Improving the Selection of Credit Risks: An Analysis of a Commercial Bank Minority Lending Program

by

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This paper examines the performance of Philadelphia's eight-bank minority loan program, The Job Loan and Urban Venture Corporation of Philadelphia (JLC),[1] and assesses its ability to select good credit risks from its total minority loan applicant pool. JLC is a non-profit corporation that was created in April, 1968 by eight Philadelphia commercial banks for the purpose of issuing and guaranteeing loans to minority entrepreneurs. Through January 1970 (the time through which the data used in this study were gathered), JLC processed 848 loan applicants, of whom 290 were approved, and received approximately three million dollars in loans.

The key issue explored by this paper - how does a bank differentiate between potentially good and potentially bad credit risks - goes beyond the questions raised by the examination of a single program's performance. To properly evaluate the JLC program's ability to select good credit risks, a generalized method for selecting potentially superior loan customers had to be developed. This methodology, as developed here and applied to JLC, has potential applications in other minority-oriented loan programs as well as other non-minority credit operations. Finally, the findings about JLC bear upon a turbulent and extremely important contemporary debate - the viability of black capitalism and the possible role of utilizing private sector capital to finance it.[2]

This paper is presented in four sections. In Section I, the functions and purposes of the JLC loan program and its loan performance are outlined in general terms. Section II delineates the design for

an empirical approach for the analysis of the JLC Program. Section III discusses empirical findings. In the final section, these findings are placed in the broader context of the black capitalism debate.

I. The JLC Program: Functions, Purposes, and Loan Performance

The JLC program functioned primarily as an intermediary between the banks and their potential minority loan customers, an intermediary that was capable of providing services as well funneling would-be businessmen (who had been unable to borrow through regular banking channels) into the JLC loan stream. JLC did pre-loan screening and loan applications packaging, and, to a lesser degree, provided post-loan technical assistance. Another important function that JLC has served, and perhaps the fundamental reason for its origin, was the provision of an "institutionalized mechanism" that would not only allow a pooling of resources available for lending to minority businessmen, but would also spread the risk burden of each bank. Risk-spreading was accomplished by a "loan guarantee" program in which the eight banks agreed to participate on a proportionate basis, according to the size of their assets; a target loss rate that was acceptable to all banks in the program was determined; JLC, in conjunction with the appropriate lending officer at each bank, allocated the loans among minority applicants. When a loan authorized by JLC and granted by one of the participating banks failed, JLC would sell notes to all the banks -- in proportion to their size -- and would use the funds from the sale of the notes to cover the loan loss. Thus, JLC did not directly grant loans, but served as an allocative vehicle for dispersing compensation to banks in case of loan write-offs, thereby spreading the risk and the costs of a write-off among the banks.

The efficiency and profitability of the JLC operation is, of course, directly related to the ability of loan officers to differentiate between loan applicants who ultimately would have been good or bad loan customers.

This study will focus upon the development of a tool to accomplish more precise measurement of the differentiation between potentially GOOD and BAD loan applicants. The refusal to issue a loan to a person who would have been an intrinsically GOOD customer is defined as a Type I error. The issuance of a loan to a person who ultimately is a BAD account is a Type II error of the credit decision. Theoretically, the refinement in the banks' capabilities to differentiate between loan customers will create a reduction in the incidence of Type I and/or Type II errors.[3]

The first step, of course, is to define carefully the meanings of GOOD and BAD. In the discussion about JLC, GOOD will be defined to mean a loan whose repayment is (at least) on schedule; all others will be considered BAD. Using this definition, as of January 1970, of the 290 loan recipients, 122 (42 percent) would be considered GOOD and 168 (58 percent) would be considered BAD. Table 1 shows the loan status for the JLC program in terms of the length of time of repayment delinquency.

Table 1: Loan Repayment Performance
-by Length of Loan Repayment Delinquency

Loan Repayment Status	Proportion of Loans		No. of Loans
Current (Payment on time)-GOOD	.420		122
Less than two months behind-BAD	.166		48
More than two months behind-BAD	.272	.580	79
Repurchased (Write-off) - BAD	.142		41
	1.000		290

This distinction between GOOD and BAD may appear overly stringent or arbitrary. For example, while it is possible to argue that a loan that is, say, less than two months behind in its scheduled repayments, either may return to current status or, in any case, eventually may be repaid in total, this does not appear to be what happens. More typically, once a JLC loan falls behind in its scheduled repayment plan,

the loan repayment status worsens. Of course, some loans that were classified as GOOD as of January 1970 undoubtedly in time will turn BAD. Finally, no matter what definitions of GOOD and BAD are utilized, it is clear that the JLC program's repayment performance record as a whole is very poor relative to other general bank loan functions. Therefore, from the banks' (and probably the minority communities') points of view, the need to find improved methods for differentiating between GOOD and BAD credit risks in the pool of minority loan applicants is real.

II. The Model for Empirical Analysis of JLC[4]

a) The Theoretical Structure

As the ability to estimate P(G), the probability that a loan applicant will be a GOOD loan customer, increases, the bank's risks (expected profits) created by its involvement in a loan program, such as JLC, will be reduced (increased). It is hypothesized that the probability that a loan applicant will be a GOOD customer is related to his credit-worthiness and the terms of the loan. There are credit important characteristics C_i that may consist of personal characteristics of the loan applicant and/or characteristics about the business for which the loan is being sought. These credit important characteristics act as a surrogate for the applicant's credit-worthiness. The loan terms offered a potential customer are assumed to be a function of C_i and the behavioral characteristics of the banks involved in the loan program, BK. The bank variable enters the loan term offer function because banks are assumed to differ in many ways, including their capabilities for screening risky minority loan applicants and post-loan servicing and follow-up. These differences among banks are, typically, exogenous to the minority loan program; though they affect the banks loan offer behavior with regard to minority loan applicants.

In general, one would consider loan size, the loan repayment maturity, and the loan interest rate to be the principal loan terms. However, for the empirical analysis of JLC, only the loan size, LS, will be relevant as a loan term variable because virtually all JLC loan customers:

(1) were given loans at the then current program rate of interest, usually about one percent below the contemporary prime rate; and

(2) received very similar non-price loan terms. For example, the maturity period for over two-thirds of the loans was five years; and over ninety percent of the loans were for periods ranging from two to five years.

Put differently, the interest rate and non-price loan terms (except the loan size) for the JLC loans were relatively invariant between loan recipients and over the survey data period. The loan size requested and, in the case of loan approval, received by the applicant were endogeneous vaiables in the JLC screening and lending process.

This hypothesized behavioral model describes the structure of a simultaneous equation system such as (1),

$$P(G) = f\ (C_i, LS)$$
$$LS = g(C_i, BK) \qquad (1)$$

Where f and g are general functions. It should be emphasized that BK is a pre-determined excluded variable from the first equation of (1). The analysis that follows will focus primarily upon the estimation of the first structural equation of (1). Note that P(G) is part of a simultaneous equation system, but is identified.[5]

b) The Multivariate Statistical Model

The structural system, represented by equations (1) above, can be estimated by Two-Stage Least Squares.[6] The resulting linear relationships have two endogenous variables LRP (Loan repayment performance) and LS (loan size).

The second stage of the statistical model will yield (2):

$$(LRP_j) = \alpha + \beta (LS_j) + \sum_{i=1}^{m} \gamma_i C_{ij} + e_j \qquad j = 1, \ldots, n \qquad (2)$$

where the dependent variable, LRP, resembles a dummy variable because it is qualitative.[7]

$$LRP = \left\{ \begin{array}{l} 1, \text{ if the loan repayment performance is considered satisfactory:GOOD} \\ 2, \text{ if the loan repayment performance is considered unsatisfactory:BAD} \end{array} \right\}$$

The subscript j represents the j^{th} loan applicant with personal and business characteristics $C_{ij}(i = 1, \ldots, m)$, which are the exogenous variables; e_j is the residual term.

$\hat{LS}_j$ is the estimate for loan size generated from the first stage of the Two Stage Least Squares estimation. Since the instruments of the first stage are C_i and BK, equation (2) will be identified.[8] This estimation method will produce consistent estimators of α, β, and γ_i $(i = 1, \ldots, m)$. For each individual, E(LRP), for a given set of LS and C_i, is the conditional probability of LRP. That is, the "calculated" LRP will be the conditional probability of an individual being GOOD, P(G), given his personal and business attributes and the size of loan received.

However, the above model is not totally satisfactory. First, the calculated values of LRP may fall outside the [0,1] interval, which makes a probability interpretation unappealing. This is acceptable, however, if the LRP calculation is interpreted as an "index" of loan repayment performance, resembling a probability measure. Higher calculated values of LRP represent higher expected probabilities for a GOOD customer. Second, the two-stage leastsquares procedure assumes that the variance is homoskedastic,[9] which is clearly untrue. Therefore,

the estimates of the coefficients will not be efficient. (We do not attempt to resolve this latter statistical problem in this paper).[10]

There are many previous studies that in various contexts attempt to develop credit-evaluating schemes, especially by using multiple discriminant analysis (MDA). Briefly, two stage least squares is preferred to MDA for the study of the JLC program for three principal reasons. First, this analysis is concerned with predictive powers of the model in terms of GOOD and BAD as well as the underlying economic-causal structural relationships. MDA and two stage least squares, as predictive tools, can be used to distinguish between populations (e.g., GOOD and BAD) very accurately. However, the MDA function can be tested as a whole to see if the populations are distinct; but the effects of individual independent variables on this separation of populations can not be statistically tested.[11] Two stage least squares, on the other hand, can be utilized to assess the relative contribution of independent variables on the probability estimator. Second, two stage least squares is specifically designed to estimate economic structure, explicitly accounting for the hypothesized simultaneity between the dependent and independent variables. This is clearly beyond the purview of MDA. Third, it is usually assumed in MDA that the explanatory variables are continuous with a priori known distributions.[12] Two Stage Least Squares, as discussed above, requires assumptions about the disturbance terms, and can utilize, with no difficulty, qualitative independent variables (i.e., dichotomous dummy variables).

III. Empirical Analysis of the JLC Program

The discussion of empirical findings is presented in the following four sub-sections:

a) Loan Repayment Performance - An improved technique for loan applicant selection will be estimated and tested.

b) DeFacto Loan Applicant Selection - A model will be estimated that "simulates" the loan selection procedures used by JLC; it will be compared with the "optimal" loan applicant selection technique developed in a)

c) JLC Loan Applicant Selection Over Time - The changes in the loan applicant selection process over time will be studied in an attempt to analyze if JLC "learned by doing."

d) Business Neighborhood Analysis - The inter-relationship between business loan repayment performance and certain socio-economic neighborhood variables in which the business was located will be explored.

Two general points about the inter-relationship between the empirical results and the data should be noted. First, Appendix A enumerates the thirty-seven variables that were available from the loan applicant data. The "best" results usually required only a few of the independent variables. This is apparently consistent with earlier credit decision/loan evaluation studies.[13] Second, the accuracy of the predictive models depends on the appropriate selection of independent variables and the extent to which these variables, as a group, explain the variation in the dependent variable. While on theoretical grounds the existence of "significant" multicollinearity among the independent variables can explain the need for only a few explanatory variables for the analysis, the JLC data does

not possess an overwhelming amount of multicollinearity.[14] Moreover, potentially harmful multicollinearity frequently could be circumvented by transforming the original data, especially into dummy variable forms. Of course, multicollinearity is acceptable when the main purpose for the regressions is prediction; this is not true for the study of the underlying economic structure.

a) Loan Repayment Performance

JLC in conjunction with the eight participating banks approved 290 of 848 loan applicants, rejected 306 applicants, and made no decision on the balance because the applications were withdrawn. Using a random sample of 145 of the 290 JLC loan recipients, an improved loan applicant selection technique, based upon the identification of the characteristics that were associated with GOOD loan performance, was devised. The hold-out sample, the other 145 JLC loan recipients not utilized in the development of the model, will be used for a test of the predictive accuracy of the empirical findings. This method avoids the potential "sample bias" problem introduced by testing the model on the data that was used for its empirical calibration. The best two stage least squares estimate for LRP using the first sub-sample of 145 loan recipients was:

$$\begin{aligned} LRP = {} & .04 + \underset{(3.63^{**})}{.02LS} + \underset{(2.88^{**})}{.02\ DATE} + \underset{(2.37^{**})}{.21EE} \\ & + \underset{(1.69)}{.02TR} + \underset{(1.30)}{.23\ RESTM} \end{aligned} \qquad (3)$$

$$\bar{R}^2 = .51$$

LS is the loan size in thousands of dollars;

TR is the total resources (annual income from all sources plus accumulated wealth) in thousands of dollars;

EE is a dummy variable for employment experience (1 if employment experience is seven years or longer);

RESTM is a dummy variable for years at current residence (1 if resident at same address two years or more);

DATE is the date the loan was issued to the applicant (DATE = 1 for April, 1968; DATE = 2 for May, 1968; etc.);

(The student - t values for the coefficients are in parentheses;

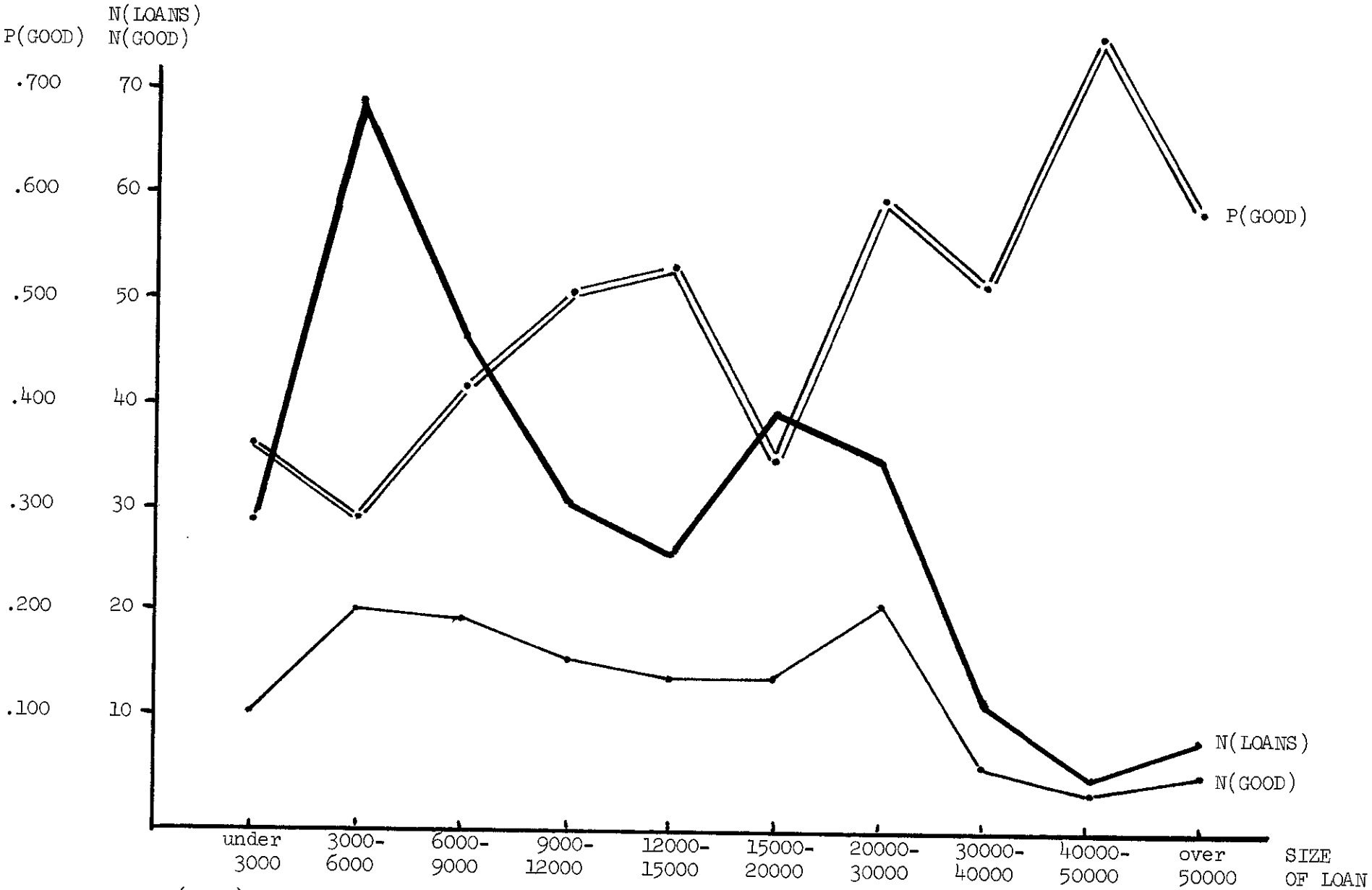
** and * denote 1 percent and 5 percent significance levels, respectively).

Equation (3) indicates the variables that are important predictors of loan repayment performance:

i. As shown in figure 1, the size of the loan and P(GOOD) are positively correlated. Also, in terms of the loans granted through JLC, there were two fairly distinct groups ($9,000 to $15,000 and over $20,000) that seemed to have better loan repayment performance. This is consistent with equation (3) which shows loan size to be an important determinant of the loan repayment performance. In particular, larger loans correlate with superior loan repayment performance. This analysis can not distinguish between three (not necessarily mutually exclusive) hypotheses, which might explain the correlation: (a) there might be economies of scale in the businesses which received loans; or (b) there may be loan screening by the banks and JLC when larger loans are requested; or (c) there may be at least two intrinsically different loan repayment populations in the sample data.

ii. Another source of ambiguity is created by the presence of the loan issuance DATE variable. Table 2 subdivides the loan recipients by performance into eleven sub-periods.[15] On average, more recent loans

Figure 1: The Relationship Between Loan Size and Successful Loan Repayment Performance



P(GOOD) = PROBABILITY OF LOAN REPAYMENT AHEAD OR ON TIME
N(LOANS) = NUMBER OF LOANS APPROVED
N(GOOD) = NUMBER OF LOANS WITH REPAYMENT AHEAD OR ON TIME

appear to have better performance records. This is corroborated statistically by the simple regression, equation (4), with RATIO (the proportion of GOOD loans as of January 1970 to total loans issued during each sub-period) as the dependent variable and PERIOD (the sub-period for which the RATIO holds) as the independent variable:

$$\text{RATIO} = .15 + .06\ \text{PERIOD} \qquad (4)$$
$$(6.56^{**})$$

$$\bar{R}^2 = .81$$

Durbin Watson Statistic = 2.29

[Note: PERIOD is the sub-period for which the loans were issued (1 = April 1968, 2 = May - June, 1968, etc.)]

Table 2 is consistent with the hypothesis that JLC and the banks have improved in their ability to discriminate between GOOD and BAD loan applicants. However, since the data represent a varied time horizon for the different loans, it is also possible that more recent loans only appear to be systematically better from a repayment view because they have not had sufficient time to "go bad." In other words, the performance data for loan recipients in this study contains a serious cross-sectional - time series pooling effect. In fact, the use of the DATE variable is an attempt to control for this problem. These two hypotheses, representing alternative explanations for the temporal effect, can not be extricated by this model, but will be examined more closely in subsection c) below.

Table 2: Loan Performance (As of January 1970)
By Sub-period of Loan Issuance

Loan Issuance Sub-period	Total number of Loans Issued	Number of GOOD loans	Number of BAD loans	Ratio GOOD/Total
April, 1968	18	2	16	.111
May-June, 1968	39	10	29	.256
July-Aug., 1968	46	17	29	.370
Sept.-Oct., 1968	31	10	21	.323
Nov.-Dec., 1968	26	16	10	.615
Jan.-Feb., 1969	39	16	23	.410
Mar.-Apr., 1969	24	10	14	.417
May-June, 1969	23	14	9	.609
July-Aug., 1969	15	10	5	.667
Sept.-Oct., 1969	15	11	4	.733
Nov.-Dec., 1969	8	6	2	.750
Totals	284	122	162	.429

iii. Finally, the employment, residency, and resources variables are very plausible predictors. Employment experience and residency are "traditional" characteristics of personal stability, and are thought to be good indicators of credit-worthiness. Larger total resources indicate a pre-application ability to accumulate wealth which seems related to those entrepreneurial skills needed for business success.

Using equation (3) as a hypothetical loan issuance decision-making tool and the hold-out sample of 145 loan recipients, it is easy to illustrate the magnitude of type I and type II errors that would be

generated. Recall that for each loan applicant j, the LRP_j calculated will be an index of the expected value of the probability of loan repayment performance, with higher values related to better expected performance. If arbitrary cut-off scores were set for accepting or rejecting applicants, the loan decision performance in terms of, among other things, the magnitude of type I and type II errors could be calculated. Table 3 shows the cumulative LRP derived from equation (3) as well as the type I and type II errors of the loan decision. A cursory examination of this table indicates that the LRP estimator does discriminate between GOOD and BAD loan repayment performance.

The discriminating power of the calculated LRP can be tested formally by examining the cumulative distributions of GOODS and BADS with a Kolmogorov-Smirnov test. This test indicated that the distributions for GOODS and BAD derived from equation (3) were statistically significantly different beyond the .001 level.[16]

It should be remembered that the ability to differentiate between GOODS and BADS is only one part of the loan issuance decision, as discussed above. In order to determine the optimal (i.e., expected return-risk) loan portfolio, one needs to know not only the probabilities of GOOD and BAD but the potential costs and gains derived from correct and incorrect decisions. For instance, using table 3, a loan issuance decision-rule that set the cut-off score for calculated LRP = .380 would reject 78% of the BADS and accept 65% of the GOODS. While this procedure would accept 79 of 122 GOODS and only 37 of the 168 BADS (i.e., Type I error is 35% and Type II error is 22%), it is impossible to evaluate in terms of profitability the merits of such a decision-rule without comparative potential cost-gain data of GOODS versus BADS.[17]

Table 3: Cumulative Probability Distribution For Hold-out Sample

Calculated LRP Cut-off Scores*	Percentage of Cumulative GOODS Only	Type I Error**	Percentage of Cumulative BADS Only	Type II Error***
.020	1	1	2	98
.080	3	3	25	75
.180	16	16	45	55
.280	23	23	63	37
.380	35	35	78	22
.480	41	41	90	10
.580	67	67	93	7
.680	75	75	95	5
.780	93	93	98	2
.880	97	97	99	1

* Hypothetical decision-rule: Issue loan to any applicant who scores above the calculated LRP cut-off score.

** Percentage of GOODS eliminated by using cut-off score at left.

*** Percentage of BADS accepted by using cut-off score at left.

b) De Facto Loan Applicant Selection

The performance of the loan applicant selection process utilized by JLC can also be examined through the development of a statistical model that is designed to explain which loan applications were accepted and rejected. Using the 290 approved loan applications and the 306 rejected loan applications (the withdrawn loan applications, in general, had much data missing, and therefore were omitted from this analysis), and a reinterpretation of equations (1) and (2), an appropriate model can be devised to explain the de facto loan applicant selection process. As before, two-stage least squares will be employed as the estimation procedure. Again, there are two endogeneous variables in the JLC loan application selection process. First, the loan size is determined through the pre-loan screening, which, among other things, attempts to package a feasible loan request. Second, there is the one-zero dichotomous dependent variable, indicating if the applicant's loan request was approved or rejected. The estimate of the dichotomous dependent variable can be interpreted as a probability-index for the loan approval, or, in other words, the probability of a favorable outcome for the loan application. The Loan Application Approval (LAA) was statistically fitted using two stage least squares as:

$$\begin{aligned} LAA = {} & -.06 + \underset{(1.37)}{.05AGE} + \underset{(1.22)}{.08MR} + \underset{(3.01^{**})}{.17EE} + \underset{(3.21^{**})}{.33ME} \\ & + \underset{(1.99^{*})}{.18SBE} + \underset{(2.99^{**})}{.02B} + \underset{(3.73^{**})}{.28PR} + \underset{(3.68^{**})}{.10ED} + \underset{(4.83^{**})}{.23LS} \end{aligned} \qquad (5)$$

$$\bar{R}^2 = .53$$

Statistically, nine variables appear to have been important to JLC for determining the outcome of a loan application:

i. Individuals in the thirty to forty-nine year-old age group have better chances for approval of their applications (AGE is a dummy variable: one for age between thirty and forty-nine, zero otherwise).

ii. Married individuals (MR) are more likely to receive loans, (MR is a dummy variable: one for married; zero otherwise).

iii. Any employment experience (measured in years, EE) is, also, positively correlated with loan approval. This variable was found to be similarly significant in the loan repayment performance analysis.

iv. Managerial experience (ME) is positively correlated with loan application approval. (ME is a dummy variable: one for any experience; zero otherwise).

v. Special business education (SBE) increases the chances for loan approval. (SBE is a dummy variable: one for any education; zero otherwise).

vi. Business located in black areas (i.e., populations of greater than 50% black) are more likely to receive loans from the JLC program. (B is a dummy variable: one if business neighborhood is more than 50% Black; zero otherwise).

vii. Business with payrolls between $750 and $3000 are more likely to receive loans. (PR is a dummy variable: one if payroll is between $750 and $3000 per month; zero otherwise).

viii. Larger Equity/Debt ratios are positively correlated with loan approvals. (ED is a decimal).

ix. The loan size (LS) is extremely important; however, in an opposite fashion to the loan repayment performance measure developed above. That is, smaller loan requests are more likely to be approved than larger loans, while it has been demonstrated that larger approved loans have superior repayment records. (LS is a dummy variable: one for loans of $6,000 or less; zero otherwise).

The significance of the dummy variable for LS in equation (5) probably reflects that applications for small loans (i.e., under $6000) may have been screened less rigorously than larger loan requests.

Also of note are some of the variables, which were specifically tested, and were found to be statistically unimportant in the JLC loan applicant selection procedures. They were: (1) the age of the business; (2) the length of ownership of the business by the loan applicant; (3) the income of the neighborhood (see the analysis below in subsection d); (4) the ratio of the loan size requested to the total worth of the business; (5) the sales to assets ratio of the business; (6) the general educational experience of the applicant; (7) the applicant's home-ownership status; and (8) the yearly income level of the applicant.

Equation (6) is the second stage equation derived from a two stage least squares estimation for the 290 actual loan receipients with LRP as the dependent variable in the second stage and the nine independent variables of equation (5) as the explanatory variables. It is designed to compare the loan approval procedure used by JLC (derived through equation (5)) with the optimal loan procedure developed above in equation (3).

$$LRP = .04 + .09\ AGE + .03\ MR + .25\ EE \quad (6)$$
$$(0.95) \quad (1.11) \quad (2.21^{**})$$

$$- .03\ ME + .04\ SBE + .03\ B + .21\ PR$$
$$(1.66) \quad (1.37) \quad (1.70) \quad (1.61)$$

$$- .15\ LS$$
$$(3.97^{**}) \qquad \bar{R}^2 = .24$$

First, the total fit of equation (6) ($\bar{R}^2 = .24$) is lower than that of equation (3) ($\bar{R}^2 = .51$). Second, all variables, except EE and LS, are <u>not</u> statistically significant at the 90% level. EE appears in equation (3) and equation (6), and is statistically significant in a similar way. However, LS (though defined slightly differently in equations (3) and (6)) appears to imply a "perverse" loan applicant selection process by JLC. In equation (6) and equation (3) larger loans were associated with better loan repayment performances; equation (5) demonstrates that smaller loans were given preferential treatment in terms of the likelihood of applicant approval.

In sum, one would have to conclude that overall the JLC de facto loan applicant selection process has emphasized on balance <u>personal</u> rather than <u>business</u> characteristics. The variables which explain the actual selection process are not well-related to the successful repayment performance predictors developed in a) above. In fact, in the case of loan size, there appears to have been a selection process which by selecting small loans is biased <u>against</u> choosing potentially successful loan applicants.

c) JLC Loan Selection Over Time

It has been argued that the JLC program should not be evaluated on the basis of loan repayment performance measures over the entire time period. For one thing, the perceived objectives of JLC by the banks involved in the program may have changed over time. The program was

established in the milieu of ethnic and political unrest during 1968, and during its early existence may have been intended (at least) partially as a public relations device for the banks. In time, however, it has been claimed that the banks wished to convert JLC into a successful profit-oriented minority loan program. It is further argued that bankers learned from early lending mistakes. If these claims are accurate, the examination of the entire time period may obscure the progress made in the more recent history of JLC. In this section, the hypotheses that (1) the de facto loan applicant selection criteria changed over time and (2) the new renditions of the loan applicant selection criteria are superior to the earlier versions will be tested.

The data set consisted of 584[18] loan applications, which had been approved or rejected. The data was subdivided into three sub-periods: April through August, 1968 -- 206 applications; September, 1968 through April 1969 -- 242 applications; and May through December, 1969 -- 136 applications. The two-stage least squares model developed in equations (1) and (2) has been estimated for each of the three time subsets of data. The results are shown in Tables 4 and 5.

Table 4. Estimates Explaining Early Sub-periods - Loan Selection Analysis Over Time - I

(Dependent Variable for Each Sub-period is L.A.A.)

Time Period	Constant	MX1	ED	PR	LS	$\bar{R}^2$
4/68 - 8/68	.11	-.09 (1.72)	.25 (2.00*)	.56 (4.86**)	.31 (4.03**)	.38
9/68 - 4/69	.17	-.47 (1.01)	.57 (9.30**)	.62 (5.22**)	.24 (1.96*)	.49
5/69 - 12/69	.07	-.04 (0.07)	.46 (2.98**)	.31 (3.01**)	.10 (1.96*)	.07

MX1 = The proportion of non-whites in business neighborhood (in decimals).
ED = Equity - Debt ratio for the firm.
PR = Dummy variable for payroll: $3,000 - $750 = 1; 0 = otherwise.
LS = Dummy variable for requested loan size: 6,000 or less = 1; 0 = otherwise.

Table 5: Estimates Explaining Later Sub-periods - Loan Selection Analysis Over Time - II

(Dependent Variable for Each Sub-Period is L.A.A.)

Time Period	Constant	MX2	PD	ED	HM	TVBA	LS	$\bar{R}^2$
4/68 - 8/68	.51	-.03 (0.10)	-.48 (3.11**)	.37 (3.03**)	.22 (4.45**)	-.02 (0.28)	.33 (3.67**)	.11
9/68 - 4/69	.13	-.07 (0.36)	.24 (1.30)	.57 (4.29**)	.05 (0.61)	.17 (3.18**)	.23 (1.92*)	.20
5/69 - 12/69	-.04	-.22 (1.11)	.39 (1.21)	.53 (1.78)	.05 (0.77)	.43 (2.02**)	.04 (2.02**)	.46

MX2 = The difference in racial composition between residential area and business area (in decimals).

PD = Dummy variable for personal debt, current monthly debt obligations: $450 or more = 1; 0 = otherwise.

ED = Equity - Debt ratio of the firm.

HM = Dummy variable for home ownership: Own (purchasing) = 1; 0 = rents.

TVBA = Dummy variable for total value of business assets: $10,000 or more = 1; 0 = otherwise.

LS = Dummy variable for requested loan size: 25,000 or less = 1; 0 = otherwise.

Table 4 contains the estimated coefficients for the set of variables which best explain (in terms of total fit, $\bar{R}^2$) the total variation in the JLC loan applicant selection process for the first and second sub-periods. Note that in Table 4 the coefficient of determination ($\bar{R}^2$) declines dramatically for the last sub-period. The opposite occurs in Table 5. The latter table contains the estimated coefficients for the set of variables which best explain the total variation ($\bar{R}^2$) in the JLC loan applicant selection process for the last sub-period. These tables are consistent with the hypothesis that the JLC criteria for loan applicant selection has changed over time.

Both of these tables suggest that business variables such as the magnitudes of the equity-debt ratios are statistically more important in the more recent loan application decisions. Table 4 indicates that smaller loan requests, though still given preferential treatment, are less likely to be granted in the later sub-periods. Moreover, Table 5 shows that larger firms (i.e., those with larger total business assets) become more preferred loan customers over time. The importance of the home ownership and payroll variables appears to diminish over time.

In order to test the hypothesis that the sub-period loan applicant selection criteria in Tables 4 and 5 represent an improvement over time, the 290 actual JLC loan recipients were used in the two stage least squares model, similar to equation (6) above, with LRP as the dependent variable. When the early sub-period selection criterion independent variables were used (i.e., Table 4), the $\overline{R}^2$ was .20; when the latter sub-period selection criterion independent variables were used (i.e., Table 5), the $\overline{R}^2$ was .39. These results indicate that the changes over time in JLC loan applicant selection criteria are consistant with the improved loan applicant performance. Apparently loans were granted in terms of more traditional banking criteria in the later sub-periods. However, it is also clear that there might be additional improvement possible in the JLC loan recipient selection. In particular, loan selection should be more dependent on the employment experience of the applicant and the size of loan requested for the business (i.e., see the estimate for equation (3) above).

d) Business-Neighborhood Analysis

The proponents of black capitalism as well as other ethno-centered ideologies frequently advocate the establishment of minority enterprises situated within the most densely populated minority areas. The usual

economic justification for such an approach is derived from regional economic base theory: income earned by minority entrepreneurs in the minority "region" is likely to be spent and/or reinvested within the region, thereby fostering through the economic base multiplier continued economic expansion and development of minority groups.

It, therefore, is appropriate to ask: Are minority businesses more likely to be successful in particular types of neighborhoods? More specifically, how does the neighborhood's racial mix and/or neighborhood's income affect the likelihood that a minority entrepreneur will succeed? In order to examine the effect of neighborhood variables on the economic performance of the JLC loan recipients, it was necessary to create a sub-sample of loan recipient businesses that 1) existed in sufficient numbers within all geographical sub-areas of Philadelphia to permit statistical analysis and 2) had similar business characteristics in terms of operations that would not be themselves affected by location. It was decided that for the JLC loan recipients, the retail and wholesale businesses seemed to be best suited for this type of analysis. Using as data, therefore, the 144 JLC loans to retail and wholesale businesses, the effects of business location on loan repayment performance were explored.

Equation (7), using ordinary least squares, was estimated to examine this relationship between loan performance and business neighborhood.[19] The dependent variable (Y) is the ratio of successful to total JLC loan customers for each of the thirteen Philadelphia macro-neighborhoods.

$$Y = 1.16 + \underset{(3.06^{**})}{1.35}\ \Delta\ MIX - \underset{(3.10^{**})}{.18}\ INC \qquad R^2 = .64 \qquad (7)$$

where Δ MIX is the percentage change in the racial composition of the neighborhood (going white to black) between 1960 and 1970;
INC in the median income (census data) for 1960 in the neighborhood.

It appears that the retail and wholesale minority businesses considered here have better repayment performances if the business neighborhood is 1) turning black and 2) relatively poor. Conversely, it seems that small minority retail and wholesale businesses will not do well in the richer, integrated areas. While these results appear to be consistent with the economic-base ideology, it is plausible that this, in part, may be explained by the hypothesis that the residents of poor, black neighborhoods have relatively low "shopping mobility." Therefore, the local stores may have at least a partial "spatial" monopoly that enhance profits and, ultimately, repayment performance on loans.

IV. The Upshot

a) Conclusions About the JLC Program

This study has empirically determined that by altering the JLC loan recipient selection criteria repayment performance could be improved. Five characteristics on the loan application were found to be the best statistical predictors of successful loan repayment for JLC loan recipients. These characteristics were:

1) the loan recipient received his loan toward the chronological end of the survey period of the JLC program;
2) the loan recipient received a relatively large loan;
3) the loan recipient had at least seven years of employment experience that was related to the type of business for which the loan had been sought;
4) the loan recipient had accumulated a relatively large personal net worth; and
5) the loan recipient lived at his current residence for at least two years.

The first characteristic might be erroneously interpreted to indicate that the loan recipient selection process improved over time as JLC and the participating banks "learned by doing." An analysis of the JLC loan applicant selection criteria from the pool of rejected and accepted loan applicants for three sub-periods of time revealed that the loan recipient selection criteria did change. However, neither the original nor the subsequent applicant selection criteria were well related to those found to be key to successful loan repayment performance. While smaller sized loan requests were more likely to be approved, loan repayment performance was better for larger loans (i.e., the second characteristic for a successful loan recipient). This analysis did not distinguish between two competitive explanations

for this: either larger loan requests are screened by JLC and the banks more carefully and/or larger loans supply the quantities of capital necessary to take advantage of economies of scale.[20] The third, fourth, and fifth characteristics of the successful loan repayer are more "traditional." They alledgedly demonstrate financial solvency and individual stability. Finally, it was discovered that the probability of successful loan repayment increased if a retail or wholesale business were located in a relatively low income neighborhood that was becoming black. This may, in part, be explained by the "Spatial" monopoly of ghetto enterprises.

This analysis, as in prior studies,[21] discovered that relatively few variables were required for the accurate prediction of credit performance. The variables that appear to be important predictors of credit-worthiness in these previous studies can be categorized into measures of fiscal performance, such as financial balance sheet data or financial ratios, and measures of stability/responsibility, such as the length of time employed. Clearly, the empirical findings for JLC loan applicant performance are ostensibly a blending of these two types of variables.

It is particularly interesting to note that Bates,[22] in a recent work that studied the experiences of the SBA minority lending program, achieved results that were, with two notable exceptions, consistent with those of this study. The Bates study, using MDA, found that financial measures, such as total assets of the business and outside net worth, and stability measures, such as work experience, are powerful predictors of GOOD and BAD loan repayment performance. However, the cross-sectional/time series effect, which has an important variate in the current study, was found to be a relatively small explanatory variable

by Bates. A more crucial difference between these two studies, however, is that Bates (as well as all the previous studies noted) in his analysis does not take into account that simultaneity may exist between loan terms and loan performance, and as a result erroneously does not use loan size as a predictor of performance.[23]

b) Minority Loan Programs and Minority Economics: The Broader View

One of the techniques currently espoused for increasing the participation of minority groups in U. S. economic activity is private sector capital lending to small minority businesses. Commercial banks have demonstrated interest in this type of arrangement, although the magnitude of lending has been small, and, in general, loan repayment performance has been poor.[24] The opponents of minority loan programs such as JLC contend, among other things, that:

1) Small minority-owned businesses located in the ghetto provide relatively low return - high risk investment opportunities.
2) Small minority-owned businesses generally are premised upon self-employment, which offers a secularly declining and relatively low rate of return to human capital.
3) Small minority-owned businesses are too often in retail trade, which is a declining sector with a particularly low rate of return.
4) Small businesses, in general, have no place in a modern technologically oriented economy because they can not take advantage of economies of scale.

These four claims are elements of the more fundamental issue: Are programs such as JLC appropriate for enchancing the future economic viability of minority groups? The validity of the four charges and the answer to this latter question can not be determined at this time. This analysis,

though a rudimentary step forward, demonstrates that minority loan programs may be able to learn from their mistakes, and over time improve their economic performance. However, it is not at all clear that this improved performance would be sufficient to induce private capital investments into minority enterprises.

Appendix A: Variables Used in JLC Analysis

The following is the list total of variables that were used for data analysis for this study:

a) The Personal Characteristics for each individual were:

(1) race
(2) sex
(3) age
(4) marital status
(5) ownership or renting of home
(6) number of years at current address
(7) location of residence
(8) income level of the residential area
(9) racial composition of the residential area
(10) rate of change of racial composition of the residential area
(11) educational background
(12) total value of personal property
(13) current average monthly personal income of applicant
(14) current average monthly debt repayment obligations
(15) other sources of funds available to applicants, including spouse's income, additional loans or rental income
(16) total of other sources of funds
(17) employment experience, defined as the length of time employed in the field of the loan being sought
(18) management experience in the field of endeavor, including supervision experience
(19) ownership experience in the field of endeavor, defined as financial control of the business
(20) experience in special business - education programs or training programs related to the business venture

b) The Business Characteristics for each individual were:

(1) type of business
(2) age of business, length of operation
(3) length of ownership of current business by each applicant
(4) income level in the neighborhood of the business site
(5) location of business
(6) racial composition of the neighborhood of the business site
(7) rate of change of racial composition of the business site
(8) scale of business at the time of each application: including total labor force, monthly total payroll, gross sales per month, total value of business assets, and estimated net worth
(9) scale of business more than six months after loan is approved, including total labor force, monthly total payroll, and gross sales per month
(10) purpose of loan
(11) type of collateral
(12) loan repayment terms
(13) loan repayment performance (data supplied by the participating banks)
(14) size of loan
(15) name of bank issuing loan
(16) amount of loan requested initially by applicant
(17) amount of loan suggested by JLC

Footnotes

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[1]The author wishes to acknowledge and thank the Human Resources Center of the University of Pennsylvania for its cooperation and assistance by providing the basic JLC data used in our study. Mr. Percy La Bohne of JLC and Mr. Norman Bitterman of the Central Pennsylvania Bank were also of great assistance. The Human Resources Center's Study entitled, "An Evaluative Study of the Job Loan and Urban Venture Corporation of Philadelphia," (October 1970) was extremely useful in the preparation of this paper.

[2]The debate about the viability of black capitalism and related issues has been quite heated. The following references represent a sample of the combatants in this debate.

a. Bernard M. Booms and James E. Ward, Jr., "The Cons of Black Capitalism," Business Horizons, Vol. XXXVIII, No. 4 (Autumn, 1969), pp. 629-643.

b. Theodore L. Cross, Black Capitalism (New York: Atheneum, 1969).

c. William F. Haddad and G. Douglas Pugh, eds., Black Economic Development (Englewood Cliffs, New Jersey: Prentice-Hill, 1969).

d. John F. Kain, "Housing Segregation, Negro Employment, and Metropolitan Decentralization," Quarterly Journal of Economics, Vol. LXXXII, No. 2 (May, 1968), pp. 175-197.

e. John F. Kain and Joseph Persky, "The Future of the Ghetto: I. Alternatives to the Gilded Ghetto," Public Interest, Vol. XIV (Winter, 1969), pp. 74-83.

f. Anthony H. Pascal, "Black Gold and Black Capitalism," Public Interest, Vol. XIX (Spring, 1970), pp. 111-119.

g. William K. Tabb, "Government Incentives to Private Industry to Locate in Urban Areas," Land Economics, Vol. XLV, No. 4 (November, 1969), pp. 392-399.

[3] Purists may be unsatisfied with this presentation because the ability to refine and reduce type I and type II errors is in general only part of the inputs needed to optimize the banks overall objective function in terms of the loan applicant selection. However, there are several sets of circumstances, all of which are likely to be consistent with the JLC situation, when refined probability estimators for loan repayment performance will be necessary and sufficient to determine optimizing bank behavior. First, if each loan account has roughly the same expected rate of return and is a relatively small part of the total bank loan portfolio, and if all loans are not perfectly statistically dependent, the reduction of type I and type II errors is clearly consistent with maximizing expected profits from the loan portfolio for a pre-specified "acceptable" risk level (i.e., this represents a bank loan portfolio diversification approach).

For the ultra-purist, expected profit maximization will be consistent with bank expected utility of wealth maximization if the objective function of the bank is linear or exponential in terms of wealth. That is, expected profit maximization by the minority loan program can be rationalized as expected utility maximization behavior under several plausible conditions. If the minority loan program represents a very small portion of the total bank assets, it is clear that the total profits generated by the bank are virtually unaffected by minority lending decisions. Put differently, the expected utility of the minority loan program is independent of changes in the bank's total profitability or wealth.

Formally, let Δ be the total profitability of the bank from all sources other than the minority lending program. Mathematically, if $U(\pi)$ is the utility index of the decision makers in the lending program, assumed to satisfy the expected utility hypothesis, and π is the program's profits, then there exists α and β (constants) such that:

$$U(\pi + \Delta) = \alpha U(\pi) + \beta$$

That is, under the expected utility hypothesis assumptions, $U(\pi)$ and $U(\pi+\Delta)$, where Δ is an arbitrary increment, will yield equivalent preference orderings in terms of the decision makers in the lending process, and all "measurable" utility preference orderings are unique, up to a linear transformation. Differentiating with respect to π and Δ, respectively, yields

$$U'(\pi + \Delta) = \alpha U'(\pi)$$

$$U'(\pi + \Delta) = \frac{d\alpha}{d\Delta} U(\pi) + \frac{d\beta}{d\Delta}$$

Let $\frac{d\alpha}{d\Delta} = a$ and $\frac{d\beta}{d\Delta} = b$, then it can be seen that

$$U'(\pi) - \frac{a}{\alpha} U(\pi) - \frac{b}{\alpha} = 0.$$

i. Jack Guttentag, "Credit Availability, Interest Rates, and Monetary Policy," The Southern Economic Journal, Vol. XXVI, No. 3 (January, 1960), pp. 219-228.

j. Donald D. Hester, "An Empirical Examination of a Commercial Bank Loan Offer Function," Yale Economic Essays, Vol. II, No. 1 (1962), pp. 2-57.

k. Donald R. Hodgman, "Credit Risk and Credit Rationing," Quarterly Journal of Economics, Vol. LXXIV, No. 2 (May, 1960, pp. 258-278).

l. Dwight M. Jaffe and Franco Modigliani, "A Theory and Test of Credit Rationing," American Economic Review, Vol. LIX, No. 5 (December, 1969), pp. 850-872.

m. G. W. Ladd, "Linear Probability Functions and Discriminant Functions," Econometrica, Volume XXXIV, No. 4 (October 1966), pp. 873-885.

n. Dileep Mehta, "The Formulation of Credit Policy Models," Management Science, Vol. XIV, No. 2 (October, 1968), pp. B30-B50.

o. J. H. Myers and E. W. Forgy, "The Development of Numerical Credit Evaluation Systems," Journal of the American Statistical Association, Volume 58, No. 3 (September 1963), pp. 799-806.

p. Y. E. Orgler, "A Credit Scoring Model for Commercial Loans," Journal of Money, Credit, and Banking, Volume II, No. 4 (November 1970), pp. 435-445.

[5]Carl F. Christ, Econometric Models and Methods (New York: John Wiley & Sons, 1966), Chapter 8.

[6]The properties of Two-Stage Least Squares are discussed at length elsewhere; for example, See A. S. Goldberger, Econometric Theory (New York: John Wiley & Sons, 1964), pp. 329-338, 357-364.

[7]The analysis can be extended to account for degrees of badness (and goodness) by a two-phase analysis. The first phase is the study we use in our analysis. The second phase would be for the group of bads only (LRP = 0) with a new dependent variable, the cost of each bad account, which, of course, is not constant. Then the information is combined to yield an expected value for the cost for each type of score when an account is bad. For a detailed discussion of this approach, see Janet A. Fisher, "An Analysis of Consumer Goods Expenditures in 1957," Review of Economics and Statistics, Vol. XLIV, No. 1 (Feberuary, 1962), pp. 64-71.

[8]Our approach is an adaptation of J. Johnston, Econometric Methods (New York: McGraw-Hill, 1960), pp. 221-228, 240-252, 259-264.

[9] See A. S. Goldberger, op. cit., pp. 232-236. By examing the two-stage least squares estimate, it is clear that it is heteroskedastic. The first stage of the two-stage least squares estimation yields $\hat{A}_{LS_j}$, the estimate of the other endogenous variable. Let X_j be row of the predetermined variables for the j^{th} person in the second stage; the row vector X_j consists of $(\hat{A}_{LS_j}, C_{1j}, \ldots, C_{mj})$. LRP is 0-1 dichotomous. Therefore, if e_j is the residual with the "classical" assumption that $E(e_j) = 0$, the distribution of e_j must be

Value of e_j	Probability of e_j
$-X_jB'$	$1 - X_jB'$
$1-X_jB'$	X_jB'

where $B = (\alpha, \beta, \gamma_1, \gamma_2, \ldots, \gamma_m)$

The variance is

$$E(e_j^2) = [E(LRP_j)][1 - E(LRP_j)]$$

since $E(LRP_j) = X_jB'$.

Therefore, the variance will differ according to the value of X_j. That is, the disturbance is heteroskedactic, varying systematically with $E(LRP_j)$ and, hence with X_j.

[10] Goldberger, op. cit., pp. 248-251, suggests a method for adjusting heteroskedastic disturbances by assuming that the diagonal of the second-moment matrix generated from the sample data is a "good" estimator for the population variances. Since the validity of such an assumption can not be assessed, this method is not used in this study. Unfortunately, Three Stage Least Squares, which would produce more efficient estimators than Two Stage Least Squares, can not be employed because it has been hypothesized that the Loan Size relationship of equations (1) is not identified. Therefore, given that Two Stage Least Squares when applied to equations (1) will produce consistent, but inefficient estimators, it is possible that the analysis will dismiss as statistically insignificant some independent variables that it should not. However, assuming the model is correct, those independent variables that are accepted as statistically significant with this estimation procedure clearly are.

[11] See Phoebus J. Dhrymes, Econometrics: Statistical Foundations and Applications, (New York, Evanston, and London: Harper and Row, Publishers, 1970), p. 76.

[12] Generally, the independent variables are assumed to be distributed multivariate normal. Gilbert, op. cit., demonstrates that dichotomous independent variables (i.e., non-continuously distributed variables) can be used in MDA, often without affecting the efficiency of the discrimination function.

[13]For example, see Orgler, op. cit., who uses only six variables for explaining the bank loan review process; and Altman, op. cit., who, using MDA, derives a predictor of corporate bankruptcy with only five variables, all of which are corporate financial ratios.

[14]Though "significant" multicollinearity is, in the final analysis, a matter of judgment, J. Johnston, Econometric Methods, Second Edition (New York: McGraw-Hill, 1972), pp. 159-168, outlines the effects of and several statistical tests for "significant" multicollinearity. This study has employed the methodology suggested by D.E. Farrar and R.R. Glauber, "Multicollinearity in Regression Analysis: The Problem Revisited," Review of Economics and Statistics, Vol. 49, No. 1 (February 1967), pp. 92-107, to test for significant multicollinearity problems.

[15]There were six loan recipients who received multiple loans in at least two sub-periods, and are therefore excluded from this analysis.

[16]See Sidney Siegel, Non-parametric Statistics (New York: McGraw-Hill Book Company, Inc., 1956), pp. 127-136.

[17]Of course, a dual cut-off score system can be used. Under such a system, if $LRP_j \leq S_1$, the applicant is automatically rejected; if $LRP_j \geq S_2$, the^{j}applicant is automatically accepted; and if $S_1 < LRP_j < S_2$, the^{j}applicant is subjected to further investigation before a decision is made. See Orgler, op. cit., for the problems and merits of a dual cut-off system.

[18]There were 12 loan applicants who had made multiple applications in at least two of the sub-periods, and were dropped from the data for this part of the analysis.

[19]It should be noted that other neighborhood variables, such as 1970 neighborhood incomes, changes in neighborhood incomes between 1960 and 1970, the racial mix by neighborhood in 1960 and 1970, and housing dilapidation variables,were tried, and found not to improve the total fit in equation (7).

[20]Andrew Brimmer and Henry Terrell, "The Economic Potential of Black Capitalism," A paper presented at the American Economic Association Meetings, New York, December, 1969. In their discussion, the authors note that there are significant economies of scale in minority-owned businesses, a result apparently consistent with this study.

[21]See for examples Altman, op. cit.; Benston, op. cit; Myers and Forgy, op. cit.; and Orgler, op. cit.

[22]T. Bates, "An Econometric Analysis of Lending to Black Businessmen" The Review of Economics and Statistics, Vol. LV, No. 3 (August 1973) pp. 272-283.

[23] Bates, op. cit., p. 278, appears to recognize implicitly that simultaneity between the loan size and loan repayment performance may exist: "While the mean values of loan amounts superficially suggest that the SBA may be handling high risk borrowers by restricting loan size, adjustment for firm size among the categories of current and delinquent borrowers refutes this notion....When loan amount is divided by total assets for each observation in the samples of current and delinquent Black businesses, respective mean values are 1.59 and 2.19....High risk borrowers apparently are not being under - financed by the SBA."

The conclusion above in light of the current study is very likely to be erroneous. First, delinquent firms in the SBA sample have mean total assets of less than one-half that of non-delinquent firms, and received loans that were two-thirds those received by non-delinquent firms. The resulting ratios referred to by Bates indicate that the loans were significant quantum changes in the available capital for each firm; and if their exist economies of scale for these business, the absolute loan size and not the ratio of loan size to total assets may be the relevant predictive variable. Second, Bates rejects the hypothesis that loan terms may have been used as part of the SBA loan applicant screening device, a hypothesis he never explicitly tests through his analysis (though it appears very plausible given the above data).

[24] "Commercial Banks and Minority Entrepreneurship," Yale Law Journal, Vol. LXXX (1971), pp. 614-646.