MODIFICATIONS OF SMALL-FARMER CREDIT
IN THE MAISAN 77 PROGRAM OF THE PHILIPPINES

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As in other developing countries, agricultural modernization in the Philippines is constrained by farmers' financial access to off-farm inputs. In the Philippines, Maisan 77, a corn production program with credit component was instituted in July 1977 to provide loans to facilitate the adoption of the production technology, especially by small farmers. Similar to many small farmer credit programs (SFCPs), however, Maisan 77 has been and is beset with high net lending costs that threaten its viability and outreach.

The high net lending costs can be attributed to three main factors: (1) low rates of interest charged on program loans, (2) high default rates, and (3) high administrative costs, particularly when loans are disbursed in cash and kind. The program, through the Philippine National Banks (PNB) and Rural Banks (RB) does not charge its clients for the full cost of extending the loans. The concessionally low rate of interest reflects a subsidy which makes program loans "cheap".

Declining repayment rates have a multiplicative effect on lending costs. The policy to disburse loans with a large portion in kind (to prevent possible diversion of funds) actually adds more costs to lenders. High arrears and administrative costs account for huge losses in SFCPs. And these losses are not recovered by non-competitive price of loans in the financial market.

This study was conducted to determine possible reforms that may improve the _Maisan_ 77 credit program. Specifically, it aimed to pinpoint suggestions that will reduce the net costs of lending and improve the financial and economic well-being of farmer-borrowers.

To accomplish these objectives, survey data were used to specify and validate a liquidity-specified linear programming (LS-LP) model. Simulations of the model were made with variations in: (1) interest rate, (2) credit limit, and (3) mode of loan disbursement. The effects of a "break-even" rate of interest was given special focus since this is the rate of interest at which the credit program recovers its lending costs.

The results of the simulations showed that:

(1) The welfare losses of the farmer due to increases in interest rates can be offset by coordinated increases in the size of loan, thus, making the credit limit as more important to the farmer's well-being than the rate of interest he has to pay.

(2) Disbursement of program loans in cash only resulted in improved financial structure and liquidity reservations for the farmer. The objective function, net cash flow and cash available increased. Reserved cash decreased while total reserved credit increased. These indicate that credit reservation tends to substitute for cash, allowing the farmer to commit more of his cash to production. A likely consequence is the possible extended outreach of the program to small farmers who have not yet been served with loans.

Cash only disbursement of loan relaxes the restriction on its use. A more versatile loan like moneylender funds will be valued highly. Thus, higher valuation of cash program loan may lead the borrower to preserve such loan--and to protect it by paying back his/her debt.

(3) The effect of break-even interest rate just by itself, is a general reduction in the farmer's welfare, though the lender recovers its lending costs. However, when coupled with increasing credit limit and an all cash disbursement of loan, results showed improvement in the well-being and liquidity position of the farmer as well.

Using simple calculations, it was shown that the public sector's net cost of lending can be reduced by simultaneous increases in interest rate and credit limit.

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CHAPTER I

INTRODUCTION

Over the past decade, technological breakthroughs have provided small farmers with various alternatives that may increase their income and growth. Most of these new technologies are capital intensive while most small farm families have little or no capital resources to invest in these economic opportunities. In developing countries, the traditional source of borrowing is the village money lender who charges interest rates as high as 100 percent per year and more. To make economic growth for small farmers possible, small farmer credit programs (SPCPs) have been instituted in many developing countries.

In most cases, however, the goals of SFCP's are not fully met. Many of them have not fully reached the small farmers targeted by the program. Over the years, serious problems have arisen attendant to credit delivery systems in developing countries. In the Philippines, for example, threats to the viability of the credit aspect of the corn production program Maisan 77 were clearly evident even in the early phases of the program. (For a brief description of the Philippine economy and the Maisan 77 program, please refer to Appendix A).

1.1 Identification of the Problem

It became certain after several years of implementation that the Maisan 77 suffered from high net lending costs. The total cost of lending so far exceeded the interest rate charged on loans as to limit the contributions that can be expected of the credit program and, perhaps, jeopardizing its continuation. This has been so for the credit component of the *Maisan* 77 program in Negros Oriental, a province located in the central Visayas region of the Philippines.

Although the M77 program has increased productivity and income of farmers in some provinces, the occurrence of serious loan default or non-repayment of production loans on a national level is quite common. Default has a multiplicative effect on lending costs (see next section for details). High costs of administering loans also contribute to high lending costs. Administrative costs are made high by attempts to police the use of loan funds. The disbursement of loans as cash and kind as in the *Maisan* 77 program complicates the problem. Both lender and borrower have to contend with higher transaction costs, cumbersome paper work, transport costs, and time and effort expended. Oftentimes, borrowers have to incur significant out-of-pocket expenses in order to obtain the loan. Furthermore, lenders are burdened with reporting requirements on different lines of funding provided by the government or aiding agency.

In the absence of donor support, funds costs are made high by an inefficient financial market on the supply side. A major problem in small farmer credit programs is the concessionary interest rate. The benefits of low interest rates are highly questionable. In fact, arguments for low interest rates are not fully documented. It is even argued that low interest rates on agricultural loans harm the rural poor instead, as concessionary rates encourage lenders to favor large loans in order to lower average lender costs per unit of money lent. Also, it is argued that low interest rate policies have a very damaging impact on the lender and inhibit the development of rural financial markets, which causes further income concentration and inefficient allocation of resources.

This study argues that policy changes are needed if the Maisan 77 is to support the growth and development goals of both the lender and borrower.

1.2 Net Lending Costs

A direct result of the low interest rate policy and high lending costs is the limited outreach and constrained delivery of the credit programs. The cost contribution of default is reflected in the following mathematical formulation of the risk premium of the lender (as adapted by Baker from Bottomley).

(Eq. 1) $$\text{Risk premium} = RP = \frac{dP + dP\ (a + f)}{P - dP}$$

where RP = risk premium

d = default rate, in % of principal loaned

P = principal loaned

a = administrative cost, expressed as a % of principal loaned, and

f = interest rate on funds lent, or opportunity cost of capital, in % of principal loaned.

By rearranging and rewriting the above equation, one gets the following:

(Eq. 1a) $$RP = \frac{d}{1 - d}(1 + f + a)$$

The coefficient $\frac{d}{1 - d}$ is defined by Bottomley as the lending risk factor. Thus, lending cost can be derived as:

(Eq. 2) $$lc = f + a + RP$$

Substituing RP by its value above gives:

(Eq. 2a) $$lc = f + a + \frac{d}{1 - d}(1 + f + a).$$

This equation shows the multiplicative effect of default on lending costs. Given a and f, lc increases (decreases) more than the increase (decrease) in d. Measures to monitor on the use of loan funds increase the administrative costs, a, and further reduce the liquidity value of the credit programs. When farmers perceive credit programs to have low liquidity value, they may choose to default on their loan. Therefore, lc is increased by a and by d and by their interaction.

Computing the lending costs

The costs of lending of the *Maisan* 77 credit program can be computed using Equation 2a. To simplify the solution, the Philippine National Bank (PNB) administrative cost specific to M-99[a] as of March, 1980 will be used since the *Masagana* credit programs (rice and corn) entail similar lending and collection procedures. Thus, a was computed to be equal to 5.4%. The cost of administration includes the following: incentive allowance and collection bonuses of government production technicians, personal expenses, vehicle depreciation, gasoline and vehicle maintenance and assignable overhead. The cost of capital, f, is estimated to be about 10% per annum while the default rate among surveyed farmer-borrowers was computed at 36.6%.

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[a]M-99 is a code for *Masagana* 99, a rice production program initially implemented in 1973 which targets an average yield of 99 cavans (1 cavan = 50 kg) of *palay* (rough rice) per hectare. *Masagana* is Filipino term which means bountiful.

This is slightly above the provincial default rate of 32.9%[a] during the same period, 1980-81. Compared with national figure among Rural Banks (RBs) on non-collateralized supervised credit program which gives 75.6% repayment, the survey area default rate is 1.5 times higher. Substituting in the values of f, a, and d into Equation 2a gives us the lending cost of the Masaganang Maisan credit program in the surveyed areas of Negros Oriental wich is lc = 90%.

The effective annual rate of interest being charged on Maisan 77 loans is 15%, including service charges. Thus it is obvious that defaulting on program credit proves very costly to the government lending institutions, notwithstanding the currently relatively low administrative cost which may have been much higher during the early phases of the program.

1.3 A Break-even Interest Rate

The determination of the break-even interest rate proceeds from the above derivation of the lending cost and profit (loss) of a credit program. The profit (loss) of a credit program such as the Maisan 77 can be expressed simply as:

(Eq. 3) $$r = i - lc$$

where r = returns or profits (loss)

i = interest rate charged on loans, and

lc = lending cost

[a] Based on the reports of three PNB branches in Bayawan, Dumaguete and Guihulugan in Negros Oriental.

Given the effective interest rate of 15% and lending cost of 90%, the profit earned by the Maisan 77 credit program in the surveyed area can be determined as:

$$r = i - lc = 15 - 90 = -75\%$$

This is a negative rate of profit or a huge loss. If one takes into account the inflation rate in the country in 1980-81, this loss figure would increase further as the interest rate decreases in real terms. For example, in 1981 the rate of inflation in the Philippines was 12.4%. Thus the interest rate in real terms charged through the Maisan 77 program can be expressed as:

$$i_\alpha = \frac{1 + i}{1 + f} - 1$$

where i_α = interest rate in real terms,

i = interest rate in nominal terms, and

f = inflation rate,

all in terms of annual rates.

Thus, the interest rate in real terms charged in the Maisan 77 program is:

$$i_\alpha = \frac{1 + i}{1 + f} - 1$$

$$= \frac{1 + 0.15}{1 + 0.124} - 1$$

$$= 0.0231$$

$$= 2.31\%$$

The cost, in real terms, of the program can be given by:

$$i_\beta = \frac{1 + r}{1 + f} - 1$$

where i_β = cost rate in real terms,

r = profit (loss) rate, and

f = inflation rate,

all stated in annual terms.

Thus, for the Maisan 77 program, the annual rate of real cost is:

$$\begin{aligned} i_\beta &= \frac{1 + r}{1 + f} - 1 \\ &= \frac{1 + (-0.75)}{1 + 0.124} - 1 \\ &= \frac{1 - 0.75}{1.124} - 1 \\ &= -0.7775 \\ &= -77.75\% \end{aligned}$$

The above calculation shows that the program's profits or returns are highly negative, signifying financial losses, due mainly to low interest rates charged on loans and high default rates. In real terms, the losses increase further as interest rates charged decrease in value.

Two methods of lowering costs of lending involve reduction of administrative costs and of default rates. However, lowering administrative costs require some long-term institutional and socio-political reforms. The highest cost is the default rate. The very destructive effect of high rates of default on credit program viability can hardly be overemphasized. But, the remedies for default are not clearly formulated.

In most countries, increasing the rate of interest charged on borrowed funds is only a matter of a policy decision and implementation by governing agencies of the policy change. A carefully drawn level of interest rate may be helpful to convince policy-makers of the need to adjust concessionally low rates of interest on loans.

The low interest rates charged on formal credit among low income and developing countries does not reflect the socially relevant cost of capital. As shown in Figure 1, it is obvious that at low interest rates, the supply of loanable funds is not sufficient to meet the demand for these funds. When this happens, credit rationing is necessary, but this will have negative effects on small farmers who may not be favored by the lenders. As the bank sets the interest rate at i_o, which is below the market equilibrium price of i^*, farmers are willing to borrow $0f_1$, but the supply of funds is only $0f_o$. At this concessional rate of i_o, the government will have to provide f_of_1--or ration credit. In order to fill this gap, governments of many developing countries will have to look for huge amounts of funds elsewhere. In the above illustration, increasing the rate of interest will increase the revenues of formal lending institutions which can allow for continued services and expansion of their credit programs.

In as much as the <u>Maisan</u> 77 credit program is not aimed at maximizing profits of its participating banks (RBs and PNBs) there is a need to increase the rate of interest on borrowed funds and/or lower lending costs so that the total lending revenues will equal total lending costs.

To determine the "break-even" interest rate, the profit or returns function r is equated to zero. Thus,

$$r = 1 - 1c = 0.$$

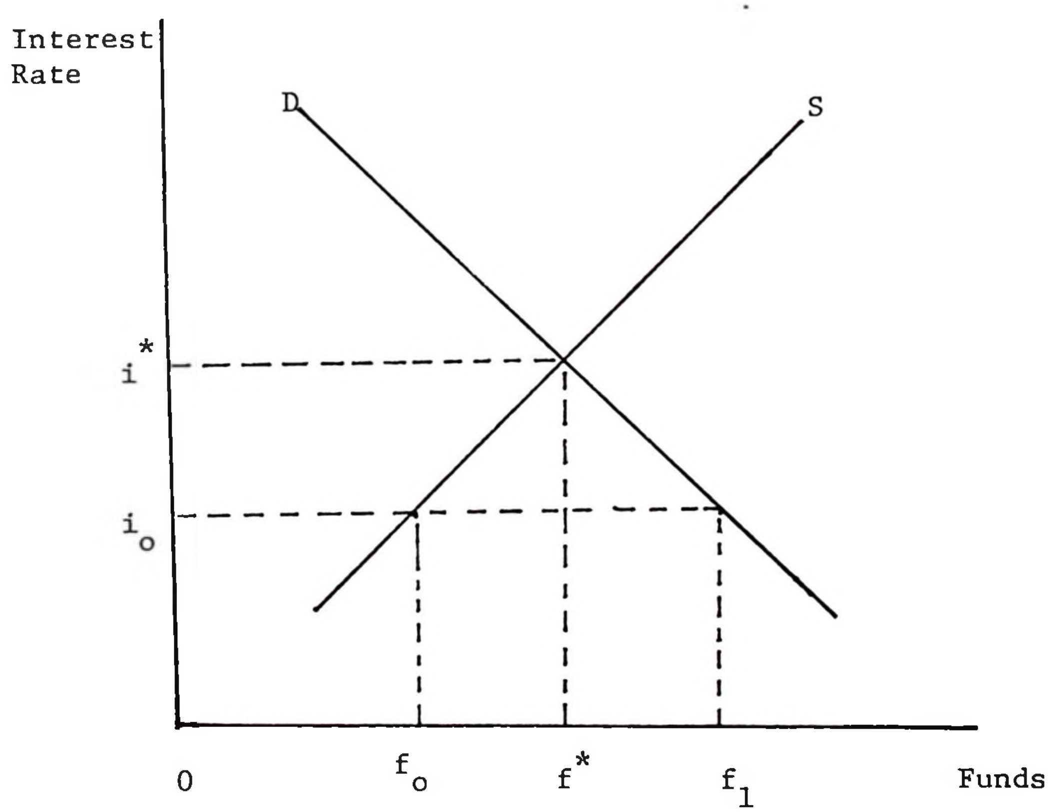

Figure 1. Equilibrium rate of interest and amount of loanable funds.

The "breakeven" interest rate can, therefore, be expressed as:

$$i^* = lc$$

where i^* is the breakeven interest rate and lc the lending costs.

This breakeven interest rate can be further defined as:

(Eq. 3a) $$i^* = f + a + \frac{d}{1 - d} (1 + a + f)$$

Given the estimated lending costs of the Maisan 77 credit program in the survey area (75% per annum), there is a need to adjust the nominal rate of interest to:

a) reflect more adequately the opportunity cost of capital, the cumbersome procedures of loan processing and other administrative costs, in addition to a risk premium to reflect high default rates; and

b) enable formal credit agencies to expand their outreach thus lessening farmers' dependence on private moneylenders who charge higher interest rates.

It is argued that increasing interest rates on program loans is not necessarily a threat to small farmers' net cash flow. Previous studies (23,29) have found that benefits to small farmers are more responsive to an increase in loan size and flexibility in use of the loan proceeds than to the variations in interest rate.

In the Philippines an interest rate on farm loans of 90% would be highly politically unacceptable and unpopular among policy makers and especially farmer-borrowers even though such rates can be found among loans from moneylenders. There is a need to adjust this breakeven interest rate from the survey area level to the national level. Using a 10% opportunity cost of capital (due to the short-term nature of lending), an administrative cost of 5.4%, and a national default rate of 24.4%, the annual breakeven interest rate expressed in terms of the outstanding balance is as follows:

i_B^* = breakeven rate of interest in terms of the outstanding balance

$$= f + a + \frac{d}{1 - d}(1 + f + a)$$

$$= 0.10 + 0.054 + \frac{0.244}{0.756}(1.154)$$

$$= 0.5265$$

$$= 52.65\%$$

Loans for <u>Maisan</u> 77 (corn) and <u>Masagana</u> 99 (rice) are released in such a way that the interest charges become automatically collected at the time of loan disbursement. Thus, for purposes of this study, the breakeven rate of interest collected at the time of loan disbursement, i_D^*, is used.

i_D^* = breakeven rate of interest collected at time of loan disbursement

$$= \frac{i_B^*}{1 + i_B^*}$$

$$= \frac{0.5265}{1 + 0.5265}$$

$$= 0.3449$$

$$= 34.49\%$$

Calculations of i_B^* and i_D^* are based on simple annual rates of interest. For loans of less than a year, i_B^* is unaffected but i_D^* is reduced if the amount collected is based on an annual rate.

1.4 Review of Literature

The modernization of agriculture in Third World countries in recent decades has made necessary the provision of capital-intensive production technology and massive credit delivery support to small farmers. The new package of technology which includes seeds, fertilizers and chemicals, requires credit as an important source of cash to procure these inputs. Thus, to transform traditional agriculture by increasing farm productivity and income of many small farmers, small farmer credit programs were established with the assumpiton that small farmers respond to economic opportunities in production with considerable economic rationality (56).

In many developing countries, therefore, credit (defined as the capacity to borrow) becomes a necessary ingredient to ensure farm firm development and growth. It provides an external source of capital for many families with low savings. Thus, external credit rationing could limit the rate of farm growth and dampen the rate of technological innovation.

In most cases, however, the goals of small farmer credit programs (SFCPs) are not fully met. Foremost of these goals is to reach out to and extend loans to more small farmers. The high net costs of the lending programs pose serious threats to their viability and continuation, and limit outreach.

The credit component of the Maisan 77 programs, for example, is a typical example of a small farmer credit program suffering from high net costs which are attributed to destructive elements like high administrative costs, concessionally low interest rates and high default rates (or low repayments). As a percent of principal loaned, administrative costs often are high (13). In the Philippines, Javier (37) reported that the administrative costs involved in the intial phases of the Masagana 99 (rice) program were large due to such innovations as "mobile" and "airborne" banks (helicopters) and the large quantity of which had to be processed in order to reach numerous farmers who applied for loans. Small loans require substantial investigation and preparation. Monitoring the use of loans and some developmental modifications tend to further increase administrative costs. While the administrative cost of lending is substantial, it is a less well researched subject. Perhaps, the main reason is the difficulty of measurement.

Gonzales-Vega (31) has noted that interest rates charged on formal agricultural loans in less developed countries are several times lower than the rates charged by informal lenders. Because they have not equated the supply and demand for formal loans in agriculture, such interest rates have generated excess demand which has made nonprice rationing of credit necessary. He further contends that low interest rates may create undesirable income transfers that favor relatively large participating farmers. Kamajou and Baker (40) argue that rates lower than break-even rates restrict the outreach of the program and/or size of individual loans, given the total funds available, and constitute a ceaseless drain on resources of the public sector.

Interest rates held below market levels have a variety of undesirable results. Among these are: reduction in savings and capital formation and efficient allocation of investment funds. They may also reduce access of small-producers to loanable funds and thereby subsidize a relatively few large farmers (49).

Ladman (43) argues that eliminating concessionary interest rates would reduce credit diversion and discourage the use of loans for political ends. However, he doubts if changes in interest rates alone would be sufficient to obtain the desired results of reaching large numbers of small farmers. Adams (1) claims that more cheap credit will not significantly increase agricultural output or help make significant numbers of rural poor better off. He suggests that improved financial intermediation in the financial markets would provide best savings opportunities in rural areas and encourage formal lenders to spread loans to a larger clientele.

The argument for increasing interest rate is supported in Bangladesh (49). Farmers complain about the higher rates but apppear to be assuaged when presented with the bank's reasons for such increases in rates. Some of the reasons explained were: that the rates are still lower than money-lender rates; that service has been improved; that the credit is available for many uses; that it is available to the very small farmers; that interest rates on savings are higher; and that banks could not afford to operate the program without the higher return. Initial results of the Bangladesh project showed that the demand for loans is still strong even when the rate of interest was increased.

Another major source of high cost of lending is non-repayment or default. It is well documented. One example is the performance of the credit component of the Masaganang Maisan (which was renamed Maisan 77 later) program in the Philippines. In general, the repayment performance of farmers involved in the program follows the pattern of poor repayments found among other programs within the country. Phases I to III, for example, recorded declining repayment rates of 80.8 percent, 67.1 percent and 53.5 percent, respectively from July, 1974 to December, 1975. The rate of repayment for Phase IV (January to June, 1976) was 39.9 percent and for Phase V (July to December, 1976), only 29.1 percent (25). In the Philippines, numerous research have been undertaken to study this problem. Studies by Muere (48), Carlos and Vera Cruz (24), and Mariano (45), elicited various reasons for delinquency based on a descriptive approach. These reasons include insufficient cash, crop failure, diversion of funds for personal purposes, marketing problems (low prices) and medical and educational expenses.

Another set of studies grouped their respondents in terms of "good" or "bad" and looked into their characteristics without considerations for the interrelatedness and interactions among the independent variables and with the dependent variable. Nevertheless, these studies found the following factors as significant factors affecting repayment: debt-paying capacity, tenure status, farm size, marketing tie-ups, cash receipts and expenses and income level (23,56).

A third set of studies aimed to determine default or non-repayment by using multiple regression analysis and discriminant analysis. Most common variables mentioned were items that are included in the generation of a farmer's net cash flow. Some of these variables were: production, amount of product sold, educational and medical expenses, outstanding loans, gross cash receipts, total income and cash expenses. Among the variables found to be significantly affecting repayment were size of loan, production per hectare, outstanding loan, misapplication of funds, total income, timeliness of collections, quantity of output sold, age of farmer, household size, availability of irrigation water, educational attainment, gross cash receipts, and borrower's attitude towards the loan. Results of the discriminant analysis showed that borrowers with good repayment records were found to have higher yields, higher total income, lower outstanding loan, and higher amounts of product sold (25,26,50).

One of the paradoxes being observed in the schema of small farmers credit programs is the occurrence of serious loan default in spite of documented success in production and income of farmers (5) This may be explained by the financial behavior of the farmer. In reality, the farmer has to finance production and consumption activities from the resources available to him. Also the farmer must provide for any contingency that may arise in the future. Seasonal cash flows require that he/she manage the deficits and the surpluses well. Thus, two significant points regarding financial behavior could be: first, the farmer must provide reserves to counter risk and uncertainty in addition to provisions for production and consumption needs; and second, he/she must manage seasonal deficits in the cash flow, usually via short-term borrowing. These are not easy for small farm families to manage.

Literature pertaining to risk dates as far back as 1939 with Kalecki's Principle of Increasing Risk (39). This is followed by Shackle's Principle of Ruin which is an early version of a safety-first rule (58). Then, Tobin (59) applied expected utility theory to demonstrate that borrowing can be optimal in the presence of positive cash balances. Boussard and Petit found that linear programming optima could be made to conform more closely with observed results by adding credit and "focus-loss" constraints. Baker (15) generalized the equilibrium conditions of the firm to include financial as well as production and marketing conditions. More specifically, credit was now conceived as a source of liquidity which acquires a value depending on the utility the decision-maker ascribes to it as a risk response. This concept is further explored in the liquidity management theory discussed in detail in the next section of this chapter.

It must be noted that this theory has been applied in various modelling studies of the firm with liquidity specification (17,20,23,40,42). These studies have tested hypotheses of the theory, developed the method, and applied the model using hypothetical data and actual field observations.

1.5 Theoretical Framework

The underlying theory upon which this study is based is the theory of liquidity management. Liquidity can be defined as the ability of the farm firm to raise cash when needed. It is measured by transaction costs of the process. Liquidity can be used to finance unanticipated investment opportunities and to counter the effects of negative events.

There are two sources of liquidity: balance sheet assets and credit. The determination of the liquidity value of assets is based on the concept that a firm is a collection of assets with aggregate value greater than the sum of values from the sale of the assets in isolation (Baker and Bhargava, 1974). An asset's liquidity can be measured by comparing the expected sale value of the asset with a 45^{o} line, OL (see Figure 2). The lower the liquidity value assigned, the greater the upward departure from the 45^{o} line. Assets such as livestock and poultry and other marketable products whose expected sales values exceed their contributions (e.g. as shown by OB) to the farm firm value should no longer be in the balance sheet.

There is no perfectly liquid asset; not even all cash. Cash can be committed to investment opportunities to generate income, but commitment reduces the firm's capacity to respond to risk. Cash can be reserved to add

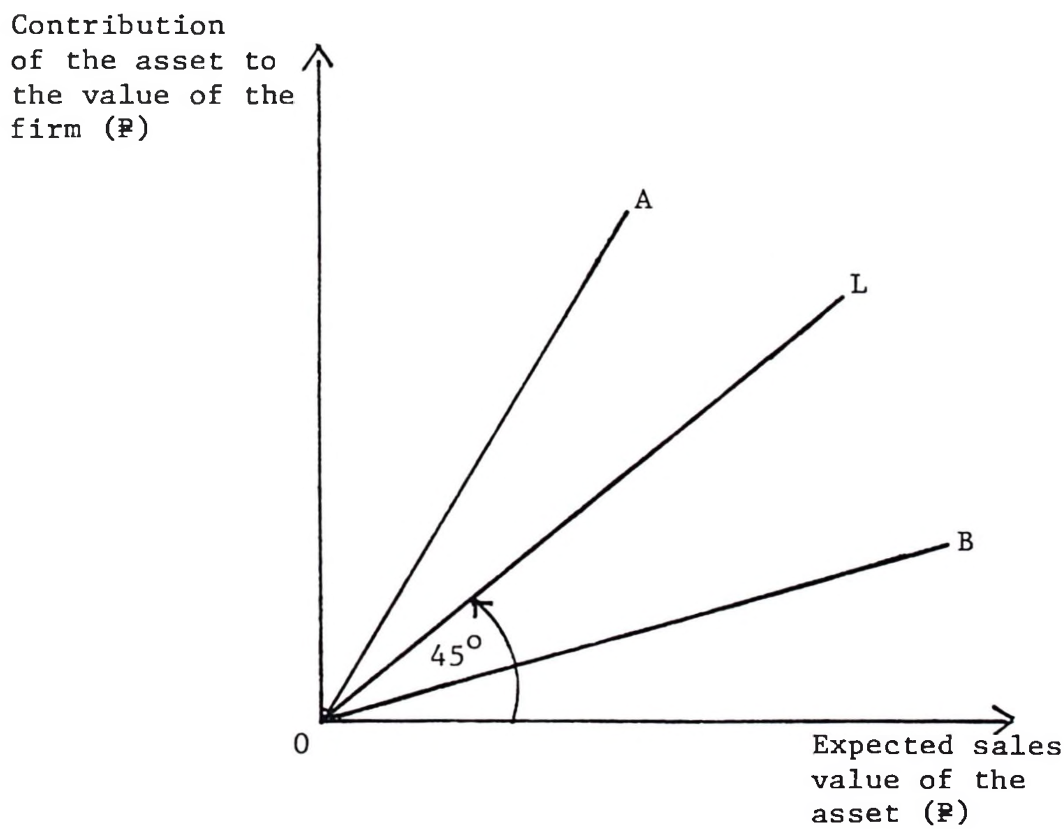

Figure 2. Identification of liquidity value of an asset with the firm.

to a farm firm's risk capacity, but this will reduce possible income; as more cash is reserved, however, the liquidity value of the additional unit of cash declines.

Credit can be defined as borrowing capacity of a farmer-borrower and/or farm/household unit. Credit can be used up by borrowing to produce loan proceeds without actually disposing of the farm firm's assets. Thus credit has a liquidity value. But, credit also can be reserved. Unused credit can be a source of liquidity since it can provide a contingency source of cash when the undrawn balance is substituted for cash reserves. It, therefore, allows the decision-maker to commit cash to production and other expenses. Consequently, a credit source that provides flexible, permanent, and accessible loan proceeds is an important source of farm-firm and household liquidity. Such a credit source will be valued and preserved by borrowers. Preserving it can be expressed in meeting loan obligations as they become due. The reserving and the repayment behavior of the borrower enables the outreach of the program to be expanded to other farmers not yet served.

As shown in Figure 3, as more credit is used, the volume left in reserve diminishes. Given the marginal value product of the credit use for loan (DD), the liquidity value curve (UU), and the cost of money (i), the optimum amount of credit usage can be determined. Interpreting the UU as the supply of loanable funds (reservation price of credit plus cost of money) and DD as the demand for loanable funds, the intersection A would indicate the optimal level of borrowing. Implied in the illustration is that if the use allowed for loan disbursements is restricted, and if the credit source is viewed as uncertain, the decision-maker may not assign liquidity value to the source of credit. The factor that may influence borrowing is the cost

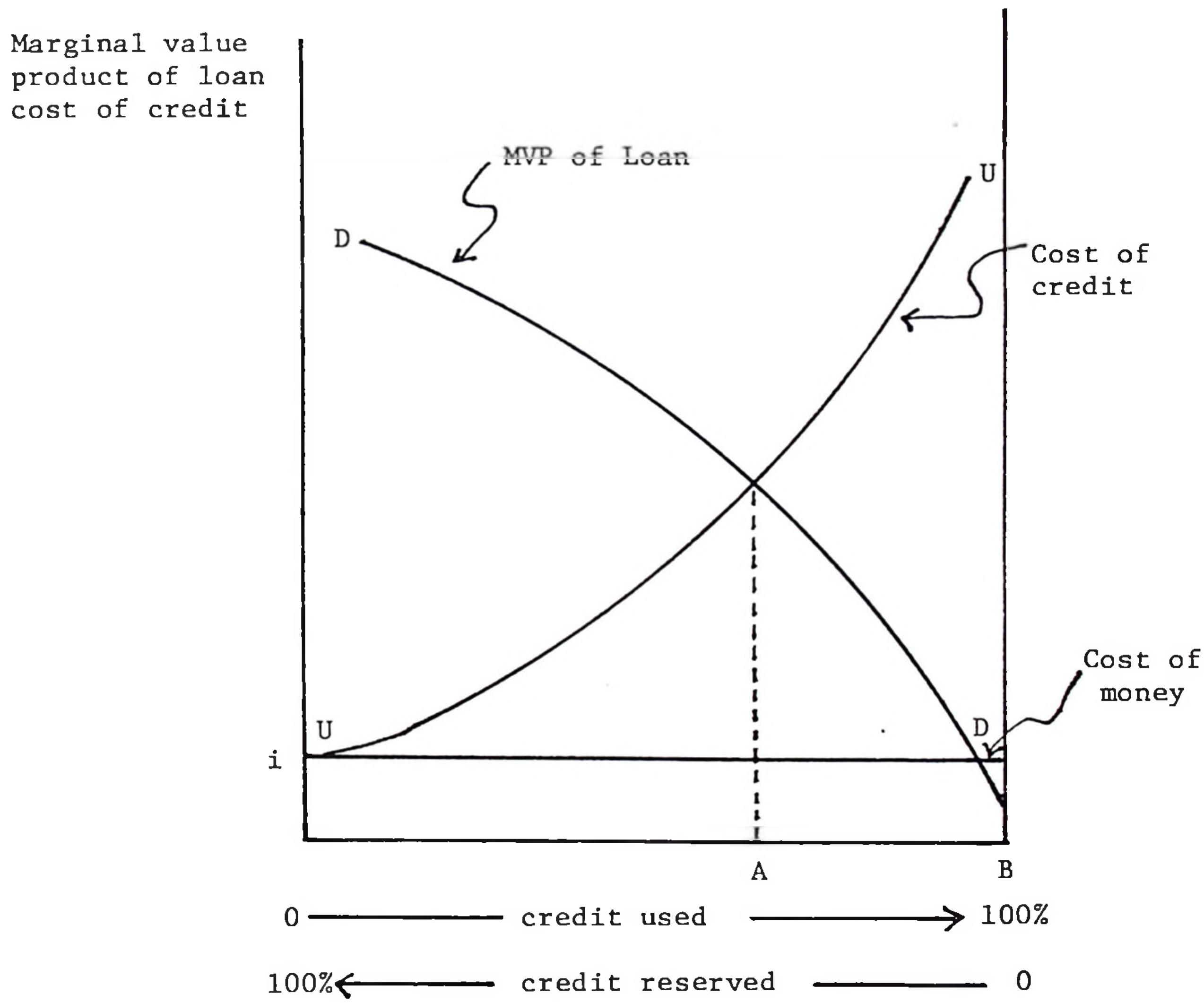

Figure 3. Equilibrium in credit allocation.

Source: Barry, Hopkin, and Baker, 1979. 2nd Ed. Financial Management. The Interstate Printers and Publishers, Inc., Danville, Illinois, p. 220.

of money and the amount borrowed limited by external credit rationing: OB, in Figure 3.

Corn farming is not exempt from the adverse effects of production risks such as drought, floods, insect and disease infestation. The seasonal nature of farming creates problems in management of seasonal cash deficits and surplus, even as prices change in the market. There are also household needs that are not easily divorced from farm production contingencies--educational expenses, weddings, funerals, village festivals, health and medical bills have to be met. The incidence of many such items is uncertain. Thus, the small farmer has to bear risks and manage seasonal deficits with limited, if not negative, cash flows. Reserves management, therefore, becomes an important issue in assessing the financial behavior of small farmers. There are real contingencies and risks that must be dealt with.

Aside from enterprise diversification, farmers can counter different kinds of incertitude in production, marketing and consumption through liquidity management. The general behavior and practice of rural households to keep cash, jewelry and other items that can be readily substituted for cash attest to their preference for holding reserves, ascribing high liquidity value to such items.

Figures 4 and 5 illustrate the behavioral assumptions underlying liquidity management reproduced from Baker (13). On each figure, the vertical axis represents the liquidity value of cash used or reserved and of credit used or reserved. The non-linearity of these relations reflect the common assumption of diminishing marginal returns from either cash or credit as the proportion in reserve increases. The decision-maker's response to uncertainty in his financial and economic environment is reflected in the height and slope of the curves. Highly-positioned and steep curves

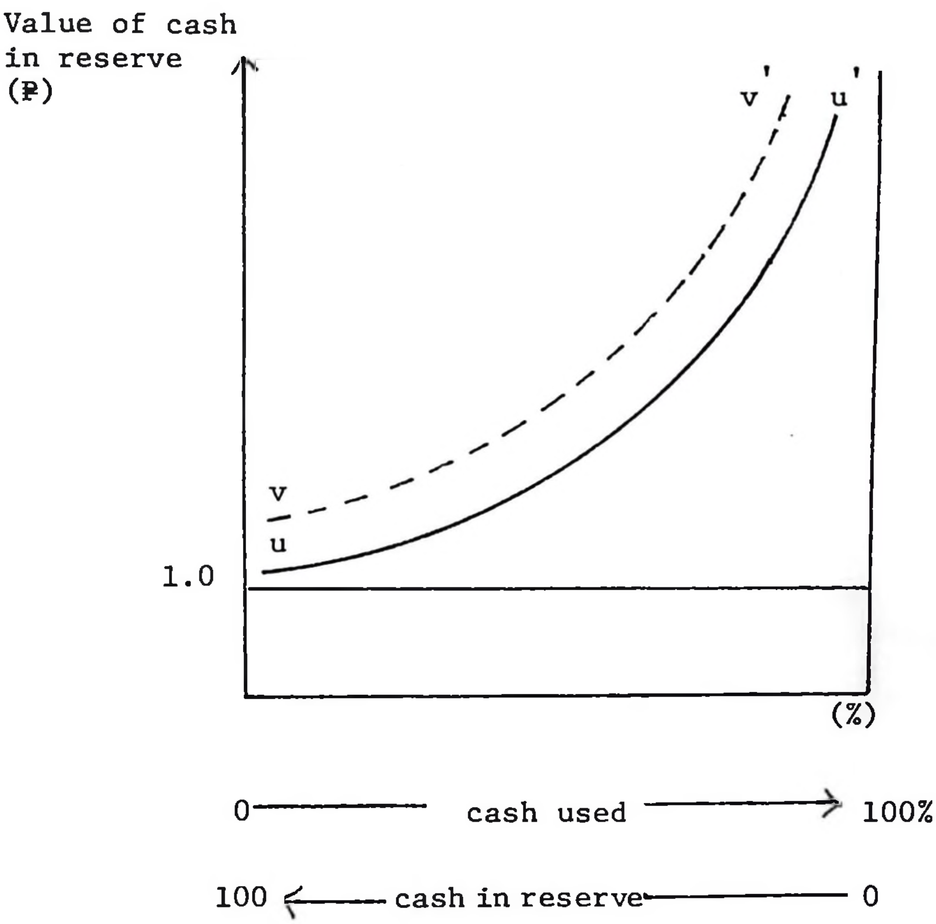

Figure 4. Value of cash in reserve.

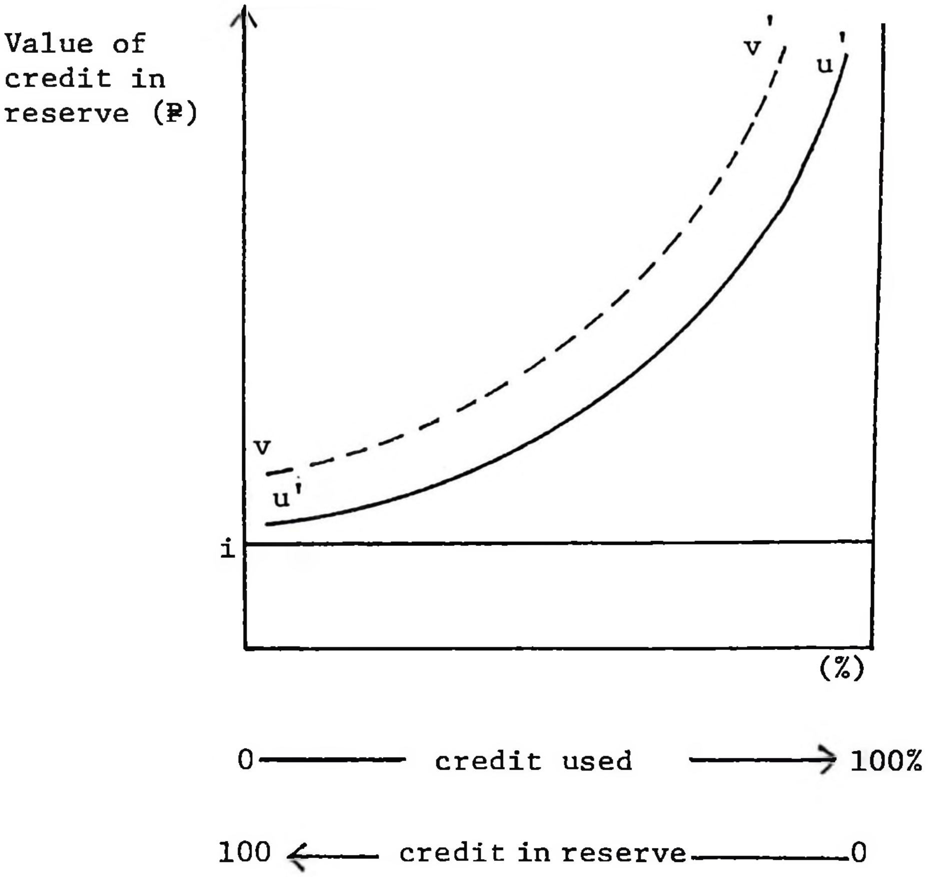

Figure 5. Value of credit in reserve.

illustrate risk-aversion toward financing decisions. A lower position of UU' relative to VV' reflects less aversion to borrowing and risks. The position of the curves may be affected by factors such as age, preference to risk, importance of risk to the manager and experience (17). A significant implication of Figures 4 and 5 is the possibility that a rational firm may use external financing (borrowing) even when holding positive cash balances.

1.6 Objectives of the Study

This study was generated by the persistent huge losses encountered by government production program such as the Maisan 77. High arrears, high administration costs, and low interest rates account for these losses. The default problem is basically behavioral, but it could be influenced also by institutional policies such as that on interest rates, use of loan proceeds, loan management, etc. A strong linkage between non-repayment and poor harvest and income also have been widely reported.

This study, therefore, aims to determine reforms in the system that can (1) reduce the net cost of lending and (2) improve the financial and economic well-being of farmer-borrowers by establishing simulations of a validated linear programming model to determine results of variations in the form of loan disbursement, interest rates and credit limits.

At a minimum, it is assumed that the changes suggested in the preceding paragraph will not diminish incentives to repay. Such an assumption seems highly plausible in as much as when the value of credit increases, the farmer-borrower's incentive to repay, and thus protect the credit, improves.

CHAPTER II

THE MODEL

To achieve the objective of this study, the small farm producing corn is modelled taking into account its production, consumption, marketing, and financing activities. The use of linear programming to model the farm, given policy specifications and the resulting effects of farmers' behavioral responses, has been proven useful in studies by Baker and Bhargava (17), Kamajou and Baker (41), Castillo (23) and Kinimoz (42).

2.1 Linear Programming Specifications

Linear programming is best described in terms of the objective function, constraints and activities. Linear functions specify how limited resources are allocated among competing activities. The general relationship is expressed mathematically as:

$$\text{Maximize } Z = \sum_{j=1}^{n} C_j X_j$$

subject to:

$$\sum_{j=1}^{n} a_i X_j \lesseqqgtr b_i \quad , \quad i = 1 \ldots\ldots m \qquad (2)$$

$$j = 1 \ldots\ldots n$$

$$\text{and } X_j \geq 0. \qquad (3)$$

where Z is the objective function or the function to be maximized;

X_j's are the activities or decision variables;

C_j's are the contributions of jth activities to the value of the objective function;

a_{ij}'s are the rates of use of (or contribution to) the b_ith constraint (or requirement) by a unit of $_j$th activity;

and the b_i's are the resource or requirement levels.

Equations (2) and (3) are the set of constraints. The constraints and the non-negativity conditions should be satisfied in optimization.

More specifically, Baker (15) argues that the liquidity approach to risk management can be illustrated as:

$$\text{Max } Z = c_1x_1 + \ldots\ c_jx_j + \ldots + c_nx_n + c_\ell x_\ell$$

Subject to:

$$a_{11}x_1 + .. + a_{ij}x_j + .. + a_{in}x_n \lesseqgtr b$$

$$a_{j1}x_1 + .. + a_{ij}x_j + .. + a_{jn}x_n \lesseqgtr b_i$$

$$a_{m1}x_1 + .. + a_{mj}x_j + .. + a_{mn}x_n \lesseqgtr b_m$$

$$a_{ca1}\ x_1 + .. + a_{caj}x_j + .. + a_{can}x_n + a_{ca1}\ x_\ell = \text{cash}$$

$$a_{cr1}x_1 + .. + a_{orj}x_j + .. + a_{crn}x_n + a_{cr\ell}x_\ell = \text{credit}$$

$$a_{\ell 1}x_1 + .. + a_{\ell j}x_j + .. + a_{\ell n}\ x_n + 2_{\ell\ell}x_\ell = \text{liquidity}$$

where:

Z is the objective function including liquidity values $C_\ell X_\ell$;

X_j's are the activity alternatives in production, consumption, marketing and finance;

b_i's are the constraints: requirements (>), restrictions (<) and equalities (=);

a_{ij} is an addition to (<0) or subtraction from (>o) b_i by a unit of x_j

c_j is an addition to (>0) or subtraction from (<0) Z by a unit of x; and

$a_{\ell j}$ is the addition to (<0) or satisfaction of (>0) liquidity by a unit of x.

2.2 Data, Study Area, Sampling and Limitations

To specify the model, coefficients were estimated with primary data taken from field survey and direct observation of corn farmers. Fifty small farmers producing corn were personally interviewed using a pre-tested questionnaire. (Please see Appendix B.) The respondents were in five towns geographically situated in the Province of Negros Oriental. Negros Oriental is a white corn-producing and a major corn-eating province located in the central region of the Philippines. It has a total land area of 503,753 hectares with about 60% classified as cultivable (61), 44% of which is devoted to corn production. Total population as of 1980 was 822,923 consisting of 97,089 farm families and 34,338 non-farm families. Females above 21 years (146,855) outnumber the males above 21 years (108,946). Average family size was six (44).

Secondary data were collected from the provincial offices of the Ministry of Agriculture, the Philippine Council on Resources Research (PCARR), the Presidential Council on Agricultural Credit (PCAC), Technical

Board for Agricultural Credit (TBAC), and from the National Food and Agriculture Council (NFAC).

To gain greater insight into the problem of poor repayment and default, Philippine National Bank (PNB) personnel and Rural Bank (RB) officials also were interviewed. A better understanding of the credit delivery system was seen after these interviews and from observing some of the records of these financing institutions.

Sampling procedure

Five towns were selected in which to sample farmer-borrowers: namely, Bayawan, Siaton, Dauin, La Libertad and Mabinay. These towns were chosen based on their geographical location within the province. (Please see Appendix C.) An effort was made to interview farmer-respondents that met the following criteria:

1) they must be small farmers producing corn who borrowed funds from the government's Maisan 77 program:
2) they must come from areas in the province with a high incidence of corn production; and
3) they must be representative of either upland or lowland small corn farmers.

The upland towns were Bayawan and Mabinay. La Libertad, Siaton and Dauin were the lowland towns. They had a total number of 2,800 borrowers. From each town, ten respondents were selected randomly from populations that met the above stated criteria. (Refer also to Section 3.3.) Each respondent was interviewed with a survey instrument translated from English into the local dialect. The translation was facilitated by the farm technicians of the Bureau of Agricultural Extension, Ministry of Agriculture.

These technicians were also helpful in locating the respondents and in establishing rapport and confidence during the interviews.

Efforts were exerted to extract unbiased information from the respondents, however, it must be kept in mind that data from interviews can never be totally accurate owing to the respondents' reliance on memory recall. In general, Philippine corn farmers do not keep records of their farm activities and results.

The sample size of 50 farmers may not be sufficient to produce significant coefficients of the variables used in the regression analysis. However, since this study is behavior-oriented, more time was devoted to an in-depth investigation of the problem of poor repayment, default and financing of corn farms than to a larger sample. The researcher gathered more understanding from a two to three-hour interview per respondent than he would have found in less time per interview with a larger sample, given the limited time and resources available for the survey. For purposes of the linear programming analysis, however, the sample of 50 farms was deemed sufficient for average data supplemented by secondary data.

2.3 Summary of Farmer and Farm Characteristics

2.3.1 The farmer and his household

The average corn farmer surveyed in this study was 47.6 years old. He had an average formal education of 6 years. More than half of his entire life, 26.9 years, was spent in corn farming.

The average household size was seven members including the respondent. Household membership includes other persons besides the nuclear family. They could be grandparents, nephews, nieces and other relatives. Two members of the seven are presently enrolled in school. Usually they were the younger children who may or may not assist in farming. The older children and adults were the primary source of farm labor.

With wide-ranging government programs geared towards small farmer development, the typical corn farmer was a member of at least one farm organization. Farm organizations serve as a means for socio-economic and political interaction. Mutual help and cooperation among members is expected. Farm organizations also become centers for communicating farm techniques and innovations. In most instances, older villagers and relatively well educated farmers were the elected officers and opinion leaders of these farm organizations. The average farmer was also a member of a religious group. Sixty percent of the respondents were owner-operators. The balance were leaseholders as provided for in the land reform code enforced at the declaration of martial law in late 1972.

2.3.2 Farm size

The average size of farm was 2.37 hectares.[a] There are four seasons per year; average corn hectarage was 1.9, 0, 1.6 and 0 hectares per season; thus the average effective crop area for corn was 3.5 hectares.

2.3.3 Soil conditions

In the upland areas, soil planted to corn is clayey, lumpy and reddish-brown in color. In the lowlands, however, soil was found to be loose and friable particularly those closer to the seashores. A characteristic difference in average farm size was observed between upland (4.0 ha) and lowland (1.3 ha) survey areas.

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[a]One hectare = 2.5 acres

2.3.4 Cropping seasons

Monsoon rains fall earlier in the upland areas than in the lowlands, enabling upland farmers to plant corn earlier than lowland farmers. Usually, more hectarage is planted to corn during the first cropping season or the wet months (June - September). Farmers realize higher yields during this period due to favorable weather and sufficient moisture. Hectarage is reduced during the second cropping or the dry season (December - March) when rainfall becomes limited and drought may occur. Season 2 covers the months of October and November while season 4 consists of the months of April and May. These are the periods when farmers usually sell corn and repay loans. The four seasons described above will be specified in the linear programming model in the next section.

2.3.5 Other crops and poultry produced

The average farmer produces other crops aside from corn, such as legumes and vegetables. These production activities, however, are not included in the model. Root crops like cassava and sweet potatoes, bananas and fruit trees are also grown by some farmers in limited quantity and area and absorb a small amount of labor. Generally, the farmer raises these crops, along with native chickens, for household consumption and for sale. The contributions of these other crops and poultry to meet some of the dietary requirements of the household are included in the model. Cash proceeds generated from sales are reflected in the beginning cash resource.

2.3.6 Labor utilization

The main sources of labor in performing farm operations were the farmer, family members, hired and exchanged laborers. Land preparation requires the most amount of labor input. This is followed by planting and cultivation combined with furrowing. Usually, fertilizing and spraying of farm chemicals could be completed in one and a half days while shelling and drying would require even less than a man-day depending on the number of workers. (See Appendix Table C for conversions used in this study.)

2.3.7 Non-farm activities

Some farmers and members of the household have various non-farm activities. These include handicrafts, tuba (or coconut sap) gathering, seasonal government contractual labor for road repairs, private employment and entrepreneurship. The average earnings from non-farm employment and activities are included in the amount of cash supply (or beginning cash) specified at the right-hand side values of the model.

2.3.8 Financial practices and attitudes

The respondents reported the need to borrow funds in times of emergency and for farm production. The two main sources of borrowed funds pinpointed were private moneylenders and the Maisan 77 program. They deplored the high rates of interest being charged by private moneylenders and wished the size of loan granted by the government program was larger.

There is a general positive attitude towards program credit. Respondents indicated benefits from the program in terms of higher yields due to application of fertilizers and farm chemicals. When asked about the possible reasons for failure to repay formal loans, the following were mentioned: poor harvests due to natural calamities (floods, drought) and pests and disease; low price of corn at harvest time; and lack of money to repay. Nevertheless the majority of respondents thought that government program loans need to be repaid.

The problems farmer - borrowers encounter in relation to the Maisan 77 credit program included: untimely distribution and availability of inputs (seeds, fertilizers and chemicals); distance from farms to banks and input distributors; and, interestingly, inadequate cash component of the program loan.

It was observed that the surveyed rural households seldom utilize the services of the local rural banks for savings. Those who reported savings accounts preferred the national bank (PNB) which they perceived to be more stable since it is owned by the government. No exact and accurate figures on savings were revealed. When asked, however, about the importance of savings, almost all respondents agreed that it is important to save-- to meet emergency needs, to buy farm inputs, to send children to school and to pay for medical and health bills.

2.4 The Data of the Model

Data requirements include average production, consumption, marketing, and financial activities of a typical small corn farmer and his household. It must be pointed out that this model recognizes the important concept of liquidity management described earlier.

The following section presents the general model's objective function, constraints and activities. (See the Appendix Table A for the LS-LP matrix).

2.4.1 Objective function

This study posits that the main objective of a corn farm-family is to maximize its net cash flow plus liquidity values, subject to the restrictions imposed by his farm land, labor supply, crop and fertilizer inventory, dietary needs, family living expenses, credit and so forth. (See below for a description of constraints.)

The objective function specifies as the maximand the net cash flow plus the liquidity value of reserved cash and credit. The net cash flow is given by the level of cash transfer to the objective function which also includes the reserved cash and credit at valuation rates found in the validation process. Reserved cash and credit are included in the model to account for risk reponse in the form of liquidity preference.

2.4.2 Constraints and requirements

All the various constraints and requirements are grouped and described in Table 1. Unless otherwise stated, these constraints and requirements are seasonally (four seasons) differentiated.

1) Land supply (LS)

This is the average farm land available for planting to corn in each season. This area is totally planted to corn during the first season (wet) and only partially during the third season (dry). Due to lack of rainfall during the dry season, farmers opt to plant crops other than corn. Different farmers plant different crops. Due to insufficient data on other crops planted, no constraints and activities related to other crops were included in the model. Besides, only a small portion of the farm was

Table 1

Model Constraints: Negros Oriental, Philippines

Row No.	Row I.D.	Row Description	Relation	Level	Unit
0	Z	Objective function	N	1.9	pesos
1	LS1	Land supply, season 1	LE	1.9	hectares
2	LS3	Land supply, season 3	LE	1.6	hectares
3	FLS1	Family labor supply, season 1	LE	426.6	man-days
4	FLS3	Family labor supply, season 3	LE	406.08	man-days
5	HLS1	Hired labor supply, season 1	LE	216.3	man-days
6	HLS3	Hired labor supply, season 3	LE	250.5	man-days
7	FCI1	Fertilizer & chemical inventory, season 1	E	0	kilograms
8	FCI3	Fertilizer & chemical inventory, season 3	E	0	kilograms
9	CI1	Corn inventory, season 1	E	5	cavans
10	C12	Corn inventory, season 2	E	0	cavans
11	CI3	Corn inventory, season 3	E	0	cavans
12	CI4	corn inventory, season 4	E	0	cavans
13	MCI1	Milled corn inventory, season 1	E	0	cavans
14	MCI2	Milled corn inventory, season 2	E	0	cavans

Table 1 (continued)

Row No.	Row I.D.	Row Description	Relation	Level	Unit
15	MCI3	Milled corn inventory, season 3	E	0	cavans
16	MCI4	Milled corn inventory, season 4	E	0	cavans
17	CBPI1	Corn by-products inventory, season 1	E	0	kilograms
18	CBPI2	Corn by-products inventory, season 2	E	0	kilograms
19	CBPI3	Corn by-products inventory, season 3	E	0	kilograms
20	CBPI4	Corn by-products inventory, season 4	E	0	kilograms
21	HI2	Hog inventory, season 2	E	0	kilograms
22	HI4	Hog inventory, season 4	E	0	kilograms
23	KR1	Caloric requirements, season 1	E	1,023,876	calories
24	KR2	Caloric requirements, season 2	E	511,938	calories
25	KR3	Caloric requirements, season 3	E	1,023,876	calories
26	KR4	Caloric requirements, season 4	E	511,938	calories
27	PR1	Protein requirements, season 1	E	22,336	grams
28	PR2	Protein requirements, season 2	E	11,168	grams
29	PR3	Protein requirements, season 3	E	22,336	grams
30	PR4	Protein requirements, season 4	E	11,168	grams

Table 1 (continued)

Row No.	Row I.D.	Row Description	Relation	Level	Unit
31	FR1	Fat requirements, season 1	E	16,386	grams
32	FR2	Fat requirements, season 2	E	8,193	grams
33	FR3	Fat requirements, season 3	E	16,386	grams
34	FR4	Fat requirements, season 4	E	8,193	grams
35	IR1	Iron requirements, season 1	E	3,254	milligrams
36	IR2	Iron requirements, season 2	E	1,627	milligrams
37	IR3	Iron requirements, season 3	E	3,254	milligrams
38	IR4	Iron requirements, season 4	E	1,627	milligrams
39	TR1	Thiamine requirements, season 1	E	446	milligrams
40	TR2	Thiamine requirements, season 2	E	227	milligrams
41	TR3	Thiamine requirements, season 3	E	446	milligrams
42	TR4	Thiamine requirements, season 4	E	227	milligrams
43	CS1	Cash supply, season 1	E	1,800	pesos
44	CS2	Cash supply, season 2	E	300	pesos
45	CS3	Cash supply, season 3	E	400	pesos
46	CS4	Cash supply, season 4	E	0	pesos

Table 1 (continued)

Row No.	Row I.D.	Row Description	Relation	Level	Unit
47	CA1	Cash account, season 1	E	0	pesos
48	CA2	Cash account, season 2	E	0	pesos
49	CA3	Cash account, season 3	E	0	pesos
50	CA4	Cash account, season 4	E	0	pesos
51	CR120	Cash reserve, season 1 at 20%	E	0	pesos
52	CR140	Cash reserve, season 1 at 40%	E	0	pesos
53	CR160	Cash reserve, season 1 at 60%	E	0	pesos
54	CR180	Cash reserve, season 1 at 80%	E	0	pesos
55	CR1100	Cash reserve, season 1 at 100%	E	0	pesos
56	CR220	Cash reserve, season 2 at 20%	E	0	pesos
57	CR240	Cash reserve, season 2 at 40%	E	0	pesos
58	CR260	Cash reserve, season 2 at 60%	E	0	pesos
59	CR280	Cash reserve, season 2 at 80%	E	0	pesos
60	CR2100	Cash reserve, season 2 at 100%	E	0	pesos
61	CR320	Cash reserve, season 3 at 20%	E	0	pesos
62	CR340	Cash reserve, season 3 at 40%	E	0	pesos
63	CR360	Cash reserve, season 3 at 60%	E	0	pesos

Table 1 (continued)

Row No.	Row I.D.	Row Description	Relation	Level	Unit
64	CR380	Cash reserve, season 3 at 80%	E	0	pesos
65	CR3100	Cash reserve, season 3 at 100%	E	0	pesos
66	CR420	Cash reserve, season 4 at 20%	E	0	pesos
67	CR440	Cash reserve, season 4 at 40%	E	0	pesos
68	CR460	Cash reserve, season 4 at 60%	E	0	pesos
69	CR480	Cash reserve, season 4 at 80%	E	0	pesos
70	CR4100	Cash reserve, season 4 at 100%	E	0	pesos
71	ICL1	Informal credit limit, season 1	L	800	pesos
72	ICL2	Informal credit limit, season 2	E	400	pesos
73	ICL3	Informal credit limit, season 3	E	800	pesos
74	ICL4	Informal credit limit, season 4	E	400	pesos
75	ICA1	Informal credit account, season 1	E	0	pesos
76	ICA2	Informal credit account, season 2	E	0	pesos
77	ICA3	Informal credit account, season 3	E	0	pesos
78	ICA4	Informal credit account, season 4	E	0	pesos
79	ICR120	Informal credit reserve, season 1 at 20%	E	0	pesos
80	ICR140	Informal credit reserve, season 1 at 40%	E	0	pesos

Table 1 (continued)

Row No.	Row I.D.	Row Description	Relation	Level	Unit
81	ICR160	Informal credit reserve, season 1 at 60%	E	0	pesos
82	ICR180	Informal credit reserve, season 1 at 80%	E	0	pesos
83	ICR1100	Informal credit reserve, season 1 at 100%	E	0	pesos
84	ICR220	Informal credit reserve, season 2 at 20%	E	0	pesos
85	ICR240	Informal credit reserve, season 2 at 40%	E	0	pesos
86	ICR260	Informal credit reserve, season 2 at 60%	E	0	pesos
87	ICR280	Informal credit reserve, season 2 at 80%	E	0	pesos
88	ICR2100	Informal credit reserve, season 2 at 100%	E	0	pesos
89	ICR320	Informal credit reserve, season 3 at 20%	E	0	pesos
90	ICR340	Informal credit reserve, season 3 at 40%	E	0	pesos
91	ICR360	Informal credit reserve, season 3 at 60%	E	0	pesos
92	ICR380	Informal credit reserve, season 3 at 80%	E	0	pesos
93	ICR3100	Informal credit reserve, season 3 at 100%	E	0	pesos
94	ICR420	Informal credit reserve, season 4 at 20%	E	0	pesos
95	ICR440	Informal credit reserve, season 4 at 40%	E	0	pesos
96	ICR460	Informal credit reserve, season 4 at 60%	E	0	pesos
97	ICR480	Informal credit reserve, season 4 at 80%	E	0	pesos

Table 1 (continued)

Row No.	Row I.D.	Row Description	Relation	Level	Unit
98	ICR4100	Informal credit reserve, season 4 at 100%	E	0	pesos
99	PCL1	Program credit limit, season 1	L	1710	pesos
100	PCL3	Program credit limit, season 3	L	1440	pesos
101	PCA1	Program credit account, season 1	E	0	pesos
102	PCA3	Program credit account, season 3	E	0	pesos
103	PCR120	Program credit reserve, season 1 at 20%	E	0	pesos
104	PCR140	Program credit reserve, season 1 at 40%	E	0	pesos
105	PCR160	Program credit reserve, season 1 at 60%	E	0	pesos
106	PCR180	Program credit reserve, season 1 at 80%	E	0	pesos
107	PCR1100	Program credit reserve, season 1 at 100%	E	0	pesos
108	PCR320	Program credit reserve, season 3 at 20%	E	0	pesos
109	PCR340	Program credit reserve, season 3 at 40%	E	0	pesos
110	PCR360	Program credit reserve, season 3 at 60%	E	0	pesos
111	PCR300	Program credit reserve, season 3 at 80%	E	0	pesos
112	PCR3100	Program credit reserve, season 3 at 100%	E	0	pesos
113	ICDB1	Informal debt balance, season 1	E	0	pesos

Table 1 (continued)

Row No.	Row I.D.	Row Description	Relation	Level	Unit
114	ICDB2	Informal debt balance, season 2	E	0	pesos
115	ICDB3	Informal debt balance, season 3	E	0	pesos
116	ICDB4	Informal debt balance, season 4	E	0	pesos
117	PCDB1	Program debt balance, season 1	E	0	pesos
118	PCDB3	Program debt balance, season 3	E	0	pesos
119	LRR1	Liquidity reserve requirement, season 1	G	400	pesos
120	LRR2	Liquidity reserve requirement, season 2	G	200	pesos
121	LRR3	Liquidity reserve requirement, season 3	G	400	pesos
122	LRR4	Liquidity reserve requirement, season 4	G	200	pesos

planted to other crops and the input requirements were minimal. However, the consumption of other crops meet some of the dietary requirements of the household, as will be shown later.

The RHS values in seasons 1 (1.9 ha.) and 3 (1.6 ha.) represent the average area available for corn production. The relation is less than or equal to allow use of land at less than the available hectarage and to ensure that no more land than is available can be used. Idling of land is also permitted.

2) Family labor supply (FLS)

Total family labor supply in each cropping season was determined by the contribution of each family member in the farming activity. Out of seven family members, five are potential sources of family labor. Two members, father and an older son provide full-time labor in the farm while the mother, who is also a housewife, and a younger son or daughter provide 0.33 man-days each of labor and another son or daughter provides 0.5 man-days of labor. Two pre-school age members of the household do not provide any family labor.

One man-day of labor was estimated at six hours of farm work to account for rest periods during hot and humid mid-day hours. The rest of daytime hours were used for feeding hogs and chickens, walking to and from the fields (some are quite a distance from the house) or tending the vegetable garden.

Days lost due to sickness, social ceremonies, holidays and Sundays are accounted for. During the third season, however, family labor supply is reduced due to a series of holidays and social and religious ceremonies.

The RHS value indicates the amount of family labor available for own farm production, for hiring out to other farms (off-farm activity) and for non-farming activities like entrepreneurship or employment. The relation is less than or equal to allow use of family labor for corn production and for hiring out to other farms. The rest could be used for non-farm activities or remain idle.

3) Hired labor supply (HLS)

The RHS values represent the amount of hired labor made available for hiring in. The farm unit uses this hired labor supply basically for corn production in both cropping seasons. The relation is less than or equal as in family labor supply.

4) Fertilizer and chemical inventory (FCI)

The purposes of this inventory is to provide fertilizer and chemical inputs for corn production in seasons one and three. The zero quantities in the RHS indicate complete utilization of whatever fertilizer and chemicals were provided by the program. The relation is an equality since the input acquired has to be used.

5) Corn inventory (CI)

The RHS value for season 1 shows a beginning inventory available for seed purposes and dietary requirements specified as 15 cavans[a] of corn. This quantity is assumed to be available at the first day of season 1 when the farm-household unit is just beginning to plant corn. The equality relation means that the amount of corn needed to meet seed and consumption requirements in

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[a] A cavan is equal to 50 kilograms of shelled corn.

season 1 is equal to 5 cavans. For succeeding seasons, the equality relation and zero RHS values indicate total depletion of corn output by seed allocation, by consumption (human and animal), by sales and inventory transfer. It is assumed that nothing is spoiled or lost in transport and storage.

Season 2 corn is provided by harvest of corn growing in season 1. Season 4 corn was provided by harvest of corn grown in season 3.

6) Milled corn inventory (MCI)

Corn for human consumption was provided by a milling process. This inventory therefore, reflects corn grits available for family consumption. The zero values of the RHS indicate total disposal of any milled corn by consumption in each season.

7) Corn by-products inventory (CBPI)

The purpose of this constraint is to allow for the feeding of native hogs mainly with corn bran. The RHS values signify total depletion of corn bran provided for by native swine consumption.

8) Hog inventory (HI)

This constraint accounts for the increase or decrease in hog liveweight after feeding or selling. The RHS values indicate total disposition of any hog raised by selling in the respective seasons.

9) Dietary requirements (KR), (PR), (FR), (IR), (TR)

The dietary constraints are introduced to assure the satisfaction of the farm-household unit with five important components of a Filipino diet, namely, calories, proteins, fats, iron and thiamine. The RHS quantities for each row represent a required dietary level computed on the basis of the Food and Nutrition Research Council of the Philippines (FNRC) recommendations. (See Appendix Tables B).

The total dietary needs for each nutrient were determined by multiplying the daily per capita requirements by the number of adults and adult-equivalents in the household times the number of days per season. In this study, three children below ten years old (including a baby above one year) are equal to one adult.

After computing total dietary needs for each nutrient, the specific contributions of other crops such as bananas, malunggay and mongo beans to meet the five nutrients were subtracted from the total need levels. Thus, the RHS values represent net caloric, protein, fat, iron and thiamine requirements that must be satisfied by corn consumption and by purchases.

The constraint is differentiated by seasons and the relation is equality to specify exact meeting of the requirements by farm-garden production and/or purchases.

10) Cash supply (CS)

The cash supply specifies the amount of cash the farm-household has at the start of the season. The level of cash is increased by selling, hiring out labor, borrowing and inter-season transfer. It is reduced by cash allocation to alternative uses and reserves. The relation is equality to indicate that cash is used, reserved, or transferred to the next season and ultimately to the objective function.

The RHS values of cash supply for all seasons also reflect added cash from sale of other crops, income from non-farm employment (excluding income from labor hired out), cash borrowed from parents, relatives and friends which was interest-free, and winnings from lotteries.

11) Cash account (CA)

This is a facilitating constraint to allow allocation of cash to alternative uses. It is an alternative to cash reserve. It provides cash use for farm-firm and household expenses and debt repayments. The constraint is an equality and the level of restriction is zero: cash allocated from supply to account is exhausted by total payments of all debts and meeting of farm and household expenses.

12) Cash reserve (CR)

These constraints are entered into the model to handle any cash reserves emanating from cash allocation activities. For example, row CR_{ij} refers to the cash reserve in the i^{th} season and at j^{th} percentage reservation. Thus, CR120 and CR260 refer to reserved cash in season 1 at 20 percent and in season 2 at 60 percent, respectively. The relations are equalities to make sure that all cash reserves are valued in the objective function.

The proportion of cash allocated for reserve every season is set at five alternative levels: 20%, 40%, 60%, 80% and 100%. These levels are arbitrarily selected to approximate the cash-liquidity value curve in Fig. 4. The amount of cash a farmer reserves would depend on the liquidity value of cash, compared with the return from using cash in alternative activities.

As more cash is released for other purposes, the liquidity value of cash held in reserve will tend to increase. Thus, the reservation of cash affects all cash-using decisions and eventually the income of farmers. In an instance where insurance is not available to buffer event risks the reservation of cash for added liquidity is a logical choice to allow for uncertainties and contingencies. The equilibrium allocation is reached where return from the use of cash is equal to the liquidity value of cash.

13) Program credit limit (PCL)

This constraint specifies the amount of formal loan which a farmer could borrow through the Maisan 77 program. This loan is noncollateral, supervised, matures in six months and bears a 12% interest rate per annum with interest deducted automatically at the time of loan disbursement. It is mainly obtained from the government-owned Philippine National Bank (PNB) and the privately-owned rural banks (RB's). Disbursement is made in cash and in kind with the cash portion intended mainly for hired labor expenses and the in-kind portion intended mainly for fertilizer and chemicals procurement. Based on Maisan 77 Guidelines for Negros Oriental (1980-81), the cash portion was placed at 21% of the limit which was set at P900 per hectare while the in-kind limit was placed at 73%. The relation is less than or equal to allow for the possibility of obtaining an amount less than the limits.

14) Program credit account (PCA)

The amount in credit account is available for loans to finance farm firm and household expenses and debt repayment. The equality relation suggests that any program credit allocated to the account is used for borrowing.

15) Program credit reserve (PCR)

Similar to cash reserve, this constraint provides for program credit that is allocated for reserve. Credit which is earlier defined as the producer's capacity to borrow, is a source of liquidity and can be used for borrowing and for reserve. The incentive to reserve program credit is the farmer-borrower's perception of the credit reserve's value relative to cash for use for firm and household outlays.

The credit reservation levels are arbitrarily set at 20%, 40%, 60%, 80% and 100% levels, to approximate the credit-liquidity value curve in Fig. 5. Thus PCR140 and PCR3100 refer to program credit reserve in season 1 when 40% is held in reserve and in season 3 when 100% is held in reserve. The relations are equalities as in the cash reserve rows.

16) Informal credit limit (ICL)

This credit limit is determined by the potential amount of funds the farm-household unit can obtain from private moneylenders in the village or town. The relation is less than or equal to allow borrowing at less than the limit.

17) Informal credit account (ICA)

This row specification is identical to the program credit account in creation and relation.

18) Informal credit reserve (ICR)

This is analogous to cash and program credit reserve rows which specify the amounts of informal credit that are allocated to reserve. The reservations are also set at five alternative levels: 20%, 40%, 60%, 80% and 100%. They are seasonally differentiated and with equality relations.

19) Program and informal debt balances (PDB), (IDB)

These rows specify the accumulation of debts every season. Borrowing generates debts which must be repaid or carried over as liabilities at the end of the planning period or not be repaid at all. The balance is equal to zero and the relations are equalities to reflect that the debts must be repaid at the end of each season or be transferred forward as unpaid obligations. In the case of informal debt however, there is the possibility of debt carry-over to the objective function.

20) Liquidity reserve requirements (LRR)

These are specifications of the total reserve requirements of the farm each season. These are entered into the model to reflect increases or decreases in the level of liquidity required brought about by the relative risk of various activities. The relation is greater than or equal to allow for liquidity reserves beyond the average limit set by the respondents. The reserve requirement is met by holding cash and/or credit reserves.

2.4.3 Activities

All the activities in this model are presented in Table 2 and can be grouped into the following major headings: production, consumption, marketing and financing activities. More specifically, the production, consumption and marketing activities include production of white corn, hiring labor in and out, milling of corn, eating of corn as a staple, meeting dietary needs, selling of corn, feeding of native hogs, selling of hogs

Table 2

Model Activities: Negros Oriental, Philippines

Col. No.	Col. I.D.	Column Description	Unit
1	PC1	Produce corn, season 1	hectares
2	PC3	Produce corn, season 3	hectares
3	HIL1	Hire in labor, season 1	man-days
4	HIL3	Hire in labor, season 3	man-days
5	MC1	Mill corn, season 1	cavans
6	MC2	Mill corn, season 2	cavans
7	MC3	Mill corn, season 3	cavans
8	MC4	Mill corn, season 4	cavans
9	CMC1	Consume milled corn, season 1	kilograms
10	CMC2	Consume milled corn, season 2	kilograms
11	CMC3	Consume milled corn, season 3	kilograms
12	CMC4	Consume milled corn, season 4	kilograms
13	SC2	Sell corn, season 2	cavans
14	SC4	Sell corn, season 4	cavans
15	FH1	Feed hogs, season 1	kilograms

Table 2 (continued)

Col. No.	Col. I.D.	Column Description	Unit
16	SH2	Sell hogs, season 2	kilograms
17	FH3	Feed hogs, season 3	kilograms
18	SH4	Sell hogs, season 4	kilograms
19	SCBP1	Sell corn by-products, season 1	cavans
20	SCBP2	Sell corn by-products, season 2	cavans
21	SCBP3	Sell corn by-products, season 3	cavans
22	SCBP4	Sell corn by-products, season 4	cavans
23	TCBP1	Transfer corn by-products, from season 1 to season 2	cavans
24	TCBP2	Transfer corn by-products, from season 2 to season 3	cavans
25	TCBP3	Transfer corn by-products, from season 3 to season 4	cavans
26	TCI12	Transfer corn inventory, from season 1 to season 2	cavans
27	TCI23	Transfer corn inventory, from season 2 to season 3	cavans
28	TCI34	Transfer corn inventory, from season 3 to season 4	cavans
29	MKR1	Meet calorie requirements, season 1	calories
30	MKR2	Meet calorie requirements, season 2	calories
31	MKR3	Meet calorie requirements, season 3	calories
32	MKR4	Meet calorie requirements, season 4	calories

Table 2 (continued)

Col. No.	Col. I.D.	Column Description	Unit
33	MPR1	Meet protein requirements, season 1	grams
34	MPR2	Meet protein requirements, season 2	grams
35	MPR3	Meet protein requirements, season 3	grams
36	MPR4	Meet protein requirements, season 4	grams
37	MFR1	Meet fat requirements, season 1	grams
38	MFR2	Meet fat requirements, season 2	grams
39	MFR3	Meet fat requirements, season 3	grams
40	MFR4	Meet fat requirements, season 4	grams
41	MIR1	Meet iron requirements, season 1	milligrams
42	MIR2	Meet iron requirements, season 2	milligrams
43	MIR3	Meet iron requirements, season 3	milligrams
44	MIR4	Meet iron requirements, season 4	milligrams
45	MTR1	Meet thiamine requirements, season 1	milligrams
46	MTR2	Meet thiamine requirements, season 2	milligrams
47	MTR3	Meet thiamine requirements, season 3	milligrams
48	MTR4	Meet thiamine requirements, season 4	milligrams

Table 2 (continued)

Col. No.	Col. I.D.	Column Description	Unit
49	BPL1	Borrow from program lender, season 1	pesos
50	BPL3	Borrow from program lender, season 3	pesos
51	RPL12	Repay season 1 program loan in season 2	pesos
52	RPL34	Repay season 3 program loan in season 4	pesos
53	BIL1	Borrow from informal lender, season 1	pesos
54	BIL2	Borrow from informal lender, season 2	pesos
55	BIL3	Borrow from informal lender, season 3	pesos
56	BIL4	Borrow from informal lender, season 4	pesos
57	RIL12	Repay season 1 informal loan in season 2	pesos
58	RIL13	Repay season 1 informal loan in season 3	pesos
59	RIL14	Repay season 1 informal loan in season 4	pesos
60	RIL23	Repay season 2 informal loan in season 3	pesos
61	RIL24	Repay season 2 informal loan in season 4	pesos
62	RIL2Z	Repay season 2 informal loan through objective function	pesos
63	RIL34	Repay season 3 informal loan in season 4	pesos
64	RIL3Z	Repay season 3 informal loan through objective function	pesos

Table 2 (continued)

Col. No.	Col. I.D.	Column Description	Unit
65	RIL4Z	Repay season 4 informal loan through objective function	pesos
66	TC12	Transfer cash from season 1 to season 2	pesos
67	TC23	Transfer cash from season 2 to season 3	pesos
68	TC34	Transfer cash from season 3 to season 4	pesos
69	TC4Z	Transfer cash from season 4 to objective function	pesos
70	ACR120	Allocate season 1 cash at 20%	pesos
71	ACR140	Allocate season 1 cash at 40%	pesos
72	ACR160	Allocate season 1 cash at 60%	pesos
73	ACR180	Allocate season 1 cash at 80%	pesos
74	ACR1100	Allocate season 1 cash at 100%	pesos
75	ACR220	Allocate season 2 cash at 20%	pesos
76	ACR240	Allocate season 2 cash at 40%	pesos
77	ACR260	Allocate season 2 cash at 60%	pesos
78	ACR280	Allocate season 2 cash at 80%	pesos
79	ACR2100	Allocate season 2 cash at 100%	pesos
80	ACR320	Allocate season 3 cash at 20%	pesos
81	ACR340	Allocate season 3 cash at 40%	pesos

Table 2 (continued)

Col. No.	Col. I.D.	Column Description	Unit
82	ACR360	Allocate season 3 cash at 60%	pesos
83	ACR380	Allocate season 3 cash at 80%	pesos
84	ACR3100	Allocate season 3 cash at 100%	pesos
85	ACR420	Allocate season 4 cash at 20%	pesos
86	ACR440	Allocate season 4 cash at 40%	pesos
87	ACR460	Allocate season 4 cash at 60%	pesos
88	ACR480	Allocate season 4 cash at 80%	pesos
89	ACR4100	Allocate season 4 cash at 100%	pesos
90	AICR120	Allocate season 1 informal credit at 20%	pesos
91	AICR140	Allocate season 1 informal credit at 40%	pesos
92	AICR160	Allocate season 1 informal credit at 60%	pesos
93	AICR180	Allocate season 1 informal credit at 80%	pesos
94	AICR1100	Allocate season 1 informal credit at 100%	pesos
95	AICR220	Allocate season 2 informal credit at 20%	pesos
96	AICR240	Allocate season 2 informal credit at 40%	pesos
97	AICR260	Allocate season 2 informal credit at 60%	pesos
98	AICR280	Allocate season 2 informal credit at 80%	pesos

Table 2 (continued)

Col. No.	Col. I.D.	Column Description	Unit
99	AICR2100	Allocate season 2 informal credit at 200%	pesos
100	AICR320	Allocate season 3 informal credit at 20%	pesos
101	AICR340	Allocate season 3 informal credit at 40%	pesos
102	AICR380	Allocate season 3 informal credit at 60%	pesos
103	AICR380	Allocate season 3 informal credit at 80%	pesos
104	AICR3100	Allocate season 3 informal credit at 100%	pesos
105	AICR420	Allocate season 4 informal credit at 20%	pesos
106	AICR440	Allocate season 4 informal credit at 40%	pesos
107	AICR460	Allocate season 4 informal credit at 60%	pesos
108	AICR480	Allocate season 4 informal credit at 80%	pesos
109	AICR4100	Allocate season 4 informal credit at 100%	pesos
110	APCR120	Allocate season 1 program credit at 20%	pesos
111	APCR140	Allocate season 1 program credit at 40%	pesos
112	APCR160	Allocate season 1 program credit at 60%	pesos
113	APCR180	Allocate season 1 program credit at 80%	pesos
114	APCR1100	Allocate season 1 program credit at 100%	pesos

Table 2 (continued)

Col. No.	Col. I.D.	Column Description	Unit
115	APCR320	Allocate season 3 program credit at 20%	pesos
116	APCR340	Allocate season 3 program credit at 40%	pesos
117	APCR360	Allocate season 3 program credit at 60%	pesos
118	APCR380	Allocate season 3 program credit at 80%	pesos
119	APCR3100	Allocate season 3 program credit at 100%	pesos
120	VCR120	Value season 1 cash reserve at 20%	pesos
121	VCR140	Value season 1 cash reserve at 40%	pesos
122	VCR160	Value season 1 cash reserve at 60%	pesos
123	VCR180	Value season 1 cash reserve at 80%	pesos
124	VCR1100	Value season 1 cash reserve at 100%	pesos
125	VCR220	Value season 2 cash reserve at 20%	pesos
126	VCR240	Value season 2 cash reserve at 40%	pesos
127	VCR260	Value season 2 cash reserve at 60%	pesos
128	VCR280	Value season 2 cash reserve at 80%	pesos
129	VCR2100	Value season 2 cash reserve at 100%	pesos
130	VCR320	Value season 3 cash reserve at 20%	pesos
131	VCR340	Value season 3 cash reserve at 40%	pesos

Table 2 (continued)

Col. No.	Col. I.D.	Column Description	Unit
132	VCR360	Value season 3 cash reserve at 60%	pesos
133	VCR380	Value season 3 cash reserve at 80%	pesos
134	VCR3100	Value season 3 cash reserve at 100%	pesos
135	VCR420	Value season 4 cash reserve at 20%	pesos
136	VCR440	Value season 4 cash reserve at 40%	pesos
137	VCR460	Value season 4 cash reserve at 60%	pesos
138	VCR480	Value season 4 cash reserve at 80%	pesos
139	VCR4100	Value season 4 cash reserve at 100%	pesos
140	VICR120	Value season 1 informal credit reserve at 20%	pesos
141	VICR140	Value season 1 informal credit reserve at 40%	pesos
142	VICR160	Value season 1 informal credit reserve at 60%	pesos
143	VICR180	Value season 1 informal credit reserve at 80%	pesos
144	VICR1100	Value season 1 informal credit reserve at 100%	pesos
145	VICR220	Value season 2 informal credit reserve at 20%	pesos
146	VICR240	Value season 2 informal credit reserve at 40%	pesos
147	VICR260	Value season 2 informal credit reserve at 60%	pesos
148	VICR280	Value season 2 informal credit reserve at 80%	pesos

Table 2 (continued)

Col. No.	Col. I.D.	Column Description	Unit
149	VICR2100	Value season 2 informal credit reserve at 100%	pesos
150	VICR320	Value season 3 informal credit reserve at 20%	pesos
151	VICR340	Value season 3 informal credit reserve at 40%	pesos
152	VICR360	Value season 3 informal credit reserve at 60%	pesos
153	VICR380	Value season 3 informal credit reserve at 80%	pesos
154	VICR3100	Value season 3 informal credit reserve at 100%	pesos
155	VICR420	Value season 4 informal credit reserve at 20%	pesos
156	VICR440	Value season 4 informal credit reserve at 40%	pesos
157	VICR460	Value season 4 informal credit reserve at 60%	pesos
158	VICR480	Value season 4 informal credit reserve at 80%	pesos
159	VICR4100	Value season 4 informal credit reserve at 100%	pesos
160	VPCR120	Value season 1 program credit reserve at 20%	pesos
161	VPCR140	Value season 1 program credit reserve at 40%	pesos
162	VPCR160	Value season 1 program credit reserve at 60%	pesos
163	VPCR180	Value season 1 program credit reserve at 80%	pesos
164	VPCR1100	Value season 1 program credit reserve at 100%	pesos

Table 2 (continued)

Col. No.	Col. I.D.	Column Description	Unit
165	VPCR320	Value season 3 program credit reserve at 20%	pesos
166	VPCR340	Value season 3 program credit reserve at 40%	pesos
167	VPCR360	Value season 3 program credit reserve at 60%	pesos
168	VPCR380	Value season 3 program credit reserve at 80%	pesos
169	VPCR3100	Value season 3 program credit reserve at 100%	pesos

and selling of corn by-products. Financing activities include borrowing from formal and informal sources, repaying the loans, allocating cash and credit to reserve and valuing cash and credit in reserve. In addition, there are transfer activities for corn inventory, corn by-products inventory and cash.

It must be noted that these activities are interrelated. They interact and are dependent on one another with cash playing a significant role in their interactions. The cash rows display the empirical specifications for the activities which reflect the values of the activity units. Activities are compared in terms of their contribution to the value of the objective function subject to the requirements and factor constraints to which they contribute.

For a picture of the model vectors, see Appendix Table A. The following is a detailed description of the model activities and their coefficients. Conversion ratios are listed in Appendix Table C.

1) Production (PC)

In the produce corn column and land supply row, the coefficient one (1) indicates that for a hectare of corn produced, there is a corresponding reduction in land available. The coefficients in the family labor and hired labor supply rows indicate the fixed proportions in which man-days of family and hired labor are required to produce one hectare of corn while the coefficient in the fertilizers and chemicals inventory row represents the kilograms of fertilizer and chemicals needed for the same activity unit.

Negative entries in the corn inventory row for seasons 2 and 4 indicate the yields per unit (cavans of corn per hectare) from the production activities. A positive entry in the cash account row exhibits the other cash requirements to produce one hectare of corn.

To indicate the relative risks involved in corn production during the season, coefficients are entered in the associated liquidity requirement rows. Season 3 is considered more risky due to the occurrence of drought which majority of respondents wailed about.

2) Hire labor (HIL)

A negative entry in hired labor supply row indicates an increase in the constraint level by a man-day of labor hired in while a positive entry in the cash account row means a reduction of cash by the value of the coefficient used to pay for a unit of labor hired in.

The seasonal variation in cash account row coefficients indicate relative surplus of outside labor in season 3. Generally, this kind of labor is provided by landless and migratory workers. Cash account row coefficient for hiring in labor represents the daily wage rate for hired in labor with food provided for the workers.

3) Mill corn (MC)

A typical farmer and his household in the province of Negros Oriental characteristically eat white corn as a main component of the daily diet. They prefer white corn of the traditional variety due to its good eating quality, high-milling recovery and ability to be stored for a longer time. Moreover, they perceive corn to give more and long-lasting energy than rice.

But corn has to be milled into grits before it is cooked and eaten. The milling process produces milled corn and corn by-products. In this study, 1.25 cavans of corn grain produces one (1) cavan of milled corn and 0.25 cavans of corn by-products which are available to be fed to native swine. For the corn milling activity, a positive entry in the corn inventory row means a reduction in the constraint level while negative entries in the milled corn and corn by-products inventories indicate increases after the milling process. Cost is incurred in milling, so a positive entry in the cash account row signifies a decrease in cash to fulfill the activity.

4) <u>Consume milled corn (CMC)</u>

The consumption of milled corn contributes to five nutrient requirements of these farmers: calories, proteins, fats, iron and thiamine. A positive entry in the milled corn inventory row denotes the reduction of this constraint level by the number of cavans required to supply a kilogram of milled corn for consumption. Positive entries on each nutrient requirement rows mean decreases in the net requirements caused by a kilo of milled corn consumed.

5) <u>Sell corn (SC)</u>

This activity is also differentiated by season to allow for seasonal variation in prices received for corn sold due to demand and supply interactions. A positive entry in the corn inventory row indicates a unit reduction while a negative entry in the cash supply row denotes increases in cash due to corn sales.

6) Transfer corn inventory (TCI)

This model allows inter-season transfers or carry-over of corn from one season to the next. A positive entry in the corn inventory row in season 1 reflects the cavans of corn used up in this season while a negative entry on the corn inventory row in season 2 implies that what is not utilized or disposed of in season 1 is transferred to season 2 and what is not utilized in season 2 is transferred to season 3, and so forth. No cost is involved in making the inventory transfers and it is assumed that there is no loss from shrinkage or spoilage.

7) Meet dietary requirements (MKR), (MPR), (MFR), (MIR), (MTR)

In each of the columns, a positive one entry in the specific diet requirement row denotes that for each unit of nutrient consumed, the nutrient inventory requirement is reduced by one unit. A positive entry in the cash account row indicates the cash spent per unit of that nutrient.

8) Borrow from program credit source (BPL)

As per Maisan 77 Guidelines for the 1980-81 crop year, a corn farmer can borrow as much as P900 per hectare per season mainly in the form of fertilizer, chemicals and cash. The negative entry in the fertilizer and chemicals inventory row represents the increase in the inventory per peso borrowed. More explicitly, .33 kilograms of fertilizer and chemicals are added to the inventory when the farmer borrows one peso from the program. The coefficient in the cash supply row represents the cash portion of the loan. Here, 21 centavos out of one peso borrowed goes to cash supply row. From each peso borrowed 6 centavos are taken as payment for interest.

The positive one entries in the program credit account denote reductions of the credit account by borrowing. Moreover, borrowing from the program creates debt that should be paid back at the beginning of the next season and this is represented by the negative 1 entries in the program credit debt balance rows. Negative entries in the liquidity reserve requirement rows indicate increases in the constraints due to borrowing.

9) Repay program loan (RPL)

Positive one entries in the program debt balance rows indicate the reduction of debts upon repayment by one peso that comes from cash account rows which are shown to have positive 1 entries denoting cash decreases. Repayments are differentiated by season to reflect seasonal transactions and are specified to be fully paid at the end of each season. Positive entries in the liquidity reserve requirement rows indicate decreases after repayment.

10) Borrow from informal credit source (BIL)

The negative 1 entries in the cash supply rows and positive 1 entries in the informal credit account rows indicate increases in cash and decreases in account, respectively, when the farm-household borrows from private moneylenders. The negative 1 entries in the informal debt balance rows signify increases in informal debt balances.

The positive coefficients in the informal credit limit and program credit limit rows illustrate the assumed interaction between program and informal credit. It is assumed that when a farmer decides to borrow a peso from the program, his informal credit limit is reduced by 0.05 while program credit limit is assumed to be reduced by 0.05 when he decides to borrow from the village or town moneylender. The negative entries in the liquidity reserve requirement rows indicate increases in the requirements due to informal borrowing.

11) Repay informal loan (RIL)

As revealed by the survey, moneylenders were reported to charge an average interest rate of 50% per season. Positive one entries in the informal debt balance rows indicate the reduction of debt upon repayment by one peso plus the interest that comes from cash account rows which are shown to have positive entries denoting cash decreases. Repayments of informal loan decrease liquidity reserve requirements as denoted by positive entries in the LRR rows.

12) Transfer cash supply (TC)

For these activities, each column transfers any cash remaining from cash supply rows of one season to cash supply rows of the next season. A positive 1 entry in the cash supply row in season 1 and a negative entry in the cash supply row in season 2 indicate that cash which is not used up or allocated in season 1 is being transferred to season 2, and so forth.

13) Allocation activities (ACR), (AICR), (APCR)

These activity columns allocate cash, program credit and informal credit to reserve so as to produce liquidity for the farm and household unit.

Cash generated from cash-producing activities like sales of corn and hogs, is utilized either for cash-using activities or held in reserve. The proportion of cash used and that held in reserve always equal to one. The relevant cash supply rows have positive 1 entries to indicate the use of cash in the process. Negative entries in the cash account and cash reserve rows show the proportions in which cash is allocated between accounting and reserves. Reserve allocations are at five alternative levels: 20%, 40%, 60%, 80% and 100%. Thus, ACR140 means that 40% of cash is allocated to reserve in season 1, implying that 60% is being committed to other cash-using activities.

Credit is an asset that a decision-maker chooses to allocate between credit account and credit reserve. The amount committed to credit account is available for borrowing while the remaining amount is held in reserve. The specification of the activities are similar to those of the cash allocation activities above.

14) Valuation activities (VCR), (VICR), (VPCR)

A major aspect of cash and credit (formal and informal) management is the valuation in reserve. The valuation activity columns are created to differentiate values of cash and credit by proportions held in reserve and to reflect the risk associated with seasonal activities.

Valuation of cash in reserve proceeds from the rational behavior a farm producer undertakes in managing his liquidity as a response to risks and uncertainties as well as other opportunities. As discussed earlier, the value of cash in reserve increases as the percentage held in reserve decreases. The values of these cash reserves are presented in Table 3. Following Bhargava's approach (20), these reservation prices at alternative reserve levels (20%, 40%, 60%, 80% and 100%) are chosen to indicate liquidity management decisions as gleaned from the survey. Positive 1 entries in the associated liquidity reserve requirement rows denote that each unit of cash valued in reserve satisfies one unit of liquidity reserve requirement. Valuation coefficients in the corresponding objective function row decrease as more cash is added to reserve. These are also differentiated by season to indicate the relative values of risks to be met in every season. The wet season (season 1) is considered more risky due to unforeseen extra educational expenses at the start of classes in June and occurrence of illness due to persistent rains.

Valuation activities of credit reserves are similar to those of cash reserves. For each valuation activity at different percentage levels, there is a corresponding unit of credit in reserve utilized and a unit of liquidity reserve requirement satisfied as shown by positive one entries in the associated program or informal credit and liquidity reserve requirement rows. The corresponding values in the objective function row denote the amount yielded or returned by a unit of credit valued in reserve.

The assumed schedules of credit reservation prices are given in Table 3. Credit reservation prices differ from cash reservation prices because of the difference between cash and credit as contributors to liquidity. In addition, the differences reflect the

Table 3

Cash and Credit Reservation Prices for the Validated Model, M_1

Cash reservation prices

Percentage of cash in reserve	Percentage of cash used	Value of reserve cash in season 1	2	3	4
20	80	2.70	2.80	2.40	2.30
40	60	2.30	2.60	2.10	2.00
60	40	1.90	2.20	1.80	1.70
80	20	1.70	2.00	1.50	1.40
100	0	1.50	1.80	1.20	1.10

Informal credit reservation prices

Percentage of cash in reserve	Percentage of cash used	Value of reserve informal credit 1	2	3	4
20	80	1.75	1.32	1.70	1.72
40	60	1.50	1.23	1.30	1.33
60	40	1.33	1.10	1.15	1.20
80	20	1.15	0.85	0.90	0.95
100	0	0.87	0.70	0.80	0.85

Program credit reservation prices

Percentage of cash in reserve	Percentage of cash used	Value of reserve program credit in season 1	season 3
20	80	0.70	0.60
40	60	0.50	0.40
60	40	0.30	0.20
80	20	0.10	0.07
100	0	0.07	0.05

producer's valuation of cash reserve relative to credit reserve with cash valued more than credit.

15) Feed hogs (FH)

As an added source of income, a typical household raises and sells native hogs. Commonly, the wife tends the pigs. Aside from the usual main ingredient fed to native hogs which is corn bran, they are also fed with kitchen left-overs, chopped banana piths or "kangkong," a native leafy and soft-stemmed legume that grows by river sides or ditches. Some hogs are left to roam around the backyard or portions of the farm to feed by themselves. Little time and attention is given to these native hogs which is similar to practices in some countries like Colombia.

A positive entry in the corn by-products inventory row denotes a decrease of 0.12 cavans in the resource to produce one kilogram of hogs. This coefficient also refers to the amount of corn by-products needed by the swine to produce a unit gain in weight. A negative 1 entry in the hog inventory row denotes a unit increase due to feeding the hogs.

16) Sell hogs (SH)

Hogs are usually sold during seasons 2 and 4. A positive 1 entry in the hog inventory row denotes a unit decrease due to selling while the negative entry in the cash supply row indicates the price received per kilo of liveweight sold. Variation in price is due to higher demand in season 4 for the holidays and festivals. It is assumed that there are no risks involved such as deaths through diseases in raising these sturdy native hogs.

17) Sell corn by-products (SCBP)

During the corn milling process corn by-products are produced. Usually there is an option for the farmer or his wife to sell the by-products to the miller by simply leaving them behind and getting a reduction in the milling price.

A positive entry in the corn by-products inventory row denotes a 0.02 cavan reduction of the resource while a negative entry in the cash supply row signifies an increase in cash per kilogram of corn by-products sold.

18) Transfer corn by-products (TCBP)

Seasonal corn by-products transfers are allowed in this model. These transfer activities do not involve costs and an assumption is made that there are no losses from spoilage.

A positive 1 entry in the corn by-product inventory row in season 1 indicates the kilograms of the resource used up or sold in this season while a negative 1 entry in the corn by-products inventory in season 2 (CBPI2) denotes that what is left unused or unsold in season 1 is transferred to season 2. The same explanation holds for corn by-product transfers from season 2 to 3 and from season 3 to 4.

CHAPTER III

VALIDATION OF THE MODEL

3.1 Choice of the LS-LP Model

A model can be validated by the acceptability of its assumptions and by conformance of its output with observations. In this particular study, the outcomes of the model were compared with observed results of contemporaneous events. More specifically, this chapter discusses the: a) choice of liquidity-specified LP model over the conventional LP; b) validated model, M1 which was specified to represent the farm and household of a typical corn farmer in the Philippine province of Negros Oriental in the current situation; c) shadow prices of specific resources and constraints as they relate to the value of the objective function; and d) "struggles" in searching for the conforming model, M1.

As a matter of determining a more appropriate methodological approach, three sets of results are compared in this section of the study. These are 1) survey means, 2) optimal levels of the conventional LP model, and 3) optimal levels of the liquidity-specified LP model. (Please refer to Table 4.)

a. Survey vs. conventional LP

Results show that both survey means and optimal levels of net cash flow, amount of borrowed funds from program lenders, corn produced, consumed milled corn and hogs sold are either nearly equal or exactly equal to each other. The main differences are in the optimal levels of program

Table 4

Comparisons of Survey Results With Conventional LP Model and Liquidity-Specified LP Model

Activity	Survey Mean	Conventional LP Model (M_o)	Liquidity-specified LP Model (M_1)
Objective function (₱)	n.a.[a]	1006	5373
Net cash flow	-1350	-1494[c]	-1635[b]
Reserve cash (₱)	1512	n.a.	1753
Reserve credit (₱)			
Formal	1450	n.a.	1380
Informal	1315	n.a.	1375
Borrowed funds (₱)			
Formal			
season 1	1281	1238	1238
season 3	597	509	509
Informal	750	0	938
season 1	n.a.	0	148
season 2	n.a.	0	320
season 3	n.a.	0	310
season 4	n.a.	0	160
Repaid funds (₱)			
Formal			
season 2	790	1238	1238
season 4	322	509	509
Informal (₱)	750	0	938
season 1	n.a.	0 (1 in 3)	148
season 2	n.a.	0 (2 in Z)	320
season 3	n.a.	0 (3 in Z)	310
season 4	n.a.	0 (4 in Z)	160
Produced corn (ha.)			
season 1	1.9	1.9	1.9
season 3	1.56	1.6	1.6

[a] n.a. refers to not available

[b] Net cash flow = objective function - reserve cash - reserve credit - beginning cash (specified as ₱2,500)

[c] Net cash flow = objective function - beginning cash

Table 4 (continued)

Activity	Survey Mean	Conventional LP Model (M_o)	Liquidity-specified LP Model (M_1)
Consumed milled corn (kg.)	1043.7	1197	1197
season 1	n.a.	181	181
season 2	n.a.	254	254
season 3	n.a.	508	508
season 4	n.a.	254	254
Sold corn (cav.)			
season 2	19.9	5.2	21.6
season 4	13.1	31.3	14.9
Sold hogs (kg.)	45	39.2	39.2
season 2	n.a.	0	7.5
season 4	n.a.	39.2	31.7
Fertilizer and chemicals acquired (kg.)			
season 1	417.2	436.6	436.6
season 3	163.9	179.6	179.6
Cash portion of program loan (₱)			
season 1	422.40	412.63	412.63
season 3	153.10	169.70	169.70

funds repaid; informal loans borrowed and repaid; and the physical amount of corn sold. The conventional LP model does not reserve cash and credit at the optimum. Neither does it result in any informal funds borrowing or repaying. In the seasonal marketing of corn, it results in more cavans of corn sold and unrealistic seasonal pattern of selling. The survey results show a selling of corn proportional with respect to seasonal production levels, i.e. more sold in season 2 than in season 4 while the conventional LP does not.

b. Survey vs. liquidity-specified LP

In many aspects, the liquidity-specified LP model results conform with the results of the survey. Optimal levels of reserved cash, reserved formal and informal credit, beginning cash, net cash flow, cash available, borrowed funds (both formal and informal), corn production, milled corn consumption, corn sold and hogs sold, are all very close to, if not exactly the same as the observed averages in the survey. The only difference is in the repayment of program or formal loan. The LS-LP model chooses to repay all borrowed funds (both formal and informal) by the end of the planning period, whereas the survey results show degrees of delinquent behavior towards repayment of loans, with lower non-payment of informal loans than formal loans.

c. Conventional LP and LS-LP

Due to absence of liquidity specifications in the conventional LP model, no optimal levels for reserved cash, reserved credit, and cash available are reported. Both models show the same optimal levels for borrowed and repaid program or formal loans, corn production, milled corn consumption, hogs sold, fertilizer/chemicals acquired;and cash portion of the program loan. The main difference between conventional LP and LS-LP models, however, lies in the activation of informal loans borrowing and repaying. Borrowing and repayment of informal loans occur in the LS-LP model and in the survey observations but not in the conventional LP model. Moreover, seasonal volume of corn sold in the LS-LP model are more similar to survey results, thus, making the LS-LP model a better representation of actual field observations than the mere LP model.

The above comparisons convincingly show that liquidity specificatons enhance the ability of an ordinary LP model to represent the actual conditions of a typical white corn farmer in the Philippines. This finding has significant methodology implications in studying the financial structure and behavior of farmer-borrowers participating in small farmer credit programs. Thus, the LS-LP model or M1 was chosen and was validated in the next section.

3.2 M1, the Validated Model

The validated model, M1, is specified as a representation of the farm unit under observation. This farm unit was defined in terms of its financial, production, consumption and marketing activities and liquidity reservations as a risk response. To be able to compare typical farm units in the present case and in other cases as specified in alternative models (which are discussed later), optimization is assumed. Table 5 shows the results of the optimization work which provides a basis for model evaluation in terms of conformity of results with survey observations.

Table 5

Optimal and Observed Mean Levels of Activities
From the LS-LP Model (M1) and the Survey

Activity	Model M1 (current)	Survey Mean	Survey Std. Dev.
Objective function, Z (₱)	5373	n.a.[a]	n.a.
Net cash flow (₱)	-1635[b]	-1350	856.1
Reserve cash (₱)	1753	1512	799.6
Reserve credit (₱)			
Formal	1380	1450	256.3
Informal	1375	1315	197.1
Borrowed funds (₱)			
Formal			
season 1	1238	1281	247.4
season 3	509	597	261.2
Informal	938	750	523.4
season 1	148	n.a.	n.a.
season 2	320	n.a.	n.a.
season 3	310	n.a.	n.a.
season 4	160	n.a.	n.a.
Repaid funds (₱)			
Formal			
season 2	1238	790	237.2
season 4	509	322	183.7
Informal	938	580	261.7
season 1 in 3	148	n.a.	n.a.
season 2 in OF	320	n.a.	n.a.
season 3 in OF	310	n.a.	n.a.
season 4 in OF	169	n.a.	n.a.
Produced corn (ha.)			
season 1	1.9	1.9	12.5
season 3	1.6	1.56	8.6
Consumed milled corn (kg.)	1197	1043.7	412.3
season 1	181	n.a.	n.a.
season 2	254	n.a.	n.a.
season 3	508	n.a.	n.a.
season 4	254	n.a.	n.a.

[a] n.a. refers to not available

[b] net cash flow = objective function - reserve cash - reserve credit - beginning cash (specified as ₱2500)

Table 5 (continued)

Activity	Model M1 (current)	Survey Mean	Survey Std. Dev.
Sold corn (cav.)			
season 2	21.6	19.9	15.3
season 4	14.9	13.1	12.1
Sold hogs (kg.)	39.2	45	21.9
season 2	7.5	n.a.	n.a.
season 4	31.7	n.a.	n.a.
Fertilizer and chemicals acquired (kg.)			
season 1	436.6	417.2	65.8
season 3	179.6	163.8	51.2
Cash portion of program loan (₱)			
season 1	412.63	422.40	125.80
season 3	169.70	153.10	57.50

3.3 Statistical Test

The survey was conducted in five towns or municipalities of Negros Oriental province with a total number of borrowers of 2,800 (N = 2,800). From every town, 10 respondents were sampled to have a sample size of 50 observations (n = 50). Since the number of observations, n, is greater than 30, the normal distribution is used. In the case of a variable with standard normal distribution, 99% of all values fall within -2.58 and +2.58 of the standard deviation.

Confidence intervals are used to test hypotheses that optimum values do not differ significantly from actual values. Acceptance of such null hypotheses is interpreted as acceptance that the model conforms to observations. Thus, the following statistical formulation is used to ascertain the conformity of the optimal model with observed results:

$$\bar{X} - 2.58 \sqrt{1 - \frac{n}{N}} \frac{s}{n} \leq \mu \leq X + 2.58 \sqrt{1 - \frac{n}{N}} \frac{s}{n}$$

where $\bar{X}$ = mean value from survey

μ = true mean value

s = standard deviation

n = sample size, and

N = population size

3.3.1 Net cash flow

The optimal net cash flow is the difference between the value of the objective function and the reserved cash, reserved credit and beginning cash. Since the value of the objective function includes liquidity values, this adjustment is necessary to derive the actual net cash flow of the average farm and household unit in terms comparable with survey observations. Statistical test shows that the optimal net cash flow falls within the confidence interval,

$$-1.350 - 2.58 \left(\frac{.99}{7}\right) (856.1) \leq \mu \leq - 1,350 + 2.58 \left(\frac{.99}{7}\right) (856.1)$$

where μ is the optimal net cash flow from the model, which is - ₱ 1,635.

The computed confidence interval at 99% level of confidence is:

$$-1,658.2 \leq \mu \leq - 1,041.8$$

3.3.2 Reserved cash

In the case of average annual reserve cash, the above equation becomes

$$-1,512 - 2.58 \left(\frac{.99}{7}\right) (799.6) \leq \mu \leq - 1,512 + 2.58 \left(\frac{.99}{7}\right) (799.6).$$

Thus, the confidence interval for the population mean is:

$$1,220.24 \leq \mu \leq 1,803.76$$

The optimal reserve cash is ₱1,753 which falls within this confidence interval.

3.3.3 Reserve formal or program credit

The optimizing farmer reserved ₱1,380 of program credit which is about 5% less than the observed mean of ₱1,450. At 99% level of confidence, this optimization level can be accepted since it falls within the confidence interval which is:

$$1,357.84 \le \mu \le 1,542.16$$

3.3.4 Reserved informal credit

The optimization level of reserved informal credit is ₱1375. This is 1.04 times the observed mean of ₱1,315. With a confidence interval of $1244.80 \le \mu \le 1385.92$ for reserve informal credit, this optimization level is also accepted at 99% level of confidence.

3.3.5 Borrowing program funds

The optimizing farmer borrows ₱1,237.88 from the government's white corn production credit program in season 1 which is almost equal to the mean observed amount of ₱1,281.60. This optimal level lies well within the confidence interval of 1191.94 and 1370.06, thus acceptable at 99% level of confidence.

For season 3, the optimal level of borrowed program funds, ₱509.09 lies very close to the lower limit of the confidence interval which is $502.97 \le \mu \le 691.03$. This optimal level can be accepted.

3.3.6 Borrowing funds from informal sources

For the optimizing farmer, he borrows an optimal level of ₱938 from informal sources. This level is 1.25 times higher than the observed mean of ₱750. At 99% level of confidence, this optimal informal loan lies very close to the upper limit of the confidence interval which is $561.58 \le \mu \le 938.42$.

3.3.7 Repayment of program funds

The optimizing farmer repays fully the program loan he borrows. The level of repayment in season 1 is 1.56 times higher than the average observed in the survey. For program loans repaid in season 1:

$$704.61 \leq \mu \leq 875.39$$

The optimal level of program loan repayment, ₱1,237.88 in season 1 does not lie within this confidence interval.

For season 3, the optimal level of repayment is ₱509.09 while the observed level was ₱321.50. As in season 1, the optimal level does not lie within the confidence level which is $255.86 \leq \mu \leq 388.13$.

It appears from these results that the optimizing farmer chooses to repay his program loans completely within the planning period. In reality, however, non-repayment rates of 62% and 54% occurred in seasons 1 and 3, respectively. These results suggest a need for model modifications that allows for non-repayment as an admissible activity.

3.3.8 Repayment of informal funds

The optimal level of informal funds paid back is ₱938 which is 1.6 times higher than the observed mean of ₱580. With the confidence interval of $485.79 \leq \mu \leq 674.21$, this optimal level lies outside the upper end of the interval and can not be accepted. As in the case of repayment of program loans, the model chooses to repay informal loans in full within the planning period, even though the survey shows about 77% repayment. Models in the future can be designed to allow for non-repayment as a rational choice of activity.

3.3.9 Production of corn

The model shows that the optimizing farmer produces 1.9 hectares of corn in season 1 which is just equal to the observed mean, 1.912. In season 3, the optimal level of corn production is 1.6 while the observed mean is a little below, 1.56. At 99% level of confidence, this optimal value is accepted as it lies within the confidence interval of $1.52 \leq \mu \leq 1.602$.

3.3.10 Consumption of milled corn

Annually, the optimizing farmer and his household consume milled white corn at a level of 1.197 kilograms. This level is 15% higher than the observed average. For milled corn consumed, the confidence interval is: $895.28 \leq \mu \leq 1{,}192.13$. The optimal level lies within this interval, thus acceptable at 99% level of confidence.

3.3.11 Sell corn

In season 2, the optimizing farmer sells 21.6 cavans of corn. This is 8% higher than the observed mean. With the confidence interval of $14.4 \leq \mu \leq 25.4$, the optimal level is well accepted as it lies within the interval.

In season 4, the optimal level, 14.93, lies within the confidence interval which is: $8.75 \leq \mu \leq 17.45$.

3.3.12 Sell hogs

To supplement family earning, a typical farmer raises and sells native hogs. In a year, the optimizing farmer sells 39.26 kilograms of live hogs.

The observed mean, however, for hogs sold was 45 kilograms, about 6% higher than the optimal level. The optimal value, $\mu = 39.26$ which lies within the confidence interval $37.12 \leq \mu \leq 52.88$, can be accepted.

3.3.13 Fertilizer and chemical acquired (kg.)

In the case of fertilizer and chemical acquired in season 1, the optimizing farmer receives 436.64 kilograms which is almost equal to the observed average of 417.18 kgs. This optimal level is well within the confidence interval of $393.5 \leq \mu \leq 440.86$.

In season 3, the optimal level of fertilizer and chemicals, $\mu = 179.52$ is also within the confidence interval of $145.37 \leq \mu \leq 182.23$.

3.3.14 Cash portion of program loan

The cash portion of program loan for season 1 in the optimal model is just slightly lower than the observed mean. At 99% level of confidence, this value of ₱416.63 is within the interval: $377.12 \leq \mu \leq 467.68$.

In season 3, the optimal level of the cash portion is ₱169.70 which is a bit higher than the survey mean. Likewise, it is also within the confidence interval of $132.4 \leq \mu \leq 173.8$ which can be accepted at 99% level of confidence.

Based on the above results it can be considered that model M1 conforms acceptably with the observations made in the survey, except for repayment of loans. In an optimizing model such as M1, it appears that a farmer chooses to repay his program and informal loans rather than incur debts. Nevertheless, it is reasonable to regard M1 as the validated model.

3.4 Optimal Constraint Levels and Shadow Prices

The shadow price of a binding constraint can be interpreted as the contribution of an additional unit of that constraint to the value of the objective function. Since the objective function includes liquidity values as in this case, the values of the shadow prices tend to be "over-estimates" in terms of net cash flow.

Looking at Table 6, family labor supply and hired labor supply appear in slack while land supply, diet requirements and credit appear as limiting resources. In the areas surveyed, labor (family and hired) supply was observed to be an unlimiting factor. There is an abundant and readily available supply of labor all year round.

As to land supply, to add a unit of land, or one hectare for corn production in season 1 and 3, would increase the value of the objective function by ₱550.61 and ₱628.48, respectively.

To add a unit of calorie requirement in seasons 1, 2, 3 and 4 would decrease the objective function by .003, .003, .001 and .001 pesos, respectively.

To add a gram of protein requirement in seasons 1, 2, 3 and 4 would decrease the value of the objective function by .034, .043, .015 and .011 pesos, respectively.

Adding a milligram of iron requirement in the diet in seasons 1, 2, 3, and 4 would decrease the objective function value by .031, .031, .019 and .02 pesos, respectively.

Adding a unit of formal loan in seasons 1 and 3 would increase the value of the objective function by ₱0.72 and ₱0.56, respectively.

Table 6

Optimal Constraint Levels and Shadow Prices

Constraint	Level	Slack	Shadow price
Land supply, season 1	1.9	0	-550.61
season 3	1.6	0	-628.48
Family labor supply, season 1	57.0	369.60	0
season 3	41.60	364.48	0
Hired labor supply, season 1	19.38	196.92	0
season 3	15.04	235.46	0
Calorie requirement, season 1	1,023,876	0	.003
season 2	511,938	0	.003
season 3	1,023,876	0	.001
season 4	511,938	0	.001
Protein requirement, season 1	22,336.4	0	.034
season 2	11,168.2	0	.043
season 3	22,336.4	0	.015
season 4	11,168.2	0	.011
Fat requirement, season 1	16,385.6	0	.014
season 2	8,192.8	0	.014
season 3	16,385.6	0	.008
season 4	8,192.8	0	.009
Iron requirement, season 1	3,253.56	0	.031
season 2	1,626.78	0	.031
season 3	3,253.56	0	.019
season 4	1,626.78	0	.02
Thiamine requirement, season 1	445.57	0	.036
season 2	226.78	0	.037
season 3	445.57	0	.023
season 4	226.78	0	.024
Program credit limit, season 1	1,710.00	0	- .72
season 3	1,710.00	0	- .56
Informal credit limit, season 1	600	0	-1.04
season 2	300	0	-1.50
season 3	600	0	-1.08
season 4	300	0	-1.21

To add a peso of informal loan into the system in seasons 1, 2, 3, and 4, would increase the value of the objective function by ₱1.04, ₱1.50, ₱1.08, and ₱1.21, respectively.

3.5 Finding a Conforming Model, M1

Various struggles were faced in the search for the conforming model. Indeed the way towards a full solution (feasible, optimal and sensible) was replete with difficulties and frustrations. It was not an easy task. The modelling work started with the specifications of the activities, constraints, their units, right hand-side values and relations and coefficients of the different variables in the matrix. For some organization, sub-matrices of production, consumption, marketing and financing were made.

Model inputs and specifications entered into the model differed in terms of the "hardness" ascribed to the evidences on which the model was developed. For example, the output and area of the farm organization, taken from the survey and used later for conformity testing, was unchanged in the process. These are considered "hard" evidences. Some of the parameter estimates involving cash receipts like informal loans were adjusted as these are considered "soft" data. There is a prevailing reluctance among respondents to report income data. The possibility of overstatement of costs and understatements of income was not disregarded. The RHS values of cash supply representing beginning cash and informal credit limit likewise have to be adjusted as these belong to the category of soft evidences. The cost of living expenses was dropped since it is a redundancy. The coefficients for feeding and selling hog activities were computed from secondary information and involves only the use of corn by-products in computing the feed-weight conversion ratios. Due to a more realistic representation of how corn is produced from a stock of seeds and other inputs to its selling, then milling for human consumption to meet five dietary needs, then for annual consumption in terms of corn by-products, extra care in converting the data from one unit to another was strictly observed, especially, after the model became feasible and optimal but results were very far from observed data. Careful scrutiny of each coefficient revealed certain conversion errors. Thus, it is possible to have convergence but illogical and wrong specifications. The reservation prices and liquidity specifications had virtually no empirical counterparts. These were freely changed to improve the fit of the model and conformance of results with survey observations.

After all specifications were entered, the model was converted into the format required for the computer program. In this case, the linear programming package called APEX-III was used to solve the model.

The initial results from a two-period model were infeasible. Upon examination, it was discovered that some of the coefficients in the model had wrong unit conversions. Thus, recomputations were required. New activities and constraints such as consume corn and diet requirements, were also added to add realism to the model. With each correction (including clerical and data entry errors) made, the number of infeasible and nonoptimal vectors gradually decreased until a full solution or convergence of all vectors was attained. Thus, after several "runs," the 2-period model generated an optimal solution. Upon closer look of the results, however, they were largely different from the survey observations. The optimal solution was highly unrealistic. Almost all of cash was being reserved in both periods thus creating a starvation of cash for food purchases and other expenses.

With such obvious nonsense, it was proposed to expand the model from a 2-period to a 4-period model. This was deemed necessary to properly account for cash receipts and cash expenses as they would normally occur in the corresponding periods or seasons. A good example is the receipt of cash loans in season 1 which was specified together with receipt of cash from corn sales and payback of loans in cash. In the 2-period model these were all combined to occur in season 1 only. A more realistic modification would be to specify production of corn in season 1, sale of corn in season 2, and repayment of loan in season 2 as was commonly observed in the field.

With the 4-period model on the other hand, new problems arose. The first few "runs" proved futile to arrive at an optimal solution. With more activities and constraints added like feeding hogs, selling hogs, fat, thiamine and iron requirements, selling corn by-products, etc., getting rid of infeasible and non-optimal vectors was a painstaking experience. Again rechecking was done to the detail. Changes were made in the assumed coefficients such as reservation prices as well as right hand size (RHS) elements like liquidity requirements. All equations that resulted from the computer program output were scrutinized and those giving rise to infeasibilities were individually computed by hand until adjustments were made either in the RHS value or magnitude of the coefficient or in a wrongly specified relation. Alternatives on some relations to better conform with logic were also made. Gradually, the number of infeasibilities diminished as changes were made. However, even though some of the infeasible vectors disappeared, non-optimal vectors stubbornly persisted. After several trials and runs with very slight changes being made, a consistent group of activities was found to cause the non-optimality. This group was temporarily extracted from the model and was analyzed further. It turned out that there was an error in logic, an incomplete specification and a missing constraint element. With this portion of the model corrected, another "run" was made. This time it was a full solution, optimal and converging! This final solution, when closely examined, gave some results that conformed closely with some of the survey observations. Thus, a final version of the model was reached after numerous revisions, now with output that conforms acceptably with field results.

To repeat, modelling is not an easy task. It is very challenging. It involves good judgment in setting up activities, constraints and assumptions. It requires critical examination of the specifications of coefficients, accuracy in transforming matrix data into computer data sets and common sense. It is a continuous process of specification, modification, correction and validation until a more accurate and realistic representation of the situation being modeled is reached. Though rigorous, it can be an extremely rewarding undertaking.

CHAPTER IV

SIMULATION RESULTS

This chapter discusses the results of the simulations performed with variations in program credit policies namely, (1) variation in interest rate, (2) variation in credit limits and (3) variation in the mode of loan disbursement. Variations were set at alternative rates of interest (12%, 24%, and 36%, the break-even rate); credit limits (₱900, ₱1300, and ₱1700) per hectare per season; and form of program loan disbursement (cash and kind or cash only). (See Table 7.)

In cash only simulations, the validated LS-LP model, M1 was modified. A new activity, buy fertilizers and chemicals (season 1 and season 3), was added in lieu of the in-kind specification in M1 which was dropped. In addition, the reservation prices for program loan were increased. (See Appendix Table D.) The last section shows effects of policy reforms on lending costs.

Effects of these changes on the financial performance and economic well-being of the farmer-borrowers are observed on the basis of five different performance measures. These measures are (1) objective function Z, (2) net cash flow, (3) reserve cash, (4) reserve credit and (5) available cash.

Objective function Z

The objective function is identified as the maximand in the model. Its value captures the effects of liquidity reserves and valuations of cash and credit through reservation prices, as well as net cash flow.

Table 7

Design of Simulations

Credit limit in SFCP (₱)[a]	Cash and Kind: i @ (%)[b] 12	24	36[c]	Cash only: i @ (%) 12	24	36
900	M1	M4	M7	M10	M13	M16
1300	M2	M5	M8	M11	M14	M17
1700	M3	M6	M9	M12	M15	M18

[a]Credit limit is specified as amount of pesos per hectare per season

[b]Interest rate is specified as percent per year

[c]36% is considered the break-even rate of interest

Net cash flow

Actual net cash flow is the difference between the value of the objective function and beginning cash,[a] less reserve cash and reserve credit in Z-values.

Reserve cash and reserve credit

Reserve cash and reserve credit are both subject to two interpretations. One is drawn directly from the objective function, where both cash and credit are valued at rates per peso reserved as given by the model specification. As such, the values of cash and credit are contributions to the value of the objective function in each specification. These are reflected in the Z-values of the objective function. A second interpretation involves stripping reserve cash and reserve credit of their valuations via reservation prices to get their peso amounts. The pesos reserved are given by levels of reservation activities. In this case, the actual number of pesos in cash and credit reserves for each specification equals the value divided by the reservation price.

Available cash

The number of pesos available in cash is given by the sum of net cash flow and the amount of pesos reserved in cash, not the value of those pesos.

4.1 Effects of Increasing Interest Rate

Results reported in the first two columns of Table 8 show that increasing the interest rate in the Maisan 77 loan program, with no other change

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[a]Beginning cash was specified as ₱2,500 in the model.

Table 8

Effects of Interest Rate Variation: Credit Limit Held Constant For Each Form of Loan Disbursement

Interest Rate (%)	Performance measure	Cash-kind Z-value[a]	Cash-kind ₱ amount	Cash only Z-value	Cash only ₱ amount
12	Objective function	5373	5373	6707	6707
	Net cash flow	-1635	-1635	- 752	- 751
	Reserve cash	1753	714	1801	751
	Reserve credit				
	Formal	1380	13175	1612	1923
	Informal	1375	1197	1545	1367
	Available cash	-	- 921	-	0
24	Objective function	5085	5085	6546	6546
	Net cash flow	-1681	-1681	-1136	-1136
	Reserve cash	1633	659	1750	745
	Reserve credit				
	Formal	1262	11864	1876	2527
	Informal	1371	1193	1556	1376
	Available cash	-	-1022	-	- 391
36	Objective function	4729	4729	6398	6398
	Net cash flow	-1799	-1799	-1208	-1208
	Reserve cash	1497	590	1674	705
	Reserve credit				
	Formal	1181	10506	1876	2527
	Informal	1366	1191	1556	1376
	Available cash	-	-1209	-	- 503

[a] Z-value denotes the value of the performance measure which reflects the effects of liquidity reserves and reservation prices

in the program, reduces the value of all performance measures. However, given the large increases in interest rate, the decreases are rather modest, e.g. about 10% for net cash flow for a 300% increase in the interest rate.

Results reported in the last two columns reflect a substantial increase in all performance measures from changing the loan disbursement from cash and kind to cash only.

The argument for cash and kind loan is to avoid possible diversion of cash funds into other expenses. "Chits" or coupons are issued to farmers which are used to acquire fertilizers and chemicals. This procedure, however, was not fully successful, especially in the early phases of the program. Some borrowers were charged with selling their inputs, in particular, fertilizers, to other farmers such as sugar cane growers. The value of the objective function for cash-only disbursement at 36% is higher than its value for cash and kind disbursement at 12%. The same directional improvement holds for net cash flow and for available cash. Clearly the borrower would benefit from a policy that changes the disbursement from cash and kind to cash only. Such a policy change also would reduce administrative costs for the lender.

The effects of increasing the interest rate on liquidity reserves are more complicated. In the present program (cash and kind disbursements), increasing the interest rate decreases the levels of all liquidity reserves. If the disbursement is changed to cash only, credit reserves increase as the interest rate increases. Thus part of the borrower's welfare increase (i.e., the value of the objective function) is absorbed in increased credit liquidity, credit reservation tending to substitute for cash reservation under cash only disbursement. The inducement toward relatively smaller commitment of credit is important in terms of potential outreach of the Maisan 77 loan program, for given resources committed to the program.

4.2 Effects of Increasing the Credit Limit

Results in the first two columns of Table 9 show that increasing the credit limit with no change in the program increases modestly the value of the objective function, e.g., 6.5% increase for an 88% increase in credit limit. Net cash flow decreases dramatically, about 150% for the same increase in credit limit. Cash available decreases even more drastically (about 266%) as credit limit is increased by only 88%. Reserve cash remains unchanged while reserve credit increases. This indicates that the modeled farmer absorbs the added welfare (i.e., Z value) mainly in the form of increased liquidity.

The effects of increasing the credit limit on liquidity reserves are strongly evidenced in credit reserves. In the present program (12%, cash-kind loan), increasing the credit limit increases the formal credit reserve. This is an interesting result. It implies that more available credit is put to reserve in lieu of cash and the amount of own cash the farmer commits to productive uses increases.

Looking at the last two columns, all the performance measures show remarkable increases as loan disbursement is changed from cash and kind to cash only. The values of the objective function, net cash flow, reserve cash, reserve credit and available cash at all levels of credit limit are higher than in the comparable credit limits with a cash-kind loan. Absorbing much of the Z gain in added liquidity occurs again. However with cash only disbursement, the loss in net cash flow and cash available is lessened--and stays higher than in current situation. To illustrate, the

Table 9

Effects of Credit Limit Variation: Interest Rate Held Constant For Each Form of Loan Disbursement

		Cash-kind		Cash only	
Credit Limit (₱)	Performance measure	Z-value	₱ amount	Z-value	₱ amount
900	Objective function	5373	5373	6707	6707
	Net cash flow	-1635	-1635	- 751	- 751
	Reserve cash	1753	714	1801	751
	Reserve credit				
	Formal	1380	13175	1612	1923
	Informal	1375	1197	1545	1367
	Cash available	-	- 921	-	0
1300	Objective function	5598	5598	7357	7357
	Net cash flow	-2810	-2810	-1166	-1166
	Reserve cash	1753	714	1776	727
	Reserve credit				
	Formal	2780	28577	2711	3647
	Informal	1375	1197	1536	1368
	Cash available	-	-2096	-	- 439
1700	Objective function	5727	5727	7981	7981
	Net cash flow	-4081	-4081	-1322	-1322
	Reserve cash	1753	714	1913	771
	Reserve credit				
	Formal	4180	45985	3557	4791
	Informal	1375	1197	1333	1149
	Cash available	-	-3367	-	- 551

value of the objective function in the 1700:12%, cash only specification, is 48% higher than at the current situation. Net cash flow increases by ₱313 and cash available also increases by ₱370. Thus the decreases in the net cash flow and cash available due to increasing credit limit on cash-kind loan can be offset by cash only loan disbursement. The farmer also is in a better liquidity position as credit reserves increases. He can use the undrawn credit balance to meet unforeseen contingencies.

Thus, with increasing credit limit and cash only loan disbursement, the farmer's economic welfare and liquidity needs as a risk response improve. This modification may well be costless to the program lender. Added benefit could be an expanded program outreach.

4.3 Effects of Simultaneous Increases in Interest Rate and Credit Limit

To identify the combined effects of the policy variables in the *Maisan* credit program, simulations of simultaneous increases in interest rate and credit limit were performed. The effects of these combined changes on welfare and financial behavior of farmers are shown in Table 10.

Results in the first two columns of the table reflect only a .56% decrease in the objective function when interest rate is increased from 12% to 24% and credit limit from P900 to P1300. This decrease is rather small as compared to the decrease from 12:900 to 36:1700 which is 3.4%. This indicates possible improvement in the objective function through combined increases in the interest rate and credit limit but up to a certain level only. Net cash flow and cash available decline dramatically while reserve cash decreases gradually. On the other hand, total reserve credit

Table 10

Effects of Simultaneous Increases in Interest Rate and Credit Limit and Change in the Mode of Disbursement

Credit Limit	Performance measure	Cash-kind Z-value	Cash-kind ₱ amount	Cash only Z-value	Cash only ₱ amount
			12%		
900:	Objective function	5373	5373	6707	6707
	Net cash flow	-1635	-1635	- 751	- 751
	Reserve cash	1753	714	1801	751
	Reserve credit				
	Formal	1380	13175	1612	1923
	Informal	1375	1197	1545	1367
	Available cash	-	- 921	-	0
			24%		
1300:	Objective function	5343	5343	7130	7130
	Net cash flow	-2822	-2822	-1287	-1287
	Reserve cash	1633	659	1745	713
	Formal	2661	28432	2716	3659
	Informal	1371	1193	1456	1271
	Available cash	-	-2163	-	- 574
			36%		
1700:	Objective function	5195	5195	7358	7358
	Net cash flow	-4093	- 493	-1661	-1661
	Reserve cash	1497	590	1686	665
	Reserve credit				
	Formal	3925	41289	3557	4791
	Informal	1366	1191	1276	1091
	Available cash	-	-3503	-	- 996

increases substantially with combined changes in interest rate and credit limit, indicating favorable liquidity results.

Looking at the last two columns, substantial increases in all performance measures are reported as loan disbursement is changed from cash and kind to cash only. The value of the objective function at all levels of coordinated changes is higher than its value for cash and kind disbursement at 12% interest rate. The same improvement is true for net cash flow and cash available. The increase in cash available, however, at 36:1700 is sightly lower than that of the current situation (12:900). Again, this indicates economic benefits from simultaneous increases in the interest rate and credit limit but only at certain levels. A policy to change loan disbursement into all cash would benefit the borrower. It would also reduce administrative and transaction costs for the lender.

The effects of simultaneous increases in interest rate and credit limit on liquidity reserves are more favorable than just increases in interest rate by itself. The effects become further improved with an all cash loan disbursement. Reserve cash decreases while total reserved credit increases, a clear indication that credit reservation tends to substitute for cash reservation. With a larger commitment of cash to farm use and smaller commitment of credit, more funds could now be released by the program lender to other farmer-borrowers, thus expanding program outreach.

Thus, increasing the interest rate, coupled with increasing the credit limit and disbursing loan in cash, benefits both borrower and lender. The welfare loss to the borrower due to increase in interest rate can be offset with increased credit limits. Surely, the lender benefits from a higher interest rate, which reduces the total net lending costs. Increasing credit limit and interest rate may not entail added costs to the lender. With cash loan disbursement, added benefits accrue to both borrower and lender. Both the borrower's economic welfare and financial organization including liquidity reserves generally improve. Cash disbursement reduces borrowing costs to the borrower in terms of reduced transaction, transportation, out-of-pocket, psychic, time and other borrowing-related costs. Costs to the lender are also reduced in terms of administrative costs, transaction costs, voluminous paper work, etc. More especially, the farmer's commitment of own cash to production allows the program lender to reach more farmers--a major objective of many small farmer credit programs.

4.4 Effects of Break-Even Interest

The break-even rate of interest (36%) gives the point at which the formal lender, in this case, the Maisan 77 credit program is neither worse off nor better off. At this rate, it simply recovers its lending costs (see Section 1.3 on the derivation of break-even interest rate.) There is no gain nor loss in lending.

4.4.1 Effects from current situation to break-even rate of interest

Results reported in columns 5 and 6 of Table 11 show that increasing the interest rate from 15% to the break-even rate with no increases in credit limit and no change in mode of disbursement, reduces the value of all performance measures. The decreases, however, are rather modest, e.g. about 12% for the objective function for a 300% increase in interest rate. The effects on performance measures, however, change when loan is disbursed all in cash. The objective function, net cash flow and available cash are substantially higher than the current situation results. This general increase indicates an improvement in the farmer's economic well-being.

Table 11

Effects of Break-even Rate of Interest on Performance Measures: Comparisons With the Current Situation and Increasing Credit Limit

Credit Limit (₱)	Performance measure (₱)	12% Cash-kind Z-value (1)	12% Cash-kind ₱ amount (2)	12% Cash only Z-value (3)	12% Cash only ₱ amount (4)	36% Cash-kind Z-value (5)	36% Cash-kind ₱ amount (6)	36% Cash only Z-value (7)	36% Cash only ₱ amount (8)
900:	Objective function	5373	5373	6707	6707	4729	4729	6398	6398
	Net cash flow	-1635	-1635	- 751	- 751	-1799	-1799	-1208	-1208
	Reserve cash	1753	714	1801	751	1497	590	1674	705
	Reserve credit								
	Formal	1380	13175	1612	1923	1181	10506	1876	2527
	Informal	1375	1197	1545	1367	1366	1191	1556	1376
	Available cash	-	- 921	-	0	-	-1209	-	- 503
1300:	Objective function	5598	5598	7357	7357	5056	5056	6903	6903
	Net cash flow	-2810	-2810	-1166	-1166	-2832	-2832	-1400	-1400
	Reserve cash	1753	714	1776	727	1497	590	1631	658
	Reserve credit								
	Formal	2780	28577	2711	3647	2525	25145	2716	3659
	Informal	1375	1197	1536	1358	1366	1191	1456	1271
	Available cash	-	-2096	-	- 439	-	-2242	-	- 742
1700:	Objective function	5727	5727	7981	7981	5195	5195	7358	7358
	Net cash flow	-4081	-4081	-1322	-1322	-4093	-4093	-1661	-1661
	Reserve cash	1753	714	1913	771	1497	590	1686	665
	Reserve credit								
	Formal	4180	45985	3557	4791	3925	41289	3557	4791
	Informal	1375	1197	1333	1149	1366	1191	1276	1092
	Available cash	-	-3367	-	- 551	-	-3503	-	- 996

Reserved cash decreases while total reserved credit increases, indicating a substitution of credit reservation for cash reservation and more commitment of the borrower's own cash for productive activities. Such effects benefit the borrower in terms of liquidity reserves to meet unforeseen events and contingencies. The lender also benefits in terms of possible program outreach and lower administrative cost, not to mention the complete recovery of all lending cost at break-even interest rate.

4.4.2 Effects of break-even interest rate with increasing credit limit and cash only disbursement

The middle portion of columns 7 and 8 show that with cash only disbursement and at P1300 credit limit, an increase of interest rate from 12% to break-even results in substantial increases in objective function, net cash flow and cash available. Reserved cash decreases gradually while total reserved credit increases drastically. Thus, both economic welfare and financial liquidity reserves of the borrower are improved. The lender benefits from recovery of all lending costs, reduced administration costs and program outreach extension to more borrower-clienteles.

It is interesting to note that at the particular credit limit of P1300, and all-cash loan disbursement, the amounts of cash available and net cash flow are still higher than at present situation levels. Further increase in credit limit, say P1700, indicate lowering levels of these two performance measures and a tendency of cash reserves to increase.

Therefore, based on these simulation results, involving the break-even rate of interest, benefits are concluded to accrue to borrowers in terms of improved financial structure, economic welfare and liquidity reserves to counter risks and uncertainties when loans are disbursed in cash only and a simultaneous increase in credit limit up to a certain level. The same variations result also in benefits to the lender in terms of full recovery of lending costs, lowered administrative costs and more farmers served as farmers use their own cash for production, thus releasing more funds for other borrowers. Cash disbursement and increasing credit limit and interest rate are costless to the lender. Lower transaction costs favor both borrower and lender, but especially the borrower as loan transaction cost becomes more important for him, particularly when he makes short-term loans like the Maisan 77 program loans.

4.5 Effects of Increasing Interest Rate and Credit Limit to the Lender

Simulation results in the previous sections have shown that losses to the borrower due to increasing interest rates can be offset by corresponding increase in credit limit and cash only loan disbursement.

In this section modifying the program in terms of variations in interest rate and credit limit are shown as these have further implications for how much the lending program can be extended. As stated earlier, small farmer credit programs suffer from high net lending cost which is a real threat to their viability and continuous operation.

At the current situation, with no changes in interest rate and credit limit and mode of loan disbursement, the lender realizes a net cost of P216 per borrower per hectare per year. Increasing the interest rate with no changes in the credit limit and mode of disbursement would result to a lowering amount or costs to the program lender. (See below.) Of course, such a modification in interest rate alone benefits the lender only.

Interest Rate	Credit Limit	Cost of Lending	Net Cost of Lending
(%)	(P)	(%)	(P)
12	900	36	-216
24	900	36	- 98
36	900	36	0

Increasing the credit limit, at the current rate, produces the following net lending cost.

Interest Rate	Credit Limit	Cost of Lending	Net Cost of Lending
(%)	(P)	(%)	(P)
12	900	36	-216
12	1300	36	-312
12	1700	36	-408

Such results may be beneficial to the borrower in terms of more credit made available at low cost, but extremely harmful to the lender.

A third variation is to increase interest rate and credit limit simultaneously. This appears to reduce net lending costs and could provide possible benefits to both lender and borrower. The results below show a decreasing pattern in net cost of lending.

Interest Rate	Credit Limit	Cost of Lending	Net Cost of Lending
(%)	(P)	(%)	(P)
12	900	36	-216
24	1300	36	-156
36	1700	36	0

A fourth modification involving cash disbursement with simultaneous increases in interest rate and credit limit may further reduce the net cost of lending. Cash disbursement usually eliminates some of the expensive administrative costs and transaction costs. Since it also makes loan proceeds valuable and versatile to farmer-borrowers, indirect effects on the program lender could be potential recovery of loan funds as borrowers protect and preserve their credit by possible repayment. With fund replenished, the program lender can expand its outreach to meet the credit needs of other small farmers.

CHAPTER V

SUMMARY, CONCLUSIONS AND IMPLICATIONS

5.1 Summary

This study identified high net costs of lending as a serious problem besetting small farmer credit programs in the Philippines. The review of literature confirms this problem. High default rates, administration costs and low interest rates account for huge losses in these credit programs. Thus, the study aimed to determine reforms in the system that can both reduce the net costs of lending and improve the financial and economic well-being of farmer-borrowers.

Primary data from a sample of 50 Maisan 77 (corn) borrowers in Negros Oriental, a province located in the central Visayas region of the country, were used to specify the parameters in a liquidity-specified linear programming (LS-LP) model.

Variations in the interest rate (12%, 24%, and 36%), credit limit ₱900, ₱1300 and ₱1700) and mode of loan disbursement (from cash and kind to cash only) were performed in the simulations of the validated LS-LP model. The effects of the break-even rate of interest (36%) were given special attention. The effects of the various changes on net lending costs were also shown. These last two sections relate more directly to the problem identified.

Highlights of the simulations can be enumerated as follows:

1. Increasing the interest rate with credit limit held constant results to lower values of the objective function, net cash

flow and cash available in both forms of loan disbursement. Cash reserved also decreases. However, program credit reserved increases when loan is disbursed in cash only.

2. Increasing the credit limit with interest rate held constant results in a slight increase in the level of the objective function but drastic decreases in the levels of the net cash flow and cash available when program loans are disbursed in cash-kind. Cash reserved remains unchanged but total credit reserves increase.
3. When program loans are all disbursed in cash, increasing the credit limit with the interest rate constant substantially increases the level of the objective function but slightly decreases the levels of net cash flow and cash available. Part of the increase in borrower's welfare, reflected in the level of the objective function, is absorbed by increased liquidity reservations.
4. Simultaneous increases in interest rate and credit limit improve the liquidity position of the borrower when loans are in cash-kind. When loans are disbursed only in cash, more favorable effects occur; the welfare of the borrower is greatly improved. The levels of objective function, net cash flow and cash available, all increased up to a certain combined level of interest rate and credit limit increase. Reserved cash decreases while total reserve credit increases, indicating that credit reservation tends to substitute for cash reservation.
5. The higher valuation of program credit, when the loan is disbursed in cash only, induces the borrower to commit more cash to

production since credit reserves can substitute for cash reserves. With more cash committed to production, net cash flow and cash available increase made possible by added credit held in reserve to meet the risks reflected in the liquidity requirements. Committing more liquid assets to production further reduces the program lender's burden to generate more loanable funds.

6. The effects of break-even interest rate with increasing credit limit and cash only disbursement are substantial increases in the levels of the objective function, net cash flow and cash available. Reserved cash decreases gradually while total credit reserved increases significantly especially at a credit limit of P300.

Using simple calculations, it was shown that the net cost of lending can be reduced by simultaneously increasing the interest rate and credit limit at the break-even interest rate, the net public sector costs is reduced to zero, regardless of the size of loan.

5.2 Conclusions

In terms of reduced economic welfare, the financial loss from the increased interest rates can be offset by a simultaneous increase in credit limit. Thus, credit limit becomes important to the borrower. He can maintain his welfare at a higher rate of interest if more credit is made available. This result confirms the need to increase the quantity of credit to farmers in relation to input use in the Philippines (54).

To minimize the high net lending costs of SFCPs, the interest rate should be increased. However, doing so jeopardizes the borrower's welfare. To balance this effect, the credit limit should be increased also and the program loan be disbursed in cash only. The last two corresponding reforms certainly benefit the farmer-borrower in terms of improved economic performance and liquidity reserves.

By disbursing program loans in cash, the use of program loan funds is greatly relaxed and unrestricted. This change significantly improves the economic well-being and financial performance of the farmer, by increasing his net cash flow and cash availability. In addition, cash disbursement can also lower total lending costs as supervision in the acquisition of fertilizers, seeds and chemicals by government production technicians and bank technicians is minimized if not totally eliminated. Moreover, disbursing loans in cash may reduce the farmer's default tendency owing to gains from protecting his credit, as reflected in high credit valuations for such a form of loan.

Education, health and social needs are as uncertain as natural calamities and infestations in most developing countries. One of the few ways to respond to risks is through liquidity management. It was evident in households surveyed that families hold cash and credit in reserve in amounts that are large relative to all assets, to meet unforeseen adverse events.

Arguments against loan disbursements mostly in kind include limitation if not prohibition of the borrower's use of credit for consumption purposes. In many developing countries, it is not easy to draw the line between household consumption and farm production expenses.

Secondly, extending loans more in kind (about 4/5 of total program loan) ignores liquidity management in the financial behavior of the producer-borrower. This can be counterproductive in terms of reducing default rate.

Thirdly, when the government lends mostly in kind, borrowers tend to look for other sources of funds, usually informal sources like private moneylenders who charge higher interest rates. These funds are more versatile in their use, including use for household consumption purposes. Such behavior could explain why in the early phases of the _Maisan_ 77 programs, it was found that some farmers opted to sell the "cheap" in-kind loan proceeds for cash proceeds. Thus, it is quite unrealistic to restrict small farmer credit solely to production needs. Farmers do need funds for liquid reserves and to meet consumption needs, too.

Criteria for evaluating success of credit policies are diverse: (1) cost of operating the credit program, (2) number of farmers served, (3) degree of meeting financial needs of farmer-borrowers, (4) level of delinquency or default rate, reflected in part in (1) above, (5) increase in borrowers' well-being and income, and (6) impact on equality in income distribution between different socio-economic social groups.

So far, the _Maisan_ 77 credit program has met criterion 5 in some degree. By disbursing loans in cash, lending procedures and supervision could be simplified. This shift would also increase the borrowers' income which could lead to commitment of more cash to production, thus reducing substantially the demand for loanable funds from the formal lenders. This policy could certainly fulfill criterion (3) and eventually expand the outreach to meet criterion (2). Criterion (6) could be met depending on government policy as to allocation of program funds to various groups of farmers. So far the other criteria have not been met by the _Maisan_ 77 credit program. These are cost of operating the program and high default rates.

The cost of operating the program could be reduced by cash disbursement of loans which leads to less administrative costs and higher net cash flows and cash availability to meet liquidity requirements. With higher incomes farmers could be expected to be more able to repay, given their willingness to repay their borrowed funds from the program, thus reducing default rates and total lending costs. Cash disbursement with coordinated increases in credit limit and rate of interest proves beneficial to both lender and borrower. At a breakeven rate of interest, the program lender neither loses nor gains while the farmer-borrower realizes higher levels of net cash flow and cash availability than if program funds were disbursed in cash and kind. Moreover, interest rates that reduce losses more likely support a widening of access to the lending program. SFCPs are more able to provide services to other unreached farmers when the cost of credit delivery are lowered and funds recovered. Thus, it fulfills a major goal for its inception, reaching out to really needy small farmers who may not have the socio-political advantage most large farmers possess. In the long-run, the credit program becomes a permanent, stable and valuable source of credit reserve.

5.3 Research and Policy Implications

Several research issues emerge from this study. Variations in the modelling and simulation outcomes of previous studies and this one demand a need for further exploration of the financial reserves management approach which entails empirical estimation of farmers' reservation prices on cash, credit and liquidity reserve requirements. There is a plausibility that the liquidity value curve would differ for decision-makers with differing liquidity preference patterns and risk aversion behaviors. Empirical information on credit reservation prices would be helpful to assess debt aversion rates, spatially, which would further help lessen the impact of small farmer credit programs.

Another important research issue pertains to influences on lending cost of high administrative costs involved in small farmer credit delivery system. A more investigative and thorough study of the nature and magnitude of administrative costs would give a better idea of more exact costs of administration and help pinpoint areas for cost minimization in the total lending structure. So far, information on administrative costs are scanty and seldom convincing. At best figures are assumed which make it hard to undertake a good evaluation of small farmer credit programs.

An important research issue pertains to default behavior of farmers. It was attempted to model default as an optimizing alternative among small corn farmers in this study but the default activity remained non-activated. Inclusion of such an option when activated would add further analytical usefulness and efficiency of the model to represent reality. The failure to specify an activated activity reflects a failure to reflect in the model gains the borrower expects to realize from defaulting.

Aside from a liquidity management approach, other means to help producers face various business and financial risks in farming could be explored and investigated. Loan guarantees, crop insurance, and so forth as alternative responses to risk need to be researched as do data and modeling requirements.

Although reported as unsuccessful in the Philippine setting, further studies are needed on group-lending schemes as a tool to lessen loan processing and other costs of administration and repayment risks. Studies could be conducted to design a modified group-borrowing scheme in the context of a cooperative system which checks individual capitalistic preferences and orientation of small farmers.

The policy implications of this study are focused on form of loan disbursement, interest rate and credit limits.

When program loan proceeds are disbursed in cash, the credit becomes more valuable to farmer-borrowers. A farmer attaches increasing value at each of remaining units of unused credit as credit reserve is reduced by borrowing. Cash is liquid. It meets the liquidity needs of farmers for both production and household consumption. Benefits from the use of production loans for other needs have been supported by several major Philippine non-repayment studies (44, 49, 55). They relate the use, diversion or misapplication of cash-kind borrowed funds to non-repayment and high arrears of program loans by farmers. Total cash disbursement plus a provision for consumption needs may alleviate the problem of delinquency in small farmer credit programs. This experience has been proven successful in the prêts de soudure program in Ivory Coast (42). Moreover, when loans are disbursed in cash, their immediate release and lower transaction costs (both to borrower and lender) make them comparable to moneylender funds which are also transacted at low costs and less time, but charged at higher interest rates. Loans disbursed in cash give farmers more freedom in use and decision-making, and more sense of personal trust and maturity.

Simulation results indicate an improvement in the overall financial performance of a small corn farmer when loans are disbursed in cash only. His net cash flow position improves and level of cash available increases. With an increase in income and productivity, they could be expected to repay borrowed program funds. A breakeven interest rate with cash disbursement also results in better financial performance and well-being of the modeled farmer than a cash-kind disbursement at the current rate. Again, with higher income, a farmer could be able to repay his loan. His ability to repay could be reinforced by a higher valuation placed on a loan at a higher interest rate. This perception could make him more willing to repay in order to protect his credit.

Regarding interest rate, a policy to increase the rate at the same time disburse in cash could be both beneficial to lender and borrower. A higher rate of interest intended to recover potential large losses in loan proceeds on the part of the program lender projects the relative value of that loan into the borrower's mind. Thus, a formal loan disbursed in cash at a higher interest rate further becomes comparable to private moneylender loans, in effect balancing rural financial market structure.

The preceding paragraphs discussed the higher value a farmer-borrower attributes to program loan that is disbursed in cash and charged at a higher interest rate. The current low rates have contributed to huge deficits in program participating banks. They have also led borrowers to go into perennial debt and have nurtured an all too common notion in them that these "cheap" loans are give-aways that they will not have to repay. Not anymore! A relatively costly program loan in cash when valued highly will be preserved. And the best way to preserve it is by repaying to maintain a good credit standing and protect such credit.

The major policy suggestions, cash loan disbursement, competitive rate of interest and higher quantity of credit, are addressed to the general problem of many small farmer credit programs which is high net lending costs that threaten their viability. Results of survey, modelling and simulations confirm the plausibility of these policy modifications.

This study, therefore, has brought into sharper focus the vital need of farmers for liquidity management and the critical issue of government supported credit interest rate in an effort to determine possible reforms that will improve the Maisan 77 credit program of the Philippines.

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APPENDICES

Appendix A

In the Philippines (a middle-income country), per capita income was recorded as $690 as of 1980. Twenty-six percent of the gross domestic product is contributed by agriculture. In 1980 it was reported by the World Bank (1982), that almost half of the labor force (46%) was engaged in agriculture. The country also had seven percent of merchandise imports in the form of food as of 1979 (60).

Maisan 77[a] was launched in July 1977 as a national white corn and feedgrains production program aimed at achieving yield of 3 tons per hectare. The program incorporated a new package of technology which included the use of improved varieties, application of fertilizer, intensified pest and weed control practices and improved planting operations. In the crop year 1978-79, production sufficiency in white corn was attained. The Technical Board for Agricultural Credit (TBAC) reported in 1981 that Maisan 77, like Masaganang[b] Maisan, its predecessor, was characterized by shrinking qualified clientele, dwindling credit, and deteriorating repayment rate.

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[a]Maisan is the Filipino word for corn production. The number 77 symbolizes the year the program was implemented.

[b]Masaganang is a Filipino adjective which means bountiful.

Appendix B

DEPARTMENT OF AGRICULTURAL ECONOMICS
College of Development Economics and Management
UPLB, College, Laguna

AN ECONOMIC EVALUATION OF THE MASAGANANG MAISAN CREDIT PROGRAM IN THE PHILIPPINES
(1980-1981)

Record No. ____________
Date of Interview ________
Place ______________

Note: This questionnaire is strictly confidential and is being used solely for academic purposes.

I. GENERAL INFORMATION

Respondent's name: ______________________

Age: ______________________

Number of years of schooling: ______________

Are you a member of any farmer organization? ________

If yes, which one? ______________________

Number of parcels of corn being cultivated: ________

Years of experience in corn farming: ____________

Variety of corn planted:

  1st cropping ______________________

  2nd cropping ______________________

Sex ______________

Civil Status:

  Single ________

  Married ________

  Widowed ________

  Separated ________

Tenure Status:

  Tenant ________

  Owner-operator ____

  Lessee ________

Household Membership and Employment[a/]

Relation to Farmer	Sex	Age	Educational attainment	Check if Presently schooling	FARM[b/]		OFF-FARM					NON-FARM				Idle Months
					No. of Months	No. of days/month	Type of work	No. of Months	Average No. of days/mo.	Average No. of hrs/day	Income	No. of Months	Average No. of days/mo.	Average No. of hrs/day	Income	

a/ Include operator

b/ Codes: MW - major works; MS - minor but significant works; MN - minor but insignificant work; O - no work

Family Living Expenses (by season)

	First Crop (₱)	Second Crop (₱)	Rest of the year
1. Food (see separate table)			
2. Clothing			
3. Education (schooling)			
4. Health care			
(hospital bills)			
(medicine)			
5. Ceremony			
(wedding, feasts, etc.)			

Other Cash Expenses (1980-81)

	First Crop	Second Crop
1. Seeds		
2. Fuel and oil		
3. Hired manual labor		
4. Hired animal labor		
5. Food for laborers		
6. Irrigation fee		
7. Transportation expense		
8. Repair and maintenance		
9. Fertilizer (for corn)		
10. Farm chemicals (herbicides)		
11. Land tax		
12. Feeds for livestock, poultry		
13. Hired tractor		
14. Livestock breed		
15. Others (specify)		

Household Membership and Employment[a]

					FARM[b]		OFF-FARM					NON-FARM				
									Average				Average			
Relation to Farmer	Sex	Age	Educational attainment	Check if Presently schooling	No. of Months	No. of days/month	Type of work	No. of Months	No. of days/mo.	No. of hrs/day	Income	No. of Months	No. of days/mo.	No. of hrs/day	Income	Idle Months

a/ Include operator

b/ Codes: MJ - major works; MS - minor but significant works; MN - minor but insignificant work; O - no work

Family Food Consumption

Food Type	Per day		Per Week		Remarks
	Qty.	Value	Qty.	Value	
Cereals (corn)					
Roots & tubers					
Vegetables					
Cooking oil					
Meat and poultry					
Beef					
Pork					
Poultry					
Fish and fish products					
Eggs					
Milk & milk products					
Others (specify)					

Other Sources of Income

I T E M	Average Annual Amount
1. Pension	
2. Support	
3. Grant from persons	
4. Lottery winnings	
5. Others	

The Form

Utilization of Cropland

Parcel No.	Location	Parcel Area (ha.)	Tenure status a/	Terms of Tenurial Arrangement: LL	Terms of Tenurial Arrangement: Operator	Crops Planted b/	No. of times planted to corn/year	Area for Specific Crops (ha.)	Type of Irri-gation c/	Months of Operation d/: J	F	M	A	M	J	J	A	S	O	N	D
Present																					
Last season	Other crops planted			Area planted		No of trees/plants		Amount Harvested last year	Amount sold last year						Amount consumed last year						
TOTAL																					

a/ Tenure Category: OP - Owner operator
AO - Amortizong owner
LH - Leaseholder
ST - Share tenant

b/ If area is planted with trees, determine also the number of trees per parcel.

c/ Irrigation types: P - pump, G - gravity, R - rainfed

d/ For each crop, draw a line indicating the period from land preparation to harvesting.

Farm Inventory

I t e m	Number and/or Description	Year Acquired	Acquisition Cost (₱)	Years to last	Cost of repair and maintenance this year	Remarks
CROP						
Land						
Cropland						
Owned						
Rented						
Houselot						
Other lands						
Buildings						
Dwelling						
Sheds						
Bodega						
Others						
Machinery & Equipment						
Tractor						
Tractor accessories						
Plow						
Harrow						
Pump						
Weeder						
Sprayer						
Harvesting tools						
Cart						
Sled						
Hoe						
Spade						
Bolos						
Others (specify)						
LIVESTOCK						
Land						
Hog house						
Incubator						
Poultry house						
Feed lot						
Syringe						
Post & fences						
Others (specify)						

Livestock Inventory

Item	Total Number	PURCHASED				BORN/HATCHED			Remarks [a]
		No.	Date of Purchased	Value Purchased	Present Value	No.	Date born/ hatched	Present Value	
Poultry									
layers									
roosters									
pullets									
chicks									
Swine									
boar									
sow									
gilt									
weanlings									
litter									
Carabao									
heifer									
steer									
young									
Cow									
heifer									
steer									
young									
Horse									
Goats									
Ducks									
Pigeons									
Others									

[a] For egg layers, note the weekly average of egg production
For mammals, take the annual frequency of giving birth and average birth rate

Cultural practices, labor input and expenditures (1980-81)

Farm Operations	Month	No. of days performed	Labor Input[a] (man-days)						EXPENDITURES				Sharing in Exp.		Check and indicate if cost of operation was done during	
			O	F	H[b]	E	A[c]	T[c]	Nature		Amount		LL	Operator	First Cropping	Second Cropping
									Kind	Qty.	Cash	In kind				
Seed treatment																
Seedbed and seedling Preparation																
Land preparation																
Plowing																
Furrowing																
Planting/transplanting																
Fertilization																
Cultivation																
Thinning																
Weeding																
Weedicide application																
Spraying																
Harvesting																
Threshing																
Hauling																
Others																

a/ Code:
O - Operator
F - Family
E - Exchange
H - Hired
A - Animal
T - Tractor

b/ Indicate the rate per unit

c/ Indicate the rate if paid separately

Production and Disposal of Crops

Crops	Total Production	LL's Share	OP's Share	H & T Share	DISPOSAL OF OPERATOR'S SHARE: Home Use	Give Away	Paid to creditors	STORED: For Sale	STORED: For consumption	SOLD: Qty.	SOLD: Price/Unit	Month of Sale	Type of outlet a/	Place of Sale	Mode of payment	Mode of transportation	Marketing Cost Incurred
CORN																	
First cropping																	
Second cropping																	
Third cropping																	
TOTAL																	

a/ Types of outlet:
- Local assembler
- Wholesaler
- Millers
- Retailers
- Others (specify)

b/ Place of sale:
- Farm
- Farmstead
- Roadside
- Buyer's place
- Town and/or barrio market

1. Do you sell your product right after harvest? Yes ______ No ______
2. In what form do you sell your product? green ______ dried on the cob __________ shelled ________
3. What are the major problems in selling your product
____
____

Indicate conversions:

cobs/sack ______ gantas/sack ______ gantas/can ______ others (specify) ______

kgs/sack ______ cobs/can ______ kgs/can ______

Market Outlet for Livestock/Poultry

Commodity	Volume/ Number sold	Form	Month of Sale	Month Bought	Place of sale[a]	Outlet		Method of transporation	Price Obtained (Range)	Method of Payment[c]
						Type[b]	Distance from farm			
LIVESTOCK										
POULTRY										

[a] Place of sale:
- Farm
- Farmstead
- Roadside
- Buyer's place

[b] Types of outlet:
- Local assembler
- Wholesaler
- Retailers
- Others (specify)

[c] Method of payment:
- COD
- Advance
- Installment
- Delayed
- Others

1. What is the major problem in selling your livestock/poultry? ______________________________

CREDIT AND LOAN USE

Loans obtained within calendar year 1980

Loan No.	Amount borrowed		Source of loan 1/	Collateral required 2/	Timing of loans			Amount Paid		Reason for late payment 3/	Nominal Interest Rate 4/	Other charges or conditions 5/
	In cash (₱)	In kind (₱)			Month received	Date due (mo./yr.)	Date paid (mo./yr/)	In cash	In kind			
11	- - -	- - - -	- -	- -	- -	- -/- -	- -/- -	- -/- -	- -/- -	- -	- -	- - - -
12	- - -	- - - -	- -	- -	- -	- -/- -	- -/- -	- -/- -	- -/- -	- -	- -	- - - -
13	- - -	- - - -	- -	- -	- -	- -/- -	- -/- -	- -/- -	- -/- -	- -	- -	- - - -
14	- - -	- - - -	- -	- -	- -	- -/- -	- -/- -	- -/- -	- -/- -	- -	- -	- - - -
15	- - -	- - - -	- -	- -	- -	- -/- -	- -/- -	- -/- -	- -/- -	- -	- -	- - - -

1/ Code for source of loan
01 RB (M-77)
02 RB (non-M-77)
03 PNB (M-77)
04 PNB (non-M-77)
05 DBP
06 Credit Union
07 ACA/FACOMA
08 Landlord
09 Merchant/comprador
10 Professional moneylender
11 Parents/relatives
12 Friends
13 Installment Plans
14 Others (specify)
-7 Don't know
-8 No response
-9 Not applicable

2/ Collateral required
01 None
02 Land
03 Farm equipment
04 Others (specify)
05 Work animals
-7 Don't know
-8 No response
-9 Not applicable

3/ Reasons for late payment
01 Crop failure
02 Family emergency (accident, sickness, death)
03 Ceremonial expense (fiesta, baptism, wedding)
04 Selda member failed to pay (if M-77 borrower)
-7 Don't know
-8 No response
-9 Not applicable

4/ Refers to official interest rate e.g. with M-77 loans it is 12% p.a. or 6% per crop season. -7 Don't know -8 No response -9 Not applicable

5/ Refers to additiona charges like the service charge in M-77 or the condition to pay in kind at a price lower than market price. -7Don't know -8 No response -9 Not applicable

Outstanding loans and liabilities as of May 1, 1981

Loan no.	Amount of outstanding loan as of May 1, 1981	Source of loan 1/	Month paid in 1980	Amount paid during 1980
1	- - - - -	- -	- -	- - - - - -
2	- - - - -	- -	- -	- - - - - -
3	- - - - -	- -	- -	- - - - - -

ATTITUDES TOWARD SAVINGS

1. A person usually saves for a number of reasons, what would you consider as very important reasons for savings?

____

____

1.1 READ REASONS NOT MENTIONED BY R. Aside from the reasons you have mentioned, the following are other reasons for saving, how important is each of these to you? (ENCIRCLE ANSWERS)

	Very Important	Important	Not Important	Don't Know	No Response
For:					
1. Emergencies	3	2	1	-7	-8
2. Old age	3	2	1	-7	-8
3. For fiestas, weddings and other celebrations	3	2	1	-7	-8
4. For children's education	3	2	1	-7	-8
5. To buy large household items like T.V., motorcycles, refrigerator, etc.)	3	2	1	-7	-8
6. To build or improve your house	3	2	1	-7	-8
7. To buy farm machinery and transport equipment	3	2	1	-7	-8
8. To buy farm animals	3	2	1	-7	-8
9. Purchase/amortize agricultural land	3	2	1	-7	-8
10. To buy seeds, fertilizers and pesticides	3	2	1	-7	-8
11. To repay debts	3	2	1	-7	-8
12. Others (specify)	3	2	1	-7	-8

1.2 Have you been able to save for the reason you listed as important?

00 No 01 Yes (GO TO Q. 2)

1.3 If No, what do you plan to do about these?

____

____

2. At what month(s) of the year are you most likely able to save? (ENCIRCLE ANSWERS)

J — F — M — A — M — J — J — A — S — O — N — D

3. Who are the members of your household who are very concerned about savings?

3.1 What does he/she do in order to save?

	Relation to respondent	Main Activity for saving
1.	______	______
2.	______	______
3.	______	______

4. The following are different ways of keeping extra money. Do you know anything about each of these?

4.1 For those R answered R, Please rank these according to your preference.

	Awareness 1/	Rank	Value (₱) as of Following Dates: Jan. 1, 1980	Start of last cropping season	Dec. 31, 1980
1. Cash at Home	xx	_	--	--	--
2. Bank Deposit	--	_	--	--	--
3. Premyo Savings Bond	--	_	--	--	--
4. Barrio Savings Fund	--	_	--	--	--
5. Barrio Guarantee Fund	--	_	--	--	--
6. Life Insurance	--	_	--	--	--
7. Loans and Receivable due from others	--	_	--	--	--
8. Other Securities	--	_	--	--	--

1/ 00 NO 01 YES -8 No response

FARMER'S ATTITUDES TOWARD CREDIT AND REPAYMENTS

(I will read to you some statements. Please indicate whether you strongly agree, agree, disagree, strongly disagree.) (ENCIRCLE ANSWERS) If R is not sure, encircle UNCERTAIN.

	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
1. It is impossible for farmers to save	1	2	3	4	5
2. A farmer should not keep his money in a bank because he is not sure that banks will give him back his money.	1	2	3	4	5
3. A farmer should borrow only if he has no savings.	5	4	3	2	1
4. Loans from the government are best because sometimes you don't have to repay them.	1	2	3	4	5
5. Farmers do not pay back their loan b cause they don't have the money to pay them.	5	4	3	2	1
6. Persons who do not pay back their loans are looked down by other people.	5	4	3	2	1
7. It is more advantageous for a farmer to postpone payment of his M-77 loans.	1	2	3	4	5
8. Farmers who do not pay back their government loans should be imprisoned.	5	4	3	2	1
9. One should always try to save even when he can rely on others for help.	5	4	3	2	1
10. Farmers should give a small amount to technicians for the help he provides them.	1	2	3	4	5
11. Banks do not really suffer when farmers do not pay on time their M-77 loans.	1	2	3	4	5
12. A progressive farmer is one who repays hi debt on time.	5	4	3	2	1

1. If a person needs something for his farm and he does not have the means to obtain it, what can he do?

____

____

1.1 If a person needs something for his household and he does not have the means to obtain it, what can he do?

Farm	Household
__________	__________
__________	__________
__________	__________

2. What do you think are the reason(s) for borrowing? ______

2.1 The following are other reasons for borrowing, how important is each of these to you? Very important, important, not important. (ENCIRCLE ANSWERS)

2.2 Referring to purposes rated important and very important, would you consider borrowing for each of this? If no Go to Q.2.5)

2.3 From whom would you borrow? ______

2.4 Why would you borrow from ______ (Source mentioned in 2.3)

2.5 If No, why would you not borrow for this? ______

PURPOSE OF BORROWING	Degree of Importance[1]	Intention to borrow[2]	Preferred Source[3]	Reasons for Preference	Reasons for not borrowing
1. To purchase amortize agricultural land	3 2 1 -7 -8	__ __	______	______	______
2. To purchase farm machinery	3 2 1 -1 -8	__ __	______	______	______
3. To purchase farm animals	3 2 1 -7 -8	__ __	______	______	______
4. To purchase livestock and poultry	3 2 1 -7 -8	__ __	______	______	______
5. To purchase seeds, fertilizers, pesticides, and weedicides	3 2 1 -7 -8	__ __	______	______	______
6. To build or repair house	3 2 1 -7 -8	__ __	______	______	______
7. To buy household items like T.V., refrigerator, etc.	3 2 1 -7 -8	__ __	______	______	______
8. For fiestas, weddings and other celebrations	3 2 1 -7 -8	__ __	______	______	______
9. For children's education	3 2 1 -7 -8	__ __	______	______	______
10. For everyday expenses - food, clothing, etc. during off harvest periods	3 2 1 -7 -8	__ __	______	______	______
11. For emergencies	3 2 1 -7 -8	__ __	______	______	______
12. Others, specify	3 2 1 -7 -8	__ __	______	______	______

[1] 3 Very important 2 Important 1 Not important -7 Don't know -8 No response [2] 00 No 01 Yes [3] If Bank, which bank

3. Who in your household (if any) would disapprove of borrowing from the following. Why?

Source of Credit	Relation to Respondent of HH Member Disapproving	Reasons
1. Friends	______	______
2. Relatives	______	______
3. Private Moneylender	______	______
4. M-77	______	______
5. Banks, Collateral loans	______	______

4. What do you think are the main functions of the following?

4.1 For those perceived as saving institutions, please rank according to your preference.

Institutions	Perception 1/	Preference for Savings 2/
a. Rural Bank	______	______
b. PNB	______	______
c. DBP	______	______
d. Land Bank	______	______
e. Private development bank	______	______
f. Credit Union	______	______
g. Samahang Nayon	______	______
h. Savings and loan association	______	______

Codes:

1/ Perception
- 01 Saving
- 02 Lending
- 03 Saving and Lending
- -7 Don't know
- -8 No response

2/ Preference for savings
Rank from 1 to 8

4.2 Why did you rank first? ______

4.3 Why did you rank last? ______

5. Do you know anything about the selda/damayan or group borrowing under the M-77 program?

00 No   01 Yes   99 No response

5.1 Is this a good way of borrowing?

00 No 01 Yes -8 No response

5.2 Why? ______

5.3 Are you a member of the selda? ______

6. Do you know the technicians assigned in your area?

00 No 01 Yes 99 No response

6.1 Are technicians helpful to farmers?

00 No 01 Yes 99 No response

6.2 In what ways are they helpful to farmers?

______

6.3 Why did you say that technicians are not helpful to farmers?

______

7. From which dealers or store do you get your M-77 (farm) inputs? (If R does not buy inputs go to Q. 8.

7.1 Is this a good dealer or not?
7.2 Why?

7 Name of Dealer(s) Store(s)	7.1 Assessment	7.2 Reasons
1. ______	______	______
2. ______	______	______
3. ______	______	______

1 Good 2 Bad -7 Don't know -8 No Response

8. Would you recommend farmers to borrow under the M-77 program?

00 No 01 Yes 99 No Response

8.1 Why? ______

9. How many times did you borrow under the M-77 program? When were these?

9.1 Why did you not borrow in ______?

Crop Year	Season	Reason for not borrowing

10. If for example, aside from M-77, the government extends additional credit to farmers, would you borrow?

00 No   01 Yes

10.1 For what things or activities will you use this loan?

____

____

10.2 Why would you not borrow?

____

____

11. Suppose you had a big income, which of the following would you undertake first, second, third, fourth, last?

Activity	Rank
a. Save	______
b. Spend for children's needs	______
c. Repay debt, if any	______
d. Buy household items	______
e. Spend on farm inputs, seeds fertilizers, etc.	______

12. If you were to repay your loans, whom will you pay first, second, third, etc.?

Loan	Rank
a. Friends	______
b. Relatives	______
c. Moneylenders	______
d. Landlord	______
e. M-77	______
f. Bank loans with collateral	______

12.1 Why would you pay______________ first?

____

____

12.2 Why would you pay______________last?

____

12.3 Why would you pay M-77 second, third or fourth?

____

13. What do you think are the reasons why some farmers fail to pay their M-77 loans on time?

____

____

14. How much cash on hand do you consider needed to meet unexpected family expenses/year?

Less than ₱100 - - - - - - - - - - - 1
₱100 - ₱300 - - - - - - - - - - - - 2
₱300 - ₱500 - - - - - - - - - - - - 3
₱500 - ₱1,000 - - - - - - - - - - - 4
More than ₱1,000 - - - - - - - - - 5

At what month(s) do you experience being closest to this minimum? ______________

15. Do you have any non-farm liquid assets to meet contingencies?

Yes _____ No _____ If No, go to Q. 17.

If Yes, which of the following best describes them?

	Less than ₱100	₱100-₱500	₱500-₱1,000	More than ₱1,000
Home Savings				
Bank Savings				
Jewelry				

16. Are you a member of any rotating credit society? ________

16.1. If yes, how many members do you have? ________

16.2. How much is the annual membership obligation? ________

17. Based on your estimate, how much can you borrow (maximum amount) from informal credit sources each year?

	Less than ₱100	₱100- ₱500	₱500-₱1,000	More than ₱1,000
Moneylenders				
Relatives				

18. Which of the following lenders is most valuable to you?

	18	18.1 Lowest	18.1 Highest
a) Philippine National Bank			
b) Rural Bank			
c) Moneylenders			
d) Commercial Bank			
e) Savings and Loan Association			
f) Relatives/Friends			
g) Rice dealer/Miller			
h) Input dealer			
i) ACA			
j) Credit Union			

18.1 Which of the above charges the lowest rate of interest on borrowed funds? the highest?

19. How much interest rate should the following charge on borrowed funds? on savings?

Lender	Interest Rate Borrowed funds	Savings
Rural Bank		
PNB		
Money lenders		
Friends/Relatives		
Rice dealer/miller		
Input dealer		
ACA		
Credit Union		
Savings and Loan Association		

20. At the end of the cropping season, whom do you prefer to repay first, second, third, etc?

Rural Bank ________ Commercial Bank ________
PNB ________ Savings and Loan Assoc. ________
Moneylenders ________ Others (specify) ________
Friends/Relatives ________ ________
Rice dealer/miller ________ ________

21. Is the amount of loan used for your corn production

too small? ________
small? ________
just the right amount? ________
large? ________
very large amount? ________

22. Is there a need to borrow funds for your corn production? Yes ____ No. ____ If yes, how much do you think should you borrow? ₱________. Is this amount enough for all parcels? Yes ___ No ___

23. From whom will you borrow? ________

24. Are borrowed funds important? Yes ___ No ___

25. Is it important to pay back? Yes ___ No ___ If yes, why? ________________
____

26. Why do some farmers fail to repay their loans?

____
____
____

27. Can you suggest some ways to improve repayment of loans?

____
____
____

28 Costs of Borrowing

a. How much was the interest rate you paid on your 1st crop loan?_____
2nd crop?__________

b. How far do you live from the

a. rural bank ________km.
b. PNB branch _______km.
c. private money lender (relative/friends)______km.

c. How often did you go to the lender before you got your loan?_____times.
After you got your loan?_______times.

d. How much transportation cost did you incur before and after acquiring loan? _________

e. Did you pay extra charges for your loan? ______If yes, how much_____

f. Did you have any assistance in applying for your loan? If yes, who assisted you? __________

g. Is there any payment in kind in connection with your loan application and processing?__________

h. In you estimate, what would be the peso value of all costs of borrowing you incurred during 1st crop?________ 2nd crop?________

29. Which do you prefer, loans given in cash?________ loans in kind? _______
combination of both? __________

30. In your opinion, what could be some reasons why farmers fail to pay back their loans on time?

____
____
____
____

31. Do you think, loans should include aside from production, provisions for household expenses? __________ If yes, are you willing to make this kind of loan? _________________

32. When did you join the Maisan 77 Corn Production Program?__________

32.1. Did you apply for production loan during that time? __________

32.2. Are you still availing yourself of this credit? _______________

33. Do you know where the funds for M-77 lending come from? __________
If yes, where? ________________

34. Is there a need to repay rural bank or PNB loans? _______________
Why? ____

35. How long do you think will the Maisan 77 program last? ______________

36. Do you think you can still borrow funds for corn production under M-77 Credit Program next year? ________ Next 3 years? ________ Next 5 years? ____________

37. What do you think of the following programs: Check

	Permanent	Temporary
a. Masagana 99	________	________
b. Maisan 77	________	________
c. Gulayan sa Kalusugan	________	________
d. Livestock & Poultry	________	________

38. If your loan size were increased, do you think you will be in a better position to pay back? ___________

39. Do you encounter any difficulties in loan application? ______________
If yes, what are these?

____
____
____

40. How can rural banks and PNB's improve their lending operation?

____
____

41. If your loan provides for consumption expenditures, will you be more able to pay back? ________________

Problems

1. What are your present farming problems?

	Crop	Livestock and Poultry
1.	____________	____________
2.	____________	____________
3.	____________	____________
4.	____________	____________

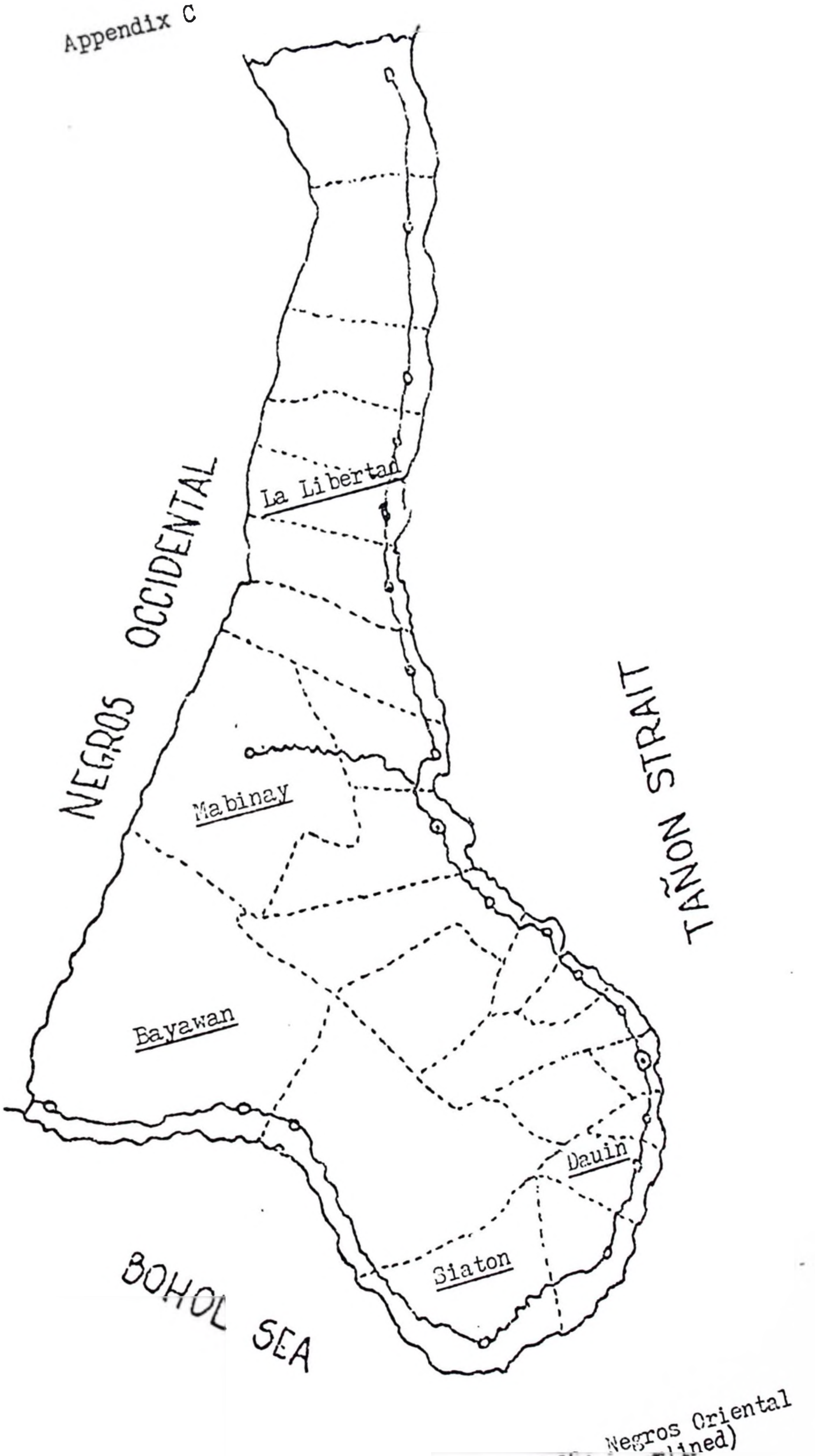
1.1. Suggested solutions.

2. What are your present financing problems?

Crop	Livestock & Poultry
____________	____________
____________	____________
____________	____________
____________	____________

2.1. Suggested solutions.

Appendix C



Location of survey areas, Negros Oriental
(Surveyed towns are underlined)

Appendix Table A

The Linear Programming Model - Vectors

CONSTRAINTS[a]	ACTIVITIES[b]							
	PC1	PC3	HIL1	HIL3	MC1	MC2	MC3	MC4
LS1	1							
LS3		1						
FLS1	30							
FLS3		26						
HLS1	10.2		-1					
HLS3		9.4		-1				
FCI1	215							
FCI3		105						
CI1	.25				1.25			
CI2	-21.6					1.25		
CI3		.25					1.25	
CI4		-13.3						1.25
CA1	42.5		4.5		1.5			
CA2						1.5		
CA3		35.0		3.5			1.5	
Ca4								1.5
LRR1	-50							
LRR2								
LRR3		-100						
LRR4								
MCI1					-1			
MCI2						-1		
MCI3							-1	
MCI4								-1
CBPI1					-.25			
CBPI2						-.25		
CBPI3							-.25	
CBPI4								-.25

[a] For code designations, see pp. 35-42.
[b] For code designations, see pp. 51-61.

ACTIVITIES

CONSTRAINTS	CMC1	CMC2	CMC3	CMC4	SC2	SC4
MCI1	.02					
MCI2		.02				
MCI3			.02			
MCI4				.02		
KR1	1430					
KR2		1430				
KR3			1430			
KR4				1430		
PR1	44					
PR2		44				
PR3			44			
PR4				44		
FR1	8					
FR2		8				
FR3			8			
FR4				8		
IR1	0.7					
IR2		0.7				
IR3			0.7			
IR4				0.7		
TR1	0.1					
TR2		0.1				
TR3			0.1			
TR4				0.1		
CI2					1	
CI4						1
CS1					-42.5	
CS4						-42.5

ACTIVITIES

CONSTRAINTS	FH1	FH3	SH2	SH4	SCBP1	SCBP2	SCBP3	SCBP4
CBPI1	.12							
CBPI3		.12						
HI2	-1		1					
HI4		-1		1				
CS1					-.9			
CS2			-6.75			-.9		
CS3							-.9	
CS4				-7.5				-.9
CBPI1					.02			
CBPI2						.02		
CBPI3							.02	
CBPI4								.02

ACTIVITIES

CONSTRAINTS	TCBP12	TCBP23	TCBP34	TCI2	TCI23	TCI34
CBPI1	1					
CBPI2	-1	1				
CBPI3		-1	1			
CBPI4			-1			
CI1				1		
CI2				-1	1	
CI3					-1	1
CI4						-1

ACTIVITIES

CONSTRAINTS	MKR1	MKR2	MKR3	MKR4	MPR1	MPR2	MPR3	MPR4
KR1	1							
KR2		1						
KR3			1					
KR4				1				
PR1					1			
PR2						1		
PR3							1	
PR4								1
CA1	.001				.012			
CA2		.001				.012		
CA3			.001				.012	
CA4				.001				.012

ACTIVITIES

CONSTRAINTS	MFR1	MFR2	MFR3	MFR4	MIR1	MIR2	MIR3	MIR4
FR1	1							
FR2		1						
FR3			1					
FR4				1				
IR1					1			
IR2						1		
IR3							1	
IR4								1
CA1	.005				.011			
CA2		.005				.011		
CA3			.005				.011	
CA4				.005				.011

CONSTRAINTS	MTR1	MTR2	MTR3	MTR4	TC12	TC23	TC34	TC4z
				ACTIVITIES				
TR1	1							
TR2		1						
TR3			1					
TR4				1				
CA1	.013							
CA2		.013						
CA3			.013					
CA4				.013				
CS1					1			
CS2					-1	1		
CS3						-1	1	
CS4							-1	1
Z								-1

CONSTRAINTS	BPL1	BPL3	RPL12	RP34
	ACTIVITIES			
PCA1	1			
PCA3		1		
PCDB1	-1		1	
PCDB3		-1		1
FCI1	-.33			
FCI3		-.33		
CS1	-.21			
CS3		-.21		
ICL1	.05			
ICL3		.05		
LRR1	-.10		.10	
LRR3		-.10		.10
CA2			1	
CA4				1

CONSTRAINTS	BIL1	BIL2	BIL3	BIL4	RIL12	R13	R14	RIL23	RIL24	RIL2Z	RIL34	RIL3Z	RIL4
							ACTIVITIES						
ICA1	1												
ICA2		1											
ICA3			1										
ICA4				1									
ICDB1	-1				1	1	1						
ICDB2		-1						1	1	1			
ICDB3			-1								1	1	
ICDB4				-1									1
CS1	-1												
CS2		-1											
CS3			-1										
CS4				-1									
PCL1	.05												
PCL3			.05										
CA1													
CA2					1.125								
CA3						1.125		1.125					
CA4							1.375		1.25		1.125		
LRR1					.05	.05	.05						
LRR2								.05	.05	.05			
LRR3											.05	.05	
LRR4													.05
Z										-1.375		-1.25	-1.125

ACTIVITIES

CONSTRAINTS	ACR120	ACR140	ACR160	ACR180	ACR1100	ACR220	ACR240	ACR260	ACR280	ACR2100
CS1	1	1	1	1	1					
CA1	-.8	-.6	-.4	-.2	0					
CR120	-.2									
CR140		-.4								
CR160			-.6							
CR180				-.8						
CR1100					-1.0					
CS2						1	1	1	1	1
CA2						-.8	-.6	-.4	-.2	0
CR220						-.2				
CR240							-.4			
CR260								-.6		
CR280									-.8	
CR2100										-1.0

ACTIVITIES

CONSTRAINTS	ACR320	ACR340	ACR360	ACR380	ACR3100	ACR420	ACR440	ACR460	ACR480	ACR4100
CS3	1	1	1	1	1					
CA3	-.8	-.6	-.4	-.2	0					
CR320	-.2									
CR340		-.4								
CR360			-.6							
CR380				-.8						
CR3100					-1.0					
CS4						1	1	1	1	1
CA4						-.8	-.6	-.4	-.2	0
CR420						-.2				
CR440							-.4			
CR460								-.6		
CR480									-.8	
CR4100										-1.0

ACTIVITIES

CONSTRAINTS	VCR120	VCR140	VCR160	VCR180	VCR1100	VCR220	VCR240	VCR260	VCR280	VCR2100
CR120	1									
CR140		1								
CR160			1							
CR180				1						
CR1100					1					
LRR1	1	1	1	1	1					
Z	2.70	2.30	1.90	1.70	1.50					
CR220						1				
CR240							1			
CR260								1		
CR280									1	
CR2100										1
LRR2						1	1	1	1	1
Z						2.80	2.60	2.20	2.00	2.80

ACTIVITIES

CONSTRAINTS	VCR320	VCR340	VCR360	VCR380	VCR3100	VCR420	VCR440	VCR460	VCR480	VCR4100
CR320	1									
CR340		1								
CR360			1							
CR380				1						
CR3100					1					
LRR3	1	1	1	1	1					
Z	2.40	2.10	1.80	1.50	1.20					
CR420						1				
CR440							1			
CR460								1		
CR480									1	
CR4100										1
LRR4						1	1	1	1	1
Z						2.30	2.00	1.70	1.40	1.10

CONSTRAINTS	ACTIVITIES									
	AICR120	AICR140	AICR160	AICR180	AICR1100	AICR220	AICR240	AICR260	AICR280	AICR2100
ICL1	1	1	1	1	1					
ICA1	-.8	-.6	-.4	-.2	0					
ICR120	-.2									
ICR140		-.4								
ICR160			-.6							
ICR180				-.8						
ICR1100					-1.0					
ICL2						1	1	1	1	1
ICA2						-.8	-.6	-.4	-.2	0
ICR220						-.2				
ICR240							-.4			
ICR260								-.6		
ICR280									-.8	
ICR2100										-1.0

ACTIVITIES

CONSTRAINTS	AICR320	AICR340	AICR360	AICR380	AICR3100	AICR420	AICR440	AICR460	AICR480	AICR4100
ICL3	1	1	1	1	1					
ICA3	-.8	-.6	-.4	-.2	0					
ICR320	-.2									
ICR340		-.4								
ICR360			-.6							
ICR380				-.8						
ICR3100					-1.0					
ICL4						1	1	1	1	1
ICA4						-.8	-.6	-.4	-.2	0
ICR420						-.2				
ICR440							-.4			
ICR460								-.6		
ICR480									-.8	
ICR4100										-1.0

ACTIVITIES

CONSTRAINTS	VICR120	VICR140	VICR160	VICR180	VICR1100	VICR220	VICR240	VICR260	VICR280	VICR2100
ICR120	1									
ICR140		1								
ICR160			1							
ICR180				1						
ICR1100					1					
LRR1	1	1	1	1	1					
Z	1.75	1.50	1.33	1.15	0.87					
ICR220						1				
ICR240							1			
ICR260								1		
ICR280									1	
ICR2100										1
LRR2						1	1	1	1	1
Z						1.52	1.23	1.10	0.85	0.70

ACTIVITIES

CONSTRAINTS	VICR320	VICR340	VICR360	VICR380	VICR3100	VICR420	VICR440	VICR460	VICR480	VICR4100
ICR320	1									
ICR340		1								
ICR360			1							
ICR380				1						
ICR3100					1					
LRR3	1	1	1	1	1					
Z	1.70	1.30	1.15	0.90	0.80					
ICR420						1				
ICR440							1			
ICR460								1		
ICR480									1	
ICR4100										1
LRR4						1	1	1	1	1
Z						1.72	1.33	1.20	0.95	0.85

ACTIVITIES

CONSTRAINTS	APCR120	APCR140	APCR160	APCR180	APCR1100	APCR320	APCR340	APCR360	APCR380	APCR3100
PCL1	1	1	1	1	1					
PCA1	-.8	-.6	-.4	-.2	0					
PCR120	-.2									
PCR140		-.4								
PCR160			-.6							
PCR180				-.8						
PCR1100					-1.0					
PCL3						1	1	1	1	1
PCA3						-.8	-.6	-.4	-.2	0
PCR320						-.2				
PCR340							-.4			
PCR360								-.6		
PCR380									-.8	
PCR3100										-1.0

ACTIVITIES

CONSTRAINTS	VPCR120	VPCR140	VPCR160	VPCR180	VPCR1100	VPCR320	VPCR340	VPCR360	VPCR380	VPCR3100
PCR120	1									
PCR140		1								
PCR160			1							
PCR180				1						
PCR1100					1					
LRR1	0.70	0.50	0.30	0.10	0.07					
Z										
PCR320						1				
PCR340							1			
PCR360								1		
PCR380									1	
PCR3100										1
						1	1	1	1	1
LRR3						0.60	0.40	0.20	0.07	0.05
Z										

Appendix Table B

Daily Food Requirements Per Person

Nutrient	Adult Male (Body Weight: 56 kg.)	Adult Female (Body Weight: 48 kg.)	Child (Body Weight: 24 kg.)
Calories (cal.)	2580	1920	1870
Protein (gm.)	63	54	37
Fat (gm.)	35	30	25
Iron (mg.)	10	18	7
Vitamin A or Retinol (I.U.)	4500	3800	2100
Thiamine (mg.)	1.3	1.0	0.9

Source: Food Dietary Allowances for Filipinos Per Day for Specific Nutrients, 1981 Food and Nutrition Research Institute (FNRI), National Science and Technology Agency (NSTA), Manila Philippines

Appendix Table C

Conversions Used

1 man-day = 6 hours of productive work

1 hectare = 2.47 acres

1 cavan = 50 kilograms

1 peso = 1/8 of a U. S. dollar, as of 1981

1 kilogram = 1,000 grams

1 bag of fertilizer = ₱ 86.40

Season 1 = 120 days

Season 2 = 60 days

Season 3 = 120 days

Season 4 = 60 days

Appendix Table D

Program Credit Reservation Prices for Cash Only Loan Disbursement

Percentage of cash in reserve	Percentage of cash used	Value of reserve program credit in: season 1	season 3
20	80	1.20	1.30
40	60	1.00	1.15
60	40	0.70	0.80
80	20	0.30	0.40
100	0	0.10	0.20

VITA

Generoso G. Octavio was born on September 27, 1950 in Niugan, Angat, Bulacan, Philippines. He completed his elementary and secondary education from the F. G. Calderon Elementary School and J. P. Laurel High School in Tondo, Manila, in 1963 and 1967, respectively.

In 1972, he obtained the 5-year B.S. in Agriculture degree from the University of the Philippines College of Agriculture and in 1976, he received the M.S. in Agricultural Economics degree from the University of the Philippines at Los Banos (UPLB) under a scholarship grant from the South East Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA). In the summer of 1978, he started the Ph.D. in Agricultural Economics program at the University of Illinois at Urbana-Champaign with a scholarship from the Philippine Government and the Integrated Agricultural Production and Marketing Project (IAPMP).

He was employed as an agricultural economist and as a research assistant before joining the faculty of the Department of Agricultural Economics, CDEM, UPLB in June 1973 until June 1974. His teaching, research and extension activities were resumed in November 1976 until May 1978.

In 1974-75, he was an assistant editor of the Journal of Agricultural Economics and Development, published by the Philippine Agricultural Economics and Development Association (PAEDA), of which he is also a member. He was also inducted into the Gamma Sigma Delta Honor Society of Agriculture in 1977.