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Testing for Sex Discrimination in Commercial Bank Consumer Lending

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Testing for Sex Discrimination in Commercial Bank Consumer Lending

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Abstract

The purpose of this study is to determine if commercial banks systematically and prejudicially discriminated on the basis of sex in granting consumer loans prior to enactment of the Equal Credit Opportunity Act (ECOA). It uses data on 37,000 paid-off and charged-off consumer loans at 30 banks in five regions of the country for the years 1965-71. The study tests the hypothesis that sex discrimination exists against the alternative (competitive market or profit-maximization) hypothesis that lenders will not systematically discriminate on the basis of sex because, to do so, they would have to turn away profitable business. It does so by analyzing the relative incidence with which loans made to males and females occur among "good" paid-off and charged-off loans over the sample period.

Given that loan rates, loss rates, and servicing costs are assumed to be invariant with sex, if prejudicial sex discrimination exists, members of the sex discriminated against will have to be better than average credit risks in order to obtain credit. Thus, on average, such borrowers should not be represented as frequently among charged-off loans as they are among good paid off loans. If no prejudicial sex discrimination exists, members of each sex should be equiproportionately represented in the paid-off and charged-off loan categories.

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The results of the study indicate that, on balance, banks did not systematically discriminate against either sex of borrower. When data were analyzed separately for each type of consumer loan, however, two possible areas of sex discrimination were found. In the home-improvement credit market, women appeared to have to be better credit risks to obtain such credit. However, this may have been economically justified as available data on loan charge-offs indicate that when women did default on such loans, the bank was forced to charge-off a substantially greater proportion of the total amount of credit advanced than when males defaulted. Thus, the equal loss assumption of our model is in doubt and no firm conclusions can be drawn in this case.

The second consumer loan market in which sex discrimination may have existed was the used-auto credit market. There, males appeared to be relatively disadvantaged. However, in this case, although male charge-offs were not particularly high on used-car loans (relative to the amount of credit advanced), no comparable data were available for females. Thus, it cannot be said definitively that sex-linked credit discrimination occurred in that market.

Overall, then, this study does not provide evidence that systematic sex-linked consumer credit discrimination was practiced by banks prior to enactment of ECOA. However, some tentative evidence exists that discriminatory sex-related differences in credit availability may have existed (possibly inadvertently--if banks erroneously deemed males to be poorer auto credit risks because they were poorer drivers) in one or two subcomponents of the consumer credit markets.

Testing for Sex Discrimination[1] in Commercial Bank Consumer Lending

I. Background

The Equal Credit Opportunity Act of 1974 (ECOA) and Regulation B of the Federal Reserve Board adopted in 1975 and since revised have prohibited sex discrimination in consumer lending. These regulations resulted from testimony presented to Congress and the National Commission on Consumer Finance that documented instances of sex discrimination in consumer and mortgage lending. In general, that testimony was either largely anecdotal or referred to a few test cases. Much testimony related to the mortgage market. No large-scale statistical study was available to document the extent to which sex discrimination existed in consumer credit markets.

Since enactment of ECOA the question has arisen as to how credit discrimination can be identified. At present, this is difficult because Regulation B no longer allows data on the sex, race, or other "protected" characteristics of a credit applicant to be collected on a consumer credit application form. However, the Civil Rights movement has recently reversed itself on similar issues in the employment area and requested that sensitive data be collected on employment applications and records to permit monitoring of possible discrimination and minority progress. Similar proposals have been proposed but have not yet been enacted in the consumer credit area, with the exception of mortgage credit, where data on sex are still collected. Having prohibited the collection of data that could be used to monitor compliance with ECOA, Regulation 8, instead, specifies a list of mandated and prohibited actions on the part of creditors and assumes that no discrimination exists so long as a creditor complies with all mandated acts and performs none of the prohibited acts.

Given that background, the purpose of this paper is twofold. First, it uses a large sample of randomly obtained data on consumer loans made by commercial banks in the late 1960's and early 1970's (prior to the enactment of ECOA) to determine whether sex discrimination existed in commercial bank consumer lending at that time. Second, it presents a methodology that potentially could be used to determine, ex post, whether an individual creditor has systematically biased its loan policies to the disadvantage of one sex, or other "protected" debtor group. However, given present restraints on data availability, such tests would not be feasible, except in the mortgage credit area, unless Regulation B were modified to allow pertinent information to be obtained for the purposes of monitoring compliance with antidiscrimination laws

II. Noneconomic Discrimination

In this paper we assume that the objective of anti-discrimination provisions is to eliminate discrimination on noneconomic grounds, in which credit availability is restricted to members of certain groups in an economically unjustifiable manner. In such instances, although the expected present value of a decision to accept a credit applicant would exceed the expected present value of the decision to reject that applicant, the applicant would nonetheless be rejected. Following the National Commission on Consumer Finance, we do not consider it discriminatory for a creditor to deny credit or charge higher rates on credit extended to members of

[1] Discrimination" has two definitions. One is to identify a significant difference between two people, items, etc., as "College entrance exams are intended to discriminate between students on the basis of the academic potential." The second definition implies prejudice, as "He discriminates against blacks." In this paper we are concerned with prejudicial discrimination. Thus, we make a distinction between "economic" discrimination, where a distinction is made between classes of credit applicants on an economically sound basis and "noneconomic" discrimination, where judgments are not economic and are therefore presumed to reflect the operation of explicit prejudice or implicit prejudice (caused by the substitution of socially biased stereotypes for true information). Where no contrary indication is given, throughout the paper we use "discrimination" in its prejudicial (or noneconomic) sense.

groups with statistically poor past payment performance, (similarly an insurance company may find it economic to charge higher rates or deny coverage to policyholders belonging to high risk classes).[2]

Consequently, in this paper, we are concerned with whether a particular class of borrowers, in this case females, obtained credit commensurate with their credit-worthiness relative to males. If not, we conclude that they were discriminated against in a non-economic manner.

III. Testing for Noneconomic Credit Discrimination

In a competitive market, one would not expect noneconomic credit discrimination to occur. If, due either to personal bias or ignorance, one creditor failed to extend credit to an acceptable credit risk, he would lose potentially profitable business to his competitors and his profits and ability to survive in a competitive market environment would be reduced.

For any given type of loan, j, we assume that costs of loan administration, the covariance of expected returns on a given type of loan with other portfolio holdings, and other nonrisk related factors that might affect the lender's rate of discount are not systematically related to the type (sex) of the borrower. Further, we assume that competitive pressures to maximize the present value of a firm, and profit-maximizing incentives in general, will cause a lender to make any loan for which the expected present value is positive. Thus, we assume that for all loans made: (1) $EPV_{ij} = (1-p_{ij})G_j - p_{ij}L_{ij} \geq 0$ for all i,

where $EPV_{ij} \geq 0$ = the expected present value for a j-type loan made to the ith type of individual.

p_{ij} = the probability that members of the ith class of borrowers will default on a j-type loan,

G_j = the present value of the gain expected on a successfully repaid loan of the j-type, and

L_{ij} = the present value of the expected loss to be- incurred if a member of the ith class of borrowers defaults on a j-type loan.

In the realm of consumer credit, contract rates are often set in advance and are standard for all customers. One reason for this is that the detection of slight differences in customer risk would not be of sufficiently great economic consequence to justify the extensive transactions costs involved in altering credit rates to correspond with the relative riskiness of each and every credit applicant. Instead, a "risk-tiered" market has tended to develop, in which creditors tend to charge standard rates for all their customers and provide credit to all applicants who are deemed to be acceptable risks at those rates. Customers who feel that they merit a significantly lower rate typically shop for credit elsewhere.

[2] The Report of the National Commission on Consumer Finance ([3] pp. 155-6) clearly shows that the Commission desired to prohibit the use of noneconomic bases for credit discrimination while allowing actuarially (statistically) based methods of determination of good and bad credit risks to be used. Regulation B of the Federal Reserve Board also acknowledges that valid statistically based techniques for evaluating individuals' comparative creditworthiness can be used so long as they don't have the effect of discriminating against protected groups. Finally, the preamble of the initial version of the Equal Credit Opportunity Act clearly states that its objective is to make credit available to all creditworthy borrowers without regard to sex or marital status. Thus, it appears that rational economic discrimination, i.e., discrimination based on relative creditworthiness, should be permissible while noneconomic discrimination against members of certain classes of individuals is to be outlawed.

Even though market sequentation on the basis of risk is not perfect (see, for instance, Boczar [1]), evidence exists that banks predominantly establish "policy" rates applicable to particular classes of loans. In particular, a majority of banks in the Federal Reserve Board's monthly consumer loan rate survey reported in a special survey conducted in early 1975 either that they had uniform rates or that their consumer loan rates were widely known in their market area. Thus, in this paper, we assume that bank rates on particular types of loans are fixed, or that G_j is invariant with the type (sex) of borrower.[3] Noneconomic discrimination, then, is assumed to take the form of excessive credit denial to a particular type of customer rather than elevated loan rates charged to that type of borrower.

If we also assume that $L_{ij} = L_{kj}$ for all types (both sexes) of borrowers,[4] then it follows that for profit maximizing (competitive) lenders, at the margin $P_{ij} = P_{kj}$ for all i, k.

Overall, we assume that lenders set policy rates for each type of loan. They then accept all credit applicants for whom the expected present value of the loan is nonnegative. Among the accepted customers there may be some of relatively low risk for whom the expected present value of the loan is positive, but have not elected to seek credit elsewhere.

In deciding how much to shop for loans, consumers will weigh the necessary transactions costs of shopping against the expected savings in finance charges. Thus, the spread of risks represented by loan customers of a given creditor will tend to be smaller on loans with relatively high rates, for loans of larger average size, and on types of loans for which greater competition exists, as all those conditions will either increase the returns or reduce the transactions costs for borrowers that seek credit elsewhere. If we assume that male and female credit applicants experience similar transactions costs in seeking alternate credit sources, the

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[3] Further support for this assumption is provided by analysis of rates charged on automobile loans, which constitute the largest consumer loan category. That analysis suggests that banks in the sample did not systematically charge higher rates to males than females, or vice versa. For instance, the 6862 good paid-off three-year auto loans made to male borrowers carried a weighted average interest rate of 11.82 percent, while the 782-three-year good paid-off auto loans made to female borrowers carried a weighted average rate of 11.96 percent. The female rate was slightly lower in spite of the fact that the average amount financed on loans paid-off by females (at $2240) was smaller than the average amount financed by males (at $2926), and loan rates tend to be somewhat higher on smaller loans to cover overhead costs of loan administration. On charged-off three-year auto loans, the average amount financed by females (at $2495) was still smaller than the average amount financed by males (at $2787), and not unexpectedly, loans made to females carried slightly higher rates (12.62 percent on their 288 charge-offs) than loans made to males (12.56 percent on 2531 charge-offs).

Similar mixed rate patterns existed for 2 1/2-year and 2-year auto loans. For 2 1/2-year auto loans, females paid 13.31 percent on their 143 good paid-off loans while males paid more (13.85 percent); also, females paid 16.59 percent on their 74 charged-off loans while males again paid more (17.05 percent). For 2-year loans, females paid 13.67 percent on their 210 paid-off loans while males paid less (13.45 percent); however, females paid 18.19 percent on their 83 charged-off loans while males again paid less (17.82 percent). In all cases, females borrowed smaller amounts than men.

Overall, no clear difference in rates charged on auto loans was discernible. In half the cases analyzed females paid more, in the other half they paid less than men for auto loans of the same maturity and loan performance. , In the largest loan category, the 3-year auto loan category, which consisted almost exclusively of new-car loans, rates paid by females and males were almost identical. Two systematic nonrate differences did exist, however, that may be of some interest. First, females systematically held smaller average size loans in every maturity category than males. That may have reflected a smaller ability to pay high monthly payments or the purchase of less-expensive cars rather than credit discrimination, per se. Second, charged-off auto loans uniformly carried higher rates than paid--off auto loans in the same maturity category. This suggests that banks may have systematically adjusted loan rates in line with perceived a priori risk even though they apparently did not adjust them systematically with the sex of the borrower.

[4] The Appendix analyzes available data on loan losses and reasons for charge-offs to identify sex-linked differences in reasons for charge-offs and in charge-off-to-credit advanced ratios. Reasons for charge-offs appear to be generally the same for each sex, with the exception that marital breakups account for proportionately more male than female charge-offs. Ratios of charge-offs to total credit advanced in the aggregate, and for both males and females, generally equal 60±10 percent. For most types of loans, male and female charge-off-to-credit-advanced ratios appear to be roughly equivalent. Sketchy data indicate, however, that females' loan-loss-to-credit advanced ratios may be higher on home improvement loans, lower on vacation loans, and higher on new auto loans (see the Appendix).

frequency distribution of accepted credit risks for any type of loan made by a given creditor should not vary with the sex of the applicant.

Given equal expected gains, G_j and losses, L_{ij} and L_{kj} for borrower classes i and k on j-type loans, profit maximizing creditors will extend credit until $EPV_{ij} = EPV_{kj}$ or $P_{ij} = P_{kj}$ at the margin. However, if a lender discriminated against one group, either intentionally due to bias or unintentionally due to ignorance, he would be less willing to grant credit to that group than would otherwise be the case, Thus, at the margin, members of that group that received loans would have lower probabilities of default (i.e., would have to be better credit risks) in order to overcome the creditor's bias against them and to qualify for a loan.[5] Symbolically, given the assumptions of our model, if a creditor discriminated against female borrowers, group "f," relative to male borrowers, group "m," one would expect to find, for individuals able to obtain credit, that

(2) $pf < pm$ *

This relationship would hold at the margin. If we assume, via the transactions cost arguments given above, that the frequency distributions, $f_i(p)$, of default probabilities for credit applicants are identically distributed for each class of credit applicant, i, this relationship would also hold for average rates of default, as given (2),

(3) $\int_o^{pf} f_f(P)dp < \int_o^{pm} f_m(p)dp$ when $f_f(p) = f_m(P)$.

This analysis suggests that de facto, noneconomic credit discrimination exists if the present values of expected gains and losses (per dollar of credit extended) are equal for similar loans, while the probability of default on credit granted to one borrower group is significantly lower than the probability of default for credit extended to other borrowers. Tests for such discrimination can be applied either to data obtained from an individual creditor or to data obtained from a broad spectrum of lenders.

IV. Tests for Commercial Bank Consumer Credit Discrimination

From 1966 through 1970, the Federal Reserve System engaged in an extensive study of bank consumer lending practices. In that study, which antedated ECOA, 30 banks in five regions of the country collected thorough socio-economic information on a random sample of approximately ten percent of consumers who repaid their loans during the period that the banks participated in the study. In addition, equivalent socio-economic information was obtained on all loans that were charged-off during that period.

Given this database and our assumptions, two types of tests for sex discrimination in bank lending are possible. One is to tally the number of charged-off loans for males and females, relate those numbers to the number of good loans paid off by males and females and determine if the charge-off rate is significantly higher for loans made to males than it is for loans made to females. If so, a case could be made that females were discriminated against by bank loan officers and/or policies. Because the sampling frames for charged-off and paid-off loans were not exactly the same, however, charge-off rates cannot be precisely calculated (as there may be some unknown variance in the desired ten percent sampling rate for paid-off loans).

[5] This statement assumes that noneconomic credit discrimination is not totally random, but rather, is related in some degree to borrower risk. I.e., it posits that a loan officer with a propensity to discriminate prejudicially against some group would not select the targets of his discrimination by lot (or, alternately, make no loans to members of that group) but rather would be more inclined to act in a prejudicial manner against credit applicants of greater perceived risk. By so doing, he would be less likely to have to answer hard questions as to why people with impeccable credentials were refused credit.

An alternative test, that achieves the same end and gives additional flexibility is to calculate the percentage distribution of male and female borrowers among charged-off and good paid-off loans and then determine if those percentages are the same or statistically different. If females were discriminated against, one would expect that the proportions of loans made to male and female borrowers would differ significantly between the two samples, with the proportion of loans made to males being higher among the charged-off loans than among the good paid-off loans.

The conclusion that if females were discriminated against, the proportion of charged-off loans attributable to males will be higher than the proportion of good loans attributable to males can be derived as follows.

Let N = the number of loans of a given type

P = the proportion of loans of a given type

p_j = the maximum acceptable (marginal) probability of loan default on a j-type loan (as determined from equation (l)

m and f = subscripts referring to males and females, respectively, and

b and g = subscripts referring to bad and good loans respectively.

Further, if any subscript in a pair (m or f and b or g) is omitted, the loan category referred to is the sum of each subcategory, i.e., N_f refers to all loans made to females while P_{mb} refers to the proportion of bad loans made to males.

Omitting subscripts referring to the type of loan, we know that

(4) $N_{fb}/N_f = \int_0^{pf} f(p)dp$ and $N_{mb}/N_m = \int_0^{PM} f(p)dp$.

Since we assume, for reasons given earlier, that default probabilities on accepted loans, f(p), are equally distributed for males and females for each type of loan, but acceptable risk cutoff points, pf and pm vary if a creditor discriminates, then from-(2), (3) and (4) it follows that

(5) $N_{fb}/N_f < N_{mb}/N_M$ and $N_{fg}/N_f > N_{mg}/N_M$

if a creditor discriminates against females. This simplifies to

(6) $N_{fb}/N_{mb} < N_f/N_M < N_{fg}/N_{mg}$

Adding 1 to each term in (6) and simplifying, we get

(7) $N_b/N_{mb} < N/N_m < N_g/N_{mg}$

Inverting (7), which reverses the direction of the inequalities, and expressing the result in proportions, we obtain

(8) $P_{mb} > P_M > P_{mg}$

If no discrimination exists, p_f should equal p_m and, consequently, $P_{mb} = P_m = P_{mg}$. Hence, since we expect no discrimination to persist in a competitive market environment, our null hypothesis is that $P_{mb} = P_{mg}$ for each type of loan. If discrimination against females (or males) exists, we would expect to find a significant difference between P_{mb} and P_{mg} or, equivalently, between P_{fb} and P_{fg}.

To test whether a significant difference in the proportion of male and female borrowers exists among good and bad borrowers, Table 1 was prepared by tallying the sample data separately for males and females. Because finance rates, service costs, loss rates, and net returns on good loans can vary with the type of loan, ideally all tests for relative frequency differences for male and female borrowers need to be segregated by type of loan. Thus, Table 1 includes data by loan type as well as loan performance.

In Table 1 the summary totals for each cell were converted to proportions, (P_{mb} and P_{mg}). Those proportions and the number of loans in each cell were then used to test whether the (competitive market) null hypothesis should be rejected in favor of an alternative hypothesis suggesting prejudicially discriminatory behavior.

Because of the large number of observations in the sample, the binomial sample means in each cell are approximately normally distributed. Thus, t-statistics were used to test the discrimination hypothesis. Those statistics are presented in the last column of Table 2.

The t-test applied to aggregate data for all consumer loans (shown in the bottom line of Table 1) did not support the hypothesis that sample commercial banks systematically discriminated against females (or males) in the granting of credit. The computed t-statistic for the aggregate data practically equaled zero. It was not even close to being significant at the 99 percent level.[6]

Additional t-tests based on binomial approximations to the normal distribution were generated for each class of loan to determine if systematic differences existed in loan payment performance for particular types of loans. The results of those tests are also shown in Table 1. They indicate that at the 99 percent confidence level (for each individual test), the null (competitive) hypothesis is rejected in only two cases. First, women defaulted at a disproportionately high rate relative to their good loan performance on used car loans. Second, women defaulted at a disproportionately low rate on home improvement loans. These results could indicate that men were discriminated against (relative to their true risk) in the granting of used car loans, while women were discriminated against in the granting of home improvement loans.[7]

Although our results suggest that banks were overly conservative in granting used car loans to men (and thereby discriminated against them in the granting of such credit), the conclusion that discrimination against

[6] Before analyzing the data in Table 1, it was necessary to decide on confidence limits. In these tests a 99 percent level of significance was required before the hypothesis that discrimination ' exists could be accepted. Had the analysis been conducted for an individual firm, a 99 percent confidence level would imply that in only one of 100 cases would apparent discrimination be indicated by chance. A 95 percent confidence level, by contrast, would give a one in 20 chance of finding apparent discrimination if, in fact, none existed and might, therefore, encourage frivolous law suits if such suits had a high potential payoff for the plaintiff (or the plaintiff's lawyer--as might be the case in a class action). If maximum payoffs to plaintiffs were great, an even higher confidence level might be desirable in order to discourage frivolous lawsuits. However, if statutory limits were placed on potential damage settlements, a 99 percent confidence limit would be satisfactory.

[7] It should be noted that by pure chance, using a 99 percent confidence level, the random probability that no apparent discrimination would be found when 11 simultaneous independent tests are run is (.99) 11 or 89.5 percent. With a 95 percent confidence level for each test, it would be only 56.9 percent. Thus, one positive result is far less likely to indicate the existence of possible discrimination if multiple tests are run, as such a result is much more likely to occur by chance in that event.

males exists would not be warranted if the assumptions of our model were not appropriate. In particular, if $L_{mj} > L_{fj}$ for used-car loans, the assumptions of our model would not hold and our conclusions would be suspect. However, while available data are sketchy and thus do not allow this alternative hypothesis to be tested rigorously, they do suggest that the loan-loss-to-credit advanced ratio for used car loans made to men is not abnormally high--in fact, it is lower than average loss-ratios (see the Appendix). Furthermore, available loan-loss-to-credit advanced ratio data for new car loans suggest that losses -on new-auto loans made to males tend to be lower relative to the amount of credit extended than losses on new-auto loans made to females. Since loan rates are approximately equal for both sexes (see footnote 3), if female used-car loan-loss ratios parallel new-car loss ratios, a case can be made that males are discriminated against relative to females in the (used) auto credit markets. A possible explanation for this finding is that males tend to be poorer auto insurance risks than females. As a result, some loan officers may have overcompensated in their decisions and judged male used-car credit applicants to be poorer credit risks, relative to females, than they actually were.

In the case of home-improvement loans, the t-statistic suggests that unwarranted credit discrimination may have existed against females--possibly because of misplaced apprehensions that, given the long maturity of such loans, some female credit applicants might be unable to meet payments due to unexpected pregnancies, marriage, and so on. However, as noted in the Appendix, the limited sample data that exist suggest that female loss/credit advanced ratios on charged-off loans were substantially higher than male loss/credit advanced ratios on similar loans. Thus, one of the basic assumptions of our model, that $L_{fj} = L_{mj}$ for all loans may not hold for home-improvement loans. Given this fact, greater lender caution in extending home-improvement loans to females may merely have reflected a rational adjustment to more adverse experience on charged-off loans, rather than credit discrimination per se.

In all other cases the t-statistics did not indicate that the null hypothesis should be rejected. In addition, with the exception of new car loans (where female credit loss ratios were elevated relative to males, as reported above) and vacation loans (where available data are very sketchy-possibly reflecting losses on only one loan made to a woman), the available loan-loss-to-credit advanced ratios reported in the Appendix do not suggest these results are invalid due to substantive violations of the basic assumptions of our model.

V. Conclusions

Overall, the available data analyzed were generally consistent with the competitive market model, They suggested that, in the aggregate, prior to enactment of ECOA, sample banks participating in the Federal Reserve Systems Credit Quality Survey did not engage in noneconomic discrimination against either males or females in the granting of consumer credit. This conclusion held true for all consumer loans and for practically every individual loan type category. In the one case where apparent noneconomic discrimination against females existed, available data on losses suggested that the basic assumptions of our model were violated in such a way that bank behavior may well have represented an economic response to higher female loss ratios on defaulted home-improvement loans. In the one case where noneconomic discrimination apparently existed against males, insufficient data existed to determine statistically whether male loss ratios were larger or smaller than female loss ratios on charged-off used-car loans. However, indirect evidence (based on female loss ratios on new-car loans and male loss ratios on used-car loans) does suggest that males may have been relatively disadvantaged-in the auto credit market. For all other consumer loan categories available data do not suggest that the (competitive) null hypothesis should be rejected; i.e., no evidence exists for those loan categories that the sample banks discriminated on the basis of sex prior to enactment of ECOA.[8]

[8] As a final caveat, it should be noted, that these tests of discrimination apply only to relative credit availability. They do not measure subjective aspects of the loan transaction.

The methodology employed in this paper can be used to test for possible discrimination in consumer lending wherever the requisite information is available and the basic assumptions of the model hold. At present it could prove useful in testing for possible sex discrimination in mortgage lending, as data on borrowers' sex are available, mortgage loan terms tend to be similar for most borrowers, and loss ratios are readily calculable. Relatedly, the methodology developed here might also prove useful in "redlining" studies if standard mortgage loans were made in different locales.[9]

TABLE 1: Tabulation of Female/Male Experience on Sampled Commercial Bank Consumer Loans, 1966-71

Performance	Charge-Offs		Good Pay		
Type of Loan	#Female/#Male	Proportion Male (P_{mb})	#Female/#Male	Proportion Male (P_{mb})	T-values for Differences in P_{mb} and P_{mg}
New Auto	191/1680	(89.8)	810/6735	(89.3)	-.67
Used Auto	288/2115	(88.0)	481/4610	(90.6)	3.26**
"?" Auto	28/254	(90.1)	73/657	(90.0)	-.03
Furn. & Appl. And Radio,TV, HiFi	41/306	(88.2)	189/1853	(90.7)	1.38
Plane, Boat, M.Home	3/87	(97.7)	43/995	(95.9)	-.36+
Home Improvement	74/1232	(94.3)	276/3163	(92.0)	-2.99**
Medical	33/126	(79.2)	86/410	(82.7)	.94
Consolidate Debts	89/629	(87.6)	250/1660	(86.9)	-.48
Vacation, Education, and Tax Payment	29/174	(85.7)	209/996	(82.7)	-1.14
Business	4/69	(94.5)	23/390	(92.7)	-.61+
Other	135/1076	(88.9)	474/3459	(87.9)	-.87
Total	934/7915	(89.4)	2999/25272	(89.4)	-.14

"?" Means no new or used car security for the auto loan was indicated.

*Positive values indicate that the proportion of male charge-offs (Pmb) is lower than the proportion of males who repaid their loans well (Pmg). Thus, significant negative signs indicate that women were relatively disadvantaged, while significant positive signs indicate that men were relatively "disadvantaged," in the sense that they were significantly less likely to default then the other sex.

**Significant at the 99 percent level (for two-tailed tests).

+ Individual t-statistics for these loan types are of limited validity. Because of the low number of charged-off loans of these types and the high percentage of males in the population, the random sampling variance is sufficiently large that the normal approximation of our data is questionable. See Cochran [2].

[9] It would not be useful for redlining studies, however, if absolutely no loans were made in a given area (see footnote 5).

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APPENDIX

Sex-Related Differences in Consumer Loan-Loss-to-Credit-Advanced Ratios and in Causes of Default

I. Because our model must assume that loan losses for a given type of loan are roughly equal regardless of sex, Table A-1 was constructed from available data on loan losses to test that proposition. Because of the sketchy nature of the data, i.e., many loan officers did not report the amount charged-off on most defaulted loans, no rigorous statistical tests were possible. However,, the available data do suggest that aggregate loan charge-offs for both males and females, and for most types of consumer loans, do tend to fall in a relatively narrow range (i.e., 60±10 percent) relative to the total amount of credit advanced on charged-off loans.

Major discrepancies (i.e., discrepancies in excess of 10 percentage points) exist in male and female loan-loss-to-credit-advanced ratios only for new car loans (where loss ratios for loans to females are 18 percent higher than loss ratios for loans to males),home improvement loans (where loss ratios on loans to females are 27 112 percent higher than loss ratios on loans to males-but only a relatively small amount of female home improvement loan losses were reported) and vacation loans (where loss ratios on loans to females were substantially lower than loss ratios on loans to males but losses on only a very limited number of loans to females, possibly only one loan, were reported).

II. Turning to causes of default, data from the first 30,000 sample loans were analyzed to determine if causes of consumer loan default varied significantly by sex. Losses were tallied for males and females by reported cause of default, and a X^2 test was run to see if male and female loss distributions could be viewed as being independent, rather than obtained from the same distribution.

The results of that tabulation and test are presented in Table 2. They indicate that a significant difference exists in the distribution of reported causes of default for males and females. However, further analysis of the table suggests that the difference is ascribable almost totally to the fact that women are much less likely to default due to marital breakups--possibly because in 1966-70, most married couples obtained credit in the husband’s name. Had that reason for default (marital breakup) not been considered, male and female defaults would not have been distributed in a significantly different manner.

Appendix Table 1: Available* Data on Male and Female Loan Charge-offs and Ratios of Charge-offs to Initial Credit Extensions, 1966-70

Type of Loan	Borrower Sex	Amount of Losses	Ratio of Losses to Amount of Advanced (%)
New Auto	M	$2,400,914	51.25
	F	11,859	69.24
Used Auto	M	1,393,591	52.04
	F	N.A.	N.A.
"?" Auto	M	238,634	63.68
	F	36,263	64.06
Furn. & Appl. And Radio, TV, Hifi	M	350,314	56.79
	F	3,078	47.82
Plane, Boat, M.Home	M	127,442	61.40
	F	6,734	64.92
Home Improve.	M	879,676	47.83
	F	9,316	75.17
Medical	M	61,077	63.44
	F	N.A.	N.A.
Consol. Debts	M	497,960	70.76
	F	1,803	63.64
Vacation, Education, and Tax Payment	M	847,728	64.49
	F	702	20.31
"Business"	M	72,855	68.80
	F	48,859	60.41
All Other	M	811,045	68.27
	F	11,765	71.38
Total	M	6,918,235	54.14
	F	130,379	63.11

* Not all respondents reported data on loan charge-off amounts, possibly because the amount was not readily accessible to the reporting loan officer, as adjustments must be made to eliminate unearned precomputed interest from charged-off loan payment obligations before actual charge offs can be calculated.

Appendix Table 2: Causes of Bank Loan Charge-offs by Sex

		Male			Female		
Causes of Charge-off	**Total # (%)**	**# Actual**	**# Expected**	**X^2 Component**	**# Actual**	**# Expected**	**X^2 Component**
Accident or Illness	492(7.4)	423	440.99	0.739	69	51.01	6.345
Reduction in Income (for other reasons)	615(9.3)	534	55.24	0.539	81	63.76	4.662
Too much debt	878(13.2)	803	786.97	0.327	75	91.03	2.823
Marriage breakup	371(5.6)	357	332.54	1.799	14	38.46	15.556
Skipped Out	1,234(18.6)	1,105	1,106.06	0.001	129	127.94	0.009
Bankruptcy	608(9.2)	564	544.96	0.665	44	63.04	5.751
Incomplete Info on borrower	43(0.6)	39	38.54	0.005	4	4.96	0.043
Falsified Application information	30(0.5)	26	38.54	0.029	4	3.11	0.255
Other (not specified)	2,365(35.6)	2,097	2,119.80	0.245	268	245.2	2.120
Total	6,636(100.0)	5,948		4.349	688		37.564
Total X^2					41.913*		

* Significant at the 95% level.