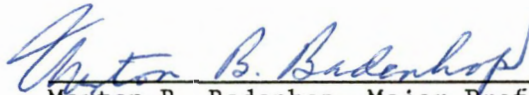


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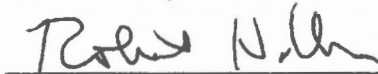
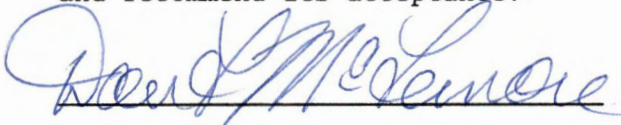
To the Graduate Council:

I am submitting herewith a thesis written by Charles Edward Meier entitled "Agricultural Cooperative Loan Repayment in Karnataka, India: A Discriminant Analysis." I have examined the final copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Economics.



Merton B. Badenhop, Major Professor

We have read this thesis
and recommend its acceptance:



Accepted for the Council:



Vice Provost
and Dean of The Graduate School

AGRICULTURAL COOPERATIVE LOAN REPAYMENT IN KARNATKA, INDIA:

A DISCRIMINANT ANALYSIS

A Thesis

Presented for the

Master of Science

Degree

The University of Tennessee, Knoxville

Charles E. Meier

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ABSTRACT

The primary objective of this study was to develop a quantitative function which could discriminate between defaulters and non-defaulters of crop production loans from primary agricultural credit cooperatives in Mandya District, Karnataka, India. This function was to be used to develop descriptive typologies of defaulters and non-defaulters which could be used to target potential defaulters for some form of supervision.

The second objective was to test six hypotheses as to why individuals are defaulters. The first was that borrowers with strong political influence are more likely to default than borrowers with little political influence. The second hypothesis was that better educated borrowers are more likely to default than less well educated borrowers. The third was that smaller farmers are more likely to default than larger farmers. The fourth was that borrowers with high average propensities to consume are more likely to default than borrowers with lower average propensities to consume. The fifth hypothesis was that borrowers with a high ratio of short-term loans to expenses are more likely to default than borrowers with lower ratios. Finally, it was hypothesized that borrowers with high debt-to asset ratios were more likely to default than borrowers with lower debt-to-asset ratios.

The function was tested using an F ratio. This test indicated that the function could not discriminate between defaulters and non-defaulters at a reasonable level of significance. Partial F tests were used to

test the contribution of each variable to the discriminant function given that all other variables were already present in the model. The household average propensity to consume was the only variable which aided the model's ability to discriminate. Given that the model was not significant, no descriptive typologies could be developed.

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CHAPTER I

INTRODUCTION

I. THE PROBLEM

The use of High Yield Variety (HYV) technologies in India requires a large investment in seasonal or annual inputs such as seed, fertilizer, and pesticides as well as medium and long term investments in machinery, irrigation, and land improvement. Where farmers are unable to finance the necessary inputs through savings, the provision of credit may be a necessary, but not sufficient, condition for the adoption of new techniques. Credit, in Mosher's terms, is an "accelerator" of agricultural development.¹ Before credit can be of use, certain essential conditions, including the timely availability of required inputs and profitable investment opportunities, must be met.²

In those areas where the preconditions for effective use of agricultural credit have been fully or partially met, many problems remain to be solved. The World Bank divides these issues into four major areas:

¹Mosher, Arthur T., Getting Agriculture Moving: Essentials for Development and Modernization, published for the Agriculture Development Council (New York: Frederick A. Praeger, Publishers, 1966), p. 121.

²Long, Millard F., "Conditions for Success of Public Credit Programs for Small Farmers," A.I.D. Spring Review of Small Farmer Credit, Vol. XIX, June 1973, pp. 71-111.

- (1) eligibility criteria and security requirements;
- (2) the level of interest rates and the merits of interest subsidies; (3) repayment performance; and
- (4) credit channels.³

This study focuses on the repayment performance of farmers who borrow from cooperative credit institutions in Mandya District, Karnataka, India.

One of the principal sources of institutional credit for farmers in India is the local Farmers Service Cooperative Society (FSS). In 1951-1952, these cooperative credit organizations provided only 3.1% of the total borrowings by cultivator households. By contrast, the informal credit market of professional moneylenders, traders, landlords, and relatives provided 91.8% of agricultural credit, with the remainder coming from government sources and commercial banks.⁴ In 1961-1962, cooperatives accounted for 15.5% of total borrowings by cultivator households.⁵ By 1971, 22% of cultivator debt was owed to cooperatives.⁶

Although these cooperative credit institutions are providing a growing share of the credit needs of farmers, their viability is threatened by the large proportion of loans which are in default each year. In the mid 1960s, overdues ranged from 14% of outstanding loans in Tamil

³The World Bank, "Agricultural Credit," Sector Policy Paper, May 1975, p. 8.

⁴Report of the All-India Rural Credit Review Committee, B. Venkappiah, Chairman (Bombay: Reserve Bank of India, 1969), p.100.

⁵Report, p. 100.

⁶All India Debt and Investment Survey 1971-1972 (Bombay: Reserve Bank of India), 1977, pp. 54-55.

Nadu to 90% of outstanding loans in Assam. In those states with "low" figures, defaults were generally increasing from 1964 to 1968.⁷ In Karnataka, recovery has never exceeded 65% for the state as a whole in the years 1965-1975.⁸ R. L. Jallapa, Co-operation Minister of Karnataka, claims that current overdues amount to Rs 500 million (\$42 million) and that only 20% of the outstanding loans were repaid in 1984.⁹

Large arrears raise the administrative costs associated with debt collection. This can exacerbate problems caused by interest rates which may be too low to cover the opportunity cost of capital, inflation, and administrative overhead without considering risk premiums.¹⁰ With low interest rates and large arrears, local cooperatives must turn each year to the next layer of India's cooperative structure, the district cooperative banks, for fresh financing. When a primary society has a sufficiently high proportion of defaulters, the district cooperative bank may refuse to provide the necessary infusion of capital. This prevents those farmers who have not defaulted from receiving new loans.

⁷Report, p. 501.

⁸Rao, P. S. Narayalla, "Analysis of the Apex Bank's Balance Sheets for the Past Decade," in the Diamond Jubilee Celebrations Souvenir, Karnataka State Cooperative Apex Bank, Limited, 1976, G. S. Hegde Aijibal, Chairman, p. 17.

⁹These figures include long and medium term loans as well as seasonal loans. See, "Firm Action to Recover Loans from Farmers," Deccan Herald, Saturday, 6 April 1985, pg. 1.

¹⁰For a discussion of the size of each of the components, see Bottomley, Anthony, "Interest Rate Determination in Underdeveloped Rural Areas," American Journal of Agricultural Economics, Vol. 57, No. 2, May 1975, pp. 279-291.

Jordan¹¹ discusses two possible methods which credit institutions can use to hedge themselves against defaults. First, a credit institution can increase the risk premium portion of the interest charges and/or require more security. The second option is closer supervision of borrowers. Increasing interest charges presents difficulties where government policy holds interest rates at artificially low levels (i.e. where there is excess demand for loans),¹² while raising the security requirements could increase the difficulties which small farmers face in obtaining non-price rationed credit brought about by excess demand.¹³

The World Bank, on the other hand, believes the second option, that of closer supervision of borrowers, has some potential for reducing arrears:

There appear to be good opportunities for offsetting a higher supervision cost against a lower delinquency rate in many institutions. Supervision has the advantage of encouraging better behavior

¹¹Jordan, John Perry, "A Discriminant Analysis of Production Credit Association Loans in East Tennessee," unpublished M.S. Thesis, The University of Tennessee, 1973, p. 6.

¹²Low interest rates are used to: 1. provide a subsidy to small farmers who must otherwise pay "usurious" rates in the informal market; 2. lower the cost of adopting HYV technology; and/or 3. offset pricing and other government policies which harm the agricultural sector. See, Donald, Gordon, Credit for Small Farmers in Developing Countries (Boulder, Westview Press, 1976), pp. 101-103.

¹³Small farmers are the first to be rationed when there is excess demand for loans. This may be due either to local social and political relationships or to cost factors which make a few large loans cheaper to administer than many small loans. For an explanation of credit rationing and interest rates, see, Gonzalez-Vega, Claudio, "Interest Rate Restrictions and Income Distribution," American Journal of Agricultural Economics, Vol. 59, No. 5, December 1977, pp. 973-976.

patterns which may eventually allow a reduction in supervisory activities.¹⁴

As the World Bank study notes, supervision of large numbers of borrowers would be a costly endeavor. These costs could be reduced if potential problem loans could be determined in advance of actual defaults. This would enable supervisory efforts to be targeted where they are most needed.

II. REASONS FOR LOAN DEFAULTS

Several possible causes for loan defaults have been identified by the World Bank,¹⁵ the Reserve Bank of India,¹⁶ and the United States Agency for International Development Spring Review of Small Farmer Credit.¹⁷ These reasons may be roughly divided into those which are a result of institutional problems and those which result from the decisions and problems of individual borrowers. Some of the reasons discussed below, especially those related to the problem of willful defaulters, may be classed as both individual and institutional. They are discussed here as institutional problems since solutions are more likely to be effected through institutional reform rather than individual defaulter repentance.

¹⁴The World Bank, p. 14.

¹⁵The World Bank, pp. 40-43.

¹⁶Report, pp. 501-536.

¹⁷Donald, pp. 137-158.

Institutional Problems

The first institutional problem is the failure to make loans production oriented. Loans should be made available when the production cycle calls for inputs and repaid when crops are harvested. Where loans are provided after the farmer has planted his crops, there may be a temptation on the part of the farmer to divert the loan to consumption purposes. When loan repayments are to be made before the farmer has harvested his crops, cash may not be available. If the interval between harvest and repayment is too long, the borrower may have sold the crop and already spent the proceeds. Samanta and Ray¹⁸ indicate that defaulters themselves complain that unfavorable repayment schedules are hindering the timely repayment of their loans.

The amount which is loaned may also have a bearing on default behavior. Loans which, when combined with the farmer's own funds, are too small to fully meet the needs of the borrower, may force the cultivator to turn to informal lending sources in order to supplement the institutional funds. The informal market sources usually charge higher interest rates and will frequently be repaid first; either to avoid the higher interest rates or to ensure the future availability of funds from traditional lenders. Loans which are greater than the farmer needs may, again, tempt the borrower to divert some portion of the loan to

¹⁸Samanta, R. K., and G. L. Ray, "Repayment of Agricultural Loans," in Some Useful Research Findings in Agricultural Extension, Communication Center, Bidhan Chandra Krishi Viswavidyalaya, Mohanpuri 741-248 Nadia, West Bengal, 5 October 1983, p. 4.

non-productive consumption. The amount which is loaned must be related to the actual costs of production as well as take account of the farmer's own funds.

In an effort to correct these problems, a crop loan system, where loan dispersals and repayments match the local cropping patterns, was recommended as early as 1945 by Dr. D. R. Gadgil, Chairman of the Agricultural Finance Subcommittee of the Government of Bombay.¹⁹ Similar recommendations were made by the All-India Rural Credit Review Committee of 1969.²⁰ Kher reports that while seasonality in lending and recovery has become more generally accepted, it had still not been fully implemented by several states as late as 1978.²¹

The need to relate the amounts loaned to the cost of production has also been incorporated into the crop loan system. Each year, a scale of finance based on local "conditions such as rainfall, irrigation facilities, soil type, level of adoption of improved agricultural practices in vogue, etc."²² is chosen to provide a base for determining loan amounts for each crop. These scales of finance have not always been correctly used: a common scale may be used for all crops; use of the scales may be a mere formality with loan amounts given on an ad-hoc basis; figures may

¹⁹See Kher, A. O., "Cooperative Crop Loan System in India," Indian Cooperative Review, Vol. XV, No. 4, July 1978, p. 524.

²⁰Report, pp. 466-500.

²¹Kher, p. 524.

²²Kher, p. 517.

be manipulated to arrive at predetermined amounts; and scales may be inflated from year to year to help borrowers cover previous debts.²³

Institutional corruption is a second possible cause of defaults to credit institutions. Many times, individuals with political power in a community will willfully default knowing that their political influence will protect them from prosecution by the lending agency. This type of willful default is especially prevalent in local cooperative institutions where defaulters may be concentrated among members of the board of directors, their relatives and friends. Reddy, using two separate discriminant analyses to distinguish defaulters from non-defaulters in a cash oriented region and a less productive subsistence region, states that "the analysis for the more productive region suggests that a defaulting borrower is more likely to be a literate high caste farmer who is related to the board of directors."²⁴

Political interference with the sound management of institutions may also take another form. Politicians who are campaigning for election to the state legislative assemblies or the national parliament (the Lok Sabha) have been known to promise debt relief measures for "overburdened" farmers. This encourages farmers to default in anticipation of the debt relief's passage; something which is often not forthcoming. This is not to deny that in extreme cases of drought or other natural

²³Kher, p. 523.

²⁴Reddy, S. Rami, "Factors Discriminating Defaulters from Non-Defaulters in Primary Credit Cooperatives," Indian Cooperative Review, Vol. XIV, No. 1, October 1976, p. 14.

disaster such relief may be necessary, but this might best be done through conversion of short-term loans to medium-term loans as was recommended by the All-India Rural Credit Review Committee of 1969.²⁵ Blank check debt relief, or even frequent conversion of loans, may only lead farmers to believe that loans are a form of government largess which need not be repaid under any circumstances.

Intra-village factionalism is another political problem which may contribute to poor recovery rates. If one group controls the local cooperative, an opposing faction may default in order to harass the present management.²⁶

Fears on the part of individuals that their cooperative may not be in a sound financial position may lead them to default in order to insure that cash is available for the next season even if the institution were to fold. When defaults reach a certain percentage of loans, the district cooperative bank may refuse to provide capital to the local society. When this threatens, an individual may deliberately default when he might otherwise have been expected to repay. This, of course, only exacerbates the institutional problem although it may be an entirely rational response by the individual.

²⁵Report, pp. 508-521.

²⁶Epstein reports that factionalism results from an imbalance between various kinship groups' economic status and political and ritual status. "In times of economic expansion...economic mobility increases" while "political and ritual status depends on the comparatively rigid principle of hereditary succession." Epstein, T. Scarlett, Economic Development and Social Change in South India (Manchester, England: The University Press, 1962), p. 131.

A lack of supervision of individual borrowers as well as limited supervision of the cooperative agencies by higher echelon administrators is another institutional problem which can contribute to high delinquency rates. Von Pischke and Adams²⁷ argue that credit, instead of being an input in the production process as often thought, is really an increase in borrower liquidity. Where there is no supervision of the borrower, the additional funds may be spent in any manner the borrower chooses. A similar lack of supervision of the lending agency may also increase defaults.

Supervision, it should be noted, is an extremely flexible term. Supervision may mean almost anything from simple call-backs by loan personnel to elaborate management services with detailed farm record keeping. Where supervised credit has been examined in the literature, emphasis has been on testing the ability of programs to help achieve national and local area farm planning goals,²⁸ rather than on testing the effectiveness of supervision on delinquency rates.

Farmer agitation movements are a final institutional problem involved with delinquencies. These movements are responses by farmers to

²⁷Von Pischke, J. D., and Dale W. Adams, "Fungibility and the Design and Evaluation of Agricultural Credit Projects," American Journal of Agricultural Economics, Vol. 62, No. 4, November 1980, pp. 719-726.

²⁸The results have been mixed. For a partial success, see, Colyer, Dale, and Guillermo Jimenez, "Supervised Credit as a Tool in Agricultural Development," American Journal of Agricultural Economics, Vol. 52, No. 4, November 1971, pp. 639-642. For a failure, see, Scobie, G. M., and D. L. Franklin, "The Impact of Supervised Credit Programmes on Technological Change in Developing Countries," Australian Journal of Agricultural Economics, Vol. 21, No. 1, April 1977, pp. 1-12.

the low prices set by the government for agricultural produce. Mass deliberate defaults are one of the protest weapons used to press their point. M. D. Nanjundaswamy, a peasant leader in Karnataka, claims that:

The farmer who doesn't repay his earlier debt does not require new loans. The extent of unpaid loans is Rs 50 crores. We don't intend repaying them because they are artificial calculations and artificial debts, since we have been looted on the price front by a crooked marketing system supported by the government. And since we have fed this country at half prices, those who have consumed our food are debtors, not us. In other words, we don't want credit if we are given scientific prices.²⁹

Individual Borrower Problems

There are several causes of loan defaults which can be categorized as individual problems rather than institutional. First, farmers everywhere are subject to crop failure when rains don't arrive or when pests do. The All-India Rural Credit Review Committee Report comments that "though the impact of this factor is sometimes exaggerated, the problem is quite real in several regions."³⁰ A similar problem is that of low returns. If prices are not high enough, or if the farmer is an inefficient producer, he may not have the income to repay.

There are some farmers who have only enough resources to provide for the subsistence needs of their household. Epstein indicates that farmers with a typical household size of 5 members require between 1 and

²⁹Interviewed in Alvares, Claude, "The Peasants Rehearse the Uprising," The Illustrated Weekly of India, 24 February, 1985.

³⁰Report, p. 508.

1.25 acres of irrigated land to provide for family subsistence needs.³¹ Loans made to farmers with this amount of land or less may not be repaid because the farmer has a very limited cash income with which to repay the loan.

Given that loans provide additional liquidity to the farmer, he may choose any of several alternative ways of using the extra funds. The farmer may prefer to spend the funds on consumption rather than on farm inputs. An individual who has borrowed from a local moneylender may choose to repay the moneylender with the funds borrowed from the cooperative institution. Finally, other investment opportunities such as re-loaning the money at a higher rate of interest may prove more attractive to the borrower than the official purpose of buying cuttings for a sugar cane field. Each of these decisions may make loan repayment more difficult.

III. OBJECTIVES

The primary objective of this study was to develop a quantitative function which could discriminate between defaulting and non-defaulting borrowers of crop production loans made by credit cooperatives in Mandya District, Karnataka, India. This discriminant function was to be used to define descriptive typologies of defaulters and non-defaulters. It was

³¹Epstein, T. Scarlett, South India: Yesterday, Today and Tomorrow, (New York: Holmes and Meier, 1973), pp. 102-103.

hoped that these typologies could be used by cooperative secretaries and extension personnel to target potential defaulters for some form of supervision.

A secondary objective was to test 6 specific hypotheses as to why individuals were defaulters. The first of these hypotheses was that borrowers with strong political influence were more likely to be defaulters than borrowers with limited political influence. This hypothesis tested the possibility that defaulters were willful defaulters who had the necessary influence to avoid prosecution.

The second hypothesis was that borrowers who were more highly educated were more likely to be defaulters than borrowers who were less well educated. This might hold true if better educated borrowers had a better understanding of the loan system and could more easily manipulate that system to avoid repayment.

The third hypothesis was that borrowers with smaller-sized holdings were more likely to be defaulters than borrowers with medium and larger-sized holdings. This tested the possibility that defaulters were concentrated among the low income small farmers.

The fourth hypothesis was that borrowers with a high average propensity to consume were more more likely to be defaulters than borrowers with a low average propensity to consume. This would be likely if borrowers with a high average propensity to consume were more willing to divert their loans to consumption than borrowers with low average propensities to consume.

The fifth hypothesis was that borrowers who have a high ratio of short-term loans to farm expenses were more likely to be defaulters than borrowers with a low ratio of short-term loans to farm expenses. A high ratio might indicate a less liquid position on the part of the borrower, or a greater opportunity on the part of the borrower to divert the loan to purposes other than payment of crop related expenses.

The sixth hypothesis was that borrowers who had high debt-to-asset ratios were more likely to be defaulters than borrowers who had low debt-to-asset ratios. Borrowers who have higher debt-to-asset ratios must use a larger share of the returns from the use of productive assets to service debts. The higher this ratio becomes, the greater the possibility that a borrower may have problems servicing his debt.

CHAPTER II

PROCEDURE

I. DISCRIMINANT ANALYSIS

The primary objective of the study was to have been accomplished through the use of the statistical tool known as discriminant analysis. Mathematically, discriminant analysis seeks to find values for a vector of coefficients in the equation

$$Y = X\beta$$

where:

Y = an $n \times 1$ vector of computed discriminant scores

X = an $n \times m$ matrix of m measurements on each of n individuals

β = an $m \times 1$ vector of variable coefficients.

X and Y are partitioned into two groups of individuals where each individual in the sample is known to belong to one of the two groups. The β coefficients are chosen so as to maximize the difference between the mean discriminant scores of each group per unit variance about those means.³¹

Two assumptions are necessary for discriminant analysis. The first assumption is that the variables have a multivariate normal

³¹Derivations may be found in Dhrymes, P. J., Econometrics: Statistical Foundations and Applications, (New York: Harper and Row, Publishers, 1970), pp. 65-77.

distribution. The second assumption is that the within-group variance-covariance matrices be equal between groups. Klecka states that "in practice, the technique is very robust and these assumptions need not be strongly adhered to."³²

New individuals may be classified into one of two groups by taking the same m measurements and computing their discriminant scores from the discriminant function. The simplest decision rule is to place an individual in the group whose mean discriminant score is closest to that of the individual. This reflects a cutoff point which is equal to the midpoint between each group's mean discriminant score.

The cutoff point may be modified to take account of the relative size of each group in the population. If it is known prior to sampling that an individual has probability p_1 of belonging to group one and probability p_2 of belonging to group two, a new cutoff point may be chosen to reflect this. Kleinbaum and Kupper suggest using $\ln(p_2/p_1)$ as the new cutoff point.³³

A Z statistic may be computed for each cutoff point in order to determine what percent of each group is misclassified. This is determined by the following formula:

³²Klecka, W. R., "Discriminant Analysis," Chapter 23 in Statistical Package for the Social Sciences, N. H. Nei, et al., editors, 2nd edition, (New York: McGraw Hill Book Company, 1975), p. 435.

³³Kleinbaum, D. G., and L. L. Kupper, Applied Regression Analysis and Other Multivariable Methods, (North Scituate, Massachusetts: Duxbury Press, 1978), pp. 427-429.

$$Z = (Y_c - Y_i) / \sigma$$

where:

Y_c = the cutoff point

Y_i = the mean discriminant score for the i th group ($i = 1, 2$)

σ = the standard deviation of the discriminant scores.

An F value may be computed to test the null hypothesis that the discriminant function does not discriminate between defaulters and non-defaulters. This is computed from the ratio:

$$F = \frac{\text{Sum of Squares Between Groups}/m}{\text{Sum of Squares Within Groups}/n_1 + n_2 - m - 1}$$

where:

m = the number of variables

n_1 = the number of individuals in group 1

n_2 = the number of individuals in group 2.

The function effectively discriminates between the two groups if the computed F is greater than the critical value of F for a chosen level of probability.

The hypotheses of the secondary objective were tested by means of a partial F test which describes the ability of a variable to contribute to the model's discriminatory power, given that all other variables are already in the model.

II. SAMPLING PROCEDURE

District Selection

Mandya District, in the South Indian state of Karnataka, was the district selected for study. The town of Mandya, which is the administrative center of the district, is located some 40 km. east of Mysore and 100 km. southwest of Bangalore. The district has an area of 4,958 square kilometers (1,937 square miles) and a population of 1,154,000 (1971). The rural population is 86% of the total.³⁴

Mandya District conformed to three criteria used to dictate the district selection. First, the district is located in the heart of a large irrigation project. The construction in 1911 of the Krishnarajasa-gar Dam on the Cauvery River near Mysore, along with an intricate network of irrigation canals, has greatly lessened the dependence of many farmers on the vagaries of India's monsoon. A dependable irrigation system greatly reduces the possibility of crop failure and hence reduces arrears in loan payments to cooperatives.

The second requirement for the selected district was the presence of an established market for local crops. Mandya is located on the main road and rail lines connecting Bangalore (population 2.9 million) and

³⁴Taluka-Wise Plan Statistics: Mandya District, Government of Karnataka, District and Regional Planning Unit, Economic Adviser's Division, Planning Department, 1977, pg. 3.

Mysore (population 476,000), the two largest cities in Karnataka.³⁵

There is an excellent road network connecting outlying villages in the district with the town of Mandya. Only 18 of 1,339 villages in the district are not accessible by road. Approximately 66% of district roads are surfaced.³⁶ There is a large sugar refinery located in Mandya. This factory provides an easily accessible market for the sugar cane grown by many of Mandya's farmers. These, or similar facilities, are a necessary precondition for successful use of agricultural credit.

The third criterion was the predominance of one or two major crops. This was a criterion of convenience which served to reduce the number of variables which needed to be considered. The irrigated areas of Mandya District met this criterion since paddy and sugar cane are overwhelmingly predominant.

Cooperative Selection

The local cooperatives from which the individual observations were drawn were chosen by the Mandya District Agricultural Extension Officer. Four primary credit cooperatives located in irrigated areas of the district were chosen. At least 75% of the borrowers from each cooperative were non-defaulters. This eliminated the need to consider defaults

³⁵Statistical Outline of India: 1982, Tata Services Limited, Department of Economics and Statistics (Bombay: Tata Press Limited, 1982), pp. 43-45.

³⁶Taluka-Wise Plan Statistics, pp. 59-60.

caused by fears that the institution itself will receive no new funds due to high default rates.

Individual Observations

Each cooperative secretary provided a list of individuals who had received a crop production loan during the 1983-1984 year. The total number of borrowers from all four cooperatives was approximately 2500. Fifteen defaulters and fifteen non-defaulters were randomly selected from each cooperative for interview. Considered together, the 60 defaulters and 60 non-defaulters should have produced the required multivariate normal distribution.

III. INTERVIEW QUESTIONNAIRE

A questionnaire designed to elicit information on family size, education, political influence, farm assets, crops grown, farm and household expenditure, farm and non-farm income, and household formal and informal liabilities was prepared. The questionnaire was translated into Kannada (the Dravidian-based language of Karnataka) and pretested on ten cultivator-borrowers from a Mandya village near the survey area. Several minor changes were made in the instrument after it was tested. The questionnaire may be seen in Appendix I.

A total of 115 interviews of the initial sample size of 120 were completed between 5 April and 25 April 1985. Each interview took approximately 30 minutes. Few of the interviews were conducted in a private

setting. Most of the interviews were conducted in the presence of a district agricultural extension agent. Local cooperative secretaries were present for nearly one-half of the interviews. In general, small crowds of local villagers gathered at each interview. Lively discussions ensued when questions were asked about the respondent's expenditures on fertilizers, seed, pesticides, and other farm inputs. The spectators remained silent, however, when questions were asked about farm and non-farm income.

CHAPTER III

VARIABLES

I. INTRODUCTION

The purpose of this chapter is to briefly describe some of the variables which could have an impact on default behavior. Operational definitions of each variable are provided along with mean values for defaulter and non-defaulter groups. Variables are divided into three major categories: (1) household characteristics including household size, education, political influence, income, and consumption; (2) farm characteristics including land and non-land assets, crop types, yields, and expenses; and (3) financial characteristics including institutional and non-institutional loan amounts, interest rates, and security requirements along with certain financial ratio variables. Summaries of the household, farm, and financial characteristics of the defaulters and non-defaulters are provided in Tables I, II, and III.

II. HOUSEHOLD CHARACTERISTICS

Household Size

The size of a borrower's household could influence default behavior in two different ways. First, the larger the size of a household, the greater the cost of household maintenance. Second, the larger the

TABLE I

SUMMARY OF HOUSEHOLD CHARACTERISTICS OF A SAMPLE OF DEFAULTERS AND NON-DEFAULTERS OF
FOUR PRIMARY CREDIT COOPERATIVES, MANDYA DISTRICT,
KARNATAKA STATE, INDIA, APRIL 1985

Variable	Defaulters		Non-Defaulters	
	Average	Standard Deviation	Average	Standard Deviation
Household size				
total	6.42	2.67	7.60	3.48
men	2.21	1.34	2.79	1.73
women	1.89	0.94	2.37	1.42
children	2.32	1.53	2.43	1.83
Education, in years				
head of household	4.51	4.90	4.92	4.95
household per capita level	3.41	2.61	4.18	2.49
Political influence	0.38	0.80	0.51	0.90
Household income, in rupees				
farm income	29,040	59,300	36,073	30,043
non-farm income	2,123	5,969	1,126	3,296
net income	20,511	43,509	24,678	21,110
per capita income	3,029	4,409	3,642	3,881
Household consumption, in rupees				
total consumption	9,049	9,155	21,689	11,637
per capita consumption	1,437	956	2,952	1,311
Average propensity to consume	1.36	1.56	0.86	0.61

TABLE II

SUMMARY OF FARM CHARACTERISTICS OF A SAMPLE OF DEFAULTERS AND NON-DEFAULTERS OF
FOUR PRIMARY CREDIT COOPERATIVES, MANDYA DISTRICT,
KARNATAKA STATE, INDIA, APRIL 1985

Variable	Defaulters		Non-Defaulters	
	Average	Standard Deviation	Average	Standard Deviation
Land assets				
equivalent irrigated acres	3.45	4.85	4.71	4.79
land value, in rupees	143,473	212,493	184,459	205,741
Farm equipment, value in rupees				
implements	560	1,210	657	982
power equipment	6,223	26,449	873	4,211
Animals, value in rupees	4,007	3,823	5,585	3,611
Total assets, in rupees	156,000	242,000	195,000	208,400
Farm expenses, in rupees	10,691	17,316	12,521	11,570

TABLE III

SUMMARY OF FINANCIAL CHARACTERISTICS OF A SAMPLE OF DEFAULTERS AND NON-DEFAULTERS OF
FOUR PRIMARY CREDIT COOPERATIVES, MANDYA DISTRICT,
KARNATAKA STATE, INDIA, APRIL 1985

Variable	Defaulters		Non-Defaulters	
	Average	Standard Deviation	Average	Standard Deviation
Institutional loans, in rupees				
short-term owed	4,818	9,063	4,662	4,318
medium- and long-term owed	345	1,569	1,150	3,301
Non-institutional loans, in rupees	8,714	21,262	5,585	10,505
Financial ratios				
debt to asset ratio	0.12	0.11	0.09	0.09
ratio of short-term loans to farm expenses	0.53	0.34	0.46	0.25

household, the less need there would be to hire labor to work the family land. This latter factor may be especially important during times of peak labor demand.

A household is defined as an extended family group which lives under the same roof and farms the same plots. Respondents provided information on the number of adult men and women age 14 or older and the number of children less than 14 years of age. The average household size for defaulters was 6.4 members compared with 7.6 members for non-defaulters. This breaks down as 2.2 adult men, 1.9 adult women, and 2.3 children for defaulter households and 2.8 men, 2.4 women, and 2.4 children for non-defaulter households.

Education

The average number of years of education completed by the head of defaulter households was 4.5 compared with a slightly higher average of 4.9 years completed by non-defaulter heads of households. Respondents also indicated the highest level of education attained by each household adult with education broken down as at least some university, at least some pre-university college, at least some high school, at least some primary school, and no schooling at all. When a median grade value was assigned to each type of school (14.5 for university, 11.5 for college, 8.5 for high school, 3.5 for primary, and 0 for no schooling), defaulter households had an average per capita adult education level of 3.4 years while non-defaulter households averaged 4.2 years.

Political Influence

In order to gauge the political influence of a household, respondents were asked if they or other members of their household were or had been: (1) a member of the village panchayat;³⁷ (2) a member of the board of directors of the local cooperative; (3) a member of the local agricultural produce marketing committee; (4) a member of a taluk³⁸ development board; (5) a member of a political party; or (6) an officer in a local farmer's club. A "yes" response to a question was assigned a value of one, while a "no" response was assigned a value of zero. Responses to the six questions were then summed to provide a measure of the political influence of a household. It is important to note that the summation procedure assumed that each position is equal in importance to every other position and that an individual with a score of five, for example, is five times as influential as an individual with a score of one. Twelve defaulter households and 18 non-defaulter households exhibited some political influence. The average score for defaulter households was 0.38 compared with an average score of 0.52 for non-defaulter households.

Household Income

Household income may be a useful variable for determining defaulter

³⁷A panchayat is a village governing council.

³⁸A taluk is a sub-district administrative unit similar in size to a United States county.

potential. Other things being equal, the higher one's income, the easier it should be to service one's debts. Four measures of income are discussed here. Gross farm income was determined by multiplying current produce prices by reported yields for each crop and summing the results for each crop. Added as additional income was sales from dairy and garden enterprises. Net non-farm income was a figure reported by each respondent for sources such as income from labor, shops, jaggery mills (small scale unrefined sugar production), and similar sources. Total gross income was the sum of total gross farm income and net non-farm income. Total net income was the difference between total gross income and farm expenses. Finally, total net per capita income was defined as total net income divided by household size.

The average gross farm income for defaulter households was Rs 29,040³⁹ compared with Rs 36,073 for non-defaulters. Defaulters had an average net non-farm income of Rs 2,123 while non-defaulters had Rs 1,127. Average total gross income for defaulter households was Rs 31,200. Average total gross income for non-defaulter households was Rs 37,200. Defaulters households had an average of Rs 20,511 for total net income compared with Rs 24,678 for non-defaulters. Average net per capita income for defaulter households was Rs 3,029 while the average net per capita income for non-defaulters was Rs 3,642.

³⁹Rs 1 = \$0.08 or \$1 = Rs 12.

Household Consumption

Other things being equal, it would be expected that the higher a household's consumption expenditure, the less available cash would be for loan repayment. High consumption expenditure might also mean the need to borrow more funds to cover production expenses or might lead to the diversion of borrowed funds to finance consumption.

Household consumption was determined by asking respondents to estimate their average monthly expenditure on food, medical expenses, electricity, kerosene, and entertainment, and annual expenditure on clothes and education. Household consumption is the summation of these items after conversion to an annual basis. Principal and interest payments made on non-institutional loans were also included. This provided estimates of house payments, marriage expenses, and similar expenditures. Per capita consumption was then computed by dividing annual household consumption by the number of individuals in a household. A household's average propensity to consume was calculated by dividing household consumption expenditure by total gross income. Defaulters had average annual consumption expenditures of Rs 9,049 and average per capita expenditures of Rs 1,437. Non-defaulters had average annual consumption expenditures of Rs 12,335 and mean per capita expenditures of Rs 1,731. The average propensity to consume for defaulter households was 1.36 compared with an average propensity to consume of 0.86 for non-defaulter households.

III. FARM CHARACTERISTICS

Land Assets

Respondents were asked how many acres of irrigated land, dry land, and garden land they owned and the total value in rupees of each category of land. Defaulters owned an average of 3.06 acres of irrigated land, 0.94 acres of dry land, and 0.12 acres of garden plots. Non-defaulters owned an average of 4.24 acres of irrigated land, 1.15 acres of dry land, and 0.18 acres of garden plots. The total average value of defaulter-owned land was Rs 143,473 compared with Rs 184,459 for the average value of non-defaulter-owned land.

A typical acre of garden or irrigated land is worth four times as much as an acre of dry land. A common unit of land in terms of irrigated acres was defined as the sum of an individual's irrigated acres, garden acres, and one-fourth of the individual's dry acres. Using this adjusted land unit, defaulter households owned an average of 3.52 equivalent irrigated acres compared with an average of 4.71 equivalent irrigated acres owned by non-defaulters.

Farm Equipment

Respondents were asked to provide information on the number of bullock carts, plows, harrows, cultivators, sprayers, irrigation pump-sets, power tillers, and tractors which they owned. The total value of each type of equipment was also provided. Only 31.6% of the defaulters owned a bullock cart compared to 65.5% of the non-defaulters. Defaulters

owned an average of 2.9 implements (plows, harrows, cultivators, and sprayers) with an average total worth of Rs 560. Non-defaulters owned an average of 3.3 implements with a average total worth of Rs 657. The average value of power equipment (electric or diesel pumpsets, power tillers, and tractors) owned by defaulters was Rs 6,223. Much of this was accounted for by two "outlier" defaulters one of whom owned a power tiller (value Rs 32,000) and each of whom owned a tractor (total value Rs 240,000). When these two individuals were eliminated from the defaulter data, the average value of power equipment owned by defaulters was Rs 1,390 compared with Rs 873 for non-defaulters.

Animals

Respondents were asked how many bullocks, cows, buffaloes, goats, sheep, and pigs they owned. Sixty-three percent of the defaulter households owned a pair of bullocks for plowing and hauling compared with 74% of non-defaulters. Eighty-eight percent of defaulter households owned dairy animals (cows and buffaloes) compared with 90% of non-defaulters. The average value of animals owned was Rs 4,007 for defaulter households and Rs 5,585 for non-defaulter households.

Total Assets

Total assets is the sum of the values given for land, implements, bullock carts, machinery, and animals owned by the respondent. The average value of assets owned by defaulter households was Rs 156,000

compared with an average of Rs 195,000 in assets owned by non-defaulters.

Crop Types and Yields

Two crops predominate in Mandya District. Paddy or rice is the dominant subsistence crop while sugar cane is the local cash crop. In addition, a few farmers grow ragi (Eleusine coracana), jowar (Andropogon sorghum), various pulses, coconuts, and groundnuts (peanuts). Generally, two crops of paddy are grown each year. Sugar cane is a longer maturing crop which takes from 12 to 15 months from planting to harvest.

Fifty-two out of the 57 defaulters interviewed grew paddy compared with 56 out of 58 non-defaulters. The average yield per acre of paddy for defaulters was 17.1 quintals (100 kgs) per crop. The average yield per acre of paddy for non-defaulters was 17.6 quintals per crop. Forty-three of the defaulters grew sugar cane with an average yield of 35 tons per acre. Fifty of the non-defaulters grew sugar cane with an average yield of 40 tons per acre.

Farm Expenses

Farm expenses included both cash and in-kind payments made during the 1983-1984 season. Included are outlays on seed, sugar cane cuttings, fertilizers, pesticides, labor, animals, and power equipment. Interest and principal payments made during the year on previous institutional loans are also included. The average amount of expenses for defaulters

was Rs 10,691. The average amount of expenses for non-defaulters was Rs 12,521.

IV. FINANCIAL CHARACTERISTICS

Institutional Loans

There are three sources of institutional loans in Mandya District. The primary credit cooperatives provide short-term crop loans. The nationalized commercial banks provide short-term crop loans and medium-term loans of from 3 to 5 years for animals, bullock carts, and similar items. The land development bank offers medium and long-term loans for animals, wells, pumpsets, and general land improvement.

Respondents were asked if they currently had a loan from any of these sources. If the answer was "yes," then for each loan they were asked: how much was the loan; how much had been repaid; how much was still owed; how much was overdue; what was the term of the loan; what was the interest rate; and what security was required. Generally, most individuals pledged land as security, although a few individuals indicated that other persons had secured their loans. The interest rate for farmers with less than 3 acres was 12.85% for crop loans while larger scale farmers paid 14% on crop loans. Medium and long term rates varied from a low of 7% for a few loans taken out in the early 1970s to more recent rates of from 9% to 18% depending on the institution from which the money was borrowed and the purpose of the loan. All individuals in the sample had short term loans from a cooperative with many having

additional loans from a commercial bank. Defaulters owed an average of Rs 4,818 in short-term loans of which Rs 4,548 was overdue to all sources combined. Non-defaulters owed an average of Rs 4,662 in short-term loans with Rs 241 overdue, usually only to sources other than the cooperative. Defaulters owed an average of Rs 659 in medium and long-term loans compared with Rs 1,150 for non-defaulters.

Non-institutional Loans

Non-institutional lenders constitute the major source of loans in the villages studied. In general, these informal loans may be used in any manner the borrower chooses. When asked the reason for a loan, many individuals answered that they were for general purposes, although many also cited marriages and house purchase as reasons. Less security is required for informal loans: at most only a promissory note and often nothing at all. There is no formal term for an informal loan. Furthermore, the borrower is usually only required to keep up with the interest payments in order not to be considered a "defaulter." Interest rates seem fairly stable within each village, although there is variation among villages. In two of the villages studied, interest rates were 12% simple interest per year. In a third, 24% was the common rate. In the fourth village, some individuals borrowed at 24% and some at 36%. The average amount owed on non-institutional loans by cooperative defaulters was Rs 8,714 compared with an average amount of Rs 5,585 for non-defaulters.

Financial Ratios

Two financial ratios were considered. The first was the ratio of short-term loans to farm expenses. This ratio is a measure of the farmer's liquidity, with a higher value indicating a more financially precarious position. The average value for defaulters was 0.53, indicating that slightly more than one-half of their expenses were financed by debt. The average value for non-defaulters was 0.46, indicating that on average, slightly less than one-half of their expenses were covered by short-term loans.

The second financial ratio was the debt-to-asset ratio. This ratio is a measure of the financial leverage of the farmer, with a higher figure indicating that more of the returns from the use of productive assets must be used to service debt. The average debt-to-asset ratio for defaulter households was 0.12 compared with 0.09 for non-defaulters.

V. VARIABLE INTERRELATIONS

The public conditions under which the interviews were conducted may well have influenced the individual responses. It was hoped that if the answers were biased, however, they would be biased by the same factor for all individuals. This bias could not be tested for at the level of the individual observation.

The overall consistency of the responses may be established, however, by examining a table of correlation coefficients (Table IV). This table showed significant positive and negative correlations between

TABLE IV

PARTIAL CORRELATION COEFFICIENTS AND CONFIDENCE LEVEL FOR
REJECTING THE NULL HYPOTHESIS THAT $r = 0$

X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8
X_1	1.00000 0.0000	0.43591 0.0001	-0.17526 0.0634	-0.04911 0.6055	-0.09889 0.2952	0.31288 0.0007	0.40714 0.0001
X_2	0.34563 0.0002	1.00000 0.0000	-0.26669 0.0043	-0.12939 0.1720	-0.13956 0.1386	0.43811 0.0001	0.40500 0.0001
X_3	0.43591 0.0001	0.28826 0.0019	1.00000 0.0000	-0.12697 0.1802	-0.20577 0.0281	0.53987 0.0001	0.38094 0.0001
X_4	-0.17526 0.0634	-0.26669 0.0043	-0.27483 0.0032	-0.04106 0.6659	0.39363 0.0001	-0.31919 0.0001	-0.22084 0.0187
X_5	-0.04911 0.6055	-0.12697 0.1802	-0.04106 0.6659	1.00000 0.0000	0.16221 0.0861	-0.13593 0.1511	-0.20140 0.0324
X_6	-0.09889 0.2952	-0.20577 0.0281	0.39363 0.0001	0.16221 0.0861	1.00000 0.0000	-0.17488 0.0639	0.07617 0.4206
X_7	0.31288 0.0007	0.53987 0.0001	-0.41919 0.0001	-0.13593 0.1511	-0.17488 0.0639	1.00000 0.0000	0.54840 0.0001
X_8	0.40714 0.0001	0.40500 0.0001	-0.22084 0.0187	-0.20140 0.0324	0.07617 0.4206	0.54840 0.0001	1.00000 0.0000

Note: X_1 = Political influence

X_2 = Head of household education level

X_3 = Equivalent irrigated acres

X_4 = Household average propensity to consume

X_5 = Ratio of short-term loans to expenses

X_6 = Debt-to-asset ratio

X_7 = Household per capita net income

X_8 = Household per capita consumption

variables which matched the theoretically expected correlations. The correlation between gross per capita household income (X_7) and per capita household consumption (X_8), for example, was positive and significant at the 0.01 level. The correlation between political influence (X_1) and the head of the household's education (X_2) was positive and significant at the 0.01 level as was the correlation between political influence (X_1) and the equivalent irrigated acres variable (X_3). There was no theoretical reason to expect a significant correlation between political influence (X_1) and the debt to asset ratio (X_6). The correlation in this case was not significant. This indicates that even if there is some bias in the individual observations, the overall responses to each question are at least consistent with the overall responses to other questions.

CHAPTER IV

DISCRIMINANT ANALYSIS

Six variables as described earlier were used in the discriminant function. These variables incorporated most of the information provided by the respondents. The variables chosen were those which best represented the hypotheses described in the secondary objective of Chapter I. The variables used were: (1) political influence, (2) years of education completed by the head of the household, (3) number of equivalent irrigated acres, (4) household average propensity to consume, (5) ratio of short-term loans to farm expenses, and (6) debt-to-asset ratio. The seven variables and their derived coefficients are listed in Table V.

TABLE V

COEFFICIENTS FOR A DISCRIMINANT ANALYSIS ON A SAMPLE OF
PRIMARY CREDIT COOPERATIVE BORROWERS, MANDYA DISTRICT,
KARNATAKA STATE, INDIA, APRIL 1985

Variable	Coefficient
X ₁ - political influence	- 0.0105955
X ₂ - head of household education	0.0546614
X ₃ - equivalent irrigated acres	0.0158878
X ₄ - average propensity to consume	- 0.2925557
X ₅ - short-term loans to expenses	- 0.7082403
X ₆ - debt to asset ratio	- 1.5599981

The sample estimate of the discriminant function is

$$Y = - 0.0105955 X_1 + 0.0546614 X_2 + 0.0158878 X_3 \\ - 0.2925557 X_4 - 0.7082403 X_5 - 1.5599981 X_6$$

where Y is the computed discriminant score for the individual, and the X_i s represent the variable values for the individual.

The mean value of the computed discriminant scores for the defaulter group was -0.73756974 compared with a mean value of -0.41368571 for the non-defaulter group. The cutoff point for deciding whether a new individual would belong in the defaulter or non-defaulter group was the average value of the two mean scores. This cutoff point was -0.57562779. New individuals whose score was less than this value would be classified as potential defaulters. New individuals whose score was greater than this value would be classified as potential non-defaulters. Table VI shows the number and percentage of the original sample of borrowers who were correctly classified by the function.

TABLE VI
SUMMARY TABLE OF A DISCRIMINANT ANALYSIS
ON A SAMPLE OF PRIMARY CREDIT COOPERATIVE BORROWERS
MANDYA DISTRICT, KARNATAKA STATE, INDIA

Class	Sample Size	Correctly Classified by Discriminant Function	
		Number	Percent
Defaulter	55	30	55
Non-defaulter	58	44	76

The F ratio for the discriminant function was 1.455 with 6,106 degrees of freedom. This F ratio was not significant even at the 0.20 level. This indicates that the discriminant function was unable, at reasonable confidence levels, to distinguish between defaulting and non-defaulting borrowers of funds for crop production purposes from primary agricultural credit cooperatives in Mandya District.

The partial F ratio for the political influence variable was 0.002 with 1,106 degrees of freedom. This ratio also was not significant. This indicates that the null hypothesis that the variable political influence does not add to the model's ability to discriminate could not be rejected. Politically influential individuals would not seem to be any more or less likely to be defaulters than individuals with little political influence.

The partial F ratio for the head of the household's education level was 0.407 with 1,106 degrees of freedom. This ratio was not significant. The null hypothesis that the head of the household's education level does not contribute to the model's ability to discriminate could not be rejected. Better educated individuals, then, are no more or less likely to be defaulters than less well educated individuals.

The partial F ratio for the equivalent irrigated acres variable was 0.112 with 1,106 degrees of freedom. This ratio also was not significant. This indicates that the null hypothesis that the variable equivalent irrigated acres does not contribute to the model's ability to discriminate could not be rejected. Farmers with smaller size holdings

would not seem to be any more or less likely to be defaulters than farmers with larger size holdings.

The partial F ratio for the household average propensity to consume variable was 2.361 with 1,106 degrees of freedom. This ratio was significant at the 0.15 level. The average propensity to consume, then, may be of some use in discriminating between defaulters and non-defaulters. A higher average propensity to consume would indicate a greater possibility of default.

The partial F ratio for the ratio of short-term loans to farm expenses variable was 0.612 with 1,106 degrees of freedom. This ratio was not significant. The null hypothesis that the ratio of short-term loans to farm expenses does not contribute to the model's ability to discriminate could not be rejected. Individuals who finance a larger proportion of their expenses with short-term loans are no more or less likely to be defaulters than individuals who finance a lower proportion of their expenses with short-term loans.

The partial F ratio for the debt-to-asset ratio variable was 1.074 with 1,106 degrees of freedom. This ratio was not significant. The null hypothesis that the debt-to-asset ratio does not contribute to the model's ability to discriminate could not be rejected. Borrowers with high debt-to-asset ratios are no more or less likely to be defaulters than borrowers with low debt-to-asset ratios.

CHAPTER V

DISCUSSION AND CONCLUSIONS

I. THE PRIMARY OBJECTIVE

The primary objective of this study was to build a quantitative function which could distinguish between defaulting and non-defaulting members of primary credit cooperatives in Mandya District, Karnataka State, India. It was hoped that the function could be used to define some descriptive typologies of defaulters and non-defaulters. These typologies would enable cooperative personnel to target potential defaulters for some form of supervision. This targeting procedure would reduce the cost of a program of supervision designed to reduced the number of defaulters. The discriminant function which was derived from primary data gathered in Mandya District in April of 1985 was not, however, successful in distinguishing between defaulters and non-defaulters. Therefore, no meaningful typologies could be defined.

The household average propensity to consume was the only variable used in the discriminant function which significantly contributed to the model's discriminatory power given that the other five variables were already present in the model. This does not imply that the household average propensity to consume by itself would be capable of distinguishing between defaulters and non-defaulters. It is possible, however, that the household average propensity to consume, in combination with

variables other than those used in the present analysis, may be useful in distinguishing defaulters from non-defaulters.

Several hypotheses may be advanced to account for the failure of the model to discriminate between defaulters and non-defaulters. The first of these would be to question the reliability of the interview data. The fact that the interviews were conducted in an open setting with no privacy may well have biased some answers. Private interviews, though more desirable, were very difficult to arrange. The novelty of having an American present in the villages seemed guaranteed to draw crowds of curious onlookers. It was hoped that if answers were biased, however, they would be biased by the same factor for all individuals. Testing for this bias at the level of the individual observation was not possible. Instead, the overall consistency of the responses was established by examining a table of partial correlation coefficients. This table (Table IV, page 35) showed significant positive and negative correlations which matched the theoretically expected correlations. Where there was no theoretical reason to expect a correlation between variables, none was present. While this does not imply a lack of bias, it does at least suggest that the responses were consistent.

A second hypothesis would be to question the reliability of the assumptions, particularly the assumption that the Mandya District irrigation system is reliable. At the end of each interview, each respondent was asked why they thought individuals in their community might have problems repaying their loans. Twenty-three of the defaulters and 18 of the non-defaulters indicated that the yeilds of the previous year had

been less than expected due to irrigation problems. In this case, defaulter behavior might be more related to an individual's past amount of saving rather than to those variables chosen for inclusion in the discriminant function.

A third hypothesis that may account for the model's inability to discriminate is that an individual's decision to default may be based on which village faction the individual belongs to. Testing this hypothesis would have involved a much longer stay in each village than was possible. Intra-village factions as a cause of loan defaults cannot be ruled out.

A final hypothesis would be that no function may be found which can effectively discriminate between defaulters and non-defaulters. This might be true if there were a large number of willful defaulters whose characteristics matched those of the non-defaulters. It may be that there are variables which can distinguish between non-willful defaulters and non-defaulters. The problem then becomes one of distinguishing the non-willful defaulters from the willful defaulters. Any variable which is used to sort the non-willful defaulters from the willful defaulters cannot then be used in a discriminant function. If the variable were to be used, it would be guaranteed to be significant because the variable has already been used to implicitly define the groups.

II. THE SECONDARY OBJECTIVE

The hypothesis that politically influential individuals were more likely to default than less politically influential individuals could not be shown to be true. This does not mean that there were no defaulters with strong political influence. There were, in fact, almost as many individuals who were politically influential and who were defaulters as there were individuals who were politically influential and who were not defaulters.

The hypothesis that the better educated borrowers were more likely to be defaulters than less well educated borrowers could not be demonstrated. Better educated borrowers are no more or less likely to be defaulters than less well educated borrowers.

The hypothesis that borrowers with a higher average propensity to consume are more likely to be defaulters than borrowers with a lower average propensity to consume was a possible explanation for defaulter behavior. The null hypothesis in this case could be rejected at the 0.85 per cent confidence level. A borrower's default behavior may be more related to the borrower's consumption patterns than to any of the other problems discussed in Chapter I.

The fourth hypothesis was that farmers with smaller holdings were more likely to default than farmers with larger holdings. The null hypothesis in this case could also not be rejected. Smaller farmers are no more or less likely to default than larger farmers. Smaller farmers, as Gonzalez-Vega has noted, are the first to be rationed when there is

excess demand for loans.⁴⁰ The excuse which credit agencies have used to justify this is that small farmers are poorer credit risks. The results here indicate that small farmers may not be any more of a risk than larger farmers.

The fifth hypothesis was that borrowers with a high ratio of short-term loans to farm expenses were more likely to be defaulters than borrowers with a lower ratio of short-term loans to farm expenses. The null hypothesis that this was not true could not be rejected. This ratio is a measure of a borrower's liquidity position. Individuals who must borrow more to finance their farm expenses are no more or less likely to be defaulters than individuals who need to borrow a smaller proportion of their expenses.

The final hypothesis was that borrowers with a high debt-to-asset ratio were more likely to be defaulters than borrowers with a low debt-to-asset ratio. The null hypothesis that this was not true could not be rejected. Individuals who have more debt to service with a given quantity of assets are no more or less likely to be defaulters than individuals with a smaller amount of debt which must be serviced with a similar quantity of assets.

⁴⁰Gonzalez-Vega, Claudio, "Interest Rate Restrictions and Income Distribution," American Journal of Agricultural Economics, Vol. 59, No. 5, December 1977, pp. 973-976.

III. CONCLUSIONS

This study failed in its primary goal of describing how defaulters of crop production loans differed from non-defaulters. Two potential areas of research are, however, suggested by this failure. The first of these would be to describe the role which village factions and local politics play in default behavior. If village factionalism is a primary cause of default behavior, then appropriate policies must be implemented which remove the cooperatives from the sphere of local politics.

A second area of research suggested by this study would be to describe how willful defaulters differ from non-willful defaulters. There is a need for a set of objective criteria which can distinguish between the two groups. These criteria might then be used to target the willful defaulters for prosecution while the non-willful defaulters are provided with the supervision necessary to enable them to use credit successfully.

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APPENDIX

SURVEY QUESTIONNAIRE

NUMBER _____ VILLAGE _____ DATE _____

1. FAMILY SIZE
MALES _____ FEMALES _____ CHILDREN _____
2. HEAD OF HOUSEHOLD HIGHEST GRADE ATTAINED _____
3. NUMBER OF HOUSEHOLD ADULTS WHO HAVE COMPLETED AT LEAST SOME:
A. UNIVERSITY _____ B. COLLEGE _____
C. HIGH SCHOOL _____ D. PRIMARY _____
D. NO SCHOOL _____
4. HAS ANY MEMBER OF THE HOUSEHOLD BEEN A MEMBER OF:
A. VILLAGE PANCHAYAT _____
B. COOP BOARD OF DIRECTORS _____
C. POLITICAL PARTY _____
D. AGRI PRODUCE MARKET CMMTEE _____
E. FARM CLUB OFFICER _____
F. TALUK DEVELOPMENT BOARD _____
5. LAND OWNERSHIP (ACRES AND RUPEE VALUE)
A. IRRIGATED _____ VALUE _____
B. DRY LAND _____ VALUE _____
C. GARDEN _____ VALUE _____
6. EQUIPMENT OWNED (NUMBER AND VALUE IN RUPEES)
A. BULLOCK CART _____ VALUE _____
B. PLOWS _____ VALUE _____
C. CULTIVATORS _____ VALUE _____
D. HARROWS _____ VALUE _____
E. SPRAYERS _____ VALUE _____
F. PUMPSET _____ VALUE _____
G. POWER TILLER _____ VALUE _____
H. TRACTOR _____ VALUE _____
7. ANIMALS OWNED (NUMBER AND VALUE IN RUPEES)
A. BULLOCKS _____ VALUE _____
B. COWS AND BUFFALOE _____ VALUE _____
C. GOATS, SHEEP, AND PIGS _____ VALUE _____
8. RUPEE EXPENDITURE PER MONTH ON:
A. MEAT AND EGGS _____ B. DAIRY _____
C. GRAINS _____ D. PULSES _____
E. MEDICAL _____ F. RECREATION _____
G. ELECTRICITY AND KEROSENE _____

9. RUPEE EXPENDITURE PER YEAR ON:
 A. CLOTHES _____ B. EDUCATION _____
10. PADDY CROP
 A. ACRES GROWN _____ B. TOTAL YIELD _____
 C. SALES, PER CENT _____ D. SEED EXPENSE _____
 E. FERTILIZER EXPENSE _____
11. SUGAR CANE CROP
 A. ACRES GROWN _____ B. TOTAL YIELD _____
 C. SALES, PER CENT _____ D. SEED EXPENSE _____
 E. FERTILIZER EXPENSE _____
12. RAGI CROP
 A. ACRES GROWN _____ B. TOTAL YIELD _____
 C. SALES, PER CENT _____ D. SEED EXPENSE _____
 E. FERTILIZER EXPENSE _____
13. OTHER CROP _____
 A. ACRES GROWN _____ B. TOTAL YIELD _____
 C. SALES, PER CENT _____ D. SEED EXPENSE _____
 E. FERTILIZER EXPENSE _____
14. OTHER EXPENSES
 A. LABOR _____ B. ANIMALS _____
 C. PESTICIDES _____ D. TRACTOR _____
 E. POWER TILLER _____ F. PUMPSET _____
15. OTHER INCOME (RUPEES)
 A. GARDEN PRODUCE _____
 B. JAGGERY MILL _____
 C. DAIRY SALES _____
 D. LABOR _____
 E. SHOP _____
 F. OTHER _____
16. LAND DEVELOPMENT BANK LOANS
 A. YEAR OF LOAN _____ B. TERM OF LOAN _____
 C. AMOUNT OF LOAN _____ D. SECURITY _____
 E. INTEREST RATE _____ F. LOAN PURPOSE _____
 G. AMOUNT REPAYED _____ H. AMOUNT OWED _____
 I. AMOUNT OVERDUE _____
17. COMMERCIAL BANK LOANS
 A. YEAR OF LOAN _____ B. TERM OF LOAN _____
 C. AMOUNT OF LOAN _____ D. SECURITY _____
 E. INTEREST RATE _____ F. LOAN PURPOSE _____
 G. AMOUNT REPAYED _____ H. AMOUNT OWED _____
 I. AMOUNT OVERDUE _____

18. COOPERATIVE LOANS

A. YEAR OF LOAN _____
C. AMOUNT OF LOAN _____
E. INTEREST RATE _____
G. AMOUNT REPAYED _____
I. AMOUNT OVERDUE _____

B. TERM OF LOAN _____
D. SECURITY _____
F. LOAN PURPOSE _____
H. AMOUNT OWED _____

19. INFORMAL LOANS

A. YEAR OF LOAN _____
C. AMOUNT OF LOAN _____
E. INTEREST RATE _____
G. AMOUNT REPAYED _____
I. AMOUNT OVERDUE _____

B. TERM OF LOAN _____
D. SECURITY _____
F. LOAN PURPOSE _____
H. AMOUNT OWED _____

VITA

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