wages (\$) by year and by state

to APR, equation (1) is estimated using the balance of overdue accounts for bank i in period t (OVERDUE_{it}) as a dependent variable in place of the total amount of outstanding loans. Revolvers should be less likely than convenience users to care about other features, such as annual fee or enhancements, since most of their cost is driven by APR. Therefore, the elasticity of demand based on the coefficient on APR in the equation with overdue loans should be larger than the elasticity of demand based on the coefficient in the overall equation (1), while the coefficient on fee

and on enhancements should be smaller than in equation (1).

To estimate how revolvers' demand responds to credit card features, data would be needed on the entire balance those customers carry from one month to the next. Unfortunately, banks report only the balances carried by customers who failed to pay the minimum balance on their credit card loans. The overdue loans reported by banks in the Call Report are therefore delinquent loans, not the total amount of revolving credit.¹⁵ To the extent that customers with delinquent loans are especially risky to the banks, they may not constitute a representative sample of all the revolvers. The reported results may not therefore yield the information about the sensitivity of all the revolvers to interest rates.

IV. Estimation Results

Changing terms of credit card plans is costly to the issuer. Issuers announce the terms in newspaper ads and in mailings sent to their prospective customers, while current customers are typically informed about the terms of their plans once a year. The terms can therefore be assumed to be fixed over a three-month period.¹⁶ Since the Call Report data on outstanding loans were collected two months *after* the TCCP data (see Section I), terms of credit card plans can be assumed to be exogenous when the loan amount is determined. Demand for credit card loans can therefore be estimated as a function of plan features using ordinary least squares (OLS).

Overall Demand for Credit Card Loans

Equation (1) was estimated using OLS. The restriction of no fixed effects was rejected at the 5 percent level.¹⁷ Bank dummies were therefore included in the estimation. Replacing time dummies with a continuous time variable was not rejected, however. The linear specification was used, as it performed better than the double log specification. The estimation re-

¹⁵ Approximately two-thirds of all credit card users are revolvers, while only about 3 percent of credit card loans are reported as overdue in the Call Report. Apparently most revolvers pay the minimum balance but do not pay the balance in full.

¹⁶ In the TCCP sample, APR often remains constant over a period of one year or longer for a given credit card issuer.

¹⁷ Fixed effects refers to estimation where intercepts are allowed to vary across individuals, here across individual banks.

Table 2
Dependent Variable: $CRLOAN_{it}$
(outstanding credit card loans for bank i in period t)
Fixed effects estimation, 1990 to 1995

Variable	Coefficient (millions of dollars)	T-statistic
APR	-41.8	-3.21*
FEE	-5.9	-1.39
GRACE	16.4	1.71***
REBATE	92.0	.69
WARRANT	22.5	1.89***
PROTECT	74.3	.68
ACCID	-4.1	-.07
TRADISC	17.2	2.07**
AUTO	18.4	1.83***
BUYDISC	-11.9	-.10
REGIS	13.5	1.60
OTHER	-89.3	-1.23
L_PERSON	43.2	1.29
TIME	72.9	6.30*
INTERCEPT	-14.7	-.03

$R^2 = 0.13$ $F = 37.32$ $N = 860$

Note: See Table 1 for variable definitions and sources.

*Significant at the .01 level.

**Significant at the .05 level.

***Significant at the .10 level.

sults are shown in Table 2.¹⁸ The coefficient on APR is negative and significantly different from zero, showing that charging a higher APR leads to reduced credit card lending. The estimated elasticity of demand for loans with respect to APR is minus 1.47 (calculated at the mean). In other words, if an average bank dropped its APR by 1 percentage point (for example, from 17 to 16 percent, a 6 percent drop), its outstanding loans would rise by about 8 percent (\$42 million for the average bank).

The coefficient on annual fee is negative, but not significantly different from zero. Credit card customers are, however, sensitive to the length of grace period, as shown by the positive and significant coefficient on GRACE. On average, extending the grace period by one day increases a bank's outstanding credit card loans by \$16 million (a 3 percent increase). Among the enhancements added to credit card plans, consumers turned out to be most responsive to extension of manufacturer's warranty, travel accident insurance, and automobile rental insurance. Adding one of the three features raised an average bank's

¹⁸ Since APR is a nominal interest rate, nominal dollars were used in the estimation.

outstanding credit card loans by \$22.5 million (4.6 percent), \$17.2 million (3.5 percent), and \$18.4 million (3.8 percent), respectively.

Given the estimated effects of adding individual enhancements to a credit card plan, it is possible to calculate how much consumers spend on average on the added enhancements. By adding extension of manufacturer's warranty, a bank can expect to increase its outstanding credit card loans by 4.6 percent. Assuming that all accounts (those that pay interest and those that do not) raise their outstanding loans

Credit card customers are sensitive to the rate of interest and also to the length of the grace period, extension of manufacturer's warranty, travel accident insurance, and automobile rental insurance.

equally, an average interest-paying customer would increase his or her outstanding loan by 4.6 percent as well. An average credit card account carries a balance of \$1,585.¹⁹ A 4.6 percent increase would raise that average by \$72.90. With a 17 percent average APR, adding extended warranty would increase an average cardholder's interest charges by \$12.40 per year.²⁰ Similarly, adding travel accident insurance would raise an average cardholder's interest charges by about \$9.40, while adding automobile rental insurance would raise his charges by \$10.25. Although it is difficult to estimate whether enhancements added to credit cards are worth the money an average customer spends on them, evidence suggests that enhancements

¹⁹ Ausubel (1995) calculated the average outstanding credit card balance up to 1993. Extrapolating his numbers for 1994 and 1995 and then computing an average over the 1990-95 period yields \$1,585. According to the Federal Reserve's *Functional Cost Analysis (FCA: National Average Report 1994)*, the average size of an active credit card account is \$1,028 for banks with deposits over \$200 million. FCA samples only relatively small banks, however.

²⁰ That number is likely to underestimate the true interest and fee charges. For example, according to Ausubel's (1995) calculations, cardholders' monthly payment rate is only about 14 percent of their balances. The remaining balance is carried over to the next month. Such a low payment rate is likely to bring additional fees, such as late payment fees.

offer no savings to cardholders.²¹ Cardholders who carry a balance on their cards are likely to minimize their spending by borrowing at the lowest possible APR and ignoring the added enhancements.

In the final specification, minimum finance charge, cash advance fee, late payment fee, and over-the-limit fee were omitted. None of these variables obtained coefficients that were significantly different from zero and each had several missing values, limiting the number of observations used in the estimation. The finding that consumers' demand for loans is not sensitive to minimum financing charges or late penalties explains why banks have been raising those penalties—customers seem to be less responsive to them than to other features.

As explained above, interest rates on credit cards are fixed in the short run and can therefore be treated as exogenous in the demand estimation. However, to test for possible endogeneity of the interest rates due to banks' screening (see footnote 13), the demand for credit card loans was also estimated using three-stage least squares (3SLS). The demand equation (1) was estimated jointly with the following supply equation:

$$\text{APR}_{it} = \gamma_0 + \gamma_1 \text{CRLOAN}_{it} + \gamma_2 i_{1\text{ yr TB}} + \gamma_3 w_t + \gamma_4 \text{DEPOSITS}_{it} + \gamma_5 t + \xi_{it} \quad (2)$$

where $i_{1\text{ yr TB}}$ is the cost of funds (measured as the interest rate on 1-year Treasury bill), w_t is the average weekly wage per employee in the finance sector for period t by state,²² DEPOSITS_{it} is the bank's deposits in domestic offices,²³ and t measures time in six-month intervals. The cost of funds, local wages in the finance sector, and the bank's deposits are exogenous instruments. In addition, an exogenous measure of income (GDP) was included as an instrument in the demand equation. The results were not significantly different from the OLS results: APR was statistically significant (although its coefficient was slightly lower in magnitude), the coefficient on GRACE remained statistically significant, and the coefficient on FEE was not significantly different from zero.

²¹ Press articles have suggested that enhancements usually do not save customers any money, and they have cited anecdotal evidence that customers charged on their credit cards just to get the perks. For example, see *American Banker*, 9/22/95, p. 12 and *U.S. News & World Report*, 1/24/94, p. 68.

²² The wages are taken from U.S. Bureau of Labor Statistics, *Employment and Wages: Annual Averages* for each year by state for finance, insurance, and real estate (4-digit SIC).

²³ To avoid endogeneity, deposits reported during the period preceding each TCCP survey were used in this estimation.

Table 3

Dependent Variable: OVERDUE_{it}(overdue credit card loans for bank *i* in period *t*)

Fixed effects estimation, 1990 to 1995

Variable	Coefficient (millions of dollars)	T-statistic
APR	-3.48	-1.89***
FEE	.49	.64
GRACE	10.00	3.02*
MINFIN	-96.90	-1.44
CASH	-10.00	-1.68***
LATE	-7.23	-2.32**
OVER	6.62	1.60
REBATE	.42	.02
WARRANT	-44.30	-1.44
PROTECT	8.22	.30
ACCID	.25	.02
TRADISC	-10.10	-.63
AUTO	3.17	.13
BUYDISC	-46.00	-1.86***
OTHER	-14.80	-.87
L_PERSON	5.00	.70
TIME	-3.25	-1.16
INTERCEPT	-155.00	-1.19

R² = 0.32 F = 21.80 N = 157

Note: See Table 1 for variable definitions and sources.

*Significant at the .01 level.

**Significant at the .05 level.

***Significant at the .10 level.

Revolvers' Demand for Credit Card Loans

With the caveats noted in Section III, equation (1) was estimated using reported overdue credit card loan amounts as a dependent variable. The results are reported in Table 3. The results indicate, as expected, that the amount of overdue loans increases at a higher rate than loans in general as APR falls: The coefficient on APR is negative and significantly different from zero, yielding an elasticity of demand for overdue loans of 2.71 (calculated at the mean). The elasticity implies that if an average bank raised its APR by 1 percentage point (for example, from 17 to 18, a 6 percent increase), its overdue (delinquent) loans would decrease by 16 percent (about \$3.5 million for an average bank), a much larger drop than for total loans. By the same token, lowering APR would increase the delinquent loans at a significantly higher rate than loans in general.

The amount of overdue loans is also more sensitive to the length of grace period (GRACE), the late payment fee (LATE), and the transaction fee for cash

advances (CASH). The last two variables were insignificant in the overall demand equation. Higher charges for late payments, just like higher interest rates, seem to encourage customers to make payments on time or to switch to another plan.

Income from Credit Cards

Since demand for credit card loans is elastic with respect to APR, banks may be expected to lose income from credit cards as they raise their rates. On the other hand, since delinquent loans increase at a higher rate than credit card loans in general when APR falls, banks' income from credit card interest and fees could increase when they raise the interest rates charged. To examine which of the two effects dominates, the following regression was estimated:

$$\text{INCOME} = \lambda_0 + \lambda_1 \text{APR}_{it} + \lambda_2 \text{FEE}_{it} + \lambda_3 i_{1 \text{ yr TB}} + \lambda_4 w_t + \lambda_5 \text{DEPOSITS}_{it} + \lambda_6 t + \zeta_{it} \quad (3)$$

The results indicate that a bank's income increases both with the interest rate and with the annual fee the bank charges on its credit card loans, holding the bank's deposits and costs constant. As Table 4 shows, a 1 percentage point increase in APR (a 6 percent change) is associated with a \$4.4 million average increase in the interest and fee income (a 10 percent rise), while a \$1 increase in the annual fee translates into a \$1 million average increase in the interest and fee income (a 2.3 percent rise) during a

Table 4

Dependent Variable: CREDINC_{it}(income from card interest and fees for bank *i* in period *t*)

1990 to 1995

Variable	Coefficient (thousands of dollars)	T-statistic
APR	4391.2	3.86*
FEE	1044.8	2.88*
DEPOSITS	.000006	17.05*
L_1YRTB	1207.5	.73
AWWAGE	-54.8	-3.14*
TIME	1886.3	1.91***
INTERCEPT	56600	-2.02**

R² = 0.17 F = 57.40 N = 1650

Note: See Table 1 for variable definitions and sources.

*Significant at the .01 level

**Significant at the .05 level

***Significant at the .10 level

six-month period, holding the bank's deposits, cost of funds, and wages constant. Thus, banks benefit from raising both APR and annual fees.

The above results are significant. Although the overall outstanding credit card loans on a plan increase when the interest rate drops (the estimated demand elasticity is greater than one), banks collect less income when they lower their rates. Customers charge more as the rate of interest drops, but overdue loans increase even faster, indicating that cardholders repay at a lower rate. The reason for the discrepancy is the adverse selection problem faced by credit card banks: When lowering their rates, banks attract high-risk customers who are more likely to default (or their existing risky customers borrow more). Since banks

Customers charge more as the rate of interest drops, but overdue loans increase even faster, indicating that they repay at a lower rate. The reason is the adverse selection problem faced by credit card banks: When lowering their rates, banks attract high-risk customers.

lose income at lower interest rates, they maintain high APRs despite declines in the cost of funds.²⁴ The best strategy for banks to maximize their income is to charge high interest rates but entice their customers with additional perks, which cost banks little and are likely to attract "good" customers with a low probability of defaulting.

Fixed Effects

As noted earlier, non-fixed effects specification was rejected by the data. The significance of fixed effects indicates that some individual banks' characteristics, besides the features of their credit card plans,

²⁴ However, if banks raised their interest rates too high, they might lose even the "good" customers, who would forgo the convenience of borrowing on a credit card and borrow elsewhere.

Table 5

Dependent Variable: APR_{it}
(annual percentage rate charged by bank *i* in period *t*)
1990 to 1995

Variable	Coefficient	T-statistic
DEPOSITS	3.25 e-11	4.59*
L_1YRTB	.061	1.82***
AWWAGE	-.001	-1.78***
TIME	-.227	-11.91*
INTERCEPT	18.673	56.68*

R² = 0.13 F = 68.07 N = 1884

Note: See Table 1 for variable definitions and sources.

*Significant at the .01 level.

**Significant at the .05 level.

***Significant at the .10 level.

affect demand for credit card loans. One hypothesis, examined in the next section, is that the size of a bank affects the demand for its credit card loans.

V. Bank Size and the Credit Card Market

Although most credit card plans are offered nationally, some consumers may be more likely to turn to the bank that holds their deposits when applying for a credit card. Even if banks offer the same credit card terms to their clients as they do to others, consumers' preferences may give larger banks (those holding more accounts) an advantage in the credit card market. To test whether larger banks have a market power advantage that lets them charge higher interest rates on their credit card plans, APR was regressed on bank deposits.²⁵ The coefficient on deposits was positive and statistically significant (see Table 5), showing that banks with higher deposits charge higher interest rates on their credit card loans, holding the cost of funds and local wages constant. The effect was small, however; a \$1 billion increase in deposits translated into an increase in the credit card interest rate of only 0.03 percent. The result indicates that large banks can take advantage of their market power and charge a somewhat higher rate of interest on credit card loans.²⁶

²⁵ To avoid endogeneity, deposits reported during the period preceding each TCCP survey were used in this estimation.

²⁶ The size of deposits did not, however, affect banks' annual fees, other charges, or enhancements.

Table 6
*Elasticity of Demand for Credit Card
 Loans at Banks by Size of Deposits*

Deposits Category Banks	Average Credit Card Loans (millions of dollars)	Elasticity of Demand for Credit Card Loans
Less than \$500 million	348.4	2.44
\$500 million-\$2 billion	359.3	.71
\$2 billion-\$5 billion	868.0	.69
Over \$5 billion	674.5	.81

Since larger issuers, on average, charge higher interest rates, they should face more inelastic demand for credit card loans than do smaller banks (otherwise their strategy would not be profitable). Is demand for loans on credit cards issued by larger banks significantly less elastic than demand faced by smaller banks? When equation (1) was estimated by size-of-deposits category,²⁷ the smallest banks turned out to be the only group where demand for credit card loans was elastic with respect to the interest rates. See Table 6 for the results.²⁸ If an average bank from the first category (deposits below \$500 million) raised its APR by 1 percentage point, its outstanding credit card loans would drop by 14.4 percent (a \$50 million decrease). By comparison, a 1 percentage point increase in the APR charged by one of the largest banks would lead to only about a 4.6 percent decrease in the bank's credit card loans (a \$31 million drop). Thus, small banks face much more elastic demand for credit card loans than large banks do. However, even when bank size was included in the regression, non-fixed effects

²⁷ Four deposit categories were used: below \$500 million, between \$500 million and \$2 billion, between \$2 billion and \$5 billion, and over \$5 billion. Each category contained approximately one-fourth of the sampled banks.

²⁸ When APR was interacted with the deposit size category in a pooled regression, the general result was confirmed: the larger the size category, the smaller the effect of APR on the amount of credit card loans. The pooled specification was rejected by the Chow test, however.

estimation was rejected by the data. That indicates that other bank-specific factors in addition to size affect demand for credit card loans.

VI. Summary and Conclusions

Using data on the terms of credit card plans and on issuing banks' financial information, this study finds evidence that consumers' demand for credit card loans is elastic with respect to interest rates charged by issuing banks. The estimated demand elasticity for the overall market is 1.47, while the elasticity of demand for the delinquent credit card loans (loans that are at least 30 days overdue) is 2.71. Consumers' demand for loans was also found to be responsive to the length of the grace period and to some of the enhancements added by the issuing banks: extension of manufacturer's warranty, travel accident insurance, and automobile rental insurance.

Since demand for delinquent loans is significantly more elastic than demand for loans in general, lowering APR would attract disproportionately larger increases in delinquent loans than in loans borrowed by customers who pay back. Banks therefore face an adverse selection problem that induces them to maintain high interest rates on credit card loans in order to minimize their losses. The adverse selection hypothesis is further supported by the result that banks' income from credit card fees and interest increases with APR. Even though lowering APR would raise banks' outstanding credit card loans, the marginal customers attracted by lower APR would be risky and more likely to default, or the existing customers would borrow more than their incomes could service.

Significant fixed effects of individual banks exist in the credit card market. In particular, the largest banks (as measured by the size of deposits) charge slightly higher rates of interest and face more inelastic demand for credit card loans. Future research should examine whether the bank size effect is associated with market *power* or market *structure* characteristics. Even after controlling for bank size, fixed effects estimation cannot be rejected. That indicates that still another bank-specific factor may be affecting demand for credit card loans, in addition to size.

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