

THE UNIVERSITY OF HULL

SMALL FARMER PARTICIPATION IN THE
INSTITUTIONAL CREDIT MARKET : A THAI
CASE STUDY

being a Thesis submitted for the Degree
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by

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SUMMARY

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The central task of this thesis is to understand why the institutional credit disbursed by rural credit programmes (RCPs) in developing countries tends to by-pass the small farmers to whom it is frequently directed. In undertaking this task, a number of secondary research objectives are pursued, notably, the measurement of credit demand and the investigation of credit-rationing procedures.

The case for RCPs is discussed and selected aspects of programme performance examined. The problem of large-farmer bias is identified and several possible explanations drawn from the literature, which relate broadly to demand-side (borrower) behaviour and supply-side (lender) behaviour. The importance of these various explanations is examined in the context of a case study of farmers in N.E. Thailand.

By constructing a series of linear programming (LP) models of representative farms, short-term credit demand is derived and the scarcity value of credit is found to be high for independent farmers (those not participating in the RCP). Questionnaire responses support a positive interpretation of the LP results (independent farmers face a credit-supply shortage) and provide additional evidence that the tendency of small farmers not to borrow from institutions cannot be explained by lack of demand. Demand schedules are constructed to quantify some of the income disadvantages facing farmers who have no access to institutional credit.

The behaviour of the major lending institution in the study area is then explored in greater detail by investigating the possibilities for

non-price credit rationing. Multiple discriminant analysis (MDA) is employed firstly to identify the precise criteria by which small farmers are excluded from the institution's loan portfolio, and secondly, to estimate the population total of independent farmers in the survey area excluded by these criteria. The number is high, indicating that lender behaviour is a major barrier to small farmer institutional borrowing. Income schedules from the MDA and LP analyses are brought together to show that some relaxation of the current rationing criteria would allow more small farmers access to rural credit without necessarily jeopardising the lender's commercial viability.

C. J. Webster

February 1985

STATEMENT AND DECLARATION

The research reported in this thesis is the result of my own investigation.

This work has not already been accepted for any degree and is not being concurrently submitted for any degree.

C. J. Webster

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Abbreviations and Conversions

BAAC	Bank for Agriculture and Agricultural Cooperatives
BOT	Bank of Thailand
EEC	European Economic Community
FAO	Food and Agricultural Organisation of the United Nations
GDP	Gross Domestic Product
GRP	Gross Regional Product
IBRD	International Bank for Reconstruction and Development
IFAD	International Fund for Agricultural Development
LDC	Less Developed Country
LP	Linear Programming
MDA	Multiple Discriminant Analysis
MPS	Marginal Propensity to Save
MVP	Marginal Value Product
NESDB	National Economic and Social Development Board
NSO	National Statistical Office
RFM	Rural Financial Market
SFC	Small Farmer Credit
USAID	United States Agency for International Development

1 Baht = £ 0.033

1 Rai = 0.16 hectares

1 Thang = 10 Kilogrammes

CHAPTER 1 :

INTRODUCTION

A Introduction

The low priority given to agriculture in the development plans of less developed countries (LDCs) during the first two post-war decades has been well documented.¹ In the drive to economic modernisation, most LDCs followed an import-substitution strategy to some degree, in an attempt to foster rapid growth in the manufacturing sector. Domestic manufacturing enterprises were protected from imports by tariff and overvalued currencies designed to reduce the cost of imported capital equipment; the urban-industrial sector was favoured artificially by low food prices; and public expenditure was heavily biased towards urban-industrial infrastructure.² The development objective was generally seen as national income growth at any cost to income distribution and industrialisation was the panacea; a skewed income distribution and a neglected agricultural sector was considered the necessary price of economic modernisation, at least in the short-term.³

By the beginning of the 1970's, academic commentators, governments and international agencies had started to reflect critically upon their industrial-oriented development programmes.⁴ This grew out of at least three important considerations. First, the new domestic manufacturing industries frequently proved to be inefficient and uncompetitive concerns, owing their continued existence to public subsidy. Though governments have often been slow to face the facts, the

industries tended to become white-elephants, mis-allocating scarce resources to produce goods far more expensively than their imported counterparts.⁵

Second, it was apparent by that time, that gains in national income (and some substantial growth-rates had been achieved), were not accompanied by a rise in the living standard of the majority of the population of those nations. The gains were accruing to the minority who benefitted from the domestic manufacturing sector, either as consumers or earners. Poverty, especially rural poverty began to emerge as an important issue.⁶

Third, following the technological advances of the 'green revolution', agriculture became a more attractive investment. First, yields increased dramatically and, more recently, variability of yields of high yielding varieties (HYVS) have been significantly reduced. Some argue strongly that capital/output ratios are superior in the agricultural sector and that efficiency in terms of national income growth, requires greater levels of capital investment in agriculture.

The attraction of investing in agriculture has been enhanced, too, by the world-wide inflation of food prices since the early '70's and the soaring of domestic food requirements associated with the population explosion. LDCs cannot afford to import foodstuff to the extent that they did during the previous two decades and have to look more to domestic food production.⁸ There has been an accompanying emphasis on agriculture as a source of exports and foreign exchange earnings, as a source of domestic food and raw material supply, and as a source of income

to the rural population, necessary for the development of a stronger domestic demand for manufactures. What we can broadly call the alternative development paradigm which emerged in the 1970s, recognised that much of what had passed for development policy was in fact harmful to long-term national economic growth and stability and to the welfare of the rural masses.⁹ Development was generally redefined to include the distribution, as well as the size, of national income growth¹⁰ and many of the effects of the industrial growth strategies were deemed undevelopmental. In particular, the industrial-protection policies were interpreted as having turned the terms of trade against agriculture, depressed rural incomes and inhibited agricultural investment and the full use of national land and labour resources. Artificial exchange rates meant lower prices for exported agriculture for the sake of a cost subsidy on imported inputs for manufacturing; and import tariffs frequently taxed imported agricultural inputs, denying farmers access to cheap foreign fertilizer, for example. Deflated domestic food prices might have helped improve the lot of the urban poor, but represented a tax on agriculture to subsidise the population of the urban-industrial centres.¹¹ This sort of policy aggravated the problem of low incomes in rural areas and discouraged farm investment and innovation.

Similarly, there was a reconsideration of the high levels of government expenditure in industry which were quite out of proportion with industry's share of GNP or work force.¹² Agriculture and rural areas, it was realised, had been starved of much needed capital investment and other public support. The

unequalising effect of this was greater to the extent that public revenues came largely from indirect taxation on consumption, which is regressive, taking a greater proportion of the budget of the poor than the rich.

The import-substitution policies had, in general, led to too many manufactured goods being produced using techniques too intensive in capital and imported raw materials. The effective cost of production for those industries did not reflect the true cost to society. This misallocation for the benefit of the few, was at the expense of the underutilisation of the country's land and labour resources and of the welfare of the rural population.

The change in emphasis towards a broader-based development thinking, with a greater priority for agriculture and rural development, involved a necessary new emphasis on the small farmer.¹³ Under the old paradigm, small farmers represented the backward traditional sector. It was that sort of backwardness that the industrial-led growth had hoped to overcome.¹⁴ Under the emerging new paradigm, it became recognised that agricultural backwardness was itself an important barrier to national development, however defined; a barrier to national income growth, to national economic integration and to the welfare of the majority of the population of most LDCs.

Given that agriculture has begun to be accorded greater priority for the sort of reasons summarised above, there are a number of reasons why the small-farm sector has received particular attention. They relate to a concern for efficiency and a concern for equity.

From the point of view of national economic efficiency, there are two reasons for focusing on the small farmer; one has to do with labour, and the other with land. By the beginning of the 1970s, the extent of the employment problem facing most LDCs had emerged. A dramatic fall in death-rates unaccompanied by commensurate reductions in birth rates led to serious levels of unemployment and underemployment as the expanded population began to reach working age. The urban-industrial sector was clearly not going to be able to absorb any but a small proportion of the labour glut due to its size and tendency towards a western-style capital-intensity. A traditional and stagnant peasant farm sector could continue to provide work for increasing family workers only at the cost of increasing underemployment and further decreasing labour productivity. Since small farmers form the majority of the populations of many LDCs, and a large part of the expanding workforce will therefore be found in the poor rural areas, the case for providing employment in the rural areas is a strong one.¹⁵ (The congestion problem of LDC cities, sprawling under an unproductive marginal service sector is also in view here). Small farmers are, and are likely to continue to be, the majority of the underemployed. A development strategy which bypasses them is grossly inefficient in its under-utilisation of labour resources. Though labour may not be a scarce resource in many LDCs, it is nevertheless a potentially valuable one which, with appropriate management, can be made more productive so that both employment and output objectives are served. The employment problem, therefore, necessitates the search for ways in which the small-farm sector can efficiently absorb more labour. The

solution lies in the modernisation of the sector using labour-intensive techniques; HYVs requiring more intensive husbandry, crop-diversification and double-cropping for example, have become key objectives.¹⁶ Efficiency of national labour resources has, therefore, been an important consideration behind the emphasis on small farmers.

So, too, has the efficiency of national land resources. Many have documented the greater efficiency with which small farmers use all factors with the general exception of labour. Lipton for example, comments that "it is the small farmer who saturates each acre, each kilogram of fertilizer, with more effort and thus grows more output per acre-year than the large farmer".¹⁷ Largely due to the intensity of labour inputs, small-farmers have, as a rule, displayed higher average land-productivities than large farmers. The higher average yields have frequently been found associated with generally lower levels of capital and the modern inputs which it purchases.¹⁸ Because of this, it has been argued by some that total national agricultural output could be raised by switching land resources from large to small scale operators.¹⁹ The scarcity of production land in many LDCs, especially in Asia, means that the argument for encouraging investment in the small-farm sector for reasons of its land-use efficiency, has taken on great importance.

Moving from the issue of efficiency to equity, small-farmers have received attention because it was largely they who suffered from the dualistic consequences of industrial-based development policies. There has been both a moral and political influence here. Development strategies which leave a significant

proportion of the population to get relatively, and in some cases, absolutely poorer have been condemned as unjust. Neither do such strategies lead to a stable state of internal politics. The focus on small farmers has undoubtedly, in many countries, been as much in the interest of national political stability and social cohesion as anything else.²⁰ Not only is it inefficient and inequitable to exclude the rural masses from the modernisation process, it is also politically unviable.

Johnson and Kilby have termed the approach to agricultural development which fully includes the small-farmer, a "unimodal strategy".²¹ This stands in contrast to the agricultural strategy which tended to accompany the import-substitution phase in LDCs, namely the commercialisation of large farms using capital intensive technologies, for the purpose of generating quickly, large amounts of agricultural surplus to support the growing industrial sector. Johnson and Kilby call this attempt at 'crash modernisation' a "bi-modal strategy", characterised as it is by a dualism in the countryside between large commercial farms in receipt of public subsidy and other incentives, and small farms practicing traditional methods and stagnating due to lack of extension, finance and other stimulants to growth.

Although small-farmers have more recently received much attention for the reasons outlined above, agricultural strategies in most LDCs probably lie somewhere between Johnson and Kilby's two extreme typologies. Undoubtedly, there has been a widespread shift away from the overtly bi-modal agricultural policies during the 50s and 60s. Although the climate of attitude towards

the small farmer has generally changed, there is, however, a tendency for such policies to persist. Frequently, small-farmer orientation has been more rhetorical than practical; it has been politically expedient to talk of serving small farmers and to set up programmes nominally in their interest. Elsewhere, genuine attempts to serve the rural poor have been hindered for other reasons, such as shortage of funds, organisational problems or inappropriate programme design.

It is in this problem area that the thesis finds its context. It is concerned with the persisting tendency of an agricultural development programme to by-pass the small farmers, even though the programme, like many others of its kind, was initially established with the service of the rural poor in mind. It focuses on one particular policy instrument which has been widely used, at least nominally, in pursuit of a broadly-based ('uni-modal') agricultural development: the rural credit programme. Through reviewing the experience of credit programmes in LDCs, it identifies the problem of a persistent bias towards large farmers. It then sets out to find an explanation for this bias in the context of a case study of farmers and a rural credit programme in a province of North-East Thailand.

Rural credit programmes have become important instruments within the more agricultural-oriented development strategies currently adopted by LDCs. As well as serving the general interest of the agricultural sector, many programmes have ostensibly been set up to channel productive resources towards the rural poor, and as Adams comments, "most LDCs now have at least one small-farm rural credit programme"²². International agencies (IBRD and FAO in

particular) have been very active in encouraging the construction of appropriate financial intermediaries²³, and much aid has flowed into LDCs in the past two decades in the form of loans for institution-building and loans for on-lending through those institutions. By 1979, the annual volume of new agricultural loans in low income countries had risen to 30-40 billion dollars.²⁴

This escalation of agricultural lending activity has been based on an understanding of credit as a vital component in the process of agricultural development. This view of credit has, in fact, been a significant feature of the agricultural-oriented development approach in general. Thingalaya makes the pertinent observation that the growing indebtedness of poor peasants was, for most, a cause for concern until recently. Indebtedness is no longer a burden, however; "the 'debt-burden' has visibly yielded place to 'credit requirement' in all literature on rural credit".²⁵ There has been a shift in conceptual framework, and credit is now given the progressive role of oiling the wheels of agricultural production. It is easy to see how this new conceptual framework for credit is a necessary part of the new development paradigm. Indebtedness in a backward peasant sector of small-scale traditional producers, meant more poverty and backwardness because of the assumption that debts are not used productively to progressively raise output. When small farmers are viewed as viable or potentially viable production units (producers of a net surplus and net savers), then indebtedness becomes a virtue, and should progress along with the commercialisation of small farms.

This revised view of indebtedness, and the importance attached to credit programmes, has been a natural response to the unfavourable factor proportions which small farmers are assumed to face; too much labour and too little capital. The general assumptions behind rural credit programmes are traced out in Chapter 2. It is sufficient to say here that rural credit programmes have generally been designed to raise farm incomes and encourage production. Important here, is the view that credit is essential for the modernisation of the agricultural sector of LDCs, especially where there is a desire to include small capital-short farmers in the modernisation programme. Normal savings are considered to be inadequate to sustain widespread and prolonged modernisation, since new technology is assumed to bear higher costs. In this sense, agricultural credit programmes are given a leading edge in the modernisation process; credit is seen essentially as supply-leading finance, stimulating development (see Chapter 2). There is another side, however, and the adoption of modern agriculture can also be seen as giving rise to a demand for more credit (demand-led finance); farmers who are modernising will demand more credit since the marginal value productivity of capital increases with the level of technology.

In sum, credit is seen as essential in the acceleration of agricultural development, and rural credit programmes therefore play an important part in the current development strategies of most LDCs. Though they tend to be aimed at the broad-base of the farming population, there is also a tendency, as we shall see in Chapter 3, for the larger farmers to receive a disproportionate amount of the funds flowing into rural areas in this way.

B Conceptual Framework, Scope and Objectives

It will be useful first to define the conceptual framework adopted by the thesis. The thesis takes as its starting point the view, discussed above, that small-farm agricultural credit programmes play a vital role in the achievement of efficient and equitable rural development. They are very much a part of the package of development policies in operation in LDCs in the 1980s. They emerged along with other complementary policy measures to help rectify an imbalanced approach to development planning and are a key tool in a broadly-based agricultural modernisation. Little more is said to justify this position than what has been said already.

If this is the starting point, how can we describe the conceptual framework? Because of the starting point and its particular view of development, at the broadest level, the ideological framework of the thesis can be described as moralist or humanitarian.²⁶ Its most basic assumption is that individuals have a right to the fulfillment of certain needs, wants and aspirations and that governments should plan and manage for the welfare of the governed. As far as approaches to rural development go, it can also be described as 'populist', in that it assumes the need for the involvement of the masses of small peasant-farmers in the modernisation process.²⁷ It assumes, furthermore, that the virtues of a market economy outweigh any of its disadvantages and that modernisation along the path of a developing capitalist agriculture can achieve the needed improvements in the standard of living of the rural peasantry.

The thesis can best be seen as examining one particular component process within the overall development process. Morriss stresses that an examination of a variety of different processes can often be more useful than the search for a single explanation of the development process.²⁸ Any theory of development necessarily comprises a particular view of a large number of separate (though related) development processes. The process with which the thesis is exclusively concerned is the process of capital-flows into the agricultural sector, or spatially phrased, of capital-flows into the rural area. This is the next broadest conceptual-framework that can be described.

We can go further, however, for the scope is narrower than that. What the thesis is primarily concerned with is the reasons why capital-flows into the rural area do not reach the small farmers to whom such flows are meant to be directed. (This is spelt out fully in the section on goals and objectives below). As such, the thesis is about barriers to the flow of capital into rural areas. This is a more specific definition of its conceptual framework.

Being concerned strictly with a single process of development, it is not necessary to make a commitment to any one particular conceptualisation of the overall long-term development process. Chisholm has emphasised the need to distinguish between models of long and short-term change.²⁹ In those terms, the thesis is concerned entirely with short-term change and has nothing to say about long-term theories of development. Its concern is with the immediate (or relatively short-term) effects of credit on the

farm/household, for the most part of the analysis, considering the effect of credit on annual income in a single production year.

Having stated this limitation, it is of course possible to draw certain relationships between the short-term framework adopted by the thesis and various national and regional development theories. For example, the role which it assumes for credit in the development process (introduced above and elaborated in Chapter 2), clearly locates the study within the bounds of the modernisation-diffusion school of regional development theory; development is assumed to be associated with the spread of innovations such as modern agricultural techniques into formerly backward areas.³⁰

An emphasis on the supply-leading role of finance in agricultural development (raising the credit-supply fosters growth), makes the framework consistent with exogenous development theories which make the growth of a region or nation dependent on external impulses;³¹ expansion of farm output and incomes associated with the use of new or new levels of inputs is assumed to be partly dependent on the instrumental flow of capital into the rural areas. Although this is true to the extent that agricultural credit represents supply-leading finance, the discussion in Chapter 2 does allow for credit's role to be understood as demand-following. This involves no commitment as to whether development is essentially endogenous or exogenous, for it does not say where the impetus to adopt innovations or to expand output, comes from. Credit, as demand-following finance need merely be seen as following a pre-existent growth in demand for

inputs. Growth may have arisen through population pressure on resources for example, as an endogenous development theory might suggest,³² or through the externally imposed demand for cash-crops by a foreign market as an exogenous theory might suggest.³³

The concern of the thesis with barriers to resource flows into peripheral rural regions, relates it to Myrdal's conceptualisation of the development process.³⁴ He emphasised the importance of the limited mobility of factors, particularly capital, because of geographical, political and institutional barriers, in perpetuating regional and national income differentials.

Though it is of some interest to draw these sort of relationships, it needs to be stressed again that the thesis is concerned essentially with a single process operating in the short term, not with a theory of development.

The framework can be still more precisely defined if we consider the issue of methodology. The methodological framework adopted is essentially a neo-classical economic one.³⁵ It differs, therefore, from a study of the same subject which takes a structuralist or systems approach for example. Harriss has defined three types of approach to the study of rural development issues: systems, structuralist/historical, and decision-making modelling approaches,³⁶ representing different paradigms in the social sciences. The decision-making modelling approach generally includes the neo-classical farm-economy studies which attempt to say something about the impact of changes in the agro-

economic environment on the farm-household decision-maker; changes such as price-rises, yield increases, land reform and credit provision. These studies range from the straight-forward agricultural-economic analysis of production relationships,³⁷ to a broader analysis of peasant decision-making and agrarian change.³⁸ Here, a neo-classical methodological framework is used to describe the role of credit in development assumed by rural credit programmes, and to investigate empirically, the demand for production credit among a sample of small farmers and the consequences of their being denied access to credit. To give a precise definition of this framework, farmers are conceived as rational decision makers (see Chapter 6 for a more detailed discussion), who operate under the profit-maximisation motive, subject to certain behavioural constraints. The individual decision maker's profit-seeking, is assumed to be constrained by security factors such as a minimum food production level and by cultural/traditional behavioural factors such as a preference for certain crops.

Finally, its neo-classical methodology gives the thesis another ideological label: positivistic.³⁹ It is positivistic in the sense that it uses theoretical constructions and assumptions that have been shown to be workable (they yield good predictions), without needing to validate the substantial truth of those assumptions. Lipton quotes the neo-classicist as saying "our evidence of the way that peasants use resources is consistent with the hypothesis that he behaves as if he maximises profit."⁴⁰ The neo-classical approach is essentially an individualistic approach. It answers questions about how well the individual

decision-maker performs within the 'system'. What it does not do (and this is an accepted limitation) is to bring the 'system' into the analysis.

In summary, the conceptual framework of the thesis can be said to be modernisationist and moralistic in its broad understanding of development and populist in its assumptions about the valid direction of rural development. It focuses on rural capital flows and particularly the barriers to capital flows and the consequences of the resulting capital shortage for small agricultural producers. It is positivistic in its methodological approach to the problem, using a neo-classical framework for the analysis of the impact of credit on farm production and income.

Having discussed the conceptual framework in this way, the scope of the thesis has broadly been defined. The scope is summarised in the objectives of the thesis which are set out below.

In the context of a case study of a rural credit programme and participating and non-participating farmers in North-East Thailand, the objectives can be summarised as follows :

1. To understand why the flow of capital resources to rural areas tends to end up in the hands of middle and large farmers.

Couched in the more specific terms of the analysis as it is presented in the thesis, this becomes :

To understand why small farmers tend not to participate in

the institutional credit market, specifically : do the reasons lie primarily in the demand or supply-side?

In pursuit of this objective, four more objectives are defined :

2. To measure the demand for production credit for a typical small farmer who does not have access to institutional credit.
3. To measure some of the disadvantages facing the small farmer who does not have access to institutional credit.
4. To investigate on the supply-side, the possibilities for non-price rationing of institutional credit to small farmers.
5. To measure on the supply-side the extent and the precise nature of the credit-rationing process, whereby small farmers are excluded from the capital channelled into rural areas via rural credit programmes.

These objectives can be further broken down and the specific objectives which emerge, determine the content of the three analytical chapters. The important subsidiary objectives which help determine the structure of the thesis are as follows :

Under objective (1) : To extract from the literature the contending hypotheses which explain why small farmers tend to be by-passed by rural credit programmes.

To measure the probability of a small farmer being found among the participants of the rural credit programme in the case study.

Under Objective (2) : To construct mathematical models of representative farms in the case study area.

To compare optimal borrowing levels derived from the models, with actual borrowing levels derived from a survey of farmers with and without access to institutional credit from the rural credit programme.

To measure the demand for institutional credit facilities expressed by survey farmers in response to a questionnaire.

To evaluate the degree to which the demand estimates from the mathematical models can be taken as normative or positive.

Under Objective (3) : To measure the marginal value productivity of short-term production credit for certain model farm types.

To establish demand schedules for short-term credit for those farm types.

To show by varying the availability and

cost of credit in the models, the effect of credit shortage and higher interest rates on the annual farm income of the small farmer without access to institutional credit.

To measure the impact of credit shortage on farm growth for the small farmer over a five-year period.

Under Objective (4) : To extract from the literature the rationale and methods of supply-side non-price credit rationing.

To identify the methods of non-price rationing used by the rural credit programme in the case study.

To measure the effectiveness of these methods in rationing credit to the farmers in the study area.

Under Objective (5) : To identify, using a multi-variate statistical technique, the precise criteria used in excluding small farmers from the rural credit programme.

To estimate the population numbers of farmers in the study area who are respectively eligible and ineligible for participation in the rural credit pro-

gramme by virtue of the size of their farm enterprise.

To show, by juxtaposing optimal income schedules with a critical rationing-criteria schedule, how non-price rationing in the rural credit programme leads to an inequitable discontinuous income-possibility schedule for farmers in the survey area.

C Organisation

The nine chapters fall into two parts. Chapters 6 to 9 form a case study in which the objectives outlined above are researched empirically. Chapters 2 to 5, on the other hand, contain background material necessary for a case study of agricultural credit in North-East Thailand, namely, material on the role of credit in agricultural development, selected problems of rural credit programmes in practice, North-Eastern agro-economic environment, and rural financial markets in Thailand.

Chapter 2 lays the theoretical foundation for the empirical analysis in Chapters 6 to 9, by presenting the fundamental assumptions regarding the role of credit in development, which underlies any rural credit programme. The theory is articulated in micro-economic terms, first from a broader sectoral perspective and second, from a farm-level perspective. On the sectoral level, it is financial intermediation (the process of borrowing and lending) which is in focus; the contribution of credit institutions (financial intermediaries) to economic growth

is discussed. On the farm-level, it is the role of borrowed capital on farm production and farm income which is the subject of discussion.

This can be considered as the formal case for rural credit programmes. It is the way credit is thought to lead to progressive changes in the sector and on the farm. Some necessary qualifications are added to the basic theoretical model, in recognition of some of the difficulties of its practical application.

Although it is possible to isolate credit and consider its relationship to production and income as a single factor, credit does not operate in a vacuum. A summary discussion follows, therefore, on the necessary context of credit in rural development. In the absence of a context of complementary input provision, such as appropriate market structures and an extension system, the theoretical model of credit's relationship to production and income falls down.

Finally, if this is the theoretical case, the question is asked: does the case in practice testify to its validity? Its two most important features are examined in the arena of the practical experience of rural capital markets in a selection of countries: does the literature tend to support the assumption that credit supply is too low and interest rates too high?

The theory and attendant qualifications presented in Chapter 2, as well as describing the most basic assumption behind most rural credit programmes, provides the general theoretical constructions

for the mathematical models in Chapters 6 to 9.

Chapter 3 looks at the literature on the practical performance of rural credit programmes and draws out, for further discussion, the problem of large-farmer bias. In doing so, it defines the problem to which the rest of the thesis is addressed and the questions for which the analysis of Chapters 6 to 9 seeks to find answers. This is the chapter which presents the mandate for the rest of the thesis.

A summary of the policy objectives and instruments which characterise rural credit programmes is given first. The chapter then focuses on the single most important issue in the evaluation of programme performance, namely, the success in meeting the credit demands of the rural population. This draws on the literature from several countries. After a general statement about performance, the evidence is presented which suggests that programmes have been successful in meeting the demand for rural credit. Related to this is evidence that credit supply is not a constraint on growth. Both kinds of evidence suggest that credit supply is, or is becoming, increasingly satisfactory in rural areas, and that it is not an important factor in constraining agricultural development.

Apparently, contrary evidence is then presented which suggests that credit supply is very much a constraint on agricultural development; evidence which indicates a high demand for credit and strong relationships between credit and production and between credit and income. It is suggested that the two types of evidence are not necessarily contradictory if we take into

account the large-farmer bias in rural credit programmes; programmes successfully cover the needs of larger farmers while smaller farmers continue to display an excess demand for extra credit.

The issue of large-farmer bias is then discussed in more detail along with other regressive effects of rural credit programmes on income and asset distribution. The general problem of unequal lending is identified and defined specifically for the purpose of the rest of the thesis as the problem of the lack of participation of small farmers in the institutional credit market. Empirical evidence of the problem is left until Chapter 5, when it is presented for Thailand in the context of the overall performance of rural financial markets.

A number of possible explanations of unequal lending are drawn out from the literature and discussed as those relating to supply-side behaviour (lending institutions) and those relating to demand-side behaviour (farmers). Three of the emerging hypotheses which require more explanation than the rest are singled out for further discussion. Two of these, concerning supply-side credit rationing, are considered together, and the discussion forms the theoretical foundation for the analysis in Chapter 8.

The chapter defines the specific research problem addressed empirically by the thesis. The issue it raises (large-farmer bias in rural credit programmes) and the questions it poses (concerning the reasons for that bias) are taken up in the empirical analysis of Chapters 6 to 9, and there is a logical

progression between the end of Chapter 3 and the beginning of Chapter 6.

There are two intervening chapters, however, containing background material to the case study which follows.

Chapter 4 looks at agriculture in the North-East of Thailand and its problems. After introducing the North-East as Thailand's main problem region, long-term agricultural changes over the last two decades are described. The discussion covers Thai agriculture in general, and provides a context for the discussion of specific North-Eastern problems which follows. Problems currently facing agriculture in North-East Thailand are discussed under the headings of environment and economic/policy problems. The last issue dealt with under the latter category is the supply of credit. This concludes Chapter 4 and provides a lead into Chapter 5 which is an expanded discussion on that issue.

Chapter 5 places the issue of agricultural credit supply into the context of Thailand's rural financial markets. First of all, non-institutional markets are described and then the institutional markets. A third section deals with certain aspects of the performance of institutional markets in Thailand. Detailed evidence is given here to show how institutional markets, and especially the government's agricultural lending bank (the Bank for Agriculture and Agricultural Cooperatives - BAAC) have performed in channelling finance into rural areas. The section serves to illustrate, in the context of Thailand, the more general comments made at the start of this introductory chapter, about the emergence of a higher priority for agriculture

in development planning in LDCs, and the importance of rural credit programmes in such planning. It also illustrates the comments made earlier about the tendency towards the persistence of a bi-modal strategy in agricultural development and the discussion in Chapter 3 about the tendency towards large-farmer bias in rural credit programmes.

The chapter concludes with a discussion of the demand for agricultural credit in Thailand. This follows on from the section before (performance of institutional markets) and leads into Chapters 6 and 7, which are concerned with estimating the demand for credit among a sample of small farmers in Thailand's North-East. Much of Chapters 4 and 5 is not strictly essential to the flow of the thesis. The material has been included for completeness, since the empirical analysis, which concerns a single credit institution and a sample of farmers in one province, needs to be understood in context (in the context of agro-economic environment and rural financial markets). The chapters are best seen as containing background material, largely descriptive in nature. The exception is the last 2 sections of Chapter 5 which present evidence that the tendency for small-farmers not to receive institutional credit is in fact a problem in Thailand, and evidence that demand for rural credit is high. These issues are taken up directly in the analyses of Chapters 6 and 7.

Chapters 6 to 8 contain empirical analysis based on two separate samples of farmers in the North-Eastern province of Korat. Chapters 6 and 7 evaluate the demand for credit for farmers with and without access to institutional credit. They draw on the

theoretical foundation of Chapter 2, and the problem they address is defined in Chapter 3 and substantiated in the Thai context in Chapter 5.

Chapter 6 is a methodology chapter, justifying the approach adopted and presenting the farm-economy models used to derive estimates of credit demand and to evaluate the consequences of credit shortage. Single-period and multi-period linear programming are the techniques used. The design of the models is described through presenting the equation structure and notes on each component set of equations. Results of the calibration process are presented in the form of farm-enterprise budgets.

Chapter 7 is designed (a) to measure the demand for credit for a sample of small farmers; (b) to give evidence from the demand-side (farmer-behaviour) with which to evaluate the hypotheses in Chapter 3 concerning the reasons why small farmers tend not to borrow from institutions, and (c) to quantify some of the disadvantages of not borrowing.

After a preliminary discussion about interpretation of the model results, single-period linear programming models are used to measure the demand for credit for farmers with and without access to institutional credit. Optimal borrowing levels are compared with actual borrowing levels derived from the survey, and conclusions drawn about credit scarcity for the two types of farmer.

There follows an analysis of questionnaire responses, designed to help interpret the models' demand estimates. If survey farmers

tend to express the desire to borrow more, then the model results can be understood positively: as description of demand levels rather than prescription. In the course of the analysis of responses, two of the demand-side hypotheses of Chapter 3 concerning reasons for not borrowing from institutions, are tested.

The final section measures the disadvantages, in terms of income forfeited, faced by a small farmer who does not have access to the cheap institutional credit of the rural credit programme. The small, independent farmer forfeits income through facing a limited volume of borrowable funds; through higher prices paid for the credit that is available; through the suppressed rate of growth caused by limited credit; and through the lack of opportunity to compensate his limited land endowment by raising the capital intensity of production.

Conclusions are drawn about the demand for credit by small independent farmers, about the reasons why those farmers tend not to borrow from an institution, and about the disadvantages they face by not doing so. This provides answers to some of the questions raised at the end of Chapter 3 about the reasons for larger-farmer bias, and helps to explain the pattern of unequal lending discussed in Chapters 3 and 5. It also measures some of the consequences of unequal lending.

While Chapter 7 explores these issues by considering farmer-behaviour, Chapter 8 approaches them from the supply-side by looking in detail at the behaviour of a lending institution. Chapter 8 explores in more detail the hypothesis presented in

Chapter 3 that small farmers tend not to borrow from institutions because they are prevented from doing so by the restrictive allocation policies of lenders. First comes an evaluation of the range of credit-rationing practices used by the BAAC. Focusing on the practice of rationing credit by excluding certain farmers from client-status by strict eligibility rule ('rationing-out'), an analysis is made to identify the precise set of 'rationing-out' criteria used by BAAC in the survey area. Multiple-discriminant analysis (MDA) is used to derive the effective set of discriminating profile variables used in this decision.

Having done this, a similar MDA model is used to estimate the population total of farmers in the survey area who wish to register with an institution and are eligible, and the numbers who wish to register but are ineligible. This gives a powerful measure of the degree to which small farmers are excluded from the inflow of capital to rural areas under a rural credit programme.

Finally, the effect of the 'rationing-out' decision of BAAC on the income-earning potential of survey farmers is measured. Bringing together the output from the linear-programming models of Chapters 6 and 7, with the results of the MDA model of Chapter 8, the section shows that farmers above and below a certain critical holding-size face different income-possibility curves because of their difference in access to cheap institutional credit.

Chapter 1 : Notes and References

1. See for example any text on development economics, for example: Brookfield, H., 1975, **Interdependent Development**, Methuen, London (Chapter 3), and Todaro, M., (Ed.), 1983, **The Struggle for Economic Development**, Longman, New York (Chapters 2, 3 and 8).
2. See for example Myint, H., 1980, **The Economics of Developing Countries**, Hutchinson, London (Chapter 9), and Todaro, M., (Ed.), *op.cit.* (Chapter 10)
3. A summary of the way in which development was defined as economic growth and pursued at the expense of rising inequalities is found for example in Mobogunje, A.L., 1980, **The Development Process, A Spatial Perspective**, Hutchinson, London (Chapter 2) and Chenery, H., Ahluwalia, M.S., Bell, C.L.G., Duloy, J.H. and Jolly, R., 1974, **Redistribution With Growth**, Oxford University Press, London (Chapter 2)
4. The introduction and Part I of Chenery, et.al., 1974, *op.cit.* provides a good example of the sort of reflective discussion occurring at this time.
5. A discussion of some of the inefficiencies of protected domestic industries and import substitution policies, and also some of the responses of governments to the observed problems, is found in Smith, S., and Toye, J., 1979, **Journal of Development Studies**, April, 15, No.3 (pp.1-18). See also Griffin, K., and Khan, A.R. (Eds.), 1972, **Growth and Inequality in Pakistan**, Macmillan, London, for a discussion of the inefficiency of domestic industry in one particular country (Part III)
6. There are many texts presenting evidence of the rise in the poverty of rural populations of LDCs during periods of high rates of growth in GNP. See for example, ILO, 1977, **Poverty and Landlessness in Rural Asia**, Geneva; and Streeton, P., 1972, **The Frontiers of Development Studies**, Macmillan, London
7. See, for example, Lipton, M., 1977, **Why Poor People Stay Poor**, Temple Smith, London (Chapter 8)
8. Griffin and James discuss evidence which indicates that even the high growth rates of many LDCs between 1950 and 1975 are not sufficient to maintain the food consumption per capita and other basic needs at acceptable levels, Griffin, K., and James, J., 1981, **The Transition to Egalitarian Development**, Macmillan, London (pp.4-7)
9. Like others, Clayton defines 3 phases of development objectives since the 1950s. The first, lasting until 1970, emphasised the rapid growth of GNP; the second, emerging in the early 1970s, shifted focus to employment creation and income distribution; and the third, appearing in the mid 1970s, added the sub-objective of

- meeting 'basic needs', Clayton, E., 1983, **Agriculture, Poverty and Freedom in Developing Countries**, Macmillan, London (Chapter 1)
10. Chenery, H., et.al., 1974, *op.cit.* was a landmark statement of this shift in development objective.
 11. A discussion of the mechanisms involved in transferring resources out of the agricultural sector is found, for example, in Griffin, K., 1974, **The Political Economy of Agrarian Change**, Macmillan, London (Chapter 5)
 12. The unequal pattern of government infrastructure investment is discussed in Frank, C.R. and Webb, R., 1977, **Income Distribution and Growth in LDCs**, Brookings Institution, Washington D.C., (Chapter 1). An examination of the relationship between public expenditure and regional growth is given by Lakshmanan, T.R., and Elhance, A., **Public Expenditure and the Performance of Regional Production Enterprises: Analytical and Policy Issues**, in Chatterjee, L., and Nijkamp, P., (eds), 1983, **Urban and Regional Policy Analysis in Developing Countries**, Gower, Hants (Chapter 7)
 13. For a general statement of the need for targetting development towards the rural poor, see World Bank, 1975, **The Assault on World Poverty**, John Hopkins University Press, Baltimore and London (pp.3-11)
 14. See, for example, Clifton, R. Wharton, **Risk, Uncertainty and the Subsistence Farmer**, in Tadaro, M., (ed), 1983, *op.cit.* (Chapter 8)
 15. ILO, 1976, **Employment, Growth and Basic Needs**, ILO Geneva,
 16. Supporting policies such as rural-works schemes will also be important
 17. Lipton, M., 1982, *op.cit.*, p.68
 18. See, for example, Berry, R.A. and Cline, W.R., 1979, **Agrarian Structure and Productivity in Developing Countries**, John Hopkins University Press, Baltimore and London, and Griffin, K., 1974, *op.cit.* (Chapter 3)
 19. See, for example, Dorner, P., 1972, **Land Reform and Economic Development**, Penguin, London, and Long, E.J., and Shukla, T. (Eds.), 1969, **Economics of Underdeveloped Agriculture**, Vora.
 20. Public expenditure on development in the North-East of Thailand, for example, has often overtly been designed to reduce support for communist insurgents among the rural population.
 21. Johnson, B.F. and Kilby, P., 1975, **Agriculture and Structural Transformation**, Oxford University Press, New York (Chapter 4)

22. Adams, D.W., 1978a, **Small Farmer Credit Programs and Interest Rate Policies in Low-Income Countries**, Studies in Rural Finance, Department of Agricultural Economics and Rural Sociology, The Ohio State University, Columbus, Ohio
23. 'Financial Intermediaries' are "institutions which hold money balances of, or which borrow from, individuals and other institutions, in order to make loans or other investments" Bannock, G., Baxter, R.E. and Rees, R., 1977, **The Penguin Dictionary of Economics**, Penguin, London (p.180)
24. Adams, D.W. and Graham, O.H., 1979, **A Critique of Traditional Agricultural Credit Projects and Policies**, Studies in Rural Finance, Department of Agricultural Economics and Rural Sociology, The Ohio State University, Columbus, Ohio (p.1)
25. Thingalaya, N.K., 1978, Rapporteur's Report on Rural Credit: Structure and Flows, in **Indian Journal of Agricultural Economics**, Vol.33, No.4, p.173
26. Chisholm identifies three types of ideologies behind development approaches: eurocentric, neo-marxist and moralist/humanitarian, Chisholm., 1982, **Modern World Development**, Hutchinson, London (Chapter 1)
27. Three basic approaches to agrarian transformation can be identified: (a) transformation based on large commercial farmers under a capitalist system; (b) transformation based on large-scale collectivised state farms under a socialist system, and (c) transformation based on the commercialisation of small peasant farms. The latter has been labelled 'populist', following the title of 'neo-narodnik' (neo-pupulist) given to those who argued against the Bolsheviks that peasants in early 19th Century Russia were efficient producers. Harriss, J., 1982, **Rural Development**, Hutchinson, London (Introduction to Part One)
28. Morriss, A., 1981, **Latin America, Economic Development and Regional Differentiation**, Hutchinson, London (Chapter One)
29. Chisholm, M., 1982, **op.cit.** (Chapter One)
30. The classic statement on the importance of modernisation - diffusion was made by Hirschman, A.O., 1958, **The Strategy of Economic Development**, Yale University Press, New Haven
31. Morriss, A., 1981, **op.cit.** discusses the differences between endogenous and exogenous theories of development
32. It has been suggested, for example, that agricultural development arises essentially from the internal pressure on resources rather than from the introduction of innovations from the outside. Externally-originating innovations may be available but are not adopted, it is suggested, until population pressure in a region forces agriculture to change in order to support more people. Hodder, B.W., 1968, **Economic Development in the Tropics**, Methuen, New York

33. For a typical explanation of the extension of a market economy into the peasant sector through the influence of export-demand, see Myint, H., 1980, *op.cit.* (Chapter 2)
34. Myrdal, G., 1957, **Economic Theory and Underdeveloped Regions**, Duckworth, London
35. That is to be distinguished, of course, from a development theory in the neo-classical framework; a theory which predicts convergence of regional or national incomes over time through a process of factor equalisation; see, for example, Bort, G.H. and Stein, J.L., 1964, **Economic Growth in a Free Market**, Columbia University Press, New York, and Williamson, J.G., 1965, Regional Inequality and the Process of National Development, in **Economic Development and Cultural Change**, Vol.13 (pp.3-43)
36. Harriss, J., 1982, *op.cit.* (General Introduction)
37. For a typical example, see Schluter, M.G.G., 1974, **The Interaction of Credit and Uncertainty in Determining Resource Allocation and Income on Small Farms, Surat District, India**, Occasional Paper No.68, Employment and Income Distribution Project, Department of Agricultural Economics, Cornell University, Ithaca
38. A classic example is Chayanov, A.V., 1966, **The Theory of Peasant Economy**, edited and introduced by Daniel Thorner, Basile Kerblay and R.E.F. Smith, Irwin, Homewood, Illinois
39. For a detailed discussion of positivism and realism in the social sciences, see Gregory, D., 1978, **Ideology, Science and Human Geography**, Hutchinson, London
40. Lipton, M., Game Against Nature: theories of peasant decision-making, in Harriss, J., 1982, *op.cit.* (Chapter 11, p.259)

CHAPTER 2 :

THE CASE FOR RURAL CREDIT PROGRAMMES

The importance of rural credit programmes in the development planning of LDCs was introduced in the last chapter in the context of the broader shift towards a more agricultural-oriented development strategy. In this chapter, the assumptions behind such programmes and therefore the reasons for their importance are elaborated. First of all, there is a summary of the body of beliefs and assumptions which can be considered to be the popular case for public rural credit programmes. There then follows a presentation of the formally-stated economic rationale behind those policies which attempt to increase the supply of credit to rural areas at reasonable rates of interest. The justification for dwelling on a formal presentation of the underlying neo-classical arguments, is that the farm-level empirical analysis of Chapters 6 and 7 presupposes, like most agricultural development planners, the basic theoretical framework embodied in those arguments.

A The Traditional Consensus

The popular case for rural credit programmes has elsewhere been described as the traditional consensus of opinion concerning rural financial markets (RFMs) in LDCs.¹ These beliefs and assumptions can usefully be summarised under two headings: those that relate to the behaviour of borrower-savers and those relating to the behaviour of lenders.

Borrower-saver behaviour. The rural poor are assumed to have a low propensity to save and to be unable, consequently, to respond

to any new savings opportunities. Hence, rural credit programmes frequently underemphasise or even ignore a savings component. The target population are furthermore considered unable to adopt new technology without access to additional credit; and credit given for production is assumed to facilitate increased production through the purchase of otherwise unavailable inputs. Borrowers are assumed to respond to low institutional interest rates, borrowing more than they would at higher rates.

Lender behaviour. Lenders can be divided into the following categories : non-institutional commercial (storekeepers, money-lenders, itinerant traders and landlords); non-institutional non-commercial (neighbours and family); private institutional (commercial banks and finance companies); and public or semi-public institutional (development banks, cooperatives and other types of credit programme).

Non-institutional commercial lenders are thought to charge usurious rates of interest, quite unrelated to their legitimate costs of operation. Non-institutional non-commercial lenders, on the other hand, are often ignored as unimportant as suppliers of cheap credit. Private institutional lenders are assumed to have an aversion to agricultural lending in general, and to small farmer lending in particular, because of the high risk involved. Public institutional lenders by contrast, are commonly assumed to have a welfare function and to be immune from normal commercial considerations of profit and loss. They are assumed, furthermore, to direct their subsidised credit to the rural poor targetted by their sponsoring agencies.

It is largely from this generalised view of rural financial markets that rural credit programmes have emerged in the way that they have. It is not an uncontested view, however, and a number of its assumptions have been repeatedly challenged in the more recent literature.² In particular, some have suggested that interest rates in the non-institutional market are less monopolistic than commonly assumed and that the case for 'rescuing' the exploited peasant-borrowers is not such a strong one.³ Neighbours and family have received more attention as sources of cheap, often interest-free credit.⁴ The assumed welfare role of public institutional lenders has been criticised as leading to non-viable institutions which offer no prospect of a stable, long-term service to the rural poor.⁵

On the borrower-saver side, small farmers have been found to be very capable savers, given the opportunity and appropriate rates of return.⁶ With respect to 'prohibitively' high interest rates, small borrowers, because of the small amounts involved, have been found quite willing to pay the high rates of the non-institutional markets.⁷ There has also been a challenge to the supposed importance of the credit constraint on innovation; successful small-farm development has been reported in situations where it is not associated with an expansion in institutional credit supply.⁸

Further elaboration on this debate is not necessary at this point; it is sufficient here to have summarised the set of assumptions which have made up the popular case for rural credit programmes, and to recognise that a number of them have been

brought into question.

Two of these are of particular importance to the thesis and are, therefore, examined in more detail later in the chapter: the assumptions (a) that farmers face extortionate interest rates in the non-institutional market, and (b) that a shortage of funds to borrow is a serious constraint on farm growth, are essential to the case for public-sponsored rural credit programmes. Some of the evidence surrounding the debate about these two issues is presented in the final section of the chapter. Chapter 5 develops this further, looking at the evidence from Thailand's rural financial markets.

We now turn to a more formal analysis of the case for rural credit programmes. In the following two sections, the role of credit in agricultural development is considered from two perspectives. First, at a broader sectoral level, we consider the role of borrowing and lending institutions (financial intermediaries) in the agricultural development process. Second, on a narrower perspective, we examine the role which credit is assumed to have in the development (growth) of the farm-firm. This relates credit to the basic neo-classical model of farm production and is the most fundamental assumption behind any credit programme.

B A sectoral Perspective: financial intermediation and growth in the agricultural sector

Financial intermediation describes the activity carried out by institutions which borrow from one set of actors and make loans to another set of actors. Such intermediating institutions

channel funds from lenders to borrowers.⁹ The agricultural lending banks and other farmer institutions which form the core of the rural credit programmes in LDC's are examples of planned financial intermediation, designed to achieve certain development goals.

The motivation behind many rural credit programmes has undoubtedly been a highly political one.¹⁰ Programmes have been set up as a political response to the presumed inadequacies of existing rural financial markets (listed in the last section), and to the more general call for a higher priority for agriculture and the rural poor discussed in Chapter 1. Programmes aimed at target groups are essential to gaining the political support from those groups and small-farmer credit (SFC) can be seen as a relatively neutral policy instrument with high visibility and popular appeal. Though this may be a major factor in getting policies off the ground and maintaining a commitment to them there are important arguments both on efficiency and equity grounds for the planned intermediation in rural financial markets (RFM's).

It has long been recognised that financial institutions can have a 'supply-leading' development function.¹¹ Gerschenkron, for example, in the general debate about whether financial services are essentially 'demand-following' or 'supply-leading', suggested that the more backward an economy relative to others, the more important would be supply-leading finance.¹²

Certainly, there can be no question about the increasing financial deepening¹³ accompanying modern capitalist

development.¹⁴ The truth must be, of course, that financial institutions are both a response to growing demand for finance in a country which is transferring (however, partially) from traditional to capitalist production and consumption modes, and also a stimulant to investment where finance, for one reason or another, is a bottleneck. There has generally been an emphasis in rural credit programmes on the supply-leading role of credit in agricultural development; credit is considered essential to the stimulation of innovation and farm development. To the extent that programmes are designed to finance an existing demand for new inputs, however, credit can be considered as demand-following finance.

There are at least three ways in which a financial intermediation can have a positive role in economic development and growth in the real capital stock of an economy.¹⁵

First, it can facilitate a more efficient allocation of a given level of assets. Tangible assets in LDC's are frequently held in unproductive forms such as underutilized land, precious metals and above normal stocks of foodstuffs. Though there are undoubtedly other reasons for these forms of asset holding, such as cultural norms or marketing constraints, the lack of productive investment opportunities is an important factor. An introduction of higher return investment opportunities would encourage the release of resources from less productive to more productive uses and offer alternative forms of liquid and divisible assets.

Second, financial intermediation can encourage a more efficient

allocation of new investment (additions to the capital stock). This rests on the assumptions that individual savers are not all the most efficient investors and that without financial intermediation, savers are not generally willing to make their savings available to the most efficient investors.¹⁶ If it is true that the savers are not necessarily investors too, and that entrepreneurs cannot necessarily save enough for the investment opportunities they see, then financial intermediaries can provide a market mechanism for transferring access to real resources. In this way, there will be a tendency for marginal rates of return to become more equal between uses and between users.

Additionally, the financial intermediary performs a risk-spreading function and achieves economies of scale in the saving-investment process. Default risk is pooled and higher risk investments are made available to savers who jointly assume the risk. Hence, short-term, relatively safe assets are turned into riskier and more productive assets through the reallocation of risk. Economies of scale are also achieved in the process of searching for and evaluating investments.

Thirdly, as implied by the notion of supply-leading finance, financial intermediation can induce new growth. Essentially, intermediation reduces the differential between interest rates faced by investors and that received by savers. With higher returns available, savers are induced to save more while investors are confronted with a lower cost of investment accompanied by a wider diversity of investment opportunities. Though there is both a substitution and income effect with increased returns to savings, it is likely, given an increasing

development of investment alternatives, that the beneficial substitution effect will outweigh the tendency of the income effect to induce a rise in the consumption rate.

Rural credit programmes are assumed to contribute to the development process, particularly in the way described under the second and third points. Small farmers are seen as net investors, having profitable on-farm investment opportunities but insufficient working capital with which to realise them. A redistribution of funds from net-savers (having a surplus of funds over profitable investment opportunities) to small farmers will, therefore, result in a more efficient allocation of new investment. Savings that would have remained relatively unproductive are redistributed via rural credit institutions, to capital-short farmers who can use them productively.

With respect to inducing new growth, this effect has been weakened by the lack of emphasis in rural credit programmes on encouraging higher levels of rural savings. There is an assumption, however, that new growth is induced on the borrower or net-investor side. An expanded volume of funds at a cheaper rate than alternative sources, encourages small farmers to make investments in inputs that they would not have otherwise made.

The application of the three-pointed argument to intermediaries operating in the agricultural sector, and primarily as lending institutions, needs some qualification. Since higher short-term returns to capital are arguably found in the industrial sector, we would expect the net effect of financial intermediation in agricultural areas to be a general flow of capital from rural to

urban areas.¹⁷ This is, indeed, what has happened in the urban-industrial based development experiences of LDCs. Certain factors tend to mitigate against this rural-urban flow of capital however, notably the unimportance of rural deposits in many credit programmes and the government regulations designed to restrict the out-migration of capital from rural areas.¹⁸

Rural credit programmes tend to be one-sided with respect to the general model outlined. Only a very few programmes have involved any substantial emphasis on mobilizing rural savings.¹⁹ In the case of Thailand's BAAC, for example, deposits from the general public accounted for only 15.7% of the bank's operating fund in 1982.²⁰ In the absence of an adequate level of rural deposits, the intermediation is between general taxation funds, foreign funds and commercial bank deposits on the one hand, and small-scale agricultural investors on the other. To cite the BAAC as an example again, the single most important source of funds in the 1982 financial year, was deposits from commercial banks (accounting for 40.9% of the 1982 operating funds),²¹ a pattern maintained solely by government regulation. Since the commercial banks are strongly urban-based, this must represent to some extent, a flow of funds from urban net-savers to rural net-borrowers.²² In other countries, rural credit institutions are more reliant on public funds, in which case the direction of flows are more difficult to assess because public funds come from a variety of tax bases which have a variable impact on rural and urban areas.

The desired effects of the financial intermediaries set up under

rural credit programmes are, therefore, a stimulation of supply-led growth, particularly in the small-farm sector, by lowering the effective cost of borrowing and increasing the opportunity to borrow; and an alleviation of bottlenecks in supply in order to meet existing demand. The service is aimed at a sector of society largely made up of net-borrowers: farmers who have opportunities for raising productivity and income through on-farm investments yet are considered to be constrained by a lack of investable funds. The funds that are channeled to them through rural credit programmes may, in some cases, represent a counter-flow to the usual overall flow of capital out of the agricultural/rural sector.

C A Farm-Level Perspective: Credit and Growth of the Farm

Two of the basic underlying assumptions in rural credit programmes are that there are production opportunities as yet unreached by farmers and that additional liquidity will enable them to reach those opportunities. Rural credit programmes as we have seen, channel a mixture of private and public funds, often non-agricultural in origin, into the agriculture sector.

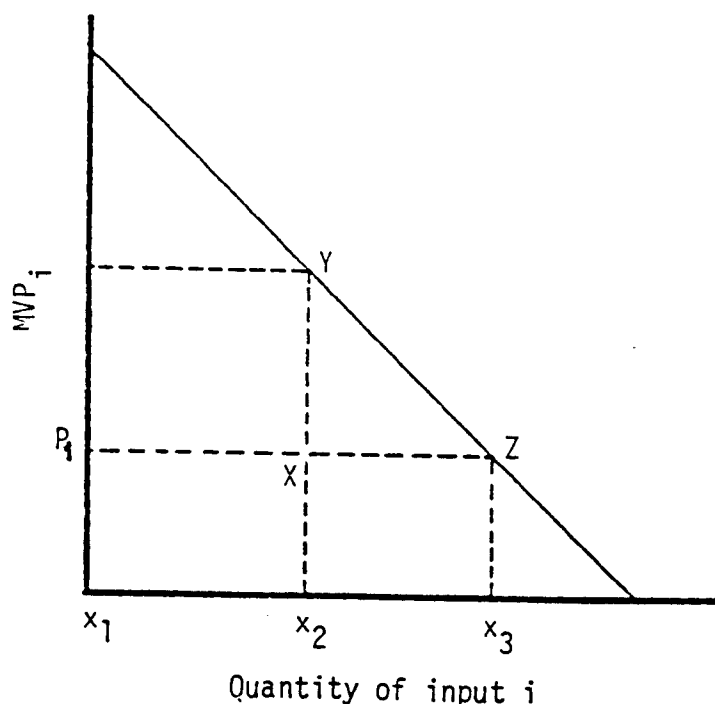
These funds, usually made available at low interest rates, are assumed to have two kinds of effects on the farm economy: a volume effect and a price effect.²³

1. Volume Effect

There are two ways in which an additional volume of credit is thought to stimulate output. First, it is assumed that small farmers can obtain insufficient credit to finance expansion in production. For example, the purchase of

larger quantities of fertilizer or the hiring of a mechanical tractor for upland ploughing may be outside of a farmer's normal means. Diagrammatically, the farm may be at point x_1 in Figure 2.1. Non-institutional credit sources may allow him to borrow a limited amount, moving him up to x_2 . Assuming the marginal value productivity (MVP) of the particular input is still above its price at x_2 (so that more of the input can still be profitably used), then additional credit from an institutional source will move the farmer to x_3 . The increase in income through the use of additional inputs facilitated by institutional borrowing is equal to the area XYZ.

Figure 2.1. Demand curve for input i showing the effect of variation in credit availability on input use



Note P_i = unit price of input i
 MVP_i = marginal value product of input i

The second way an additional volume of credit is thought to stimulate output is by its influence on the farmer's attitude towards risk. A farm-household may possess a certain level of savings which could potentially be used to purchase inputs and raise production above the current level, but nevertheless chose not to invest those savings. Savings may be uninvested because they represent security against unforeseen emergencies or against subsistence consumption peaks. If an additional source of credit from an institution is viewed as a secure and reliable alternative to savings, then a rural credit programme may induce farm-households to invest more of their risk-offsetting savings in farm production. In terms of Figure 2.1, the shift from x_2 to x_3 would, in this case, be made in part by the farmer's own released savings. This fits in with Baker's view of credit as an asset.²⁴ Credit can be seen as an asset rather than a sum borrowed from a lender; an amount that can be borrowed if necessary (an asset that can be liquidised), rather than simply an amount borrowed. Seen in this way, the transaction between borrower and lender involves the exchange of 'credit' for a loan. A borrower's 'credit' asset is reduced by the amount he borrows. If he does not borrow, his asset is undepleted, amounting to the maximum sum borrowable, and it remains as a reserve. In this sense, 'credit' is like jewellery, inventories, cash or any other liquid asset which can be used as a reserve. The greater a farmer's credit 'reserve' the more likely he is to invest savings in farm production.

A credit source which lends for consumption as well as production is likely to have a greater impact on the release of other liquid assets for production expenses in this way.

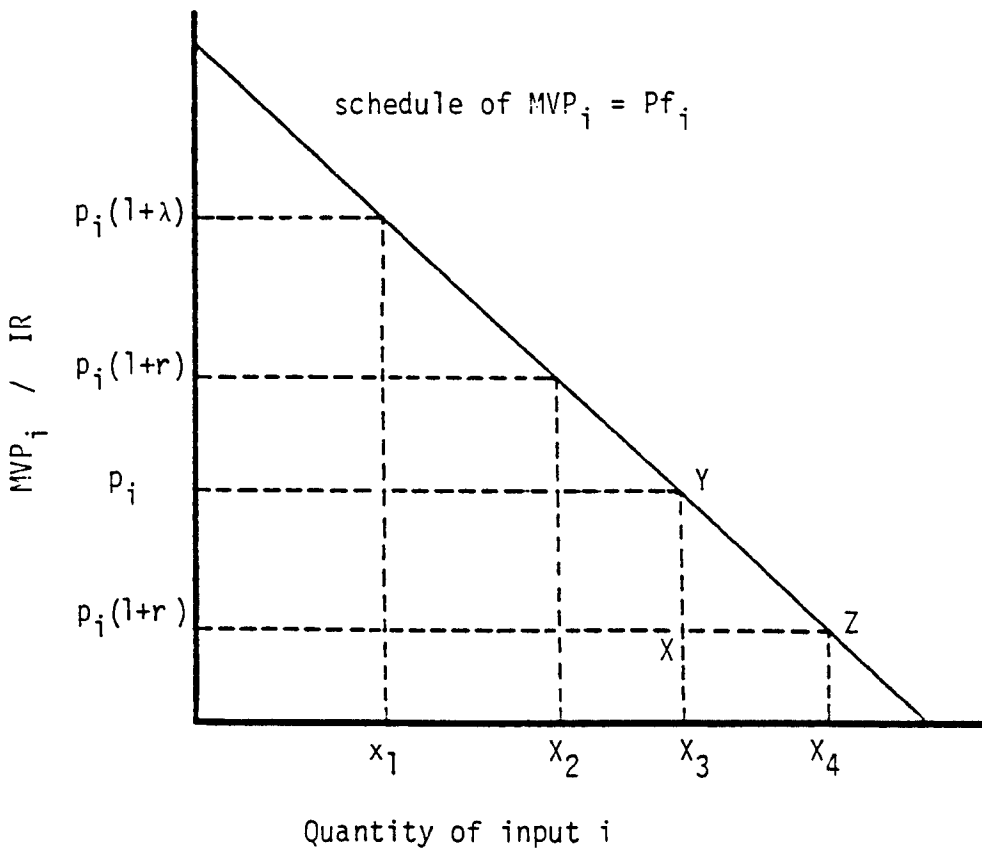
2. Price Effect

It is often assumed that a lowering of the price of credit (interest rate) will occur not only by the provision of cheap credit, but also by the effective competition represented by a rural credit programme, inducing non-institutional suppliers to reduce their profit margins. The 'price-effect' refers to the effect of price on the volume of credit used or volume of inputs purchased. For a given outlay on interest charges, a lower interest rate enables a farmer to borrow a larger volume. Diagrammatically, a lower interest rate enables a farmer to move to the right along his demand curve (Figure 2.2).

Optimal input use occurs when the marginal value product of input i is equated with the price (p_i) of input i . This equilibrium point is given by x_3 in Figure 2. This assumes that savings are sufficient to purchase as much of an input as is profitable. If money has to be borrowed to purchase the input, however, the cost of borrowing must be added to the cost of the input and price (p_i) becomes $p_i(1+r)$ where r = the interest rate on borrowed funds. Now if the non-institutional interest rate = λ , the effective price of input i in figure 3 is $p_i(1+\lambda)$ and the equilibrium quantity purchased = x_1 . A credit programme which reduces the unit cost of credit from λ to r will result in a shift in the quantity purchased from x_1 to x_2 . The lower interest rate

allows more inputs to be purchased and therefore leads to greater output. David and Meyer²⁵ present this problem in the form of a typical neo-orthodox farm production model. A farmer is assumed to maximise profit subject to a production function $f(x_1, x_2, \dots, x_n)$, input prices p_i 's, product price P and a constraint equating input costs with savings (S). The Lagrangian form of the maximisation problem is :

Figure 2.2. Demand curve for input i showing the effect of variation in the price of credit on input use



Note λ = higher interest rate on credit
 r = lower interest rate on credit
 P_i = price of input

Source : adapted from David and Meyer (1979) p.4

$$\Pi = (P^*f(x_1, x_2, \dots, x_n) - \sum p_i x_i) + \lambda (S - \sum p_i x_i), \quad (2.1)$$

which is maximised when

$$S = \sum p_i x_i \quad (2.2)$$

$$\text{and } f_i = p_i (1 + \lambda), \quad (2.3)$$

where Π = profit;

λ = Lagrange multiplier;

f_i = marginal product of input i ; and

Pf_i = marginal value product of input i ;

p_i = price of input i ; and

P = product price

Where input costs are equated with savings (no borrowing is necessary), $S = \sum p_i x_i$ and the expression $\lambda (S - \sum p_i x_i)$ equals zero. When savings are not a constraint, therefore, profit equals the difference between total value of production and total cost of inputs. With an assumed λ of zero, marginal value product of input i is equated with price of input i , ($Pf_i = p_i$). This is represented by x_3 in Figure 2.2 where $MVP_i = p_i$.

If, however, savings are a constraint on input use, the expression $(S - \sum p_i x_i)$ becomes negative and λ represents the cost of borrowing to supplement savings. In the maximum profit equation above, Π = revenue - input costs - borrowing cost.

In terms of Figure 2.2, when $\lambda =$ zero, optimal input use is determined by equating MVP_i with p_i and equals x_3 . A

borrowing cost of λ will result in input use x_1 where $MVP_i = p_i(1+\lambda)$. If the borrowing cost is reduced by a rural credit programme, say to r , input use will rise to x_2 .

Figure 2.3 presents the problem in a different way, showing the relationship between the physical input/output ratio and the ratio between the price of input and output. The plotted schedule is the total product curve for input i , representing the relationship between output and input i .

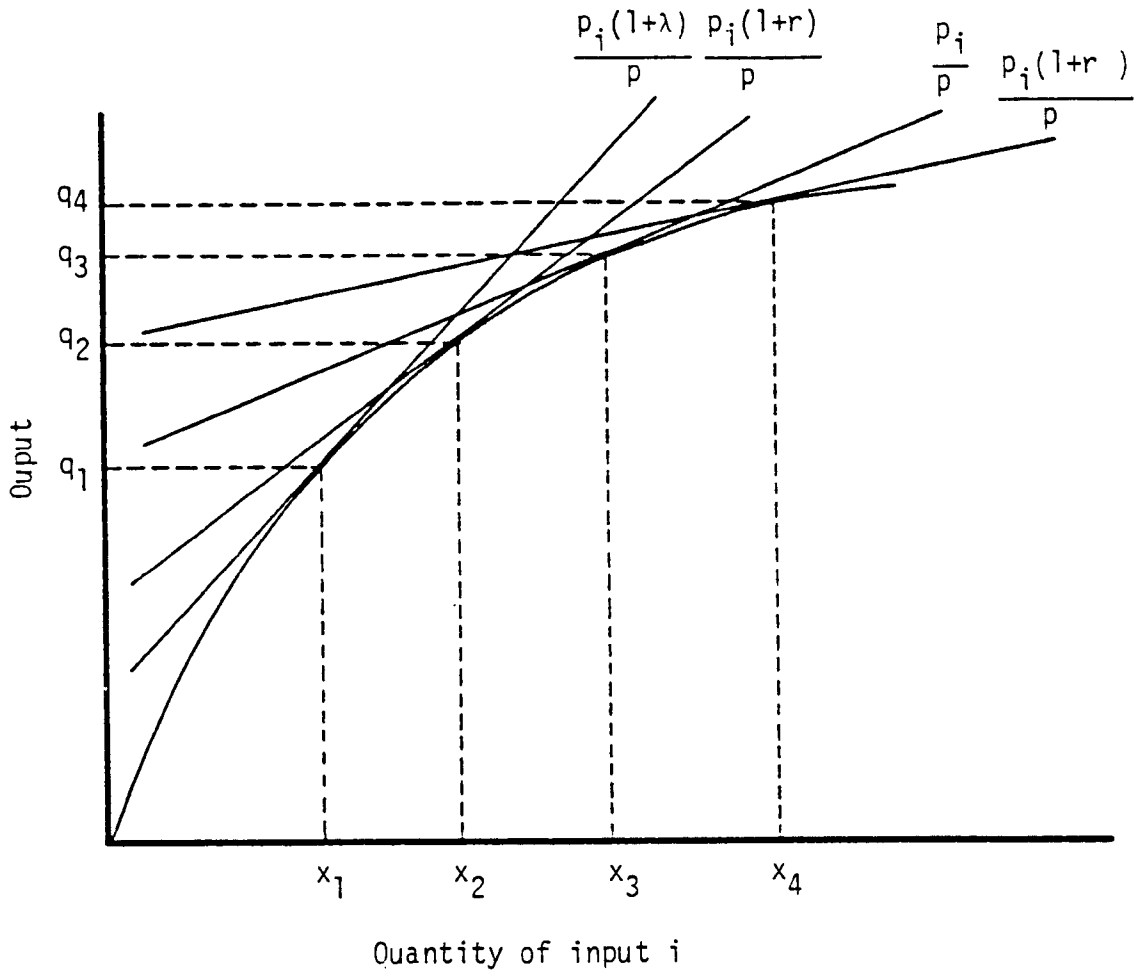
Where a farmer uses only his own savings, input and output quantities are determined by the ratio of input to output price (p_i/P) and equal x_3 and q_3 . With an interest rate of λ , x and q are determined by the ratio of input price (including the cost of borrowing) to output price: $p_i(1+\lambda)/P$, and equal x_1 and q_1 . A lower interest rate r , introduced by a rural credit programme, raises input use and output to x_2 and q_2 respectively, determined by the ratio $p_i(1+r)/P$.

This basic model can be used to illustrate how cheap credit can become a welfare subsidy in countries where the inflation rate exceeds the institutional interest rate. In this situation, the real interest rate r becomes negative. The expression $p_i(1+r)/P$ approaches equality with p_i/P as r gets smaller (as the real rate of interest diminishes). Where r is negative, the value $p_i(1+r)/P$ is smaller than the value p_i/P and even higher levels of x and q are attainable. x_4 and q_4 are the optimal input and output levels when the implicit subsidy represented by a low institutional interest rate is taken into account.

When rural credit programmes serve largely the wealthier members of the farming population, an income subsidy equal to XYZ in Figure 2.2 is effectively made to farmers who least need a subsidy.²⁶

In this section the volume and price effects have been defined in terms of the increased quantity of input (and, therefore, increased output) associated respectively with an increased volume of credit supply and a lower price of credit. The analysis in Chapter 6 uses these theoretical constructs and also introduces a second type of price effect which can be termed P_2 . While the price effect defined above (call it P_1), refers to the effect of price on volume of credit used, P_2 refers to the effect of the price of credit on income without any change in volume. In Chapter 7, we are concerned with the effect of credit on income, an effect which can be broken down into three components. Farm income increases (a) as the volume of credit increases due to an expansion in supply (volume effect); (b) as the volume of credit increases due to a lower rate of interest (price effect P_1), and (c) as a given volume of credit is borrowed at a lower rate of interest (price-effect P_2). In Chapter 7, we will find that the linear assumptions of the models used to derive demand curves, prevent the measurement of the P_1 effect. The volume effect and the P_2 effect can be measured, however, and are analysed in an evaluation of the income forfeited by a small farmer through operating outside of the formal credit market.

Figure 2.3 Total product curve for input i showing the relationship between interest rate and quantity of input and output



Source : Adapted from David, C., and Meyer, R., 1979, p.4

3. Qualifying the basic model

The basic neo-orthodox model rests, of course, on the usual assumptions of perfect knowledge and certainty and profit maximising motivation. These qualifications are normal and an acceptable limitation on any formal micro-economic analysis. The limitations can be dealt with in various ways. A farmer's attitude towards risk, for example (which affects his pursuit of maximum profit) can be modelled by including a risk premium as a cost, additional to the input price, to find the modified equilibrium output. In Chapters

6 and 7, where a series of programming models of the farm economy are developed on the theoretical foundation of the basic model presented above, the restrictive profit-maximising assumption is qualified to account for farmer's behaviour with respect to risk aversion, traditional crop preference and attitude towards family labour.

A second sort of qualification relates to the failure of the basic neo-classical model to take into account the fungibility²⁷ of credit. A cash loan, whether tied to a particular expenditure or not, becomes pooled with the farmer's other liquid assets when it reaches his pocket. The addition to his liquid assets will have consequences not just for the expenditure to which the loan was tied, but to all other farm-household expenditures. The loan cannot strictly speaking be thought to proceed directly from the lender to the purchase of the authorised inputs. While the authorised inputs may still be purchased, it may be for example that they would have been purchased in the absence of a loan and that the additional liquidity created by the loan is used to purchase something quite different. The problem need be no different if a loan is made in kind; credit in kind can be sold or exchanged by the borrower and used to purchase anything else.²⁸

The fungible nature of loans causes two types of problem when it comes to analysing the impact of credit on farm output.²⁹ The first problem arises when trying to predict the change in farm output associated with a loan of x units. There are two sides to this prediction problem: the proceeds

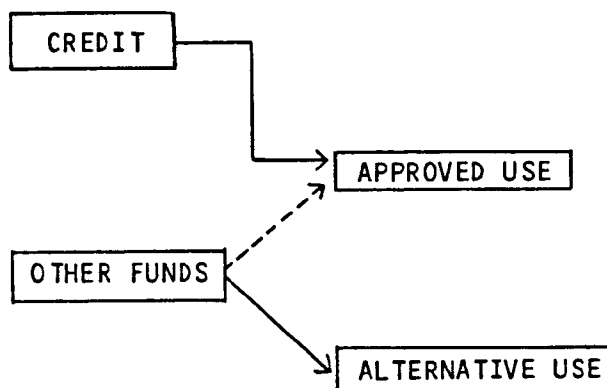
from a loan may be used as a substitute for other owned funds in purchasing a particular input, or alternatively they may be diverted to a completely different use.

The substitution problem is expressed diagrammatically in Figure 2.4a. A borrower may purchase the inputs authorised by the lender in the loan agreement and it would appear that the loan of x units has led to the purchase of y inputs and an increase in output by z units. If, however, the borrower had intended to purchase the y inputs, whether he received a loan or not, the loan, which can conceptually be thought of as purchasing the y inputs, has merely substituted for the funds which would have been used on their purchase. Those funds are now freed for expenditure on anything else wanted by the farm-household. If, for example, an electric ceiling fan were high on the list of expenditure priorities, the money that would have been used on inputs if there were no loan, can now be used to purchase a fan. The net effect of the loan on the farm-household economy is the addition of one consumer-durable. Because of the fungibility of money, credit can be conceptualised as substituting for other funds in this way and transferring purchasing power from and to any 'sector' of the farm-household economy. Credit is fungible between alternative farm uses (between crop types, between different inputs); between farm and household uses; between consumption and production uses; between farm production and non-farm household production; and between direct farm production (seeds and fertilizer, for example) and indirect farm production via consumption by family

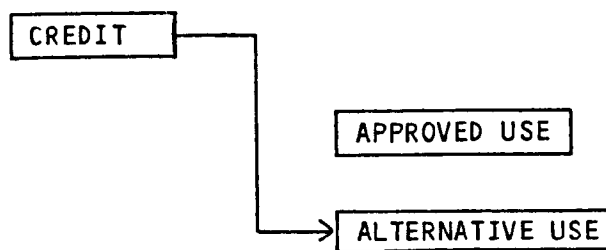
labour. Rice (1977) is one of the many sources reporting the importance of the substitution of credit for other funds.³⁰

Figure 2.4. Substitution, diversion and attribution problems in measuring and predicting the impact of credit on the farm

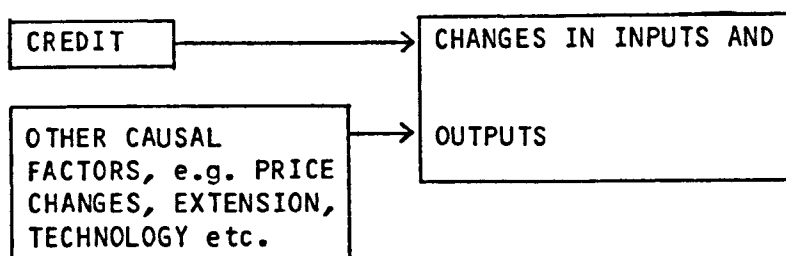
2.4a The substitution problem



2.4b The diversion problem



2.4c The attribution problem



The diversion problem is a more obvious form of loan misuse. A farmer may acquire a loan for a certain use and then use it to purchase something entirely different without making the authorized purchase. A commonly cited example of this is the use of loan funds meant for production, for ceremonial expenses. Adeniyi Osuntogun³¹ found that the use of cooperative credit for non-farm activities was important in Nigeria, accounting for 60.6% of borrowed funds in the survey area. Diversion should be difficult if lenders maintain regular and systematic supervision. In cases of diversion to alternative productive activities, credit officers may merely adjust the original loan agreement to show the new use.³² Figure 2.4b illustrates the diversion problem diagrammatically.

Substitution and diversion cause problems in predicting the effect of credit on the farm. They mean that the relationship between credit, inputs and output may not be as straightforward as predicted by the model represented in Figures 2.1 and 2.2). A second type of problem arises when trying to measure post facto, the impact that credit has had on a farm. This has been termed the attribution problem³³ and is confronted whenever credit impact is measured by a cross-sectional comparison of borrowers and non-borrowers or by a longitudinal comparison of farmers before and after borrowing. Isolation of the changes effected by the use of credit is confounded by other important differences between the group with credit and the group without. This is so even when the two groups consist of the same farmers in a

longitudinal study and when two groups in a cross-sectional study are well matched. Observed differences between farmers with and without credit can be explained by the credit factor, but also by a series of endogenous and exogenous factors. Endogenous factors include differences in management ability, attitude towards risk, the level of technology adopted and differences in savings. Exogenous factors include differences in the prices of input and output, differences in the variability of prices and yield, differences in extension advice, irrigation, weather and soil quality. Many of these potentially influential variables are difficult to quantify in a production model.

Because of the problem of (a) attributing to credit a particular effect, distinct from the effect of other factors, and (b) predicting the impact of credit in the face of substitution and diversion of funds, a more relevant concept for evaluating the impact of a loan is additionality. This refers to the net effect on the farm or the farm-household of extra credit. The additionality resulting from a loan is the true net impact of additional credit and can only be estimated by approaching the question: what would have happened in the absence of the loan? If we are interested in just the production effect, as most credit studies are, the additionality is the observed changes in input and output minus the changes that would have occurred without the loan. If we are interested in the wider household welfare, we could examine the net changes in total farm-household inputs and outputs.³⁵

The implication of these qualifications for the basic neo-classical model are straightforward and can be illustrated by reference to Figures 2.1 and 2.3.

Diversion of a loan which is designed to move a farmer's use of input i from x_2 to x_3 in Figure 2.1, will result in the farmer remaining at x_2 despite having received a loan. (This implies that the amount needed to raise x_2 to x_3 will yield benefits greater than the increase in income XYZ if invested in some other input). The basic model assumes that a loan made for the purchase of input i will result in an increase in input i .

Substitution does not actually change the principle in Figure 2.1 only the logic behind it. The basic model assumes that a loan tied to the purchase of input i will move the borrower from x_2 to x_3 . If the borrower would have purchased x_3 of input i even without the loan, the loan substitutes for savings which can then be spent on something else. However, as long as the purchase authorised by the loan agreement is actually made, Figure 2.1 can be used to describe the effect of the loan. It describes the effect of the loan if the substitution process is conceptualised such that the loan is used to purchase input i , thus releasing savings for another expenditure. The result of the loan is, therefore, a shift from x_2 to x_3 and an income rise of XYZ , plus an additional expenditure or investment. If there is an alternative conceptualisation such that savings are used to purchase input i and the loan is spent on the other

expenditure (and either conceptualisation may be made since the truth is, all funds are fungible), then Figure 1 does not strictly describe the effect of the loan.

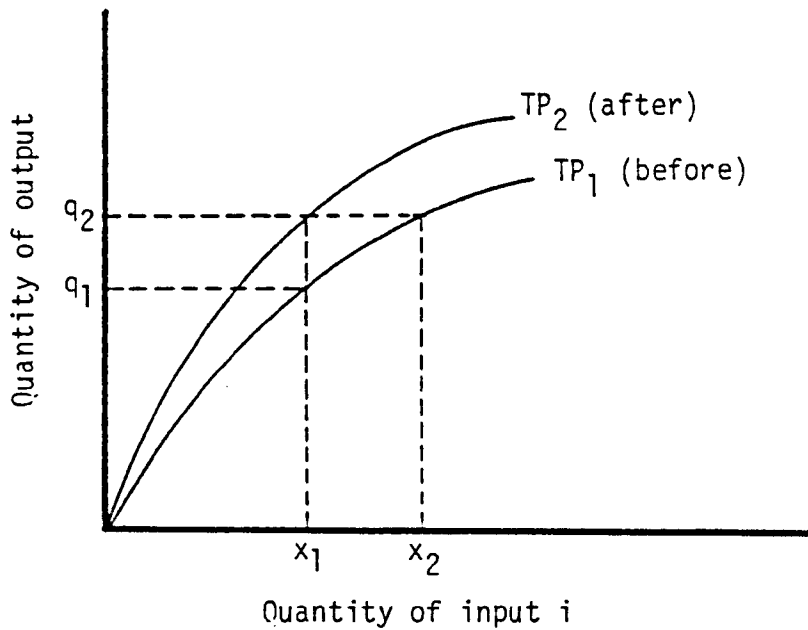
When a loan tied to input i substitutes for savings, the basic model does not capture the additionality, for that lies outside of Figure 2.1. There is nothing wrong, however, with conceptualising the effect of the loan in the way that Figure 2.1 does, for there is an association between the loan and the purchase of input i , and the loan can be seen as being spent on that input thus freeing other owned funds. The weakness in using this conceptualisation is that the effect of credit on the farm-household is underestimated. It can be viewed as a conservative understanding of ^{the} effect of credit; credit will, at least, be associated with the purchase of the authorised inputs (the shift from x_2 to x_3 and the income rise of XYZ). To the extent that substitution occurs, it will also raise the welfare of the farm-household through increasing purchasing power in other areas.

The difficulty for the basic model, caused by the attribution problem, can be illustrated by Figure 2.5 which is an extension of Figure 2.3. The total product curve relating quantity of output to quantity of input i , is associated with one particular production function. Assuming that a sample of farmers surveyed before and after taking a loan remains on the same production function, the before-after difference might be expected to be, for example, a shift from x_1 to x_2 and a related shift in output

from q_1 to q_2 . Consider, however, the possibility that by the time of the 'after' survey, farmers have moved to a higher production function through shifters in the production function quite independent of credit (weather or technical information, for example). TP_1 relates to the original production function and TP_2 to the higher function. An output increase from q_1 to q_2 will be observed even if the quantity of input i used remains the same as the 'before' level. The loan could be completely diverted and the predicted rise in output still be observed. This is not a weakness in the basic neo-classical model per se, it illustrates a weakness in using it over-simplistically in measuring the effect of credit by the comparison of two groups. To the extent that groups can be matched or shifter-variables can be included in the production model, the problem is reduced.

Having made these qualifying remarks about the neo-classical model, it is necessary to reaffirm its usefulness in conceptualising the role of credit in the farm economy. Firstly, diversion of loan proceeds can be avoided by due attention to loan supervision. An adequate level of supervision can be very costly in a large rural credit programme, but the need for a vast number of credit officers is reduced when joint-liability groups are used as a method of securing loans. When all farmers within a group are jointly responsible for each member's timely repayment, it can be expected that the probability of a borrower using a loan for its authorised purpose is high, especially when

Figure 2.5 The attribution problem illustrated using total product curves



diversion would lead to repayment difficulties. Loan discipline imposed by friends and neighbours eager to retain their group's credit rating, is often more effective than loan discipline imposed by an unfamiliar and 'distant' official.

Secondly, it can be hypothesised that there are certain circumstances in which it seems that substitution is less likely to be a problem. Small farmers operating at low levels of technology, earning little and saving little, are less likely to substitute a loan for owned finance than are more wealthy farmers. Put another way, small farmers are more likely to be constrained in their level of production by lack of finance than are larger farmers.³⁶ In an important respect, this makes the basic model more

appropriate to the small farmer; lacking financial resources, the association between a production loan and an increase in quantity of input i (and the associated increase in output) is more likely to be causal. The analysis in Chapter 7 presents some evidence for this assertion: BAAC farmers, it appears, use loans to release some of their savings for other uses, while independent farmers (with significantly less resources) using all their savings and borrowing what they can, do not reach the optimal level of production (Chapter 7, Section C).

Thirdly, even when substitution does occur, the model represented in Figures 2.1 to 2.3 can be considered an adequate working model for the lender whose primary interests are lending for agricultural production and recouping its loans. In terms of this purely commercial objective, it is sufficient for the lender to know that having authorised a loan for the purchase of input i , x units of input i are purchased and q units of output can be expected as a result of the investment. If it can be shown that the marketable value of q is sufficient to cover repayment of principal plus interest, then, other things being in the borrower's favour, the loan will be made. It does not really matter to the lender that the borrower might have purchased those inputs even without the loan and that the additionality caused by the loan is the purchase of a consumer durable rather than increased production. It is sufficient for the lender to know that a certain investment (to which the loan is tied) is expected to produce a certain

output; and the model can be taken as merely describing this threefold relationship between loan, inputs and output. Of course, from a broader development perspective, it should matter to the lender whether the true impact of a loan is increased production or the purchase of a consumer-durable. The problem of rural credit programmes misdirecting their subsidised funds is pursued in the next chapter.

D Credit in Context

Credit for agricultural development does not, of course, operate in a vacuum. This has commonly been overlooked or underemphasised by both policy makers³⁷ and analysts.³⁸ The basic model discussed above recognises that credit only influences production, mediated through the purchase of production inputs. Credit is not an independent input. An understanding of the full complexity of the rural economy would greatly enhance the understanding of the way credit works in any particular situation. This would involve bringing into the analysis all relevant system components such as patron-client relationships, kinship ties, local price structures, exchange labour practices and local custom. Some have advocated such an approach as the only really satisfactory method of analysing the impact of credit on rural development.³⁹ To include more factors in the analysis will undoubtedly increase explanation, although there is a danger of 'fuzzing' the picture so that an analysis becomes so complex that all one is left with is a descriptive case study. Accepting, however, that a farm-firm model, while not ideal, is still useful, it is important to bear in mind the

conditions necessary for the success of credit in inducing production increases. The basic model presented in the last section, by assuming that credit leads to an increase in inputs purchased, assumes a measure of favourability in these conditions. The conditions (the necessary context of credit) are summarised in the following.

Additional credit in the absence of locally available and appropriately priced inputs is unlikely to have any effect on production. Innovation⁴⁰ requires an available supply of inputs; credit only provides the financial command to acquire those inputs. Inputs may be supplied through cooperatives, farmer-groups, local merchants or extension or other government programmes. The emphasis on packaging of services has meant that scarcity of inputs is not now so often a problem with credit programmes. Packaging can cause its own problems, however, since a package of services is susceptible to failure through the failure of one essential component.⁴¹

Innovation not only requires a supply of inputs, it requires suitable **marketing opportunities**. Initiative to innovate is likely to be low if a farmer cannot see openings for marketing his new product or his increased production. This is a function of distance from market centres, popularity of the new products,⁴² level of demand of existing products, farmers' information, and availability of and access to local buyers. Marketing is, perhaps, most uncertain and therefore most a constraint to innovation when the farmer relies on farm-gate sales (this is also the strategy which gives the farmer the lowest price). Where a farmer can sell produce to processing

mills or government buyers (especially at a fixed price), he can be more certain about making the investment. Marketing cooperatives foster even greater certainty, the same institution perhaps providing credit, input and marketing services.

There may be adequate input supplies and marketing opportunities, but unfavourable **product prices** may be a severe disincentive to innovation. Where agricultural prices are deflated, government pricing policies may be a necessary accompaniment to credit disbursement policies. Localised policy can also help here through warehousing and postponement of sale, enabling farmers with sufficient surplus to ride-out the troughs in the annual cycle of product prices.

Education of the farmer is a fourth necessary condition for the productive use of credit on the farm. **Extension** programmes have achieved widespread importance in their own right and some credit programmes have their own extension workers.⁴³ The assumption is that a farmer needs educating concerning the use of his new and existing resources to his best advantage. If it can be shown that farmers in an area are commonly employing sub-optimal methods and farm plans through ignorance, extension is likely to help generate increased production. Extension in the form of closely supervised credit programmes has, however, been criticised, on the grounds that farmers are possibly in a better position to determine which activities have higher marginal profitability to them, than are experts from government agencies.⁴⁴ The debate about which party is in the best position to prescribe the 'best' farm practices can be clarified by making

a distinction between those farmers who choose not to use more 'efficient' technologies and those who fail to use them because of certain constraining factors, one of which is a lack of knowledge.

Appropriate input supplies, marketing opportunities, product prices and extension advice can therefore be seen as necessary conditions for the productive use of farm credit. In essence, credit will only be used to finance innovations if the innovations are perceived as profitable (in the widest sense) by the farmer. He needs the correct input supply and price structure, marketing openings, product price and knowledge and ability in order to profitably employ additional capital on the farm. These should not, of course, be seen as a deterministic set of conditions but rather as probabilistic contingencies. The problem can be seen from the point of view of the risk a farmer is willing to take in order to adopt an innovation. For although inputs may be available at comparable prices, perhaps to traditional inputs, a new variety of seed may be unacceptable because its yield variance is greater than traditional varieties even though its average yield may be higher. For a small farmer, especially in the case of his subsistence crop, the lower end of the yield distribution may take him below subsistence level, which he may classify an unacceptable risk.

It is not necessary here to elaborate any further on these complex issues; the important point for our purposes is that credit is only useful for farm production as far as (a) it enables the purchase of formerly inaccessible inputs, and (b) those inputs are seen as a profitable and otherwise desirable

investment.

E The Case in Practice: Evidence of the Performance of Rural Capital Markets

We now take up, for further discussion, two of the most important assumptions underlying rural credit programmes: the assumption that there is a credit shortage in RFMs which constrains farm output, and the assumption that interest rates are prohibitively high in the non-institutional market. These were introduced at the beginning of the Chapter along with the other assumptions which were collectively referred to as the traditional consensus. It will also be noticed that they are essential assumptions behind the formal economic case for rural credit programmes as presented earlier.

Demand for credit is discussed first, and then the question of interest rates. The two assumptions suggest that RFMs are not constructed to facilitate agricultural innovation and development. They lead us to expect evidence of excess demand for capital among small farmers and of excess profiteering in the traditional lending sector.

1. Demand for credit

A 1974 cross-country comparison of agricultural loans by type of lender⁴⁵ showed that, at that time, only a small percentage of farmers in any of the countries reported received institutional credit. Though there was a wide variation (0 to 40%), the mean was only 13% over 36 countries. Of these, commercial bank loans were few, and

were concentrated on the larger farmers who use them for relatively capital intensive investments. The bulk of institutional loans came through public programmes and these, too, have been shown to be concentrated on larger farmers despite their nominal orientation towards small farmers.⁴⁶ Though many rural credit programmes have stepped up their coverage in recent years, their tendency, discussed in the next chapter, to by-pass the mass of small farmers, must mean that a large proportion of farmers in LDCs still rely on the non-institutional sector for their credit need.

Little research has been done on non-institution credit markets and there are, therefore, few hard facts to draw upon. Widely-held opinion, however, is that informal credit is probably used more to meet short-term consumption needs than for production purposes.⁴⁷ The high interest rates and short-term nature of non-institutional loans indicates that the informal capital market is poorly adapted to medium-term lending for investment in production.⁴⁸ Since informal lenders constrain themselves to short-term lending and access is severely restricted to institutional loans, it follows that most longer-term investments have to be financed from private savings or from sale of assets.⁴⁹ For small farmers with hardly sufficient funds to purchase inputs at the beginning of the year, this means that significant on-farm improvements are generally impossible. The price of borrowed capital (interest rate) can be taken as a crude measure of demand for short-term production loans in the non-institutional market. Rates are indeed high

compared with commercial bank rates. A classic study by U.T. Wai (1957),⁵⁰ though giving a very heterogenous picture across 36 countries, suggested 40% per annum might be a representative figure.⁵¹ The issue of interest rates will be taken up in the next section, but a median as high as 40% (the mean is higher) is prima facie evidence for excess demand for capital in the RCMs of these 36 developing countries.

In addition, several case studies have included questions to farmers asking whether or not they have sufficient production credit. Lowdermilk, for example, showed that out of a sample of farms of different sizes in Pakistan, 75% reported the non-availability of funds. The percentage was nearer 80% for the smallest farms (2.5 - 12.5 acres).⁵²

Generally, there is no shortage of evidence to show that small farmers have a shortage of funds from institutional sources, be they public or private.⁵³ The literature is full of impressions about the shortage of production credit from non-institutional sources, but lacking in empirical evidence. This is discussed further in the context of Thai rural financial markets in Chapter 5, and some evidence presented in the case study of North-East Thailand in Chapter 7. However, the apparently high interest rates indicate a possible excess demand and if interpreted as such support the argument for the building of new financial intermediaries to increase the supply of rural credit. Supportive evidence comes from studies where farmers have expressed a frustration in acquiring funds.

We now turn in more detail to the debate concerning the interpretation of non-institutional interest rates.

2. Interest rates

As we have seen, an important assumption leading to the disbursement of cheap credit through rural credit programmes is that non-institutional commercial lenders charge exorbitant interest rates through monopolistic practices. Rates are kept high, it is supposed, by imperfect markets caused by a shortage of capital supply, imperfect knowledge, imperfect spatial, social and political access, and inelastic demand schedules of small farmers.⁵⁴

This assumption has been questioned on the grounds that the rates charged are reasonable relative to the cost of the services they provide: funding of high risk ventures often without collateral, providing highly flexible terms tailored to individual clients.⁵⁵

The diversity in the non-institutional market is so great that it is hard to describe it categorically as generally monopolistic. This may be a good description of the market in a village containing only one money-lender. In other situations competition is great and is far from meeting the conditions of a monopolistic situation. Two things suggest a degree of monopolistic practice, however: relatively low fixed costs and a wide variation in the terms of lending between borrowers. The suggestion is that it is unlikely that the enormous variation in rates charged can be explained by differences in lending costs. Further evidence

lies in the tendency for small farmers to display an inelastic demand for credit.⁵⁶ Constrained by a cyclical pattern of demand determined by the crop production cycle, and borrowing small sums in general, high interest rates seem not to deter small farmers from borrowing. This demand behaviour would certainly allow the development of monopolistic lender behaviour. Monopolistic behaviour will be moderated, however, by competition from other lenders, including institutions, and to the extent that borrowers are sensitive to interest rates. The mitigating effect of competition from other lenders is, however, weakened as the importance of particularistic ties between lender and borrower increases.⁵⁷

It is easy to see why the monopolistic money-lender theme continues where researchers find landlords lending to tenants, green sales,⁵⁸ wide variation in interest rates and little evidence of commensurately high fixed lending costs. It really requires figures for costs and revenues to go much further in this discussion.⁵⁹ Revenues are estimable through looking at interest rates, but moneylender operating costs are virtually impossible to investigate.

Informal lender interest rates vary from very low up to multiples of 100. Wai⁶⁰ separates his 36 country study into usual and occasional rates. Usual rates had a median of 40% per annum and occasional rates (10 - 20% of loans) clustered around 100%. A World Bank survey of 1974 found the median nominal rate for a cross-section of countries to be 50%.

The variation across countries is, however, extreme and medians and means are very flexible with respect to the countries included in the computation. As one commentator has said, "it would hardly be worthwhile pursuing such an inquiry if it wasn't so centrally important".⁶² Compared to interest rates in the order of the above, how do costs compare?

The only avenue open here is to look at the operating costs of institutional lenders which is well documented. Costs in the order of 5 to 25% of annual loan disbursements seem to be the case here.⁶³ There is a prima facie case for assuming that informal lenders have lower operating costs than institutional lenders. They tend not to use special buildings and staff and they cover much smaller geographical areas. Any economies of scale reaped by institutions would have to be very significant to match the cost advantage of non-institutional lenders. What about the cost of capital? To the extent that moneylenders can raise capital for on-lending from accumulated savings, relatives and informal associates, they have a cost advantage here, too. If they have to borrow from commercial sources for on-lending, they are at a disadvantage compared to the institutions who generally receive funds at below the market price. It seems unlikely that administrative costs and capital costs for non-institutional lenders should be much greater than for institutions; if anything they should be less. Considering administrative costs alone, a considerable level of monopolistic profit is implied.

But what of the size of the legitimate risk premium hidden in the non-institutional interest rates? This is really where the opposition to the extortionate money-lender theme is voiced. Bottomly, for example, refers to the hazards of weather and prices and the volatile nature of the money lender's income, linked as it is with the income of small farmers. He attempts to construct cost curves for money lenders, showing sharply rising risk premiums and concludes that monopoly profit plays little part in the level of informal interest rates.⁶⁴

On the other hand, Wai⁶⁵ found that default rates cannot explain high interest rates and, therefore, suggests that it is the inelastic demand of borrowers and a lack of alternative sources which allow usurious rates to be charged. Nisbet, arguing on the same side as Wai, found in rural Chile and Colombia, little price competition and many instances of high interest rates unexplained by observable costs.⁶⁶ Additionally, the familiarity of the informal lender with his clients, his ability to select good clients and the greater effectiveness of pressure to repay from a local lender, should all go towards making default relatively less of a problem for the informal lender.

Donald suggests that excess profits could be made at income levels which would appear low to an outside observer.⁶⁷ The appropriate indicator of monopoly profit, he suggests, is an above-average income level for lenders.

A priori reasoning and the sketchy evidence that does exist

seem to support the monopolistic money-lender argument. The case is far from certain, however, and particularly if default and the associated risk can be proved to be high in any situation, the argument may go the other way.

Where does this leave our discussion about the case for intervention in rural financial markets? It certainly goes to show that the case for rural credit programmes is far from proven on the grounds of freeing small farmers from the grip of evil money-lenders. If default costs along with administrative costs are low for informal lenders, then there is at least a need for increased competition in the credit market in order to move interest rates nearer to equality with lending costs. The idea that money-lenders are evil and should be squeezed out no longer holds much sway, but increased competition will increase the supply of credit and tend to reduce any monopoly profit that is being made. Adams suggests that this has not in fact taken place in general since the bias in rural credit programmes towards larger farmers has meant little competition between institutional and non-institutional lenders.⁶⁸

Where monopoly profits are being made, there is a case for the building of new financial intermediaries to reduce them and to bring about a socially more optimal use of scarce resources.

Where monopoly profits are not being made, can a case for intervention still be made on the basis of the observed informal interest rate structure? Consider the possibility

that the wide variation in interest rates is a result of locally low elasticities of supply of capital, coupled with wide variations in the levels of demand at different locations. Low elasticities of supply may be due to an immobility of funds, a lack of desire or ability to expand business on the part of small lenders, or difficulties in new lenders entering the market.

The low mobility of both funds and borrowers may, therefore, account in part for the great variation in interest rates, and whether profit margins of money-lenders are excess or normal, this could represent a further argument for financial institution building in RFM's.

There are, therefore, at least three possibly important factors contributing to the high and varied interest rates of non-institutional rural lenders: (a) monopolistic practices; (b) high risk premiums, and (c) local variations in demand coupled with supply bottlenecks. The importance of each factor in any one situation will vary, and it is probably not useful to make a generalisation. Only if high interest rates could be explained entirely by (b), would the interest rate argument not constitute a case for intervention in RFMs. Since this is unlikely, the concern over high and varied informal lending rates would seem to be a legitimate consideration in the case for rural credit programmes.

F Summary

In this chapter, the basic case for rural credit programmes in LDCs has been presented. The traditional assumptions about RFMs which have led to the establishment of such programmes have been outlined along with the formal economic rationale. Most fundamental perhaps of all assumptions is the model of the farm-level impact of credit, for this expresses what the programmes are intended to achieve in terms of agricultural development. The model and its qualifications, provide the conceptual framework for the empirical analysis of credit demand among North-Eastern Thai farmers in Chapters 6 and 7. The two issues of the supposed high demand for and price of credit commented on in this chapter, are also taken up later in the thesis. Here, they were introduced as two of the most important assumptions in the traditional consensus of opinion about rural financial markets in LDCs, with some supporting discussion in Section E. In Chapter 3 the first of these issues, demand for credit, is discussed in the context of the general performance of rural credit programmes in meeting rural credit needs in LDCs. This discussion provides an introduction to the problem of unequal lending. In Chapter 5, both issues are examined specifically in the case of Thai rural financial markets. Then in Chapter 7, in the context of explaining the pattern of unequal lending in rural credit programmes, credit demand is measured for a sample of small farmers and the impact of credit shortage and high interest rates on farm income estimated.

Having presented the background to rural credit programmes in

Chapter 1 and the underlying assumptions (the 'case') in this chapter, the next chapter goes on to examine selected aspects of their performance in practice, focusing on the central theme of the thesis: the problem of unequal lending.

Chapter 2 : Notes and References

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18. The Bank of Thailand, for example, requires 60% of the locally generated funds of rural branches of commercial banks to be disbursed within the same locality
19. Adams, D.W., 1978b, *op.cit.*
20. Bank for Agriculture and Agricultural Cooperatives, **Annual Report**, 1982, BAAC, Bangkok (p.42). Like many other rural lenders, the major obstacle to mobilizing rural savings as a source of operating funds is the low interest rate which the BAAC is allowed to offer investors
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26. The area XYZ equals the subsidy when q_4 and x_4 are compared with the quantities of input and output reached by a non-borrowing farmer (q_3, x_3). If wealthier farmers have less of a need to borrow, this is probably the best comparison to make. If a farmer normally borrows, however, and at a real rate of interest above zero, the amount of subsidy will be larger than the area XYZ
27. 'Fungibility' can be defined as the property of interchangeability. Money is fungible because it can serve for, or be replaced by (an indefinite number of) other items

28. Examples of this practice are cited by Scobie, G.M., and Franklin, D.L., 1977, *The Impact of Supervised Credit Programmes on Technological Change in Developing Agriculture*, in *Australian Journal of Agricultural Economics*, Vol.21, No.1 (pp.1-12)
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40. Innovation is used here to mean any new farming practice, whether a new technology or a shift along an existing production function. This includes the purchase of additional inputs facilitated by credit, as assumed in the models presented in Figures 2.1 and 2.2.
41. This problem is discussed from the point of view of credit in Baker, C., 1973, *op.cit.*
42. New technology grains have been reported unpopular because of taste and colour
43. A good example of a programme which recognises the importance of extension to the effectiveness of credit is an IFAD/IBRD funded experimental lending programme in Thailand, initiated by the BAAC in collaboration with the Department of Agricultural Extension. See project proposals and reports, BAAC, Bangkok
44. Adams, D.W., and Graham, D.H., 1979, *op.cit.*
45. World Bank, 1974, *Bank Policy on Agricultural Credit*, IBRD, Washington
46. Evidence for this assertion is discussed in Chapter 3 of this thesis, in a general context and Chapter 5 in the specific case of Thailand
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53. See, for example, Rao, P.B., 1973, *The Economics of Agricultural Credit-Use in Southern Brazil*, Andhra U.P., Andhra Pradesh, India; George, K.M., 1977, *Nature and Pattern of Demand for Agriculture Credit*, in *Financing Agriculture*, Vol.9, No.2 (pp.3-27); Nepal Rastra Bank, 1972, *Agricultural Credit Survey Nepal: Summary and Recommendations*, NRB, Kathmandu, Nepal

54. Bhadburi, A., 1973, Agricultural Bankwardness Under Semi-Feudalism, in *Economic Journal*, Vol.83, No.329 (pp.120-137)
55. Adams, D.W., 1978a, *op.cit.*; Adams, D.W., 1980, *op.cit.*, Singh, K., 1968, Structural Analysis of Interest Rates on Consumption Loans in an Indian Village, in *Asian Economic Review*, Vol.10, No.4 (pp.471-475)
56. Many studies measuring small farmers' demand for credit have found it to be inelastic. See, for example, Nasseem, M., 1975, Credit Availability and the Growth of Small Farms in the Pakistan Punjab, in *Food Research Institute Studies*, Vol.14 (pp.65-80)
57. Bhadburi, A., 1973, *op.cit.*
58. 'Green Sales' refers to sale of a crop to a purchaser before harvesting
59. The discussion is taken further in Chapter 5, drawing on estimated figures from Thai case studies
60. Wai, U.T., 1957, *op.cit.*
61. World Bank, 1974, *Bank Policy on Agricultural Credit*, World Bank, Washington, D.C.
62. Donald, G., 1976, *op.cit.* (p.93)
63. Donald suggests a range of this order in his review of the 20 volume AID Spring Review on Small Farmer Credit: Donald, G., 1976, *op.cit.* (Chapter 9)
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65. Wai, U.T., 1957, *op.cit.*
66. Nisbet, C.T., 1967, *op.cit.*
67. Donald, G., 1976, *op.cit.* (Chapter 8)
68. Adams, D.W., 1980, *op.cit.*, for example

CHAPTER 3 :

RURAL CREDIT PROGRAMMES : THE PRACTICAL EXPERIENCE AND THE ISSUE OF UNEQUAL LENDING

The chapter examines selected aspects of the performance of credit programmes, progressing from the general to the particular. After summarising the major types of policies which have tended to constitute rural credit programmes, it makes a general statement about overall programme performance. The focus then narrows to the specific performance issue of success in meeting the demand for rural credit. The discussion is couched in terms of a debate about whether or not credit is a constraint on growth in rural areas. An attempt is made to clarify the debate by introducing the idea of unequal lending in credit programmes and the rest of the chapter is concerned with this more specific performance issue. It is discussed in Section C in the context of other regressive effects of rural credit programmes on income and asset distribution. Section D then goes on to present the various hypotheses found in the literature which give an explanation for the problem of unequal lending. The chapter concludes by focusing on 3 of these hypotheses for a more detailed discussion in preparation for the empirical analysis chapters.

A Programmes and Policy Objectives and Instruments

Chapter 2 spelt out the major assumptions which have underlain most rural credit programmes. Now we turn to a consideration of the array of policies in which these assumptions are embodied. We can distinguish at least eight types of policy objectives and tools: the building of new financial institutions; increasing the supply of credit to rural areas; nationalisation of part or all

of the financial system; regulation of the size of agricultural loans made by institutions; regulation of the size of commercial bank lending to agriculture using loan quotas; loan guarantee and crop insurance schemes; preferential rediscounting; and differential interest rates. Objectives and tools are listed together because it is sometimes hard to distinguish one from the other. For example, the first three policies listed above can be seen as objectives; there are political reasons for building new financial institutions, for increasing the supply of rural credit and for nationalisation. Each is a policy objective in its own right with its own underlying rationale. The first and third, however, can also be seen as policy instruments for achieving the second. The other five are more obviously policy instruments although some may be construed as objectives too (such as loan guarantee and crop insurance schemes). Because of the ambiguity in such a categorisation, they are simply listed together as constituent policies of rural credit programmes.

Given the assumptions outlined in Chapter 1, it is not difficult to see why the creation of **new institutions**¹ has been given major emphasis. These provide the context for many of the other policy tools such as artificially low interest rates. New institutions are created for at least two reasons: out of general frustration with the perceived poor performance of existing RFMs and out of a desire by governments to reach target groups. They will be more necessary in some places than others, and for different reasons. In Africa in general, for example, they are clearly of importance since the financial services in rural areas are poorly developed.² In other cases, Asia in general, for example, it is

more the apparent inefficiency and inequality inbuilt into existing markets which has led to the building of new institutions. However, many new institutions are staffed by personnel from existing institutions and are often constrained by the same government regulations. They are highly visible political weapons and their impact is often just as high on that score as any improvements they might effect in the RFM.

Very often the new institutions are established with the aid of foreign agencies. Once established they rely on a mix of foreign loans, discounted central bank loans, public funds and deposits from the public and other institutions. Many have experienced problems with defaulters as their programmes get under way and when this has coincided with pressure to rely less on subsidised funds (such as through an increase in the re-discount rate from central banks), then institutions have found themselves in a precarious position. The most frequent response to this predicament is to reorganize the institution's loan portfolio towards larger clients who are thought of as representing a lower risk and as cheaper to lend to.

The policy objective of increasing the supply of credit³ to rural areas involves the creation of new institutions, but it is also much broader than that. The general assumption is that additional credit channeled into the rural areas through institutions (whether new or existing) will filter down to all strata of the rural population. Quota systems which attempt to direct the lending of commercial banks have been widely used to effect this general increase in supply of rural credit. Though

there has undoubtedly been success in expanding the supply of rural credit,⁴ there has often been little evidence of this supply penetrating very deeply the strata of rural society. Too frequently, it seems to have saturated only the top layer. Tommy and Adams⁵, for example, found in Brazil, that out of a sample of 388 farmers 11 of the largest received two thirds of the increased formal credit supply over a three year period. There was no evidence of filtering down, therefore, of the 300% increase in formal loans to agriculture that occurred in Brazil over the study period.

Nationalisation of part or all of the financial system has occurred in a number of countries (India, for example).⁶ The greater control was thought to facilitate the pursuit of credit to rural area goals. Some evidence exists, however, to indicate that the same problems exist in public as in private financial institutions. Loans are biased towards larger farmers basically because whether their employers are public or private, managers are judged, and themselves judge success, on normal commercial criteria.⁷

Loan-size regulations are a widely enforced policy tool designed to direct more finance to small farmers.⁸ Maximum loan sizes are specified to encourage lenders to disburse their funds in smaller packages than they might do otherwise. Two problems tend to render such regulations ineffective. First, ceilings may be so high that they effectively ration credit only to the very large clients. Second, the higher cost of disbursing funds in small loans has encouraged some lenders to comply with such regulations by breaking down loans to single borrowers into a number of

smaller loans.

The loan quotas referred to above have been applied in varying strength. Commercial banks in Thailand, for example, currently have to allocate 11% of their end-of-year deposits to agriculture, a percentage which has increased steadily over the last few years.⁹ Two sorts of problems have reduced the effectiveness of this sort of measure. First, commercial banks have been able to comply with the regulations by lending to agro-industry.¹⁰ Second, commercial banks may experience difficulty in meeting the quota successfully because of their lack of experience and expertise in the field of agriculture. This problem has been overcome in Thailand by allowing commercial banks to complete their quotas by making deposits with the governments' agricultural lending bank (BAAC).

Loan guarantees and crop insurance schemes¹¹ have been used to transfer the risk from the lending agency to a third party. This is aimed at reducing the risk involved in lending for what is often highly unpredictable production. These schemes protect both the lender and borrower. The main problems which have been encountered with crop insurance and loan guarantees is the unpredictability of crop failure and the difficulty in assessing the claims of a large number of people in a short space of time. There is a trade-off between validating the legitimacy of claims and quickly providing relief in disaster areas. Either way, the schemes are expensive and fraught with management difficulties.

Preferential rediscounting is a common mechanism used for financing credit programmes.¹² The central bank of a country

will offer to rediscount loans to selected groups or for selected purposes at preferential rediscount rates. The difference between the rates paid and the rates charged by lending institutions is often an effective incentive to lend to the designated groups or purposes. There are two sorts of problems here, however. First, funds to lender institutions are fungible so that the extra liquidity generated by the rediscount spreads need not end up as extra loans to the target groups. Second, as with other sources of cheap funds, the rediscounting facility discourages lenders from mobilising rural deposits as a source of operating funds.

Differential interest rates are perhaps the most characteristic feature of rural credit programmes. Low interest rates are attached to loans to agriculture by public institutional lenders and sometimes (by regulation) by private lenders. Within the agricultural sector, rates vary. The BAAC in Thailand, for example, charges an annual rate of between 7 and 14% depending on the purpose of the loan. Generally, rural credit programmes offer credit at several percentage points below the equivalent formal market rate and well below informal commercial lender rates. The basic problems associated with such interest rate schemes include the following: regulated low interest rates discourage commercial banks from lending to agriculture; lower interest rates attached to loans to small farmers encourage lenders to make loans to larger clients; and low interest rates chargeable on loans usually mean low rates payable on deposits, a move which discourages the expansion of deposits from the public.

B The Performance of Rural Credit Programmes in Meeting the Demand for Rural Credit

1. Performance : a general statement

Having summarised the major characteristics of rural credit programmes in terms of policy content and commented on some of their weaknesses, we now look in greater detail at the success with which such policies have operated. Much has been written about this issue, particularly from the point of view of the efficiency of this sort of intervention. Adams and Graham¹³ contend that the experience in this area over the last two decades has led to the emergence of a new consensus of opinion about rural financial markets. Reference has already been made to this in Chapter 2 when discussing the popular assumptions behind rural credit programmes. Adams and Graham's paper summarise these views. They include the view that real and nominal interest rates are too low in institutional programmes, leading to distortions in rural financial markets; that non-institutional commercial lenders should be seen as a valuable part of RFMs and encouraged to operate efficiently and equitably rather than squeezed out; that rural savings should form the basis of rural credit programmes, not public or external subsidy; that packaging of loans and tying of loans to specific production inputs ignores the most useful aspect of money (its fungibility) and encourages misuse; and that low interest rates encourage misallocation of funds to large farmers who have less need for subsidised credit.

The underlying theme in these assertions is that rural

credit programmes are run inefficiently (they are propped-up by public regulation and subsidy) and perform their intended lending function inefficiently (cheap credit does not get to small farmers), and that their long-term viability as commercial operations are greatly in question.

The issue we want to focus on in this chapter, however, is narrower than Adams and Graham's critique. It is concerned not so much with the overall performance of rural financial markets, but with the success of credit programmes in satisfying the demand for agricultural credit.

There is an apparent degree of confusion surrounding this issue. On the one hand, it is frequently reported that existing credit supply is severely constrained; either insufficient in volume or over-priced or both. On the other hand, it is reported that credit is not a constraint and that rural credit needs are satisfactorily being met. The conflicting evidence is examined below and then a suggestion made which attempts to make sense of the apparent confusion.

2. Performance : successful coverage and other evidence that credit is not a constraint on growth

Government credit programmes and case studies from many countries have frequently given glowing reports of the success of policies designed to provide the rural population with credit. Rapid expansion of the clientel of lending institutions are reported and conclusions drawn about achieved objectives. A typical example is Thailand's BAAC which reported in 1982 that its services were made available

to 2,117,155 farm families or nearly 50% of the total number of farm families in Thailand.¹⁴ This was a 2.7% increase in coverage over the previous year which indicates that the expansion in number of clients is keeping well ahead of the expansion in farming population.¹⁵ Similarly, it was reported that institutions in India, as long ago as the year 1970/71 seemed likely to meet about 50% of the nation's credit needs for annual production.¹⁶ In Latin America, an even more encouraging picture has been given, with an estimated 70 to 90% of rural credit needs in 1971 being provided by institutional lenders. The percentage for Taiwan in the same year was of the same order.¹⁷

The ratio of agricultural credit to agricultural GDP (agricultural credit ratio) is another indicator of the success of rural credit programmes. The agricultural credit ratio for Jamaica rose from 32.3% to 53.2% between 1970 and 1978.¹⁸ D'Mellow reporting on efforts to lend to India's small farmers comments "Institutional finance for agriculture has succeeded, to a significant degree, in replacing exploitative non-institutional finance...the fact of institutional agencies being able to satisfy a growing proportion of the credit needs of cultivators is quite gratifying".¹⁹

Reporting on the rural credit situation of the large number of countries included in the 1974 Spring Review, a USAID publication stated that scarcity of credit may not at present be an important constraint on production using traditional techniques.²⁰ Similarly addressing the

relationship between credit and agricultural output, a Latin American study of 18 countries found that at a national level, credit ratios were uncorrelated with farm growth, even though ratios were high and rising fast, indicating that credit is not a constraint on growth.²¹ A weak relationship between credit availability and farm growth is apparently further evidenced by the widespread growth of new techniques (seed and fertilizer) in the Pakistani Punjab which was quite independent of any significant credit expansion or reform.²²

The reported successful coverage by rural credit programmes suggests that credit demand in rural areas is being serviced to an increasingly satisfactory degree. Studies which report a weak relationship between credit and farm growth suggest that credit is not an important constraint on production, which in turn implies less demand for additional production credit than could be assumed if credit were an important constraint. A third voice suggesting that demand may not be as high as often thought comes from those who have tried to explain high non-institutional interest rates in terms of factors other than excess demand. Rather than indicating monopoly practices in the face of excess demand, high interest rates have been related to high administrative costs, high opportunity costs of lending, and risk.²³ It has also been observed that as well as the very high rates, it is common to find very low rates in the informal credit market²⁴ which are not in themselves compatible with a high level of demand.

3. **Performance: farm-level evidence that credit is a constraint on growth**

Set against the reported successes of credit programmes in many countries and the suggestions from some analysts that credit is not an important constraint to agricultural development, there is much convincing evidence that demand for credit is high and that for many farmers its scarcity is a constraint.

Lipton²⁵ usefully breaks down the demand for additional credit into three constituent parts. His conceptualisation can be represented by the following expression :

$$C_a = C_r + C_{trad} + C_{innov} \quad (3.1)$$

A farmer requires additional credit (C_a), firstly to replace existing credit borrowed on unsatisfactory terms (C_r), secondly to expand traditional production (C_{trad}), and thirdly to allow him to innovate (C_{innov}). Lipton does not attempt to estimate replacement credit, only making the comment that although the causes of high interest rates are disputed, the hardships caused by them are not. C_{trad} , he suggests, can be estimated by observing the difference in credit per unit area between large and small farmers using traditional technology.²⁶ Larger farmers, with greater command of capital (including credit), are more likely to employ credit to an optimal level and, therefore, give some indication of the credit intensity that smaller farmers might reach if their access to credit were greater.²⁷ Another indicator for C_{trad} is the difference in interest

rates paid by small and large farmers in areas of traditional technology. This may be a valid indicator to the extent that the difference is not explained by risk or disbursement costs. There are plenty of farm-level studies which have documented a significant difference in both credit per unit area and interest rates between large and small farmers.²⁸

To illustrate the importance of C_{innov} , Lipton simply presents some farm budget figures from an Indian case study in which non-traditional production requires a greater cash input than traditional production. This need not be a general principle, but is likely to be the case where the adoption of innovation involves a switch to purchased inputs; where an innovation is heavily dependent on a whole package of inputs; or where an innovation is particularly intensive with respect to one input.²⁹ Credit as a constraint on innovation has emerged from many studies. In a study of Philippine farmers, for example, there was only a 27% increase in the value of loans for new seed investments, while cost increases (as well as estimated production increases) were significantly higher than 27%.³⁰ This implies a positive value for C_{innov} and a finance constraint on innovation.

Daines, in a study of Guatemalan small farmers, found that there was an apparent strong relationship between credit and the expansion in crop area. The implication is that credit allows fuller exploitation of available local resources.³¹

Schluter, using a linear input-demand model, evaluated the determinants of the adoption of various modern technologies for a sample of small farms in India.³² Significant independent variables explaining variation in the use of modern rice varieties were credit, assets and two measures of production area. Credit was measured as a dummy variable relating to the maximum borrowing limit faced by a farmer given his scores on certain profile variables. Credit was also found to explain a significant amount of variance in the use of fertilizer. These results, and indeed the hypotheses behind the models, are consistent with the neo-classical model of credit in the farm-firm presented in Chapter 2; access to credit seems to allow the purchase of additional (in this case, new technology) inputs.

A study of Philippine rice farms, using an alternative linear model, showed that there was a relationship between credit and the efficiency of resource allocation.³³ This, again, is consistent with the basic model of Chapter 2, indicating that credit allows the purchase of inputs necessary to optimise the productivity of available resources. An efficiency-gap function was specified in this study which related a farmer's allocative efficiency to a number of explanatory variables. Allocative efficiency is measured by the observed difference between a farmer's marginal value product (MVP) for an input and the price of that input; efficiency of output is optimal when MVP equals price. The access/no access to credit dummy variable explained a significant amount of variation in allocative

efficiency among the sampled farmers; other things being equal, farmers with credit are more likely to equate MVPs with input prices. This suggests that there was a positive demand for credit among non-borrowers.

David and Meyer³⁴ refer to a selection of studies which have used mathematical programming techniques to show the importance of credit in the farm-level economy. In a study of farms in Rajasthan, Agarwal and Kumwat³⁵ showed that even with existing technology, optimal production required the employment of credit. More credit was needed when new technology was introduced into the model.

? Looking at participants in a supervised credit programme in Columbia, Whitaker et.al.³⁶ found that a lack of working capital constrained farm output. Loans made available to farmers through the programme led to an expansion in output and profits.

Another South American study³⁷ found that a sample of Columbian farmers could raise their net farm income by borrowing greater amounts to finance new technology.

Farmers in the Gezira Scheme in the Sudan were found to require credit in order to reach optimum income levels with existing technology.³⁸

A study of small farmers on the Pakistan Punjab³⁹ found that resource utilisation was constrained by the limited amount of credit available. Farmers would bring more owned resources into production and adopt higher technologies if

they could borrow more.

The body of empirical farm-level studies from which these examples are drawn, present a generally consistent picture. Available amounts of credit frequently constrain net farm income, profits and production. This is true whether production possibilities include existing technology only or existing plus new technology. Such studies suggest that there should be a strong demand for additional credit (both C_{trad} and C_{innov} in Lipton's terms) among the sort of farmers represented in the studies.

The results of empirical studies like these may seem to conflict with the impression given by the reported successes of rural credit programmes and with the comments made by those who have tried to show that farm growth and innovation are not constrained by credit to any significant degree. The apparent problem can probably be satisfactorily resolved by considering the level of analysis of the two types of studies. Studies such as the 20-volume AID Spring Review which suggested that credit may not be a constraint on growth under existing technologies have largely been aggregate studies looking at aggregate measures of production credit disbursement, credit ratios and credit programme coverage for example. The farm-level studies, on the other hand, have tended to be disaggregate studies, frequently focusing on small farmers or representative samples in which small farmers are predominant. The use of credit demand and supply indicators at an aggregate level

disguises very serious differences between groups of farmers, namely, too much cheap credit for larger farmers and too little credit at expensive rates for small farmers. The successfully wide reported coverage of a national rural credit programme may hide the fact that while a very high proportion of the country's larger farmers are serviced, very few small farmers have received any benefits. The lack of relationship between credit and farm growth found, for example, in the South American study reported above,⁴⁰ could be partly due to most of the increased credit supply going to larger farmers. If larger farmers tend to substitute credit for savings, as has already been noted, it is understandable that a growth in the volume of agricultural credit need not be associated with a commensurate growth in output. If disaggregate figures were available, we would expect that an expansion of the volume of credit to smaller farmers would be more related to growth in output since smaller farmers are more likely to be capital-short and, therefore, less likely to use credit as substitute finance.

The farm-level studies which conclude that credit shortage is a constraint on the income and growth of smaller farms are, therefore, quite consistent with aggregate studies which report the success of rural credit programmes. They may well also be consistent with aggregate studies reporting a lack of correlation between credit and output.

This selective overview of the performance of credit programmes in providing for the credit needs of rural populations, has served to highlight a fundamental problem

with subsidised rural credit programmes: their tendency towards a large-farmer bias. We now turn to this issue in greater detail.

C The Regressive Effect of Rural Credit Programmes on Income and Asset Distribution

It is a common observation of rural credit programmes world-wide that subsidised credit tends to end up in the hands of the wealthier farmers. Small farmers tend to be excluded from the portfolios of public as well as private institutional lenders.⁴¹ Even if this was not the case at the outset of a credit programme's life, loan portfolios have increasingly taken on the characteristics of commercial financial institutions. There are a number of possible reasons for this, including the low interest rates chargeable on loans and high administrative costs. Section D of this chapter takes up this discussion.

The concentration of loans from rural credit programmes into the hands of larger farmers has a number of consequences.

First, the fortunate borrowers often realise a real income transfer since high rates of inflation coupled with artificially low institutional interest rates often means that real interest rates are zero or negative. This has especially been the case in South American countries.

Second, the borrowers, who already have a greater command over resources find themselves with an even greater share of economic power. To the extent that funds are fungible within the farm-household economy, their increased liquidity raises their general

welfare not just their productive capacity.

Third, if borrowers successfully use loans to increase production, an increased income-earning capacity is added to any income-transfer or expanded consumption benefits they might receive.

Fourth, even if real rates of interest are not negative, low interest rates which do not cover lending costs are an effective welfare payment. If the borrowers are primarily larger farmers, it is those who need it least that receive any subsidy implied by the low rates.

Fifth, it is possible that borrowers with greater capital availability may bid up the price of inputs in local factor markets. Less resourceful non-borrowers are then faced with an even more constrained command over resources. Where the non-borrowers are the smaller farmers, they face a double disadvantage.

In addition to the institutional lender's propensity to lend to larger farmers, there are several other features of rural credit programmes which should be mentioned, which also tend to affect adversely, income and asset ownership distribution. Low interest rate ceilings, for example, lead to low rates given on saving deposits (where this facility is available). The inequity of this is as bad as its inefficiency since small farmers are denied decent rates of return on their small savings and are, therefore, compelled either to invest at low rates or to invest elsewhere, which often means in unproductive assets. Where inflation is

high, real rates on deposits may even be negative leading to an effective income transfer away from the rural poor.

Second, very few credit programmes make significant amounts of medium and long term loans. Loans for seasonal production are important, but where factor markets are seriously distorted, especially the land market, there seems little long term hope of reducing inequalities. Griffin⁴² has shown how distortion in one market is all that is needed to produce distortions in all others. Harlem Davis⁴³ laments the lack of medium and long term credit in El Salvador for financing the more deeply needed structural change in that country. It would not be particularly progressive, however, to expand long-term loans to a clientele comprising mostly the wealthier farmers. This would result in a growing disparity in asset ownership and income producing capacity which would be accelerated to the extent that loans are used by larger farmers to purchase land from small holders.

Third, it has been suggested that the total cost of borrowing from an institution, expressed as a percentage of loan, is higher for smaller farmers.⁴⁴ The often cumbersome bureaucratic procedures involved in acquiring an institutional loan are thought to result in significant costs to the borrower per transaction. The unit cost of transaction (as a % of loan value) will rise as the loan amount falls so that the effective rate of borrowing cost may be a lot higher for smaller borrowers than large borrowers even if they face the same nominal rate of interest.

Fourth, as a result of the exclusion of a significant proportion of rural populations from institutional credit sources and as a

result of the institutions' emphasis on production loans, there has apparently been little competition between institutional and non-institutional lenders. While larger farmers find a cheaper and increasingly abundant supply of formal credit from private and public sources, small farmers still have to borrow from non-institutional lenders on generally less favourable terms. Possibly there is some filtering down of finance from clients of institutions to smaller farmers borrowing from those clients. This may expand the supply of non-institutional credit and may help deflate interest rates. To the extent that monopoly profit is involved, it is not an equitable arrangement to provide large farmers with subsidised funds indirectly for on-lending to poorer farmers at higher rates. If institutional clients on-lend at rates merely designed to cover legitimate costs and risk, however, then such filtering down could be construed as an efficient means of financing smaller farmers.

D Explanations for Patterns of Unequal Lending

1. Some important explanatory hypotheses

There is little dispute over the general picture of large-farmer bias in rural credit programmes. The cause of such a pattern is, however, subject to discussion. There are at least six types of explanation which emerge from the literature, three of which emphasise supply-side behaviour, the other three emphasising demand-side behaviour.⁴⁵ These are summarised in the following paragraphs.

(a) **Supply-side**

First, it is suggested that small farmers are excluded from institutional loan portfolios largely because of the high unit-lending costs of disbursing a given amount of funds in small packages.⁴⁶

Second, with a similar emphasis on the commercial behaviour of lending institutions, some say that the bias against small farmers is due to lenders' normal aversion to risk; small farmers are considered too risky to lend to at the imposed low rates of interest.⁴⁷

Third, there are those, notably commentators with a structuralist perspective, who emphasise the role of local elites and the existing power structure in barring access of small farmers to institutional credit facilities. This need not necessarily go as far as a neo-Marxist 'conspiracy' argument. Lipton,⁴⁸ for example, opts for an attempted convergence of neo-Marxist and neo-classical approaches, synthesising theories of class interests and individual optimization. It is essentially an approach which treats the village as the appropriate unit of study, rather than the individual firm or decision maker. To the extent that individual firm decision-making is considered in such a structural model it is not strictly a supply-side approach; it is included here, however, because of the strong emphasis Lipton places, like the neo-Marxists, on the restriction of the supply

of credit to small farmers. The restriction of supply is said to occur through the exercise of political, economic and social power by village elite in the complex matrix of relationships within a village.

(b) Demand-side

First, small farmers have been thought to have a low demand for additional credit because of a lack of suitable investment opportunities (or lack of knowledge of investment opportunities) and/or a sufficiency of existing finance.

Small-farmers do not borrow from institutions because they do not need to. They may have a sufficient supply of finance already, from savings and non-institutional lenders. This is consistent with those who maintain that high informal interest rates are not associated with monopoly practices, but rather reflect an equilibrium price of lending to a risky market.

On the other hand, they may not need institutional credit because they are unprogressive, not wishing to expand production, or because they are unaware of innovations which would enable them to productively absorb more capital. In poorly endowed regions such as Thailand's North-East, for example (the location of the case study in the later chapters), it could reasonably be argued that there is little need for additional credit because of the absence of suitable investment opportunities. There are so few crops that can be

grown on the poor soils of this drought-prone region, that it would seem likely that many farmers would soon reach the capital absorption ceiling above which production cannot expand either extensively or intensively.⁴⁹

Second, it has been suggested that although small farmers may need additional credit, they do not wish to register as clients of credit institutions for fear of losing their regular supply of consumption credit.⁵⁰ A rapid and reliable source of consumption credit is an important 'asset' to a small farm household. It is essential to their management of risk and enables them to cope with crises such as crop failure, medical and ceremonial expenses. If a farmer risks losing this important credit supply, his 'optimal' response may well be to forego the opportunity of greater access to production credit for the sake of maintaining his capacity to absorb consumption crises. This would seem the more likely, the more the institution's credit is tied to production and the more uncertainty there is in the agro-economic environment.

Third, just as the high unit cost of lending may discourage institutions from lending to small farmers, it may be that a high unit cost of borrowing discourages small farmers from becoming clients of institutions.⁵¹ Interest can be considered only part of the total cost of borrowing. In addition, there is

the opportunity cost of labour diverted from the farm at busy periods, costs of travelling to the bank and other transaction costs. If such transaction costs are unrelated to loan size, they will form a greater percentage of the loan as the size of the loan gets smaller. The total cost of borrowing from an institution (expressed as a percentage of loan value) may be prohibitive for farmers wanting to borrow only small amounts. It may even cost them less to borrow from non-institutional commercial lenders.

It is likely that there is truth in each of these six types of explanations, the importance of any one, varying according to local circumstances. None excludes the possibility of any other. We now examine three of these explanations in greater detail. The two 'supply-side' explanations which emphasise the commercial behaviour of lending institutions are considered together (rural credit programmes tend to exclude small farmers because of the high risk and high administrative cost of lending to them). On the 'demand-side', the total borrowing cost explanation is selected for further discussion.

These particular explanations are singled out for the following reasons: they require more elaboration than the others; they are the three that are most directly amenable to policy manipulation, being directly influenced by policy variables (the others can be viewed as 'givens' in the operating environment, though

that is not to understate their possible importance); and they are three of the explanations which are tested in the empirical analysis of Chapters 6 to 8. The discussion of credit rationing in the following section (under the supply-side explanation of unequal lending), forms the theoretical basis for the empirical analysis of Chapter 8.

2 Unequal lending due to the commercial behaviour of lending institutions

(a) Credit rationing: the basic model

Formal financial institutions, whether private or public, tend to operate under normal commercial criteria of profit-maximisation and loss-avoidance subject to certain regulations and other constraints. Under these conditions, the continued lack of institutional borrowing among the rural poor can be seen as a logical outcome of the institution's supply allocation problem. To understand this, we have to say a little about the influence of interest rates on a lender's behaviour.

A profit-maximising lender will equate its marginal cost of lending to a particular type of borrower, with its marginal revenue (interest rate charged). Social optimality will be achieved where interest rates faced by borrowers are equated in turn with the marginal products of inputs purchased.

The market mechanism of rationing credit in a way that

is both privately and socially optimal is, therefore, to charge different rates of interest for different borrowers, where the rate on the borrower's side is equated with his marginal return to the investment financed, and on the lender's side is equated with the marginal cost of making the loan to any particular borrower. Each farmer will be given a loan of a certain size determined by the relationship between these various marginal costs and revenues. If a loan is made to a farmer which is larger than the optimum amount (defined in terms of the above), the marginal cost of lending to him will be greater than the value of the additional production induced, resulting in a socially sub-optimal allocation. This is, in fact, what happens when lenders are forced into a position of non-price credit rationing by the imposition of low interest rates. Low interest rates generally mean that lenders are faced with excess demand from all borrowers for loans at the going price. Non-price rationing becomes necessary and, as we shall see, it is the small borrowers who are rationed first. The borrowers who end up receiving loans for socially sub-optimal investments are those who are not rationed; the larger farmers. They receive extra credit at the lower price and achieve a private optimal production position. It is socially sub-optimal because the amount of credit given to the large farmer above the normal market equilibrium amount (under a market-determined interest

rate) could have produced higher returns if lent to a small farmer.

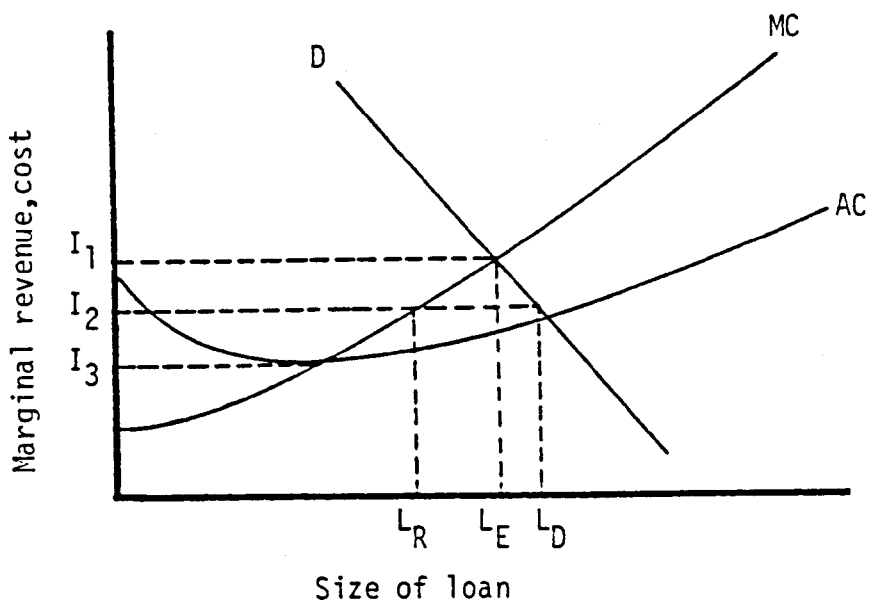
Non-price credit rationing can be generally defined as the practice of making smaller loans than those demanded at a given price. The individual farmer, when rationed, faces an excess demand for credit. The lender will generally ration a loan if the marginal cost of making it is greater than the interest rate charged on it. To fail to do this would be to let marginal costs exceed marginal revenue which leads to a decline in the lender's profit situation. When an artificially low interest rate is imposed on a lender, the lender is therefore forced to ration loans to equate marginal costs with the imposed marginal revenue level. These points are illustrated in Figure 3.1.

The equilibrium combination is at the point where the demand curve of a borrower intersects with the lender's MC curve. Here, the interest rate = I_1 and the equilibrium loan size L_E . With the imposition of an artificially low rate, say I_2 , an excess demand gap ($L_D - L_R$) appears; the difference between the size of loan the lender is willing to make at that rate and the size of loan demanded. In order to equate marginal cost and revenue, loan size is restricted by the lender to L_R . The borrower is rationed for the sake of the lender's allocative efficiency.

We can also see from Figure 3.1 the effect of an

imposed interest rate which is lower than the trough of the lender's average variable cost (AVC) schedule for a particular borrower. In this circumstance, marginal revenue (interest rate) is lower than AVC and rationing will take the form not of further reduction in loan size, but of exclusion from the lender's portfolio. I_3 is the interest rate below which this happens. We can call this 'rationing-out'.

Figure 3.1. The effect of an artificially low interest rate on lender behaviour for a particular borrower



Note : D = Demand schedule for a particular borrower

MC = Marginal cost to lender of lending to a particular borrower

AC = Average variable cost of lending to a particular borrower

I_1 to I_3 = Interest rates

The first two 'supply-side' explanations of unequal lending on Page 101 suggest that the cost of lending to small farmers is high because of a high risk premiums and transaction costs, so that I_3 (where MC and AVC curves intersect) lies above the interest rate which lenders are forced to charge. Small farmers are, therefore, excluded because the interest rate chargeable cannot cover the costs of lending to them whatever the size of the loan.

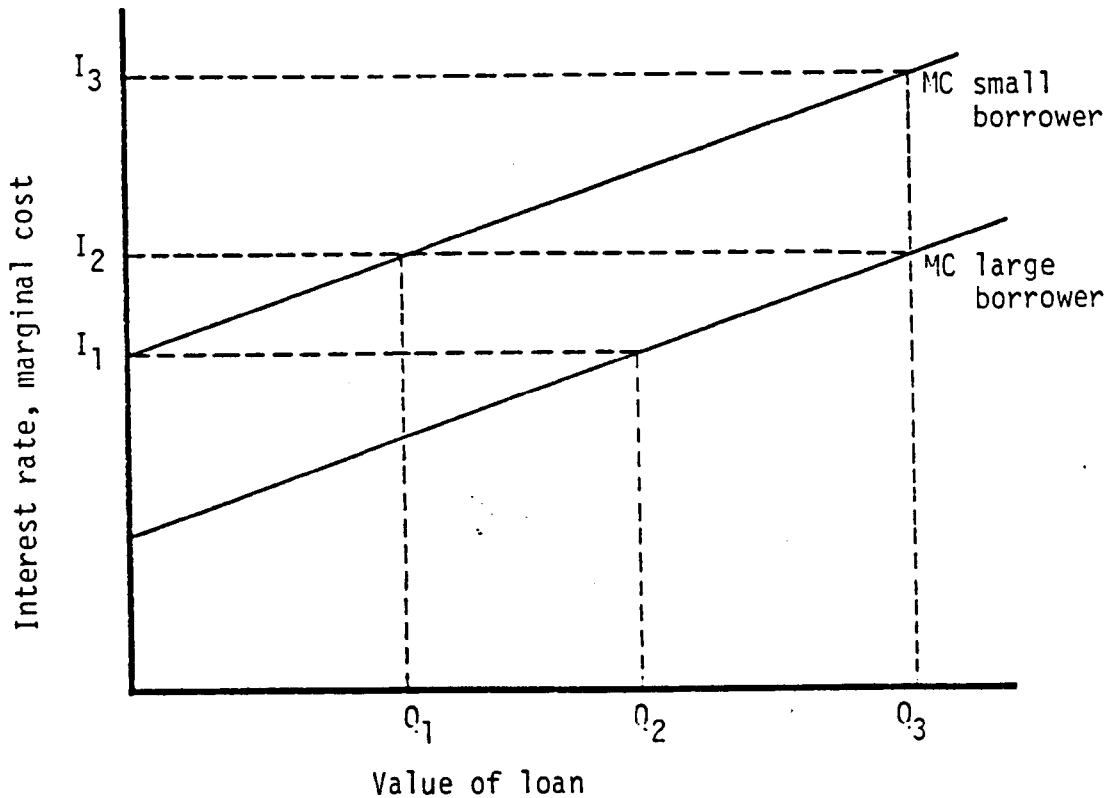
This is the basic case for rationing within the neo-classical framework. Drawing separate marginal cost curves for large and small borrowers, we can illustrate the differential effect of an imposed interest rate on the two groups (Figure 3.2). The basic assumption behind Figure 3.2 is that the unit costs of lending are higher for small than for large farmers due to higher risk and transaction costs rates.

At interest rate I_2 , a lender is able to make loans of value Q_3 to larger borrowers but only Q_1 to small borrowers. If the interest rate were allowed to be determined by the market, small borrowers would have access to more credit. They could borrow Q_3 , for example, if they were willing to pay I_3 for it. The imposed low rate, limits small farmers to lower amounts of credit than large farmers.

This differential effect also means that as the imposed interest rate falls, it is the small borrowers who are

eliminated from the lending programme first. At interest rate I_1 , for example, the lender can still make a loan of Q_2 to a large borrower, but lending to the small borrower becomes unprofitable as zero is reached on the horizontal axis. This point is equivalent to I_3 in Figure 3.1 and the small farmer in Figure 3.2 is rationed out of the lender's portfolio.

Figure 3.2 The differential effect of an artificially low interest rate on small and large borrowers due to differences in the marginal cost of lending



This provides an adequate explanation in terms of lending costs for (a) small borrowers facing a greater restriction on borrowing than large borrowers, and (b) small farmers being rationed out altogether.

A more extreme form of this explanation has been suggested which hypothesises an even greater differential effect when a low interest rate is imposed. Gonzalez-Vegas schematized the process as the "iron law of interest rate restrictions".⁵² Basically his thesis predicts that as interest rates become increasingly restrictive, small borrowers will borrow increasingly smaller amounts while large borrowers borrow increasingly larger amounts. Whereas in Figure 3.2, we assumed that both large and small borrowers experienced a drop in loan value (rationing) due to a fall in the interest rate. Gonzalez-Vegas suggests that it is only the small farmers that tend to be rationed. Recognising the higher unit costs of lending to small farmers, lenders, he suggests, make the decision to ration and ration out farmers at the lower end of their client spectrum. Faced with a restricted marginal revenue and excess demand for the cheap credit, lenders ration only their most costly customers, restricting loan size to small borrowers to try and equalise marginal costs and marginal revenue (bringing L_D down to L_R in Figure 3.1).

As a result, as the interest rate decreases, small borrowers move to the left along the lender's marginal cost curve (MC in Figure 3.1), whilst large borrowers, not being rationed, move to the right along their demand curve (D in Figure 3.1). This leads to smaller borrowers receiving both a relatively and absolutely

smaller share of institutional-lender funds. Furthermore, while larger borrowers move further to the right of their demand curves, absorbing greater amounts of cheap credit, many small farmers are pushed, so to speak, so far to the left along the lender's supply curve (rationing is so severe for smaller farmers) that they become ineligible for institutional loans and are rationed out.

The pattern of lending by the BAAC in the case study of North-East Thailand examined in Chapter 8 is consistent with Gonzalez-Vegas' hypothesis. Small farmers below a certain income level are not permitted to register as clients; they are rationed out. The larger farmers, however, when they have become clients can effectively borrow as much as they can prove they need; they are not rationed at all.⁵³ Chapter 7, furthermore, shows that clients (larger farmers) tend to move to the far right of their demand curves reaching their private optimum position associated with the artificially low interest rate.

The implication of these differential effects of rationing for the allocation of the subsidy implied by low interest rates is regressive. Large borrowers receive a large subsidy or income transfer. Small borrowers who are not rationed receive a smaller income transfer. Rationed, small borrowers, for whom marginal cost and revenue is equated through loan-size limits, receive no subsidy in the sense of the above (loans

below cost), though they do receive a subsidy to the extent that capital loaned to them has a higher opportunity cost in alternative uses. Non-borrowers, those either rationed out of institutional lender portfolios or otherwise excluded, receive no subsidy at all.

(b) **Types of Credit Rationing**

As we have seen, non-price rationing occurs when a greater value of credit is demanded than is available at the low interest rate ceilings faced by lenders. The theoretical case is presented above; how does this work out in practice? Rationing takes basically two forms, which have been termed intensive and extensive.⁵⁴ Intensive rationing is more appropriate for farms of a larger size and, perhaps, for credit programmes involving a limited project area. Extensive rationing is more appropriate for wider-spread programmes covering a large number of smaller farms.⁵⁴

Intensive Rationing. Rationing described in this way is 'intensive' because it concentrates relatively large amounts of finance on fairly small groups of target borrowers. Borrowers are identified on the basis of their potential production capacity, and the basic assumption is that loans will raise them to higher production and income levels otherwise unobtainable. Repayment can only be expected if the investment is successful. Because fairly large sums are involved,

the lender must make sure that it is only the farmers for whom a good chance of success can be predicted that receive loans.

This can be attempted in a number of ways. The most common has been to construct farm budgets for the potential borrowers in order to estimate their post-investment cash flows. A farm budget may be constructed for a representative farm in a project area, or for representative farms by area or region. Only farms who prove able to support repayment commitments after a loan-financed investment are eligible.

An alternative method has been suggested which places more emphasis on managerial ability in assessing credit worthiness.⁵⁵ The basis of such a method is to assess the efficiency with which a farmer is currently managing his farm.

Intensive rationing is supply-leading finance, clearly articulated in policy. It has traditionally been favoured by foreign donors⁵⁶ and special government programmes and projects. It reaches relatively few farmers in specified target groups; for example, participants in localised projects such as land redevelopment or dairy projects.

Extensive rationing. This involves allocating a limited amount of credit to all those holding certain minimum qualifications. Loans are made in this way,

for example, to all those applicants whose area of land under a certain crop reaches a specified minimum level⁵⁷; to all those having a good debt repayment record; or simply to all those who have membership of a cooperative or farmer group. The BAAC's procedure for rationing short-term credit would fit in here; credit is allocated fairly liberally to all those judged suitable to receive client status.

More specific rule-of-thumb criteria used in rationing credit extensively include crop sanctioning, credit quotas and loan ceilings.⁵⁸ Crop sanctioning involves the rationing of credit to specified crop types only. A credit quota is a rule-of-thumb method for limiting loan sizes according to the lender's evaluation of the reasonable credit requirements for a given activity. This may take the form of specifying the maximum amount per unit area which can be lent for any particular crop, based on an estimation of production costs. Legal limits take the form of maximum loan size regulation or a regulation constraining the loan to be equal to or less than a certain percentage of the estimated marketable value of the crop to be produced.

It is usually short-term production credit which is rationed using standard criteria and regulations, and it is the method most commonly used by public rural credit programmes.

(c) **Problems caused by Credit Rationing**

We have already seen how rationing can tend to increase the concentration of income and assets in rural areas through its differential effect on small and large farmers. Intensive rationing is worse than extensive rationing in this respect because of the limited coverage which it implies. This is true at two stages. First, because of the lengthy and sometimes sophisticated methods used, lenders have to limit the number of potential borrowers who are subjected to evaluation. Second, it is only the relatively better endowed who will pass the test and be allocated credit in an intensive way.

In addition to the problems of income concentration, rationing can cause problems for the lender which in turn make it even more difficult to service the small farmer. Both types of rationing can be seen to contribute to the poor performance of rural credit institutions, mainly through encouraging delinquency.

Intensive rationing often attempts to absorb risk and the impact of uncertainty by tight management of repayments. This is especially so when the same agency is involved in both lending and marketing so that repayments are easily deducted. Returns to capital are variable since, like equity, they consist of a residual; the return on investment after deduction of regular repayment sums. There are certain reasons why this residual may be very low, zero or negative.

First, intensively rationed loans are usually large relative to the pre-loan financial status of borrowers and are associated with new technologies and high repayment burdens. Such loans may well push a farmer beyond his risk-bearing or managerial capabilities. Second, variability in weather, crop performance and prices are often high, and adverse circumstances may result in insufficient cash-flows to sustain repayments. Repayments are particularly vulnerable when repayment capacity rests solely on the productivity of the loan-financed innovation.

Both problems eventually lead to default and repayment problems. The problem is compounded to the extent that borrowers do not consider institutional loan repayment to be morally obligatory or otherwise necessary. Delinquency problems lead naturally to a contraction in credit services as the lender tries to keep its commercial head above water. It is the small farmers, considered more costly to lend to, who suffer first as lenders take action to reduce costs by re-organising their loan portfolios even more towards larger clients. Examples of projects involving intensive credit rationing and experiencing repayment problems are not hard to find. Drawing an example from the BAAC in Thailand, repayments as a percentage of loans maturing fell as low as 22 per cent in the special projects reported in the BAAC's 1981 annual report.⁵⁹ Extensive rationing, whether in the context of a project or a

wider programme, may have the same detrimental effect on institutional viability and an institution's willingness to lend to small farmers. Extensively rationed loans may be made to borrowers of widely differing ability, resource endowment and production potential. The problems here include the following. First, loans may be made to farmers who, though satisfying the appropriate criteria, are not in a position to use the loan productively because of managerial inability, family circumstances or access to inputs or markets for example. Second, loans may be made to farmers who have no real intention of repaying: those, who either wish to take advantage of the institutional lender's position (those who have criminal intent) or those who simply assume the money to be a public handout. Also a problem here are the situations where farmers unwittingly assume more debt than they can cope with because of the absence of cultural norms which normally limit a farmer's willingness to go into debt (such as the obligation to reciprocate).⁶⁰ Third, loans may be made to farmers who are so marginal that any adversity and accompanying repayment problems would be of crisis proportion. Fourth, the small size of extensively rationed loans may lead to problems when the approved input packages are indivisible, or where, even if there is no programmed package, the approved loan use involves indivisible technologies. Failure to acquire some input or to acquire it at the right time, may

jeopardize the whole project. This may lead to either crop failure or lower than expected yields, and thence to cash-flow and repayment difficulties. Alternatively it may lead to the borrower recognising the risk involved in implementing partially improved technologies and deciding to remain with his traditional technology despite the loan.

Like intensive rationing then, there are features of extensive rationing which can aggravate repayment problems. In the long run, this can only be to the detriment of the rural poor as lending institutions, faced with artificially low fixed interest rates, reduce costs the easiest way by rationing out smaller farmers.

This excursion into the issue of rationing has expanded for us the hypothesis that rural credit programmes tend to be biased towards larger farmers because of the normal commercial behaviour of lending institutions. Central to this argument is the belief that imposed low interest rate ceilings seriously limit an institution's revenue earning and its long term viability. Institutions attempt to bring costs more in line with limited revenues by contracting their lending to small farmers for whom risk and administrative costs are highest. If institutions were allowed to charge realistic interest rates, the problem as defined above would be overcome. Small farmers could be charged

rates that would cover the costs of lending to them; there would theoretically be no excess demand for cheap credit and, therefore, no need for non-price rationing; and small farmers would have an expanded supply of institutional credit at a price they are willing to pay.

3. Unequal lending due to the small farmer's real costs of borrowing from an institution

(a) Total borrowing costs in the borrowing decision: the basic model

The argument in the previous section is a supply-side explanation and presupposes that small farmers wish to borrow from institutional lenders. We now turn to one of the demand-side explanations which suggests that one reason behind the lack of participation of small farmers in rural credit programmes is their lack of demand for institutional credit due to the high real costs of borrowing.

The three basic assumptions here are the following. First, nominal interest rates are only a part of the total borrowing costs faced by a borrower in the process of applying for, receiving and repaying a loan. Second, small and new borrowers pay a higher proportion of their total borrowing costs in loan transaction costs than large borrowers. And third, as a consequence of this cost structure, small and new borrowers demand lower amount of credit at a given interest rate than do large borrowers with lower transaction costs. These principles are illustrated in

Figure 3.3. Adams and Nehman⁶¹ suggest that if transaction costs are taken into consideration in the decision to borrow, so is the effect of the general inflation rate on the nominal rate of interest. Figure 3.3, therefore, shows real rates of interest and borrowing cost as well as nominal rates. The figure represents the more extreme case where inflation is higher than the artificially low institutional interest rate and the real interest rate is therefore negative. The principles remain the same, however, whether the real rate of interest is low-positive or low-negative.

Real borrowing cost rates are reduced by inflation for both large and small borrowers. Where the large borrower faces low transaction costs, however, his real total borrowing cost rate may become negative while the small borrower still faces a high positive real borrowing cost rate.

The figure assumes that the small borrower faces a total borrowing cost rate of BC_s , made up of I_n nominal interest rate and $(BC_s - I_n)$ other transaction costs. The real negative rate of interest (I_r) reduces his real borrowing cost rate to RBC_s . The existence of high transaction costs means that only Q_2 credit is demanded by the small borrower. Distance $(Q_3 - Q_2)$ is the reduced demand effected by the small borrower's high transaction costs.

On the other hand, the large borrower is assumed to have a total borrowing cost rate of BC_L , made up of I_n nominal interest rate and $(BC_L - I_n)$ transaction costs. Deflating the nominal rates, he faces a real interest rate of I_r and a real borrowing cost rate of RBC_L . For the large borrower, the distance $Q_6 - Q_5$ is the reduction in credit demanded due to transaction costs. Because these transaction costs are low, the reduced demand is small and RBC_L is still negative.

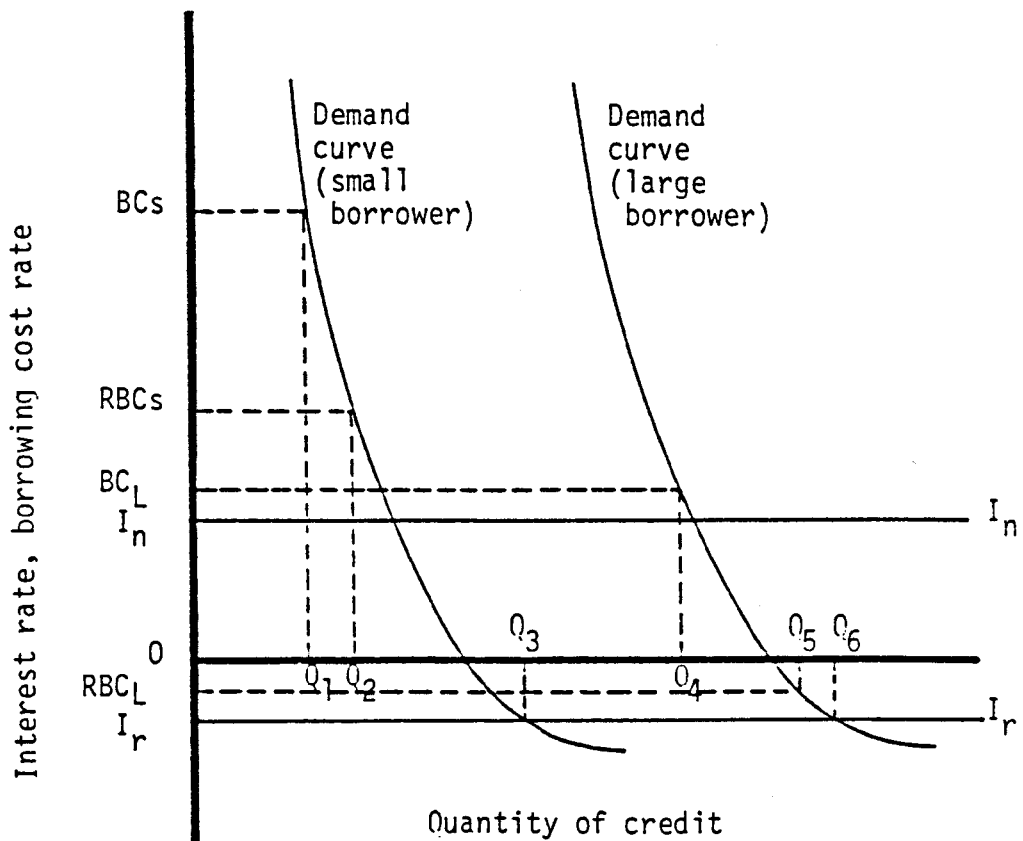
A number of other observations can be made here. As already noted, a negative real interest rate represents an effective subsidy to the large borrower. The small borrower, while receiving the same subsidy, is operating on a more inelastic section of his demand curve. The impact of a given subsidy is, therefore, greater for the large borrower because he is operating on a more elastic part of his demand curve. The effect of the subsidy on the small borrower is $Q_2 - Q_1$, while its effect on the large borrower is $Q_5 - Q_4$.

There are two differentiating factors, therefore, in the cost structure facing large and small borrowers. First, higher transaction costs (and therefore higher total borrowing costs) mean that the reduction in credit demanded when the total costs of borrowing are considered, is greater for the small than for the large borrower. This leads to a lower demand for credit by small farmers than by large farmers for any given interest rate. Second, the higher transaction costs

facing a small borrower put him on a more inelastic part of his demand curve compared to the large borrower, even if the nominal interest rate is the same for both. This means that the effect of the 'inflation-subsidy' is weaker for the small borrower:

$$(Q_2 - Q_1) < (Q_5 - Q_4)$$

Figure 3.3 The effect of total borrowing costs (real and nominal) on a large and a small borrower



(b) The components of borrowing costs

Adams and Nehman suggest that this conceptualisation of the real costs of borrowing will give greater insight into the small farmer's use of rural credit programmes, than an analysis which equates borrowing costs with

interest charges.⁶² They propose a total borrowing cost (BC) formula which is made up of the nominal interest rate (I_n), the transaction costs of acquiring and repaying the loan (TC) and an off-setting negative cost, the change in the purchasing power of money over the loan period (P) :

$$BC = I_n + TC - \Delta P \quad (3.2)$$

If we further assume that a farmer is not in a position to know precisely in advance his transaction costs, or the actual change in prices, we can write an expression for his expected borrowing costs (BC_E) :

$$BC_E = I_n + TC_E - \Delta P_E \quad (3.3)$$

It is suggested that BC_E is a more relevant consideration in a farmer's decision to borrow than simply I_n . Transaction costs (TC) is the new component in the traditional equation. There are at least three types. First, additional charges may be made by the lender. These may include application and registration fees, service and closing charges, bribes, the effective cost of having to purchase other services from the lender at inflated prices, and the cost of having to maintain compensatory balances with the institution.

Second, the involvement of a third party in the transaction may push up costs. Where a bank official,

extension officer, local leader or co-signer is involved, for example, the borrower's additional costs might include the cost of lost working hours during their visits, of hospitality or of bribes or fees.

Third, the opportunity cost of the time involved in transacting the loan may be considerable. In one study, 5 to 7 trips were reported for a single loan.⁶³ This cost will be higher the further away the lender's office is, the longer the queueing period and the more the visits coincide with peak labour periods on the farm.

The change in purchasing power component (ΔP_E) will be more important in situations where inflation has been steadily high over a long period.

(c) The differentiating effect of transaction costs

Figure 3.3 assumes transaction cost rates to be higher for small borrowers. There are a number of reasons why this should be so. The first is purely a function of the size of loan. Where transaction costs are constant per transaction, irrespective of loan size, the transaction cost rate (and therefore borrowing cost rate) will be higher for smaller loans.

In addition to this, there is some a priori reason for suggesting that in all three of the components of transaction costs mentioned above, larger borrowers may face lower costs than smaller borrowers. Additional charges are less likely for the larger borrower because

of the lower unit cost of lending to him and lower risk. Large farmers are probably also less susceptible to surcharges through manipulation and exploitation. They may also be more exempt from compensatory balances at poor rates of return because of their greater assets.

Large farmers are less likely to be dependent on local leaders, cosigners or other informal third-party involvement. They are also probably in a better position to negotiate terms with any third-party that is necessary.

It is with the opportunity cost of time that the greatest differences are likely to be found. Being a better all-round risk, the large farmer will have to spend relatively less time in transacting the loan than the small farmer. He may well have only to make a telephone call or send a letter to make the transaction compared with a number of days, travelling and waiting for his less influential counterpart. Personal influence reinforces the risk factor here, as too, may bribery.

Empirical evidence for different levels of transaction costs between large and small farmers is however limited. In a study of farmers who borrowed from the Agricultural Development Bank of Pakistan in 1962-63, Shahjahan estimated that the effective annualised borrowing costs for 6 month loans ranged from a low of

18% for the largest borrowers to a high of 74% for the smallest borrower.⁶⁴ Nehman similarly found that the annualised borrowing costs for a sample of institutional borrowers in Brazil varied between 18% for the largest farm size to 44% for the smallest farm size for loans of 6 months duration.⁶⁵ In both cases, small and large borrowers paid identical nominal interest rates: 7% per annum in Pakistan and 13% per annum in Brazil. Although this evidence on borrowing cost rates supports the theoretical propositions, actual transaction costs were higher for large borrowers in both examples. This means that the higher rates faced by smaller borrowers is purely a function of their small loan sizes and are not aggravated by higher actual transaction costs as predicted.

A further comment about these studies, and the one other presented by Adams and Nehman, in their 1979 paper,⁶⁶ is that it is actual transaction costs that are measured, not expected transaction costs. No one has produced any evidence of the size of expected total borrowing costs for large and small farmers. It may well be that expected costs are much lower than actual costs and also that actual costs enumerated in studies such as Shahjahan's and Nehman's are not perceived as costs by borrowers or potential borrowers. There seems to be quite a large conceptual leap between identifying a significant transaction cost rate for small farmers (through quantifying costs of travel, entertaining loan

officials and opportunity cost of time) and concluding that high transaction costs discourage small farmers from borrowing from institutions.

4. Preliminary to the analysis in Chapters 6 to 9

In Chapter 7, addressing the issue of the failure of small farmers to participate in Thailand's major rural credit programme, we examine the strength of some of the explanatory hypotheses presented in the foregoing sections. The major part of the analysis concerns estimating the derived demand of a representative independent⁶⁷ small farmer in the study area. This amounts to testing the research hypothesis that small farmers do not use institutional credit because they have no suitable investment opportunities or because they have sufficient finance (the first demand-side hypothesis in Section D.1.(b)).

The analysis also extends to estimating the crude level of demand for institutional credit facilities; respondents were asked whether or not they wished to register with a credit institution. This has a bearing on all the demand-side hypotheses in Section D.1.(b).

An assessment is made of the importance of the two other demand-side explanations. Farmers were asked whether they consider that there are significant borrowing costs in excess of interest charges, involved in taking out an institutional loan. In a crude way, this estimates the importance of expected transaction

costs. The effect of expected transaction costs on the decision to borrow or not is evaluated by testing the research hypothesis that the proportion of farmers expecting significant transaction costs is higher in the sub-sample of farmers who did not wish to register with a credit institution than in the sub-sample of farmers who did want to register. This amounts to testing the third demand-side hypothesis in Section D.1.(b). A similar test is made of the hypothesis which states that small farmers tend not to borrow from institutions because of the risk of losing their normal supply of consumption credit (the second demand-side explanation in Section D.1.(b)). The proportion of farmers who consider that registering with a credit institution would jeopardize their normal consumption credit supplies is compared for two sub-samples (farmers wanting to register and farmers not wanting to register).

The supply-side hypothesis which states that small farmers do not tend to borrow from institutions because they are rationed out (first and second supply-side explanations in Section D.1.(a)) is tested indirectly in Chapters 7 and 8. First, if the demand analysis of Chapter 7 reveals a buoyant demand for credit and institutional credit facilities among independent farmers, this will imply that small farmers are somehow prevented from becoming institutional clients; perhaps, by restrictive eligibility criteria (a form of

rationing). However, it may be for reasons of ignorance and lack of promotion rather than supply-side restriction that farmers wishing to register have not registered yet. In Chapter 8, therefore, we examine in some detail the effective criteria used by Thailand's major agricultural lending bank (the BAAC) to exclude small farmers from its services; the criteria used in selecting suitable farmers for client status. Having enumerated these criteria in the first section of Chapter 8, a sample of independent farmers who wish to register with BAAC are classified into 'accepted' or 'rejected' using a classification model based on the derived discriminating (selection) criteria. The result is an estimate of the number of farmers who would be rejected if they applied and an estimate of the number who would be accepted. This amounts to testing the hypothesis that small farmers tend not to borrow from institutions because they are rationed out of the institution's portfolio.

Before moving to this analysis, we first examine the case of agricultural credit in Thailand. We start by giving an overview of Thai agriculture with emphasis on the North-East (Chapter 4). This provides a background to the analysis in Chapters 6 to 9 which is based on two samples of North-Eastern farmers. The overview then extends to a description of Thailand's rural financial markets (Chapter 5). Chapters 4 and 5 are two background chapters designed primarily to provide a

context for the case study. The research questions addressed in the case study, however, follow directly from the issues discussed in this chapter and the preceding chapters.

Chapter 3 : Notes and References

1. Numerous examples could be given of new institutions set up under rural credit programmes. The Bank for Agriculture and Agricultural Cooperative in Thailand, examined in Chapters 6 to 9 of this thesis, is one. The Development Bank of the Philippines is another (discussed in Saito, K.A. and Villaneuva, D.P., 1981, Transaction Costs of Credit to the Small-Scale Sector in the Philippines, in *Economic Development and Cultural Change*, Vol.29, No.3 (pp.631-639))
2. Adams, D.W., 1980, *op.cit.*, and Osuntogun, A., 1980, *op.cit.*
3. Some of the facts relating to the Indian experience of policies designed to increase the supply of credit are discussed by D'Mello, L., Lending to Small Farmers: The Indian Case, in Howell, J., 1980, *op.cit.* (Part 1, Chapter 2)
4. Chapter 5 of this thesis gives an account of the rapid expansion of credit supply in rural Thailand
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6. See Shetty, S.L., 1978, Performance of Commercial Banks since Nationalisation of Major Banks: Promise and Reality, in *Economic and Political Weekly*, Vol.13, No.31 (pp.427-439)
7. Adams, D.W. and Graham, D.H., 1979, *op.cit.*
8. The loan ceilings operated by the BAAC in Thailand, for example, are discussed in Chapters 5 and 7 of this thesis.
9. Meyer, R.L. and Baker, C.B., and Onchan, T., 1979, *Agricultural Credit in Thailand*, Economics and Sociology Occasional Paper, Department of Agricultural Economics and Rural Sociology, The Ohio State University, Columbus, Ohio. See Chapter 5 of this thesis for a further discussion.
10. This should no longer happen in Thailand since the regulations exclude agro-industry from the quota. A separate quota percentage is set, above the agricultural loan quota, which may be met either by additional agricultural lending or by agro-industry lending.
11. For a discussion of crop insurance with some examples, see Oury, B., 1970, Crop Insurance, Credit Worthiness and Development, in *Finance and Development*, Vol.7, No.3 (pp.36-42)
12. The rediscounting policy operating in the Central Bank in the Philippines, for example, is described in Sonderval, P.R., 1980, Agricultural Credit and Small Farms: Experiences, Policies and Programs, in *Journal of Agricultural Economics and Development*, Vol.10, No.1 (pp.75-96)

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14. BAAC, 1982, *op.cit.* (p.14)
15. 'Coverage' measured in these terms (number of farmers registered with an institution), overestimates the real success in meeting credit needs, since for one reason or another, a significant proportion of registered bank clients may not receive a loan in any one year
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17. Adams, D.W., 1971, Agricultural Credit in Latin America: A Critical Review of External Funding Policy, in *American Journal of Agricultural Economics*, Vol.53, No.2 (pp.163-172)
18. Graham, D., and Bourne, C., Agricultural Credit and Rural Progress in Jamaica, in Howell, J.,(Ed.), 1980, *op.cit.* (Part 1, Chapter 3)
19. D'Mello, L., 1980, *op.cit.*
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21. Adams, D.W., 1971, *op.cit.*
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23. Bottomley, A., 1963a, *op.cit.*
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24. Rozental, A.A., 1970, *Finance and Development in Thailand*, Praeger, New York
25. Lipton, M., 1976, *op.cit.*
26. An example of a similar approach whereby the optimal credit input for farmers in an area is assessed by examining the farm practices of the most efficient producers in the area, is suggested in FAO, 1975, *Agricultural Credit for Development*, World Conference on Credit for Farmers in Developing Countries, Rome, 14-21 October, Food and Agricultural Organisation of the United Nations, Rome
27. The tendency for larger farmers to substitute credit for savings means that this 'rule of thumb' technique is likely to be more valid than it might at first seem; the greater the substitution, the more the credit:area ratio approximates the capital:area ratio and the less confounding is the difference between large and small farmers with respect to owned capital.

28. See, for example, Griffin, K., 1974, *op.cit.* (Chapter 2)
29. For example, the introduction of tobacco in Thailand involved a sharp rise in labour requirements on the farm. Similarly, sugar cane and Cassava, for example, both require high labour inputs at harvest time and relatively high expenditures on transporting harvested produce to market
30. FAO, 1971, *Introduction and Effects of HYVs of Rice in the Philippines*, FAO, Rome
31. Daines, S.R., 1975, *Guatemala Farm Policy Analysis: The Impact of Small Farm Credit on Income, Employment and Food Production*, Analytical Working Document No.10, Bureau for Latin America, AID, Washington
32. Schluter, M.G., 1974, *The Interaction of Credit and Uncertainty in Determining Resource Allocation and Incomes on Small Farms, Surat District, India*, Occasional Paper No.68, Department of Agricultural Economics, Cornell University, Ithaca
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39. Nasseem, M., 1975, *op.cit.*
40. Adams, D.W., 1971, *op.cit.*

41. See, for example, Von Pischke, J.D., 1980, *op.cit.* and Adams, D.W., 1977, *op.cit.*
42. Griffin, K., 1974, *op.cit.*
43. Harlem Davis, L., 1975, *Are Small Farmer Credit Programs Getting at the Cause of Small Farmer Problems?*, USAID, El Salvador
44. A more complete discussion of this assertion is given in Section D.3 of this chapter
45. The term 'demand-side' and 'supply-side' are not used in a strict sense here; they refer to whether the tendency of small farmers not to borrow from institutions is primarily due to a lack of demand or a restricted supply, whatever the more specific reasons might be
46. Gonzalez Vega, C., 1977, *Interest Rate Restrictions and Income Distribution*, in *American Journal of Agricultural Economics*, Vol.59, Dec., (pp.973-976)
47. Von Pische, J.D., 1980, *op.cit.*
48. Lipton, M., 1980, *op.cit.*
49. The analysis in Chapter 6 of this thesis, indicates that this limit has been reached by the sample of institutional client-farmers, but not by the sample of independent farmers
50. See, for example, Baker, C., 1973, *op.cit.*
51. Adams, D.W., and Nehman, S.I., 1979, *Borrowing Costs and the Demand for Rural Credit*, in *The Journal of Development Studies*, Vol.15, No.2 (pp.165-177)
52. Gonzalez Vega, C., 1977, *op.cit.* (p.975)
53. They do face loan-size limits, as described at the beginning of Chapter 8 of this thesis, but the limit of 30,000 baht was found in the North-Eastern Study Area, to be far above the average credit requirement of a BAAC client. For the wealthiest clients of BAAC, especially in the more prosperous of Thailand's regions the 30,000 baht ceiling may well represent an effective rationing instrument
54. A discussion of the different situations in which the two types of rationing are appropriate, is found in FAO, 1975, *op.cit.* (Chapter 3)
55. *Ibid.*
56. Donors still attach great importance to intensively rationed credit, disbursed through agricultural projects, but in recent years they have also increased their efforts to target more of their funds into wider based, small farmer oriented programmes

57. This commonly occurs when credit policy is used to achieve macro-planning objectives in the agricultural sector. See Harlem Davis (1975), *op.cit.*, for a South American example
58. These rationing procedures are identified in the context of a Mexican case study by Ladman, J., 1974, A Model of Credit Applied to the Allocation of Resources in a Case Study of a Sample of Mexican Farms, in **Economic Development and Cultural Change**, Vol.22, No.4 (pp.279-301)
59. For example, only 36.2% of maturing loans were repaid on time in the Public Welfare Department's Sericulture projects in Self-Help Settlements. A new village development project achieved a repayment rate of only 22%, a sugar-cane replacement project performed a little better at 36%, and two dairy promotion projects achieved a better, but still unsatisfactory rate of 60% of maturities repaid. BAAC, 1981, **Annual Report**, BAAC, Bangkok (pp.32-49)
60. Bouman, F.J.A., 1977, Indigenous Savings and Credit Societies in the Third World: A Message, in **Savings and Development**, Vol.1, No.4 (pp.181-214)
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62. *Ibid.*
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64. Shahjahan, M., 1968, **Agricultural Finance in East Pakistan**, Asiatic Press, Dacca
65. Nehman, S.I., 1973, *op.cit.*
66. Adams, D.W., and Nehman, S.I., 1979, *op.cit.*
67. 'Independent' refers to the lack of any institutional affiliation, i.e. not a cooperative, bank or other institution's client

CHAPTER 4 : NORTH-EASTERN AGRICULTURE AND ITS PROBLEMS

Chapter 3 defined the specific problem area to which the thesis is addressed. Chapters 6 to 9 go on to explore the issue of unequal lending in a case study of farmers in Thailand's North-Eastern region. It would be unsatisfactory, however, to proceed to the empirical analysis without giving adequate attention to the patterns and problems of agriculture and agricultural finance which form the context of the case study. A discussion of the agricultural finance context is left to the next chapter. A discussion of the agricultural context is necessary because the empirical chapters involve the analysis of the production activities of survey farmers: the derivation of farm-enterprise budgets, the construction of model farms and the derivation of optimal farm-plans. There can be no understanding of agricultural credit in the process of rural development in abstraction from the agro-economic environment. The focus of the chapter is the agro-economic environment of the North-East, which is discussed against the background of national trends. A regional perspective is taken because the North-East is a well defined and relatively homogeneous unit environmentally, agro-economically, politically and culturally, and has long been the concern of development analysts and planners. The comments made about the region in general will also apply to the case study area which is in the province of Korat. Against this background, a more specific description of agriculture in the survey villages is found in Chapter 6 in the form of representative farm-enterprise budgets, and in Chapter 7 in the form of a generalised description of farm-plans, output by the representative farm economy models.

The North-East is first introduced as a problem region with a high incidence of poverty, related to backward agriculture. Recent national trends in agriculture are then discussed in Section B, as a background to the more specific discussion in Section C of current problems facing North-Eastern agriculture.

A Thailand's North-East : a problem region

The North-East has, for a long time, been recognised as the Kingdom's main problem region.¹ Culturally, politically and geographically it has traditionally been isolated from the rest of the country. Its environment is particularly unfavourable and its agricultural problems are, on the whole, more severe than in any other region. Per capita income has persistently remained the lowest of all regions, in 1976 standing at only 52% of the national average and 57%, 43% and 28%, respectively, of the North, South and Central Regional averages. The low level of per capita income is associated with a relatively low regional product. While about one third of the nation's population live in the region, its GRP as a proportion of GDP has been below one fifth for the last two decades, actually falling between 1960 and 1979, from 17% to 14.7%.³ Poor performance in both agricultural and non-agricultural sectors has contributed to this poor regional output performance, both sectors lagging well behind their national counterparts. So, too, has the composition of the regional economy; the region's dependence on agriculture is greater than that of the Kingdom as a whole, and its share of the more productive and generally faster growing non-agricultural activities is below average. In 1976, agriculture accounted for 45% of GRP and 92% of regional employment in the North-East,

while nationally it accounted for 28% of GDP and 52% of national employment.⁴

The region's dependence on agriculture is one factor behind low per capita incomes. Although there are many causes of poverty in the North-East, there is a high degree of association between low per capita incomes and the practice of underdeveloped agriculture using low technology. In particular, rural poverty has been shown to be strongly associated with farm families who operate rain-fed rice farms on the higher and less fertile paddy land, growing little else but rice.⁵ Since this describes many of the North-East's rural population, it is not surprising that 147 (60%) of the Government's 246 targetted poverty districts and sub-districts are located in the region.⁶ Using the NESDB poverty line of 165 baht per person per month, a substantial 45% of the North-East's rural population are classified as poor. This compares with 34% in the North, 33% in the South, and 15% in the Central Region. Put another way, 52.3% of the Kingdom's total rural poor are found in the North-East. Since the region's share of the total population is only 34%, this represents a considerable regional concentration of poverty.

B Trends in Thai Agriculture over the Last Two Decades

A discussion of the underdeveloped agriculture associated with the region's poverty, needs to start with a look at national agricultural trends; the regional pattern of agriculture is better understood in this wider context.

Between 1960 and 1980, national agricultural production

(agricultural GDP at constant prices), grew at an annual rate of around 5%. When measured in real value, the growth rate is even higher at 5.8%, due to improvements in the terms of trade for agriculture during the period. The growth rate was sufficiently high to keep ahead of population growth and agricultural GDP per capita rose by an annual rate of 2.8% over the twenty-year period. The national performance has therefore been impressive and compares very favourably with most other countries of the world over the two decades.⁸

The average rate of growth of 5% p.a. does, however, conceal a declining trend during the period and this has led to concern about the future of Thai agriculture. A 1982 World Bank report identified three distinct periods in the development of Thai agriculture in recent years: the 1960's, the first half of the 1970's, and from 1976 to the beginning of the 1980's.

(a) The 1960's

In the 1960's, growth of agricultural GDP (constant prices) was high, at an average of 5.5% p.a. This was a "capacity acquisition phase" when agricultural output expanded mainly by bringing hitherto unfarmed land into production. The expansion, which started in the 1950's, was prompted by market impulses and facilitated by an acceleration of road and communication infrastructure. The new production land was, in the most part, cleared public forest land, although other public land such as communal pastures and waste land were also take over by squatter farmers. Much of the national expansion in area under maize, kenaf and cassava

(crops which became major export earners during the 1960's and '70's), used land that was not farmed before 1960.¹⁰ This affected the North-East in particular, where production had historically been confined to paddy-cultivation on the lower river terraces. The importance of area expansion is indicated by one commentator's calculation that around 90% of the increase in production of export crops between 1951 and 1964, excluding rice and rubber, was due to the extension of crop-growing area, leaving only 10% due to yield improvement.¹¹

While diversification into non-rice upland crops was facilitated by forest encroachment during this period, so was the expansion of rice, particularly rainfed rice, which accounts for around 75% of all paddy land. Rice was, in fact, the single most important frontier crop, and the associated increase in rice production due to area expansion has been variously estimated as one half or one third of the total increase in rice production during the years 1957-1967.¹²

Not all newly cleared land was used during the 1960's period of frontier expansion, however, and excess capacity was acquired. Thus, during the 1960's the area of farm holdings grew at an average rate of 4.1% p.a., while planted area grew at only 3.6% p.a. The result was a low cropping intensity, averaging at 61% during the period.

(b) 1970 to 1975

By the early 1970's, a plateauing-out of area expansion could be detected. Welsch¹³ argued that the falling volume of cassava and maize exports towards the end of the 1960's, indicated a slowing down of frontier development, since these were two important frontier crops which had only a limited domestic market.

This coincided with a slight drop in agricultural output growth. Growth of agricultural GDP (constant prices) fell from the 5.5% p.a. achieved during the 1960's to 5.1% p.a. during the 1970 to 1975 period. Cassava, however, continued to expand at a rapid pace, output rising by 11.8% between 1971 and 1972 and by around 25% between 1972 and 1973, much of this expansion being in the North-East.

Despite the overall decline in performance, growth in the real value of output reached a peak during this period due to a significant improvement in the terms of trade for agriculture, largely through higher crop prices. The world commodity boom of the early 1970's caused large price increases for most important crops, especially for cassava, rice, sorghum and sugar cane. Particularly important for the North-East was the cassava price which quadrupled from 0.58 to 2.34 baht/kg at the start of the 1970's (cassava meal, wholesale price).¹⁵ The result of these favourable prices was a 10% p.a. average real growth in agricultural output in the first half of the 1970's, with approximately half of this due to improvements in crop prices and half due

to physical output growth. As a consequence, real incomes improved considerably in the North-East as elsewhere during these five years.

(c) 1976 to the beginning of the 1980's

During this period, three factors contributed to a significant slowing down in the rate of growth of agricultural output. First, with the exception of rice and cassava prices, agriculture's terms of trade suffered a general decline from the heights of the first half of the decade. The cassava price remained high for the five years, but slumped during 1981 and 1982. It is likely to stay at the lower level with the introduction of import restrictions by the important EEC market. The price of rice has remained steady but is expected to suffer with the steadily increasing supply in the world market. Second, most of the country's frontier land had been exhausted by this time so that growth was no longer possible through clearing new area. Third, as a result of frontier land exhaustion, the stock of cleared but unused frontier land was brought into production, the average cropping intensity rising from 72% between 1974 and 1976, to 81% between 1978 and 1980. The expansion of production into these previously cleared but unused areas contributed to a drop in yields; much of the land was marginal (hence, it was the last of the cleared land to be cultivated) and the scarcity of land for extensive expansion encouraged the reduction or omission of fallow periods.

Agricultural GDP growth consequently fell to 3.5% p.a.

during this period. The decline over the two decades from 5.5% in the 1960's to 5.1% in the first half, and 3.5% in the second half of the 1970's was actually worse than these overall figures suggest. This is because the deceleration was greatest in the crop sector, which accounted for approximately three-quarters of agricultural GDP during the period. In that important sector, the annual rate of increase in agricultural GDP dropped from 5.2% to 3.3% p.a. between the first and second half of the 1970's.

These national trends have an important bearing on North-Eastern agriculture. In sum, agriculture in the North-East faces a curtailment of opportunities for expansion of production through frontier development; falling yields, low and stagnant prices of cassava and other upland crops, and a predicted drop in world rice prices. It now faces serious problems in maintaining the level of real agricultural incomes, problems which would have been more evident in the last 20 years had it not been for the cushioning effect of frontier development and inflated agricultural prices. Intensification can be the only real option if per capita farm incomes are not to spiral downwards. The region's agriculture is still largely extensive, with generally low levels of technology and diversification. The extensive expansion since the 1950's undoubtedly inhibited intensification, with resources being channelled into the cultivation of new areas.

There are, however, many inherent barriers to the intensif-

ication of agriculture in the region which means that modernisation will not take place as an automatic response to the exhaustion of land. The following section discusses some of these barriers. Most are not new problems; they have been in existence during the recent period of general expansion. With no more virgin land to expand into however, they will be increasingly felt and their resolution will become increasingly essential.

C Current Problems in North-Eastern Agricultural Development

A distinction has generally been made between two kinds of problem: "environmental" and "economic".¹⁶ The unfavourable environment has often been emphasised as the root cause of the region's agricultural backwardness, a position loosely taken by the recent World Bank study on Thai agriculture.¹⁷ Others have seen the remoteness of the region from markets and inputs as more important.¹⁸ Dixon emphasises the importance of both aspects:

"While a thorough understanding of the nature of, and problems stemming from, the North-Eastern environment is necessary in any study of the region, this must be seen as only part of the picture and the interaction of the totality of factors making up the region's backwardness must be constantly borne in mind"¹⁹

1. Environmental Problem²⁰

Geographically, the North-East consists of the korat basin, a plateau of 100 to 200 metres, bounded by mountain ranges to the West and South, and by mountains and the Mekong river to the North and East. The region is dissected by three

major rivers which flow generally Eastwards into the Mekong on the Laotian border. The influence of topography on agriculture cannot be understood without an appreciation of the heterogeneous nature of land forms and soils; small variations in geomorphology have important implications for a farmer.

There are five major geomorphological features within the boundaries of the North-East: low alluvial flood-land, low, middle and high river terraces and hills.

The alluvial flood-lands follow the 2 rivers running across the plateau and are made up of recently deposited alluvia; better drained and more loamy on the levees and badly drained and heavier in clay beyond the levees. Their fertility is the highest of all North-Eastern soils and their water-holding capacity is good. These are the best areas for paddy production on two accounts: firstly, the relatively good fertility gives better yields and allows dense planting, and secondly, their low elevation ensures an adequate supply of water in most years for early planting and a drought-free maturing period. The major problem facing paddy grown on these soils is the risk of flooding. One consequence is crop loss due to the floods;²¹ another is that short-strawed high-yielding varieties are often considered too risky because of their greater susceptibility to flood.

The low river terraces contain the next best soils of the North-East. On the lower slopes they are most fertile,

though there they are subject to flooding from adjoining flood-plains. Further up slope, they become less fertile through leaching, and more susceptible to drought.

The middle terraces consist of older alluvium which because of higher elevation and age are more leached and less fertile. They retain water for only a short period in most years because of the slope, height and sandy content. The consequences for rice production are serious: there is frequently insufficient water for land preparation and transplanting until late in the growing season, and water quickly drains away after the rains have stopped, cutting short the maturing period. This effectively shortens the growing period on this type of land resulting in poor yields. Lack of water also prevents the successful use of HYV's which generally require a stricter moisture regime. The later the rains come, the shorter the growing period, and if the delay is too long there is often no time for land preparation (which uses buffalo and requires soils to be soft), before it is too late to plant. In this situation, paddy land is left unplanted and it is probably these middle-terrace paddies that account for much of the unplanted paddy land that is reported each year.²²

The high terraces have very low quality soils, heavily leached and retaining very little water during the year. They are suitable only for hardier, drought-resistant crops and only kenaf and cassava have been grown successfully so far. Beyond the high terraces, on the hills, cultivation of

even cassava is generally impossible because of thin and infertile soil with virtually no water holding capacity.

The second critical environmental factor is rainfall. It is the combination of an unreliable rainfall regime with the land form and soil patterns discussed above which is the crux of the North-East's environmental problem. Annual rainfall in the region is, in total, sufficient for wet rice cultivation at an annual average of 1300 mm. It is, however, its variability which is the problem. Dixon comments that the variability is "greater than for any other area of similar climate, except for Northern Australia".²³ A total of 80% of annual rainfall falls in the wet season between April/May and October. This leaves the dry season too dry to sustain non-drought-resistant crops without irrigation. Generally, the rainfall pattern is unimodal with modal rainfall in August/September, but in the heartland of the Korat plateau it is bi-modal with a distinct dry period around June and July. This means that the hazards of unpredictable rainfall are felt twice. Firstly, the commencement of the rainy season is unpredictable. This causes uncertainty in farm planning, since farmers have to wait for the rains to come before they can start the preparation of paddy land, and cannot be sure how much of their land will become sufficiently wet, early enough to be brought into production that year. Secondly, the dry period in June/July is also unpredictable. Since most farmers will wait until the dry spell has passed before transplanting, this means that the critical nursery period

between planting seeds and transplanting cannot be accurately controlled. If the drought is prolonged, seedlings become old and are transplanted too late to produce many tillers, so that lower yields result. An extended mid-season drought can kill seedlings, necessitating the re-planting of a nursery. The result is either lower yields because of the late second start, or no yield if the seedlings are lost too late to plant a second time.

The implications of these patterns of land forms, soils and rainfall on the agriculture of the region, can be summarised in the following generalised description of a North-Eastern crop-year. This description also serves as background to the empirical analysis of Chapters 6 to 9. It describes the general pattern of farming which characterises the survey area in Korat province. This is elaborated with more specific detail in Chapter 6 by the presentation of farm enterprise budgets for survey farmers, and at the beginning of Chapter 7 by a description of optimal farm plans produced by the linear programming models.

The crop year generally starts in April, with the planting of cassava and kenaf on the high terraces (upland). Since farmers will be wanting to start on the preparation of paddy land with buffalo as soon as the rains have softened the ground sufficiently, upland preparation tends to involve a hired tractor and the upland crops are planted before paddy preparation really gets underway. Cassava and kenaf can be safely planted before the June/July drought as they are

generally resistant enough to withstand it.

After the planting of upland crops, paddy production can get underway first on the alluvial flood-lands, since soils there become moist for ploughing and seedlings become ready for transplanting relatively early in the season. A farmer will be able to start work on other higher paddies as the rainy season proceeds, starting on the low terraces and completing the preparation of middle terrace paddies, perhaps well into the season. If rains are late, he may judge that the growth that can be expected before flowering of the paddy, is insufficient to warrant the investment, and some or all of his highest situated paddy fields will remain unplanted. When the rains have finished around October, the water level in the bunded paddies falls until the soil is exposed and drying out starts. The drying out process starts first on the middle terraced paddy and proceeds with time to the flood plains.

Such a pattern of environmental constraints has a number of consequences for the development of North-Eastern agriculture. Generally, there is always a high degree of risk involved. This inhibits intensification and greater commitment to farming, and causes low and unstable farm incomes. Specifically, opportunities for intensification and diversification are small. Intensified rice production is only really possible in the flood plains where water supply is adequate and the most reliable. This comprises only about 10% of all paddy land in the North-East.²⁴

Intensification on the remaining 90% requires some degree of irrigation. Diversification is inhibited because the land that is free from flooding (and therefore most suitable for other field crops), suffers poor fertility and drought. In the middle terraces where it is possible to grow either paddy or other field crops, farmers invariably have a traditional preference for paddy. On the highest cultivable land there seems to be little other than kenaf or cassava which will survive the poor conditions. There have been some experiments with alternative cropping patterns in the North-East, including a ground nut/rice cropping system, and dry-seeded upland rice,²⁵ but success has been limited and as yet, no widely applicable viable alternative to existing systems has emerged. There is, however, a strong current emphasis on rainfed agricultural research among government departments and external agencies. It can be expected that the importance of intensification and diversification to agricultural growth, will lead to new and sustained efforts in the search for solutions to environmental problems now that further extensive growth is impossible.

Irrigation, as a solution for North-Eastern agriculture, dates back at least to the 1950's, when the Government prepared a plan for the widespread construction of irrigation tanks. The Mekong Committee later took the concept further, on a grander scale, but to date it has commonly been felt that irrigation is probably of less immediate importance than the development of rainfed agriculture. This is evidenced by its underemphasis in the

Last 3 National Social and Economic Development Plans (1972-76; 1976-80; 1981-86). The apparent lack of success of irrigation schemes, indicated by very low utilization rates of existing irrigation facilities, seems to be a result of management problems, including delays in construction of distribution systems and a lack of a co-ordinated package of complimentary services, especially credit and extension.²⁶ The latter two are discussed below along with other non-environmental problems.

2. Economic and Policy Problems

The economic and policy problems facing North-Eastern agriculture are, generally speaking, of the same nature as those facing agriculture throughout the country. Some are felt more severely in the North-East than elsewhere. The problem of spatial isolation from input and output markets for example, has commonly been cited as a major factor behind the region's backwardness.²⁷ Another example discussed in more detail in the next chapter is institutional credit supply, which has traditionally been comparatively under-provided in the region.

The more important of these economic and policy problems are discussed in the following. They do not, of course, exist independently of the region's environmental problem; one type of problem aggravates the other.

(a) **Agricultural Research.** The paucity of fruitful research into rainfed agricultural techniques is a major problem for the North-East. Much of the research

investment in recent decades has been channelled into improved crop varieties which are most suitable for well irrigated areas. The new technology has, therefore, often benefitted only the few better off farmers,²⁸ leaving the majority of poorer rain-dependent farmers to their traditional low-yielding varieties. It has already been noted that success in rainfed agricultural research has been limited, but that with the number of projects currently in existence²⁹ and with the current level of commitment, there are signs that this problem is being addressed in a more serious way than it has been in the past.

- (b) **Agricultural Extension.** Research is ineffective in generating agricultural development without a good extension system. An effective extension system requires a wide coverage, a reasonable depth of coverage, well trained officers, and good two-way links with research centres. The extension service in Thailand has been criticised for its inadequate coverage, poorly trained workers, disorganisation, and lack of contact with agricultural research. Commenting on the poorly trained extension workers, Welsch suggested that the top 10% of Thai farmers were more advanced than both the extension workers and the researchers. Cochrane³¹ emphasises the problem of lack of co-ordination between the several government agencies responsible for the research/extension process.

A further weakness in the extension system seems to be its lack of responsive interaction with farmers. The nature of the projects and crop and livestock promotion exercises undertaken by extension agents is generally determined at a high level in the extension department, relating to nationally derived quotas of various products. There is little scope for a flexible and interactive approach to local farm-planning which would be more likely to lead to optimal use of farm resources.

A major World Bank loan has, however, been made to the Department of Agricultural Extension to facilitate its reorganisation. The plan involves a more efficient hierarchical network of officers down to the sub-district level, including subject-matter specialist officer, and brings the effective district officer/farmer ratio down to 1:2,200.³² It is hoped also that the 5th National Economic and Social Development Plan's series of policy statements designed to improve the agricultural extension system³³ will further improve the effectiveness of the extension service.

Intensification and diversification of North-Eastern agriculture will largely depend on the decision by North-Eastern farmers to modernise their farms. Given appropriate incentives, this is only likely to happen through the frequent visits of locally based extension

workers, giving correct and practical advice on appropriate techniques.

(c) **Market Development.** Undoubtedly, the distance of the North-East from Bangkok and the more prosperous Central Plain and its geographic isolation, still play some part in inhibiting trade and production. However, the rapid expansion of the road network over the last two decades has greatly reduced this problem. The North-East has received a substantial proportion of the 95,500 kilometres of new roads built nationally between 1961 and 1982. 60,000 of the current 104,000 kilometres of roads in the Kingdom are local and rural roads. This represents a considerable opening-up of the Thai countryside.³⁴ Cassava and kenaf now get transported to provincial centres from formerly quite inaccessible upland areas in the North-East and the Friendship Highway means that produce from most market centres in the region can be transported to Bangkok within a day.

The areas for which physical remoteness is still a major problem are the fringe provinces of the region; some of the Eastern districts of Sisaket, for example, are still approached only by mud tracks frequently made impassable during the rainy season.

In addition to the improved road network, the good number of processing plants established in the North-East have meant that farmers have not had to travel too

far to sell or negotiate the sale of their produce, and transport costs have been kept down.³⁵ In this sense, market development has tended to follow production trends without much government intervention.

While the major markets for its agricultural products lie outside of the North-East, the region will always be vulnerable. There is evidence that the Bangkok rice market treats the North-East as a buffer stock, decreasing purchases there before any other region in times of surplus.³⁶ The limitations on cassava export and the predicted fall in rice and sugar-cane prices on the world market³⁷ highlight the problem faced by a region dependent on world prices for the economic well-being of its farmers. The drop in cassava prices in 1981/82, for example, resulted in a significant fall in farm incomes.

There is only a limited scope in the short-term for domestic market development in the North-East. There may be more scope in the future with the introduction of new food crops such as ground nuts and legumes, and the Government could encourage the development of meat markets by relaxing its monopoly on slaughter-houses.³⁸ At present, the lack of a significant domestic market (due largely to low incomes), the dependence on export markets, and the remoteness of some of its peripheral districts, act as important constraints on the development of North-Eastern agriculture.

(d) **Pricing and Regulatory Policy.** North-Eastern farmers, along with all other Thai paddy farmers, are affected adversely by two particular government policies. Firstly, domestic paddy prices have been kept at an artificially low level through the operation of the rice premium (an export tax on rice).³⁹ The premium effectively keeps the price of rice down in urban areas, but at the expense of the farmer who often bears the brunt of the tax as wholesalers reduce their farmgate prices. The Government has introduced price stabilisation measures, but farmers frequently find it impossible to sell at the government's minimum price. The North-East suffers particularly from this policy, being the major rice producing region of the Kingdom.⁴⁰

Secondly, a restriction on fertilizer imports has meant that farmers can only purchase the higher priced domestically produced products. For reasons of inefficient central pricing, and market control production, domestic fertilizers are priced well above current world prices. Domestic products are not only over-priced, but are also the more expensive mixed compound fertilizers. Relaxation of import controls would increase farmers' access to fertilizer by making available the lower cost single nutrient types, as well as reducing the cost of mixed compound types.

The current high cost of fertilizer relative to crop prices acts as a serious disincentive to intensify

production. The poor product/fertilizer price ratios accompanied by the poor fertilizer response of North-Eastern soils mean that the expected net returns on most major crops are too low to make the risk of higher input costs acceptable. Most cassava and kenaf are consequently produced with no chemical fertilizer at all and what little a farmer can afford is applied to his rice crop. Chemical fertilizer used per rai, averaged nationally at only 1.1 kg for cassava in 1974, compared to 3.37 kg for rice.

In 1979, Thailand's cultivated area received an average of 8.16 kg of fertilizer per rai (51 kg/ha) which compared with 110 kg/ha in Indonesia and 330 kg/ha in Korea.⁴¹ Cochrane (1974) estimated that a reduction in the cost of fertilizer by 25% would raise returns on rice, maize and cassava by an amount equal to twice the cost of the fertilizer.⁴²

At present, apart from the inadequate fertilizing of paddy, it is only where farmers enter into a contract with a processing or marketing company and receive a package of inputs necessary for them to meet their production quota, that fertilizer is used at all optimally in the North-East. This happens mainly with sugar and tobacco, and it is only selected farmers who benefit by receiving inputs as part of a production contract like this. Other farmers may grow these crops but have to bear the risks and investment costs themselves, inevitably using less fertilizer and

producing a lower quality crop.

- (e) **Land Tenure.** Security of tenure is important for successful agricultural development in at least three ways. First, it encourages long-term planning, including long-term capital investments and production of crops with a longer-term pay off; second, it enables farmers to take medium and long-term loans against the security of their property; and third, it encourages a responsible use of land such as the adoption of soil conservation and fallowing practices.

It may seem that the North-East, with only 9% of farm households classified as tenants and 3% of farmland rented,⁴³ should have no great problem here. The problem lies, however, in the great variation that exists in the type of land title deeds. Only 6% of Thailand's total area has full title deeds even though 52% is classified as privately occupied. The rest of the 52% is made up of 20% with permanent possession rights, 16% with either no deeds at all or covered by non-transferable certificate, and 10% illegal squatter settlements on public forest land.⁴⁴

The proportion of land without full security of tenure is slightly lower in the North-East than in other regions, but it nevertheless constitutes a major barrier to long-term improvement of farm land and diversification into longer-term cropping patterns.

(f) **Agricultural Credit.** The role of credit in agricultural development was discussed at length in Chapter 2. Some summary comments are introduced here concerning credit in the North-East, which are then expanded in the discussion of Thai rural financial markets in the next chapter.

Any development in agriculture, whether long-term land improvement, the adoption of new cropping-patterns or the use of additional fertilizer, needs to be financed. With the very low per capita income in the North East, it is to be expected that farmers will have problems financing developments of this sort if they cannot borrow. Welsch referred to Thailand as a "capital short country".⁴⁵ Cochrane in 1974 commented that "the supply of agricultural credit is still very short of requirements and relatively few farmers are being reached by institutional sources".⁴⁶ In 1982, the Annual Report of the BAAC claimed that just under a half (2,117,115) of Thailand's farmers were being served with BAAC credit facilities.⁴⁷ With a 2.7% growth in the number of farmers served over 1981/82, this seems to indicate some progress. The figure of 2,117,115 is somewhat misleading, however, since it includes all farmers who are members of cooperatives and farmer associations served by BAAC, many of whom may not actually have access to farm credit because of institutional rules and procedures.

The North-East has, throughout the history of

institutional credit, been under-served compared to other regions. The situation is improving however and in 1980 the proportion of all BAAC disbursements going to the North-East was 24%,⁴⁸ a percentage still somewhat less than the region's share of the national population (about one third), and well below its share of the country's agricultural land (41%). Lightfoot⁴⁹ investigating coverage of BAAC in the North-East, found that in a case study of one district, institutional credit was by no means easily accessible to a large proportion of farmers. Only 9% of all farmers in that district were direct clients of BAAC; the proportion of sub-district (Tambon) populations who were direct clients varied from 2% to 20%. About half of all the villages had no direct clients of the bank, and in 15 villages accounting for 10% of the district population, there was no contact with any credit institution at all.

These comments are sufficient to place the issue of credit alongside the list of other economic and policy problems facing North-Eastern agriculture. Although the case study in Chapters 6 to 9 focuses exclusively on credit, it should be borne in mind throughout that the issue is only a single component part of the overall agricultural problem in the survey area and in the region as a whole. Little more will be said about these other problems; the chapter is designed to provide a context for the empirical analysis in terms

of agricultural patterns and problems in the case study region.

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17. World Bank, 1982, *op.cit.*
18. Cowan, J.A., and Chalmers, R., undated, **Economic Growth and Structural Change in North-East Thailand**, Bangkok
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21. For example, an estimated 1.6 million rai of paddy was washed away by floods in the North-Eastern province of Surin during August 1982 (Bangkok Post, August 17th, 1982)
22. Unplanted paddy land in the crop year 1980/81 totalled approximately 13.5 million rai, or 18% of total paddy land in the country (estimated by subtracting the area planted under paddy (first crop only), from total paddy land, National Statistical Office, 1978, **1978 Agricultural Census Report, Thailand**, NSO, Bangkok)
23. Dixon, C.J., 1977, *op.cit.* (p.217)
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25. For example, an EEC crop-diversification project based in Khon Kaen Province examined the possibilities of a ground nut-rice cropping system as a replacement for cassava and a dry-seeded rice project was sponsored by the International Development Research Centre, Canada, in conjunction with the Department of Agriculture, Thailand
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CHAPTER 5 : RURAL CREDIT IN THAILAND: AN OVERVIEW

If the last chapter provided the agricultural context to Chapters 6 to 9, this chapter goes on to supply the context in terms of financial markets. A discussion of the rural financial market context is necessary because the empirical chapters involve the analysis of the demand and supply of credit among survey farmers: the measurement of demand for short-term credit; the evaluation of the degree of credit supply-shortage; the measurement of the effect on income of interest rate differentials in non-institutional and institutional markets; and the evaluation of the effects of rationing procedures of a major institutional lender. There can be no understanding of agricultural credit in the process of rural development in abstraction from the context of rural credit markets. The discussion here takes a national perspective since the markets affecting the survey area are most easily described at that level. Most information concerning the operations of commercial banks, for example, is available at a national level. Attention is focused on the North-East region where possible and appropriate.

The chapter is particularly important in three respects: Firstly, it describes the activities of the Bank for Agriculture and Agricultural Cooperatives (BAAC). This institution is the rural credit programme upon which interest is focused on Chapters 6 to 9. There, we are interested in the demand for and access to its services, and particularly in Chapter 8 with the procedures by which it excludes small farmers. Here, it is described in terms of its general operations and set in its wider context of the credit markets operative in rural Thailand. These are discussed in Sections A and B

under the headings of non-institutional and institutional markets.

Secondly, it illustrates, in the context of Thailand, some of the points made in the first two chapters. As an introduction to the thesis, Chapter 1 discussed the trend towards a greater priority for agriculture in LDC's, especially as it effected the flow of funds to agriculture. Section C of this chapter summarises the Thai experience in this respect, looking at the performance of institutional credit markets in supplying finance to Thailand's agricultural sector. Then, focusing on more specific aspects of the performance of Thai financial institutions, the Section goes on to illustrate the problem of unequal lending, which was the major subject of discussion in Chapter 3. Section C discusses the Thai experience of this problem alongside three other performance issues which were also introduced in Chapter 3: institutional viability, types of loan and the regional distribution of funds. Section D takes the discussion of demand for credit in Chapter 2 further, looking at some of the evidence for Thailand.

Thirdly, it completes the background discussion necessary for the empirical analysis of the second half of the thesis. Most importantly, it presents evidence to show that Chapter Two's unequal lending problem does in fact characterise the Thai institutional credit market. This provides a foundation for the analysis to follow, which presupposes that the problem exists in Thailand and seeks to understand some of the reason for its existence.

A major part of that empirical analysis concerns measuring the demand for credit among a sample of small farmers, to see if a lack of demand on their part can help explain the unequal lending pattern. Section

D, in this chapter, provides a specific context for that analysis of demand by its review of the demand for agricultural credit in Thailand.

A Non-Institutional Markets

Chapter 2 described three types of sources of borrowed funds: non-institutional non-commercial lenders, non-institutional commercial lenders and institutional lenders. This section discusses together both categories of non-institutional lender describing the important features of the non-institutional markets operative in the rural areas of Thailand. Because of the importance of consumption credit in the non-institutional market, the overview is given in terms of rural credit rather than exclusively agricultural credit.

Outside of the commercial banks and the government's BAAC, very little comprehensive information has been published about rural financial markets.¹ The studies which do give information about Thailand's non-institutional credit market vary greatly in scale, purpose and method. A national study by Pantum et.al. in 1962-63² remains the most comprehensive available source. The approach taken here, therefore, is to summarise some of the findings of that report³ and to supplement them with reference to a number of more recent though less comprehensive studies.

The characteristics of the non-institutional market are discussed under 4 headings: its importance compared to the institutional market; types of lender; interest rates; and types of collateral.

1. **The relative importance of non-institutional credit.** Table 5.1 lists nine credit studies since 1957. Although there

are problems in comparing results across studies, the percentages in the last column do suggest a trend towards a decreasing incidence of non-institutional borrowing. This is consistent with the expansion in institutional lending reported later in this chapter. The survey of North-Eastern farmers reported in Chapter 6 of the thesis (hereafter referred to as Survey 1 or the 1981/82 survey)⁴ found that 43% of the number of debts among survey farmers were to non-institutional lenders. This is very close to the figure produced by the 1975/76 study in Table 5.1. When the value of debts is considered rather than the number of debts, the 43% in the 1981/82 Survey falls to 19%, reflecting the lower average value of a non-institutional loan.

2. **Types of Lender.** Of the two types of non-institutional sources, the 1962/63 survey found the non-commercial lenders to be the most important for all but the Central Region, and it was relatives rather than neighbours which were the most important under this category. This pattern was strongest in the North-East where 50% of loans and 58% of loan value were accounted for by relatives. The importance of relatives as non-institutional lenders in the North-East was also evidenced in the 1981/82 survey, which found that 57% of all non-institutional loans (25% of all loans from all sources) came from that source.⁵ This has implications for the cost and ease of borrowing, since many loans from relatives come with low or zero interest charges and do not require collateral.

Table 5.1 : Surveys of Rural Credit in Thailand, showing the percentage of credit from non-institutional markets in each survey

Year of Survey	Title	Author	% of Credit from Unorganised (Non-institutional Markets)
1957/8	Indebtedness and Rice Trade of Farmers in the Central Plains	Uthis Naksawasdi	90.0
1962/3	Agricultural Credit in Thailand	Panthum et.al.	94.5
1967/8	Indebtedness and Rice Trade of Farmers in the Central Plains	Uthis Naksawasdi	75.0
1970/1	Indebtedness of Farmers Whole Kingdom	Ministry of Agriculture	65.6
1971/2	Agricultural Credit in North Thailand	Panthum Disyamonthol	39.3
1971/2	Survey of Farmers' Indebtedness Whole Kingdom	Ministry of Agriculture	72.2
1972/3	Agricultural Credit in N.E. Thailand	Panthum	29.0
1974/5	Capital Accumulation Agricultural Sector	Prajerd Sunsarp	53.0
1975/6	Indebtedness of Thai Farmers	Ministry of Agriculture	42.5

Source : Somsak Tambunlertchai, 1984, *Rural Credit in Thailand*, Paper presented at the USAID Seminar on employment and rural credit, Bangkok, March 31, 1984, Table 10, p.23

The 1962/63 Survey found loans from neighbours to be the highest in the North and lowest in the North-East, accounting for 24.1% and 12.1% of loans respectively. This pattern can partly be explained by the prevalence in the North of multi-crop systems involving vegetable and fruit crops. Smaller farmers frequently rent land from larger neighbours to produce minor crops at certain times of the year, and are therefore more likely to borrow from neighbours. In the North-East, however, there is very little dry season production and only a very small variety of crops can be grown. This limits the chance of renting land for off-season secondary crop production. Another reason for the lower importance of neighbour-sources in the North-East is the lower per-capita incomes in the region (see Chapter 4); there are fewer wealthy neighbours than in the North and elsewhere.

The Central Region with its greater degree of commercialisation was the only region in the 1962/63 survey where commercial lenders were the most important source of rural credit (accounting for 65.9% of loans and 57.8% of loan value). By contrast, the 1981/82 survey found that in the North-East, loans from non-institutional commercial lenders accounted for only 37% of non-institutional loans (17% of all loans from all sources).

The 1962/63 Survey looked at the importance of the different types of commercial lender. Shopkeepers were the most important in the Central Region (39.2% of loans), a pattern

that was reflected nationally (16.5% of loans). There was a big difference between the percentage of loans and percentage of loan value, indicating that although shopkeepers were the most important, they generally made only small loans.

Crop purchasers were found to be relatively unimportant sources of credit throughout the country (8.6% of loans), though in the South they were more important than shopkeepers. The pattern in the South may be explained by the predominance of plantation agriculture which tends to involve more production and sales contracts, and a generally higher degree of organisation than non-plantation agriculture. The pre-sale of crops to creditors has often been thought to be widespread and exploitative, mainly because of the low valuation of crops. There is little evidence for this in the 1962/63 survey, however. Nationally, only 6.3% of principal and 15% of interest was repaid in kind, and in the Central Region, where borrowing from crop-purchasers most frequently occurred, only 7% of borrowers were committed to sell to their crop-purchasing creditors.

Landlords, money-lenders and other sources of commercial credit such as travelling tradesmen, all played a relatively minor role in providing credit to rural households. Nationally, landlords were the least important of these three, accounting for 2.1% of loans, while 'others' (mainly travelling-tradesmen) and money-lenders accounted for 7.9% and 5.4% respectively.

There is a consistency in this pattern of non-institutional commercial lending when we compare it with the 1981/82 survey, although some categories of lender are not comparable. Like the earlier survey, the 1981/82 survey found merchants⁶ to be the most important of the commercial lenders (28.2% of non-institutional loans and 13% of all loans). Money-lenders and landlords were of minor importance and, as in the 1962/3 survey, the former was more important than the latter (money-lenders accounted for 4.4% of non-institutional loans and 2% of all loans, while landlords accounted for 2.2% of non-institutional loans and only 1% of all loans).

In summary, the 1962/3 survey found that all forms of commercial lending were more important in the Central Region than elsewhere. This coincides with greater modernisation, higher farm incomes and greater market development in that region, and contrasts with the greater importance of intra-family borrowing in the poorer regions with less modernised agriculture, in particular the North-East. The 1981/82 survey, though not strictly comparable with the earlier survey, supports its findings, both in the importance of relatives as non-institutional lenders and in the relative importance of the different types of commercial lender.

- 3 **Interest Rates.** Much has been said in Thailand, as elsewhere, about exorbitant rates and monopolistic practices. Onchan, for example, comments that it was primarily to free farmers from usurious lenders that the

original Capital Cooperatives were set up in 1916.⁷ Annual rates of interest well above urban capital market rates are frequently reported. The 1962/63 survey found the average for the whole country to be 2.4% per month or 28.8% annually. The average annualised rate faced by the North-Eastern farmers in the 1981/82 survey was close to this at 26%. Higher rates than these have been found in other studies: a 1976/77 survey of corn farmers found that small farmers paid an average annual rate of 63.5% on cash repayments, medium sized farmers paid 43.7% and large farmers paid 35.1%.⁸

The possible reasons for high interest rates such as these were discussed in Chapter 3. The traditional monopolistic money-lender explanation was contrasted with the suggestion that high rates may, in some cases, be attributed to high default risk, high administrative costs and an immobility of funds (Chapter 3). There are three findings in the 1962/3 survey which contribute to our understanding of the level of interest rates charged in rural Thailand. First, it found that only a small proportion of all borrowers paid really high rates; only 13.8% of borrowers were charged over 5% per month. A clear pattern also emerged of higher rates being faced by smaller borrowers. For example, the average monthly rate fell from 3.6% for farmers with net incomes of less than 2,000 baht, to 2.7% for farmers with 20,000 baht and over. The high rates, therefore, are not evenly spread. Second, although it is the smaller borrowers as a whole who faced higher rates, they also received a significant

proportion of their loans interest-free. In fact, the category of smallest borrowers in the survey (borrowing less than 500 baht), while paying the highest average monthly rate of 3.2%, nevertheless received the largest proportion of low or zero interest loans (51.1% of all loans to that group were at a monthly rate of between 0 and 0.9%).

Third, the survey found generally high rates of default among borrowers which suggests that the high interest rates might not be unreasonable. The survey reported that for the country, as a whole, the percentages of borrowers repaying principal and interest were 57.0% and 81.9% respectively. It is not clear, however, whether these referred to bad debts or to all past-due loans. It is possible to make an estimation of the reasonable nominal rate that must be charged, given a certain default rate, in order to achieve a given real rate of return. If it is assumed that 25% is a reasonable measure of the default rate among Thai non-institutional borrowers and that lenders need to receive an effective rate of return of 15%, the following expression⁹ gives the nominal rate which they need to charge.

$$R = N - \frac{D}{T} - \left(\frac{D}{T} N \right) \quad (5.1)$$

where R = effective rate of return;

N = nominal interest rate;

D = value of defaults (non-payments); and

T = total value of loans made

Using the figures suggested, N turns out to be 53.33%. It seems, therefore, that lenders could charge up to around 50% per annum and, because of defaulters, still be making only a 15% effective return.

The figures of 57.0% and 81.9% above were national averages. It is interesting to note that the survey's default percentages for the North-East, where borrowing from relatives is that much more important, were below the national average, with 64.4% and 91% of borrowers respectively repaying principal and interest.

As for the relationship between rates and type of lender, it was the shopkeepers and landlords who were found to charge the highest rates, both with a mean monthly rate, for the whole country, of 3.5%. Relatives (interest-free loans included) were the cheapest source with a monthly rate of 1.8%.

We may conclude from this evidence that the high rural interest rates, discussed in general in Chapter 3, are indeed found among the non-institutional commercial lenders in rural Thailand. The wide variation in rates reported in the studies above is also consistent with the general pattern discussed in Chapter 3. Lack of data on default rates prohibits an accurate assessment of whether the high rates are reasonable or not. Defaults in the institutional market, are well documented, but for the non-institutional market the 1962/63 study provides the only readily available figures. Inferring from these a conservative 25% default

rate, interest rates as high as 50% may not be unreasonable.

4. **Types of Collateral.** Drawing again on the 1962/63 survey, a high degree of flexibility was found with respect to the method of securing loans from rural lenders. Only 23.6% of all borrowers reported the securing of loans with any collateral at all. 49.1% gave no security and 27.3% failed to respond. The reasons for the low importance of collateral in the non-institutional market are at least two-fold. First, borrowing from relatives frequently involves spoken agreements where both kinship ties and honour or reputation preclude the asking for security. Second, small loans to poor farmers with few assets to offer as collateral are often made at higher interest rates. This may help to explain the differences in average interest rates reported for different borrower-size categories. The mean monthly rate of interest for the smallest borrower category for example (borrowing below 495 baht), was 3.2% compared to 1.9% charged to the largest borrower category (borrowing over 3,000 baht). Land, though the single most important type of collateral, was nevertheless reported for only 17.3% of all borrowers.

Accepting the limited nature of available data, this section gives some indication of the relative importance and the important features of the non-institutional credit market in rural Thailand. Far more material has been published on Thailand's growing institutional credit market by both academics and institutions themselves in their own reports. The following section looks, firstly, at the historical

perspective of the institutional market and secondly at the major institutions involved. Section C then goes on to examine their performance according to selected criteria.

B Institutional Markets

1 Historical Perspective¹⁰

The Credit Co-operatives of 1916 were the first significant attempt at institution-building for the capital needs of Thai farmers. It was not until 1947, however, that the Bank for Cooperatives was established specifically to finance these and other types of co-operative. The flow of funds to the rural sector increased steadily through this Bank, so that by 1966, when it became reincorporated as the BAAC, it had disbursed over 840 million baht to Co-operatives for on-lending to farmers. From 1966 the BAAC, in accord with the Act which brought it into being, started lending to individual client farmers as well as co-operatives. A year later in 1967, the Bank of Thailand (BOT), Thailand's central bank, first started to direct resources into the rural credit markets by receiving authorisation to re-discount promissory notes associated with agricultural production loans. In 1971, authorisation was extended to cover notes for agricultural marketing loans, and in 1974 livestock transactions were included. This source of finance for rural credit institutions seems not to have been very popular with commercial banks, largely because of the constraints the BOT put on allowable interest rates. The spread between borrowing and allowable lending rates is

narrow when the high cost of administering agricultural loans is considered. In 1975, the BOT, therefore, introduced a quota mechanism, encouraging agricultural lending by regulation rather than by incentive. Commercial banks were required to have 5% of their total value of loans outstanding at the end of the year in agriculture. The quota increased to 7%¹¹ in 1976, to 9% in 1977, and to 11% in 1978, though 2% of the 11% could include loans to agrobusiness. Currently, the quota requires that 11% of outstanding loans be to agriculture, and an additional 2% to agrobusiness. This measure has had a very significant impact on rural finance. Prior to the quota system, only 5 of Thailand's 29 commercial banks lent to agriculture to any degree, and less than 2% of all commercial bank loans went to the agricultural sector. Currently, 16 of them have significant direct agricultural lending programmes, and all of them, because of the quota regulation, lend a certain proportion to agriculture. If they cannot meet the quota through direct lending, they can make it up by deposits with the BAAC. Largely as a result of the expansion of commercial bank's deposits with BAAC, the total value of agricultural loans disbursed tripled from 1,084.1 million baht in 1973, to 3,354.8 million baht in 1975.

In addition to rediscounting notes for agriculture and setting an agricultural loan quota, the BOT further encouraged agricultural lending by requiring that all new branches of commercial banks lend 60% of locally generated deposits to local borrowers. One third of these locally-

lent funds must be for agricultural purposes. At the same time, restriction of the opening of new branches was relaxed, and the number of branches shot up from 895 in 1975, to 1,065 in 1976; 170 in one year. Previous rates of expansion averaged at around 50 new branches per year.

As a result of these developments, there is an institutional financial market of considerable size operating in the rural areas of Thailand. The three major types of institution which are the suppliers in this market have already been named: the semi-public BAAC, the commercial banks and the Co-operative Societies. The Farmer Associations make a fourth type of institutional lender, though they are much less important than the other three. The important characteristics of each of these four types of institutions are described in the following section.

2 The Bank for Agriculture and Agricultural Co-operatives (BAAC)

Set up by a government Act in 1966 to both finance the Kingdom's Co-operatives and extend loans to individual farmers, it is currently the largest single source of agricultural credit in Thailand. It draws its funds from four major sources, in addition to its own capital. In order of importance these are: deposits from commercial banks, rediscounted notes within the B.O.T., savings and time deposits from the public, and foreign agencies. It is overwhelmingly a lending bank relying on government regulation and subsidy for its operating funds. Until recently, individual farmer clients were required to deposit

a sum equal to 5% of their loan for a 3-year period at 9% interest. That having stopped now, due to high administrative costs, there is no great attempt to mobilise rural savings to weaken BAAC's reliance on government support. The narrow interest rate spread between the rates at which the BAAC can borrow and on-lend funds, has acted as a strong disincentive to expand the bank's role as a savings institution. In 1982, only 15.7% of BAAC's operating fund was accounted for by deposits from the general public.¹²

These funds which enabled 11.799 million baht to be disbursed in 1982, are channelled to the Thai countryside through a network of 66 branches and 545 district-level field offices.¹³ There are three types of borrowers: individual clients, Co-operative Societies and Farmer Associations. Individual clients accounted for 75.9% of disbursements in 1982; Co-operative Societies 23.6% and Farmer's Associations 0.5%, so the individual client sector is by far the most important.

Individual clients are farmers who have been accepted for registration with the Bank and they may or may not borrow in any one year. Although each farmer applies to register¹⁴ and is accepted as an individual client, he must first join an informal farmer group and his registration application must be supported by the group leader. The groups are designed to function primarily as joint-liability groups which means that tenants or farmers with very small landholdings should be able to become clients.¹⁵ Through a rapid programme of expansion over the last 18 years,

individual clients now number 1,110,692,¹⁶ about one quarter of the total number of farm families in Thailand.

Three types of loan are offered to registered clients: short, medium and long-term loans.¹⁷ Short-term loans are made for annual production and marketing expenses of the informal group's main crop, secondary crop and livestock activities, and for consumption expenses to allow for the postponement of sale of produce. The maturity period is fixed at one year with a basic rate of 14% interest. Generally, all BAAC loans, whatever the term, are fixed at a 14% non-compounding annual rate. Short-term loans are secured generally by group-liability, members making a new liability contract with each new annual loan. Group members can, under certain conditions, if they wish, take out a loan larger than the 30,000 baht ceiling imposed on group-secured loans, if they mortgage property or obtain the signatures of two guarantors. Although evaluation of the loan, including validating the loan purpose and securing it, involves the whole group, individual contracts are made with each borrowing farmer. Groups are usually made up of around 10 members, though some are as large as 30.

Medium-term loans are made for investments with an expected payback period of three years and cover such items as small land developments and farm equipment. Security may either be mortgaged property or the signatures of two guarantors. The total amount of short-term (main and secondary activity) loans and medium-term loans must not exceed 60,000 baht.

Long-term loans are made to farmers with sufficient mortgageable property for major investment projects such as well digging, dikes, ditches and land reclamation. A ceiling of 5 million baht and a floor of 10,000 baht operate on these loans, and the maturity period depends on the particular project but should not exceed 15 years.

In addition to the three main types of loan, individual farmers may receive BAAC credit through cash credit lines (proven clients only) or through integrated development projects. BAAC started lending to farmers participating in such projects in 1977 and has, to date, helped finance 39 projects organised by a variety of agencies.

Co-operatives are the second category of BAAC borrower. BAAC has maintained its commitment to servicing these institutions inspite of poor repayment records, since the government favours cooperatives as the basis of a modernising Thai agriculture.¹⁸ 853 of the 1,089 Agricultural Cooperatives in the Kingdom were registered as clients of the BAAC as of March 1983. Although they represented 798,446 farming families, the 2,783 million baht disbursed to them in that year would have reached a number of farmers considerably less than that total, because of non-borrowing members. Co-operatives receive BAAC funds for four sorts of purposes. Firstly, they receive loans for on-lending to members. Societies can borrow for the purpose of making loans to members for short-term production and medium-term investments. This type constitutes the bulk of BAAC funds to Cooperatives, accounting for 86% of

disbursements in 1982. Cooperatives are permitted to on-lend at 14% per annum having borrowed at 11%, so that BAAC effectively subsidises their administrative costs. Secondly, they receive loans for the purchase of inputs and equipment for re-sale to members. This type accounted for 5% of BAAC's disbursements to co-ops in 1982, and are given on terms similar to the first type. Thirdly, they receive loans for purchasing and marketing members' produce. These are designed to help the societies expand their role in market development. They accounted for 9% of BAAC's co-op disbursements in 1982. Fourthly, they receive long-term loans for the development of their own fixed assets. Co-operatives can borrow to enhance their own facilities; for the construction of processing plants or warehouses for example. There has not been a great uptake of this type of loan, however, and in 1982 none were disbursed at all.

Farmers' Associations are the third category of BAAC client. Operating mainly as credit organisations, and organised along similar lines to the Co-ops, but on a smaller scale, they may borrow from BAAC under the same four categories. The terms, such as the ceilings imposed are, however, generally more restrictive. Unlike the Cooperatives, the Associations have received a declining amount of funds from BAAC in recent years, dropping from over 183 million baht in 1978 to 57 million baht in 1982. The decline has largely been due to the response of BAAC to a poor repayment performance, coupled by a lack of political commitment to this type of farmer-group.

3 Commercial Banks

The 16 commercial banks currently lending to agriculture offer a variety of services to farmers. All have at least a small agricultural portfolio in addition to their deposits with BAAC. The government-owned Krung Thai Bank seems to have been the first to start lending to agriculture in a significant way. Since its first programme in 1958, commercial banks have offered short, medium and long term loans to a growing number of farmers. Traditionally, land has been required as collateral, even for short-term loans, but, more recently, the joint-liability system has been introduced, opening up the banks' services to a wider selection of farmers. The Thai Farmers Bank and the publicly owned Bangkok Bank both have a significant programme of lending small amounts on the basis of joint liability.

Not many commercial banks provide finance for cooperatives. The Bangkok Bank is the most important, lending to some of the better organised cooperatives, especially for fixed asset development.

Several of the banks are important financiers of agricultural-related projects, such as the Krung Thai Bank which has provided credit for projects run by the Office of Accelerated Rural Development in the country's sensitive areas. The Thai Farmers Bank and the Bank of Ayudhya are two other important project financiers, supporting projects concerned with plantation development, irrigation, village

infrastructure and other integrated rural development schemes. Most banks have found it relatively easier to lend to agri-business and disburse credit for example to vegetable and oil processing plants, fruit, vegetable and fish canneries, rice and sugar mills and animal-project processors. Interest rates vary according to lenders, borrowers, size of loan and length of maturity, but have averaged at a few percentage-points higher than the BAAC's subsidised rate.

4 Cooperatives and Farmers' Associations

At the early stages of formation, a Cooperative usually operates entirely or primarily as a credit organisation. They are financed from a variety of sources including ownership capital and deposits from members, commercial banks and government agencies. The BAAC is the most important source, however, accounting for 86.1% of Cooperatives' total liabilities in 1975.

The formation of a Cooperative requires a minimum of 150 farmers. These are then allowed to borrow a maximum of 1 million baht in the first year, a ceiling which increases until after the third year when it becomes an amount equal to ten times the capital stock of the Cooperative. Some societies have grown to a membership of several thousand, and with growth and time usually follows a diversification into input and equipment purchase and sale, buying, warehousing and marketing of members' produce. Members can borrow large loans by mortgaging their land, but most loans are secured by individual or group guarantee in the same

manner as BAAC. Unlike BAAC, however, the loan ceiling for any individual member is set by the size of his paid-up capital. A single share of stock worth 50 baht entitles a member to borrow, and each additional 50 baht share increases his loan ceiling by 1000 baht.

Farmers Associations mirror the Cooperatives in many ways, the major technical difference being that they are not incorporated under the 1968 Cooperatives Act. They bear many resemblances to young Cooperatives although they are in general six or seven times smaller in terms of membership. Funds are received almost totally from BAAC and re-lent mainly for input costs to members, using land and group liability as collateral. Like the Cooperative and BAAC Farmers, Association members pay a concessionary 14% annual rate of interest.

C Performance of Institutional Markets

1 Performance: flow of funds to agriculture

It has already been noted in Section B.1. of this Chapter, that the total volume of funds directed towards the agricultural sector has increased enormously in recent years. The total volume of credit to agriculture (from BAAC and commercial banks) rose from 2,051 million baht in 1973 to 14,173 million in 1977.¹⁹ At the end of 1978, commercial banks, through direct lending and deposits with BAAC, had 19,993 million baht in agricultural loans, which equalled 12.4% of total bank loans.²⁰ A good way of expressing the

growing importance of borrowing in Thai agriculture is to express the total value of credit as a proportion of the total value of agricultural GNP. Credit/agricultural GNP ratios rose from .028 in 1973 to .134 in 1977, suggesting a steady financial deepening in the agricultural sector.

The role of commercial bank direct lending has gradually increased, so that the percentage of all agricultural loans accounted for by commercial banks rose from 38% in 1977 to 44% in 1978.²² The BAAC remains the single most important financier of agriculture, however.

By 1981, institutional lenders were meeting between them an estimated 66% of Thailand's short and medium term agricultural credit needs. Lee and Jao²³ commented that this expansion has taken place very largely under the regulative influence of the Bank of Thailand, and that normal market forces would naturally induce banks to finance trade and services rather than agriculture. This is particularly true in Thailand, they suggest, since the majority of commercial banks are controlled by just six or seven families who tend to manage the banks more as means to draw finance to family businesses than as suppliers of the general-market demand for finance.²⁴ An IMF expert criticised these commercial banks as being more concerned with profit than with the social responsibility of financing development.²⁵ If this is so of commercial banks, then the success in expansion of agricultural lending under government regulation is even more notable. There is still a long way to go, however, before the credit/agricultural

GDP ratio reaches the level of the more progressive Asian countries, which are lead by Taiwan and Japan.

The overall pattern of agricultural lending is encouraging. A more complete evaluation, however, involves looking at the composition of this flow of funds along certain important dimensions. In the following, three areas are discussed : type of loans, distribution between regions, and distribution between individual farmers.

The latter takes up the issue of unequal lending raised in Chapter 3 and looks at some of the Thai evidence.

2 Performance : Institutional Viability

Two measures of performance of the institutional credit market relate to the viability of the market and are therefore important with respect to the maintenance of its service to farmers. There is no ready source of data in either of these areas for commercial banks, so the discussion is confined to BAAC.

Institutional viability is determined largely by the spread between the rate at which loans are made to borrowers, and the overall cost of lending. Administration costs and repayment rates are two of the component parts of lending costs. Lending costs (LC) can be expressed in the following way :

$$LC = CF + AC + CD \quad (5.2)$$

where CF = cost of funds to lender

AC = administration costs

and CD = the effective cost of defaulted loans

Disbursing much of its credit as annual production loans to individual clients, we would expect BAAC to have high administrative costs.²⁶ Adding to the costs of transaction and account maintenance, costs are pushed up through loan supervision which is necessary to ensure that loans are used for the authorised purpose.

A factor mitigating against high supervision costs, however, is the organisation of clients into groups. This has undoubtedly helped alleviate the problem as group members, being responsible for each other's repayments, exercise their own mutual discipline. Negotiation costs are also reduced through using the group leader as a representative of other members.

In 1981, BAAC's administrative expenses amounted to 5,496 million baht.²⁷ As a percentage of that year's 10,659 million baht disbursements, this equals 5.16%. This represents a considerable drop over previous years; largely a result of efforts by the bank to reduce operating costs.²⁸ This percentage has been falling consistently since 1971 when it was 12.6%. It nevertheless is higher than the comparable statistic for commercial banks and needs to come down further if BAAC is to become financially more viable without being propped up by subsidy and regulation.

While it is the BAAC's individual clients who contribute most to administrative costs, it is its farmer-institution clients which have been the worst defaulters.²⁹ Individual clients have a relatively good repayment record for short-term loans averaging at 77.78% principal repaid on time between 1978 and 1982. Defaults are worse for longer-term maturities, the average 1978-82 rate principal repaid on time being 62.62% for medium-term loans and 65.68% for long-term loans.³⁰ Cooperative and Farmer Associations by comparison fare much worse. This has been the subject of concern in recent years and new and stricter rules have been applied to counter the problem. The problem seems to lie on both the side of the borrowing institution and the BAAC. Inefficient, irresponsible and sometimes corrupt management, especially in the Farmer Associations, has partly been to blame. On the other hand, lengthy delays in receiving BAAC funds has often encouraged societies to re-lend to members, the members' repayments which should have been re-paid to BAAC at the end of the year. In 1982, members of client Cooperatives repaid only 44.2% of matured principal. Not all of this (rather low) figure was repaid to BAAC; only 50% of Cooperatives were able to repay to BAAC 90% or more of their members' own repayments. Farmers Associations repaid a better proportion of their members' repayments to BAAC in 1982, but members repaid only 29% of matured principal.³¹

It is difficult to assess accurately the cost of this varied repayment performance. One reason is that the measure of repayment rate reported in BAAC statistics (the percentage

of matured principal repaid), does not tell us the extent of bad debts. Loans falling overdue can be rescheduled, and not all those left in arrears are written off. It also underestimates default because it fails to include interest payments falling past-due. If we assume, however, a conservative effective default rate of 10%, an average cost of borrowed funds of 8% and administrative costs of 5%, total lending costs are given by the following expression:³²

$$\begin{aligned}
 LC &= .08 + .05 + \frac{.10}{1-.10} (1 + .08 + .05) && (5.3) \\
 &= 25.56\%
 \end{aligned}$$

This is considerably higher than the 14% charged on most loans and represents a threat to the long-term viability of the BAAC. The trend in default rates is not clear, so it is not possible to say whether the critical spread between lending costs and revenue is narrowing or broadening. Default rates have been rising for Farmer Associations and short and medium-term loans to individual clients, but falling for individual client's long-term loans for refinancing old debts. Default on loans to Cooperatives and for investment has remained static. Set against these trends, there has been a steady rise in the institutional interest rate in recent years, and there is pressure from some quarters to bring it up even further.

3 Performance: Type of Loan

Chapter 4 looked at the problems of agriculture in Thailand's North East. The low technological status of

agriculture in that region would suggest that long-term finance is essential for agricultural development. This could be said of all regions except the Central Region perhaps (where agricultural modernisation has advanced to a significantly higher level than elsewhere). Long-term finance will allow vital improvements in land-productivity through land reclamation, re-organisation and conservation schemes. It will also allow the diversification of farm production into crops with longer-term pay-back such as fruit, kapok and other tree-crops, and into livestock.

The term structure of loans to agriculture does not, however, reflect the importance of long-term finance. Long-term loans accounted for only 13% of BAAC's disbursements to individual clients in 1982, and this was a marked increase over previous years (the figure was, for example, 5% in 1975). The situation is paralleled in the commercial banks although, like BAAC, there has been some limited progress. This represents a serious deficiency in Thailand's agricultural finance as it stands. Although short-term capital is needed to make full use of existing farm resources, it is only through longer-term investments that farmers will be able to move to more advanced production functions as they diversify, mechanise, irrigate and efficiently manage all the land to which they have access.

There are at least two important factors mitigating against the expansion of long-term credit. First, the current confusion in the issue of land titles (referred to in

Chapter 4) means that only a fraction of farmers who claim to own land, can actually use that land as security against a long-term loan. Second, a lack of bank officers who are experienced in evaluating long-term farm projects has meant both a tendency not to disburse much credit for such projects, and also a significant failure rate in long-term lending.³³ Lending to badly designed projects has resulted in poor repayment rates. An important contributing problem in the case of the BAAC is that long-term loans have to be evaluated and approved in Bangkok, resulting in time delays and other problems associated with the distance between lender and borrower. A regional level of administration and an increase in the number of long-term loan officers in each province (currently just one) would help overcome these problems.³⁴

Medium-term loans are important for those intermediate technological advances such as investment in farm equipment, additional land or livestock purchasing to supplement a main crop activity. The BAAC has traditionally had a better record here, medium-term loans rising from 26% of all disbursements in 1970 to 42% in 1976. By 1982, however, through a rapid expansion in short-term lending and progress in long-term lending, that proportion had fallen to 12%, even lower than the proportion formed by long-term loans. In fact, since 1979, the actual value of disbursements of medium term loans fell.³⁵ This may indicate a falling off of demand among long-standing clients due to the successful use of previous loans during their time as clients.

4 Performance : Regional Distribution of Funds

A little has already been said in Chapter 4 about the North-Eastern region's share of credit. Those comments are expanded here in the context of the performance of the institutional credit market. The focus is on BAAC because of the unavailability of regional data for the other institutions. From an initial concentration in the more prosperous Central region, there has been a more recent emphasis on improving the regional distribution of disbursements. This has been particularly felt by the North-East. Thus, the numbers of BAAC clients in that region increased by 321% between 1971 and 1980 compared with a 267% increase in the whole Kingdom. The percentages for the North and South are less than for the North-East but greater than the national figure, while the Central Region's clientel grew at well below the national rate. Similarly, between 1971 and 1976, the number of districts served by BAAC rose by 42% in the North-East compared to 30.6% nationally, and 14.7% in the Central Region. There can be little doubt about the trend towards a more even distribution of BAAC services across the Kingdom. Table 5.2 shows two things in this respect. First, the real increase in BAAC disbursements between 1970 and 1980 was relatively high in the two regions for which mean disbursements per farm holding were lowest (the North-East and the South). Disbursements in the North-East increased by 50% in real terms, a higher growth rate than all regions except the East.³⁶ This indicates some improvement in the regional distribution of the volume of disbursements. Second,

despite improvements, a disproportionate provision of credit in the Central Region still persists. Thus, the mean disbursement per farm holding in the Central Region (Table 5.2) is over four times that of the North-East and well over twice that of the North and South. The low value of disbursements per holding in the North-East reflects both the low proportion of clients among the Region's farmers and a low value of disbursement per client. In 1976, the disbursement per client was only 4,143 baht in the North-East compared to 7,607 baht in the Central Region. This difference may be partly due to lower demand in the North-East associated with the poor productivity of land in the Region. It seems unlikely that this is the complete explanation, however; unless we can say that demand has been saturated in the North-East, at the currently low levels, there is a need to channel disproportionately greater amounts of credit into the region in order to reduce the regional inequality in the supply of institutional finance for agriculture. The same applies to the North and South Regions. The general discussion of demand for rural credit in Thailand at the end of this chapter (Section D), and the demand analysis in Chapter 7, indicate that demand has not been saturated. The results of that analysis show that the typical farmer in the North-Eastern study area has a substantial excess capacity for absorbing short-term production credit.

Table 5.2 BAAC Disbursements by Region, 1976-1980

	Total amount disbursed (millions of baht)				Real Increase 1976-1980	Mean Disbursement Per Farm Holding 1979 + 1980 (baht)
	1976	%	1980	%	%	
North	1181	27	2059	25	20	2084
North-East	900	21	2025	24	50	1181
Centre	789	18	1464	18	24	4828
East	347	8	829	10	59	3527
West	697	16	1115	13	7	4043
South	404	9	791	10	32	1365
Thailand	4318	100	8285	100	26	2020

Source : Lightfoot, R.P. and Fox, J., 1983, Table 2, p.11

5 Performance : Distribution of Funds Between Individual Farmers

Although the inter-regional distribution of credit is somewhat unequal, the distribution between different strata of farmers within any region may be even more unequal. Having commented on the rigorous criteria used by banks to assess the credit worthiness of a Thai farmer, Onchan concludes :

"Not many areas or farmers can meet such standards. Hence, all banks tend to concentrate their lending services to big farmers living in the prosperous districts near the suburban towns. This tendency cannot avoid the public criticism that banks operate

to make rich farmers richer and poor farmers poorer."³⁷

BAAC, as the major single source of finance to Thailand's small farmers recognises that this is a problem. A BAAC report to the World Bank commented that while there are serious deficiencies in all of the component services vital to meeting the needs of the rural poor,

"...both adequate credit and extension support have been particularly lacking for many of the smaller farms."³⁸

The reason for the lack of adequate credit for small farmers was in the same paper, put down to the fact that :

"the existing farmer registration and credit worthiness regulations of the BAAC must ensure that the farmer has the ability to repay the loan."³⁹

In an analysis of BAAC client statistics, Lightfoot and Fox have shown that farmers with smaller holdings are seriously under-represented in the BAAC clientel.⁴⁰

Area of farm-holding or area planted can be taken in general, as an indicator of farm income-earning capacity (the relationship is not so clear for livestock farms⁴¹) and therefore, as a measure of economic status. Because renting is relatively unimportant in the North-East, holding size is also an indicator of wealth, though this is somewhat complicated by the uncertain status of many farmers' title-

deeds.

Lightfoot and Fox report that the modal size of holding for BAAC clients in the North-East is 20-30 rai.⁴² This compares with the 10-20 rai modal category for North-Eastern farmers as a whole.⁴³

Using data for the total number of farmers in the region under different size categories and comparing it with numbers of BAAC farmers in those categories, we can say something about the probability of a farmer of a certain size category being a BAAC client. The following analysis does this using the Agricultural Census of Thailand 1978 and a short-term loan survey carried out by BAAC in 1980.

The objective is to estimate, for each holding-size category, the proportion of the North-East population total who are BAAC clients. The Agricultural Census gives numbers of holdings under certain size-groupings. It involved 100% enumeration so the figures can be taken as population statistics. The BAAC client survey on the other hand was a 1% sample of all clients. Estimates of numbers of clients in different size categories, therefore, are sample statistics and have to be expressed within confidence intervals. The analysis involves the following steps:

1. Group the BAAC clients in the client survey into holding-size categories. To try and isolate the influence of livestock farms (small holding area with relatively large turnover, farmers with the smallest

holdings (0 to 10 rai) are divided into two further groups: 0 to 3.99 rai and 4 to 9.99 rai.

2. Compute the number in each category as a proportion of all clients in the survey.
3. Compute confidence intervals around each proportion so that inference can be made to the North-East population. The interval around each proportion is given by the following expression :⁴⁴

$$P_{iS} \pm Z \sqrt{\frac{P_{iS} Q_{iS}}{N}} \quad (5.4)$$

where P_{iS} = proportion of category i in the sample

$Q_{iS} = 1 - P_{iS}$

N = Sample size (all categories)

$P_{iS} Q_{iS}$ = the best estimate of the standard error of the 'mean' P_{iS}

4. Multiply each estimated proportion by the total number of clients in the North-East to get an interval estimate of the population number of clients in each size category.
5. From the Agricultural census, find total numbers of holdings in each size-category for the North-East.
6. For each size-category, divide the estimated number of clients in the North-East by the total number of holdings in the North-East, to give, by size-category, the probability of a North-Eastern farm-holder being a BAAC client. The results are presented in Table 5.3.

Table 5.3. Probability of a North-Eastern Farmer being a BAAC Client, by Size of Holding

Holding size (rai)	Point Estimate (proportion or probability)	Interval Estimate (P = .95)
0 - 3.99	.079	.060 to .098
4 - 9.99	.016	.011 to .021 *
10 - 19.99	.082	.075 to .089 *
20 - 29.99	.183	.169 to .197 *
30 - 49.99	.281	.267 to .295 *
50 - 79.99	.451	.414 to .488
80 - 139.99	.200	.165 to .235
140 +	.285	.134 to .436

Note: * indicates categories with significantly lower probability estimates than the next largest category

Source : Computed from survey data (BAAC short-term loan survey, 1980), and Agricultural Census Statistics (1978)⁴⁵

A clear pattern emerges in which smaller firms are under-represented among BAAC clients. The smallest category (0-3.99 rai) is probably inflated because it includes livestock farmers whose holding-size understates the size of their farm enterprise when compared with crop farmers. Excluding holdings up to 3.99 rai, the probability of being a BAAC client increases steadily as holding-size increases, until the very largest categories are reached. Only 1.6% of all North-Eastern farmers with between 4 and 9.99 rai were BAAC clients in 1980. On the other hand, the proportion of farmers with holdings between 50 and 79.99 rai who are

clients is significantly higher at 45.1%.

The significance of the difference in probability between categories can be assessed by looking at the overlap between intervals. Each of the four categories between 4 and 49.99 rai has a significantly lower probability than the category above it ($P = .95$). Since the chance of being found among the BAAC clientel is significantly lower for smaller farmers, we can conclude that BAAC has concentrated its services on the middle and large farmers.

A further dimension to the issue of the distribution of BAAC services between strata of farmers is the distribution over tenure types. This is less important in the North-East, however, since such a large proportion of the region's farmers have some form of ownership of their holdings (95% in 1978).⁴⁶ Tenants and part-tenants are in fact over-represented among BAAC farmers in the North-East, representing 11% of all clients, while they form only 5% of the region's farmers.

D Demand for Agricultural Credit in Thailand : A Discussion Preliminary to the Analysis of Demand in Chapters 6 to 9

In this discussion and the analysis which follows (Chapters 6-9), it will be helpful to distinguish between three types of demand which shall be termed effective demand, potential demand and latent demand.

- (a) Effective demand refers to actual borrowing. It is credit demanded, measured by credit used.

- (b) Potential demand refers to an expressed desire for credit, not necessarily associated with actual borrowing. There are a number of factors such as availability which may prevent potential demand becoming effective demand.
- (c) Latent demand refers to a capacity to absorb credit, not necessarily associated with a desire to borrow.

The various surveys that have attempted to enumerate the level of debt among Thai farmers reveal a generally high level of effective demand for credit. The first rural-economy survey, conducted in 1930-31⁴⁷ found that all three types of demand were high; borrowing was important to farmers and more credit was needed.

The 1962-63 debt survey,⁴⁸ drawn upon earlier in this chapter, found that 60% of Thai farmers had some sort of outstanding loan. It also established that effective demand was significantly higher in the central plain than other regions. The North-East was found to have a significantly lower effective demand for credit by both the 1962-63 survey and a second survey in 1962 by Long.⁴⁹

A Survey by Peters⁵⁰ in 1966 supported this picture of the North-East, finding that in one North-Eastern province, only 36% of farmers had outstanding loans. While the effective demand was low, potential demand was not: 81% of farmers wanted to borrow. This large gap between effective and potential demand strongly indicates a problem of supply-shortage. A large percentage of farmers, it would seem, saw the need to borrow but either could not find a source or could not borrow on terms which suited them.

A survey by Pantum⁵¹ in 1973 covering the North-East, indicated a higher effective demand, but a lower potential demand than Peter's results; 51% of farmers were in the habit of borrowing, while around 60% saw the need for borrowing.

Given the recent rapid expansion of finance flowing into the agricultural sector (see Section C.1 of this chapter), indebtedness (the effective demand for credit) must have been rising steadily. Lightfoot and Fox,⁵² for example, found for a sample of North-Eastern farmers in Khon Kaen province, that the mean value of loans to BAAC clients at constant prices, increased by 4 to 10 times when their average loan size before and after 1976 was compared. Reviewing the limited evidence available, Onchan concluded that the level of debt among Thai farmers, as a whole, was rising.⁵³

An important feature of credit demand is that there is a strong positive relationship between demand for borrowed capital and income. This is true of both effective and potential demand. The 1981/82 survey of North-Eastern farmers reported in Chapter 6 of this thesis, found this pattern for farmers' institutional debts (Table 5.4).⁵⁴

The 1962-63 debt survey found the same pattern for potential demand, potential demand being correlated with both income and cultivated area (Table 5.5).

The pattern is also revealed in the regional incidence of debt. The higher effective demand in the more prosperous Central Region was noted in Section C of this chapter. The greater importance

Table 5.4. Debts by Net Agricultural Income Category for a Sample of North-Eastern Farmers (1982)

Net agricultural income category (baht)	Mean institutional debt (baht)
Negative or no cash income	885
1 - 1,999	774
2,000 - 3,999	810
4,000 - 5,999	1,419
6,000 - 7,999	2,920
8,000 - 9,999	2,498
10,000 - 11,999	3,835
12,000 - 14,999	3,990
15,000 - 19,999	4,243
20,000 +	6,140
All	1,703

Source : Lightfoot, R.P., 1983, Table 16

of money-lenders in that region as sources of non-institutional credit, gives further evidence of a greater effective demand there. Since it seems reasonable to suggest that relatives and neighbours are the preferred source of non-institutional credit, generally making lower interest charges, the greater use of money lenders in the Central Region indicates that supplies of credit from preferred sources have been exhausted. This is in contrast with the North-East where relatives accounted for a high 50% of loans in the 1962-63 survey.

Table 5.5. Proportion of Borrowers Desiring Loans by Income and Area Cultivated, for a Sample of Thai Farmers (1962-63)

Net Income (baht)	%	Area (rai)	%
1 - 1,999	56.64	1 - 5	49.09
2,000 - 4,999	61.33	5 - 10	54.00
5,000 - 9,999	75.86	10 - 20	57.39
10,000 - 19,999	76.79	20 - 50	72.49
20,000 +	87.50	50 +	90.85
All incomes	68.19	All areas	68.19

Source : Rozental, A.A., 1970, p.57

One consequence of this relationship is that effective demand will grow among farmers whose incomes are growing. Since those farmers are the ones who generally have better access to credit and on better terms, effective demand is likely to grow among one group of farmers, leaving those with low and stagnant incomes with a low and static effective demand for credit. Put simply, richer farmers will tend to borrow more, which in turn will lead to greater growth in incomes. Poorer farmers, less able and perhaps less motivated to borrow, will tend to remain at existing income levels as they forfeit the growth-generating effects of borrowing. This problem is examined empirically in Chapter 7 (Section E.2).

It has already been noted too, in Section C, that while the volume of finance to agriculture has grown tremendously, its coverage of the farming population has been less than equitable. Through rationing procedures, lenders have tended to exclude

smaller farmers. This has a consequence for the pattern of demand in rural areas. The better-off farmers with relatively easy access to credit are more likely to have a strong effective demand for credit. Demand among the smaller farmers, however, is more likely to be potential demand. This assumes (a) that they want to borrow, and (b) that they face availability problems (a supply shortage). The analysis in Chapters 6 to 9 examines this issue empirically.

Through examining the effect of credit supply on the output of a series of model farms, the analysis estimates the magnitude of latent demand; how much credit can the farm absorb?

Through examining the response to questions put to farmers concerning the desire to borrow, it assesses whether that latent demand can be described as potential demand; how much credit would the farmer borrow if he were able?

In examining credit demand in this way, the underlying issue of interest is the problem posed by Chapter 3: the reasons for the non-participation of small farmers in the institutional credit market. The analysis focuses the BAAC's programme.

Recently, the BAAC's rate of recruitment of new clients has noticeably declined.⁵⁵ This is surprising given the rates of institutional market participation implied by the probabilities in Table 5.3. There is no income category in which more than 50% of North-Eastern farmers are clients and only 8.2% (\pm 0.7%) of farmers in the modal farm-size category for the North-East are clients.

The possible reasons for the decline in recruitment, relate to the explanations for the lack of participation of small farmers in the institutional market, discussed in Chapter 3. The decline may imply that farmers operating independently of any credit institution (a) have a low latent demand (they cannot absorb much more working capital on the farm); (b) have a low potential demand (they can absorb extra working capital but either do not want to borrow or do not want to borrow from the BAAC); (c) are unacceptable to BAAC as clients whatever the nature of their demand, or (d) do not, because of inadequate promotion of BAAC facilities, have opportunity to become clients. The empirical analysis in the following chapters seeks to increase our understanding of these issues.

As an introduction to that analysis, however, this section has shown that there is historic evidence that Thai farmers have a positive potential demand for credit and could use more credit if it were made accessible to them. Rozental in 1970, commented about the Thai farmers and the challenge of modernisation :

"The extent to which this orientation (towards commercial agriculture) will actually be translated into effective demand depends on the supply of funds available to him and the terms at which he can borrow".⁵⁶

Onchan, in a similar vein noted in 1979 that :

"the amount of indebtedness does not represent potential credit needs of Thai farmers. Many farmers without security may not be able to borrow. Some want to borrow but cannot borrow as much as they need".⁵⁷

Chapter 5 : Notes and References

1. A report for the USAID in 1978 (Meyer, R.L., et.al., 1978, **Rural Financial Markets in Thailand: Assessment and Recommendations**, USAID, Bangkok), hardly mentions the non-institutional side of rural credit, and because of lack of data, confines discussion to the institutional market.
2. Pantum, Thisyamondal, Virach, Aromdee and Long, M.F., 1965, **Agricultural Credit in Thailand, Theory, Data, Policy**, Kasetstart University, Bangkok
3. The section draws on the survey report (ref.(2) above) and from a discussion of some of the survey results in Rozental, A.A., 1970, *op.cit.*
4. The survey is described in Chapter 6 of this thesis.
5. Lightfoot, R.P., 1983, **Survey of 1,500 Farmers in North-Eastern Thailand: Notes from Preliminary Descriptive Statistics**, Unpublished research report, BAAC, Bangkok
6. This would approximately coincide with the shopkeeper and crop purchaser categories in the 1962/63 survey.
7. Onchan, T., 1979, **The Burden of Debt of Thai Farmers: An Overview**, Discussion Paper, Centre for Applied Economics Research, Kasetsart University, Bangkok
8. Reported in Onchan, T., *Ibid*
9. See, for example, Rozental, A.A., 1970, *op.cit.*
10. The next three sections draw largely on the following sources : BAAC, various dates, **Annual Report(s)**, BAAC, Bangkok; BAAC, various dates, unpublished reports, BAAC, Bangkok; BOT, various dates, **Annual Economic Report(s)**, BOT, Bangkok; Bangkok Bank Monthly Review, various dates, BB, Bangkok; Ingle, C., et.al., **Bank for Agriculture and Agricultural Cooperatives**, in AID, 1973, *op.cit.* AID, Washington, D.C., (Volume 12); Meyer, R.L., Baker, C.B. and Onchan, T., 1979, **Agricultural Credit in Thailand**, Economic and Sociology Occasional Paper, Department of Agricultural Economics and Rural Sociology, The Ohio State University, Columbus, Ohio; and Onchan, T., 1979, *op.cit.*
11. 7 % of 1975 deposits
12. Statistics relating to BAAC's operations come from the published BAAC Annual Reports, unless otherwise stated
13. Number of branches and district offices at the end of 1983
14. The registration procedure and the criteria used in assessing the suitability of applicant farmers are discussed at the beginning of Chapter 8 of this thesis.

15. It is apparent from recent survey work carried out by the BAAC, that some leaders of joint-liability groups, sometimes stipulate land-title ownership as a requirement for membership of their group. This contravenes the spirit of the joint-liability system and the underlying BAAC regulations, but is largely outside of BAAC's control; group leaders have a legitimate say in who joins their groups. Excluded farmers can theoretically form their own group. Lightfoot, R.P., August 1984, personal communication
16. 1982 end of year figures
17. Details of BAAC regulations and procedures come from the following sources: BAAC, 1982, **Regulations (Amendment)**, English Translation, BAAC, Bangkok; and BAAC, 1982, **Annual Report**, BAAC, Bangkok
18. For a statement of this commitment, see for example, Tohtong, C., 1980, **The BAAC and Agricultural Cooperatives in Thailand**, translated transcript of an address given at the Strategies for the Development of Agricultural Cooperatives in Thailand Symposium, Kasetsart University, August 22, 1980, BAAC, Bangkok
19. Meyer, R., et.al., 1979, *op.cit.*
20. Lee, S.Y. and Jao, Y.C., 1982, **Financial Structures and Monetary Policies in South-East Asia**, Macmillan, London
21. Office of Agricultural Economics, undated unpublished report, OAE, Bangkok
22. Bangkok Bank, November 1978, **Bangkok Bank Monthly Review**, BB, Bangkok
23. Lee, S.Y. and Jao, Y.C., 1982, *op.cit.*
24. *Ibid.*
25. Thailand Year Book, 1975-76, (p.M1), Temple Publicity Services, Bangkok
26. Excluding development project lending, 76% of BAAC disbursements in 1982 was to individual clients, mostly for short term production loans. The administrative costs of financing Cooperative and Farmer Associations are less significant because of the large value of each transaction. The administrative cost of on-lending these amounts to individual Coop-clients is born by the Coops and Associations themselves, not by BAAC
27. This figure includes fixed and variable costs and excludes interest paid on all borrowed funds, and reserves for doubtful accounts (from BAAC, 1981, **Annual Report**, BAAC, Bangkok; and BAAC internal records)
28. This has been achieved through regular evaluation of branch performance. Branches are grading according to certain criteria, one of which is operating costs, and receive certain benefits for good performance.

29. The BAAC published figures on default rates refer only to principal repaid on time. The rates quoted here would be somewhat different if repayment of interest on time was also accounted for, or if bad debts only were measured. There seems to be an influx of repayments shortly after the due date, so that the percentage repaid on time would be significantly higher if measured at the end of April rather than March 31st.
30. BAAC, 1982, *op.cit.*
31. *Ibid*
32. See, for example, Meyer, R., et.al., 1979, *op.cit.*
33. Bailey, D., (consultant agriculturalist at BAAC), 1983, personal communication
34. *Ibid.*
35. BAAC, 1982, *op.cit.*
36. The table breaks the Kingdom down into 6 regions. Most of the East and West Regions come under the area referred to the Central Region elsewhere in this thesis.
37. Onchan, T., 1979, *op.cit.* (p.98)
38. BAAC, 1982, **Credit for Subsistence Farmers in the Poverty Areas of the North and North-East, Preliminary Proposals**, BAAC, Bangkok (pp.1-2 to 1-3)
39. *Ibid.*
40. Lightfoot, R.P. and Fox, J., 1983, **Institutional Credit and Small-Scale Farmers in North-Eastern Thailand**, Occasional Paper No.5, Centre for South-East Asian Studies, The University of Hull, Hull
41. Livestock is important as a subsidiary activity in the North-East but is less important as a main farm enterprise
42. Lightfoot, R.P. and Fox, J., 1983, *op.cit.*
43. Office of Agricultural Economics, 1981, *op.cit.*
44. Blalock, H.M., 1972, **Social Statistics**, McGraw-Hill, Kogakusha, Tokyo (Chapter 12)
45. National Statistical Office, 1978, **1978 Agricultural Census Report Thailand**, NSO, Bangkok
46. Using the Agricultural Census definition of 'owned' which excludes land used free.
47. Zimmerman, C.C., 1931, **Siam: Rural Economic Survey 1930-1931**, Bangkok

48. Pantum, I., et.al., *op.cit.*
49. Long, J.F., et.al., 1963, **Economic and Social Conditions Among Farmers in Changwat Khonkaen**, Bangkok
50. Peters, C.W., 1966, **Agricultural Credit and Marketing in North-East Thailand**, USOM Working Paper, Bangkok
51. Pantum, T., 1973, **Agricultural Credit in North-East Thailand**, publisher unknown, Bangkok
52. Lightfoot, R.P., and Fox, J., 1983, *op.cit.*
53. Onchan, T., 1979, *op.cit.*
54. Lightfoot, R.P., 1983, *op.cit.*
55. Personal communication with BAAC officers
56. Rozental, A.A., 1970, *op.cit.*, (p.60)
57. Onchan, T., 1979, *op.cit.* (p.88)

CHAPTER 6 :

EVALUATING THE DEMAND FOR CREDIT : METHODOLOGY

A Introduction to the Analysis

1 The Range of Available Techniques : justification of the choice of linear programming

It is possible to identify at least three different types of methodological approach¹ to studying the dual problem of credit impact and credit demand² at the farm level: descriptive, econometric and programming.

Studies taking a **descriptive approach** have attempted to identify the differences between borrowing and non-borrowing farms or between borrowers, before and after, and to attribute them to borrowing. Typically, it is differences in farm expenses, production and income which are compared. A Phillipine study, for example,³ found a 15% difference in operating expenses per hectare and a 4% difference in net farm income between borrowers and non-borrowers. The implication in such studies is that credit leads to an increased level of inputs and production and that demand is high among non-borrowers. While generating much useful information and suggesting hypotheses to be tested, descriptive studies can generally say little about specific relationships and processes. What they do say about the differences between categories of farmers, is frequently open to doubt because of the problem of attributing causality to the credit factor. Disturbance factors can never be completely overcome in cross-sectional studies and

historical disturbances cause problems in longitudinal studies.

An econometric approach has been used in three ways. Production function models have been used to examine the effect of borrowing on production technology. The hypothesis being tested here is that borrowers operate on a more advanced production function and that demand for modern inputs is high among non-borrowers. Some studies include credit as an independent variable in the function, treating credit as an input.⁴ The rationale here is rather tenuous since credit only effects output through the inputs it purchases and cannot be strictly said to have an independent effect on output as other inputs do. Other studies have compared production functions for borrowers and non-borrowers, hypothesising that borrowing leads to changes in production relationships.⁸ This can overcome the problem of treating credit as an input, but presents another conceptual problem. To assume that credit alters production relationships is to assume that the adoption of different technology is contingent on borrowing. This need not necessarily be so, especially with short-term credit. Where modern inputs are divisible, variations in credit are just as likely to be associated with variations in input levels on a modern technology production function as with shifts in the coefficients. It is medium and long-term credit which is more likely to lead to technology shifts. A further problem with a production function analysis is disturbance factors and the direction of causality in observed

relationships. If uncontrolled variables such as irrigation or technical knowledge lead to higher levels of inputs or a higher level of technology, then the causality may well run from higher production function coefficients to credit rather than the other way round. Increases in investment and production through irrigation and extension may lead to increased borrowing. Studies using this approach assume that borrowing leads to increased investment and production.

Input-demand functions are the second type of econometric model used. These are conceptually less problematic since they do not specify a necessary relationship between credit and technology change, nor treat credit as an independent input. Input-demand studies hypothesise that credit or capital availability is one of the variables explaining the level of input use. For inputs such as fertilizer, production area and modern seeds, input levels are regressed on a number of explanatory variables including credit availability.⁶ This represents a straightforward test of the formal neo-orthodox model presented in Chapter 2 in which credit is assumed to allow the purchase of more inputs which lead to a rise in production and income.

Efficiency gap models are a third econometric approach. They hypothesise that borrowing is associated with greater efficiency in the allocation of inputs. Optimal efficiency in the allocation of farm resources is assumed to be at the point where marginal value products of inputs are equated with input prices. Some studies simply compare the gap between MVP and price for borrowers and non-borrowers, the

assumption being that it is the borrowing which has led to a smaller gap (greater efficiency). This is unsatisfactory to the extent that other factors such as attitude towards risk, technical knowledge and owned capital are also important in explaining the 'efficiency gap'. A way round this is to specify an efficiency gap function which regresses the gap between input MVP and price on a series of explanatory variables including, for example, indices for technical knowledge, irrigation, production area and credit availability. A study of Philippine farmers using this approach found a credit dummy variable (borrower/non borrower) to explain a significant amount of variance in the efficiency gap.⁷

Mathematical programming is the third methodological approach commonly used in credit impact/demand studies. Typically a single-period linear programming model is used. A series of linear equations is constructed to represent a model farm in an area which is relatively homogeneous with respect to environment, production technology, prices and resource availability. The model farm is given a choice of production activities which, depending on the purpose of the investigation, represent existing technology in the area or technology new to the area. Farmers are generally assumed to maximise profit subject to subsistence and other behavioural constraints. Operating expenses are financed by savings and borrowing. Examples of single-period models are many, and the results of some were mentioned in Chapter 3. Dhawan and Kahlon⁸ present a typical example for the Indian

Punjab. There have been a few Thai examples such as Onchan's LP model of Central Plain farms⁹ and Priebprom's model of rainfed farms in the North-East.¹⁰

Multi-period and recursive linear models have also been used. These have either extended over a one-year period in which case the periods are months¹¹, or over several years where the periods are cropping seasons or years.¹² Monthly period models have been used for examining liquidity management, while annual or seasonal period models can show the impact of credit on farm growth. Recursive models differ from multi-period models in the assumptions which they embody concerning the farmer's decision behaviour over time. Quadratic programming models have attempted to incorporate risk considerations more explicitly.¹³

The objective of these programming exercises has frequently been to compare model solutions for farmers with different amounts of credit. This has been achieved by either parameterising the credit constraint to see what happens to output as credit availability changes, or by deriving separate models for borrowers and non-borrowers. By comparing solutions for borrowers and non-borrowers or institutional and non-institutional borrowers, the impact of credit in the model is identified. Demand is also readily measured by the scarcity value of credit which is an output of the model's dual solution.

There are several strong attractions of using a mathematical programming approach for investigating the role of credit on

the farm.

First, it offers great flexibility in analysis, particularly in exploring the consequences of variations in costs, prices and resource endowments. This makes it particularly appropriate for examining the impact of different credit supply circumstances.

Second, the impact of credit is measured precisely and unambiguously within the model, being arrived at by mathematical deduction. This contrasts greatly with econometric approaches which can never completely overcome the uncertainty introduced by uncontrolled disturbance factors.

Third, most assumptions are clearly articulated and the consequence of any particular assumption on the model's result can be closely examined.

Fourth, programming models present a clear mathematical representation of the neo-orthodox allocation model discussed in Chapter 2.

Fifth, in addition to measuring the impact of credit on output and income, the models can generate much additional information about the farm economy because they are systems models rather than narrowly defined models of particular production relationships, for example. Modelling the complete (generalised) farm system, for example, enables the analyst to simultaneously evaluate the productivity of different factors, the degree of shortage of important

resources, the consequence of resource shortages, the optimal cropping pattern, the optimal level of borrowing and the surplus of family labour. Another very useful output is the shadow prices of constrained resources. These can be interpreted as the marginal value products (MVP) of those resources.

By parameterising a particular resource constraint, it is possible to plot MVP's against volume and thus derive a demand schedule.

For these reasons, it was decided to use a programming methodology to develop the analysis which follows. A linear programming technique was chosen because of its well tested use in similar studies and because of the greater complication and resource requirements needed to develop a quadratic model. The development of the models, both single and multi-period are described in the rest of this chapter. But first it is necessary to qualify all that follows by recognising the weaknesses associated with the methodology.

First, the typical farm represented by the model is an abstraction so that while it is representative of the area as a whole, it may not closely resemble any one particular farm. This is a weakness when models are used to make prescriptions for individual farms. A representative farm is generally a valid basis for making statements about the farm economy of an area so long as the area possesses a reasonable degree of homogeneity with respect to the important variables.

Second, most programming studies have dealt with the farm-firm only.¹⁴ This leads to a partial (but nonetheless important) assessment of the impact of credit on the farm as a total farm-household. It is a more complex task, especially at the data-collection stage, to model an integrated farm-household economy. It is especially difficult to derive input and output coefficients for small scale cottage industries which are undertaken on a very casual and secondary basis. A series of interesting farm-household models were produced under a rural off-farm employment project run by Kasetsart University, Thailand.¹⁵ These do not examine credit as a variable, however, being primarily concerned with the optimal allocation of farm and non-farm production activities.

In adopting a farm-only model in the analysis which follows, the limitations of a partial view have to be accepted. To the extent that substitution of the loan for owned funds is unimportant, however, the partial farm-only view becomes more realistic (see the comments in Chapter 2, Section C.3).

Third, it is very difficult to adequately capture risk management behaviour in a deterministic model of a generalised farm. The procedures that have been used, (quadratic modelling and subsistence constraints¹⁶ for example), improve the model's fit but probably still underestimate the importance of risk aversion in limiting borrowing activity.

Fourth, testing the goodness-of-fit of a programming model

is problematic. At the calibration stage goodness-of-fit can be understood as relating to the degree to which the model's input and output coefficients reflect the real values. To test the success with which the model as a whole replicates the dynamics of a real farm economy is virtually impossible. This is more problematic to the extent that a model is conceived normatively (how should the farmer operate if he had full knowledge, access to inputs etc.).

Fifth, non-integer programming models assume complete divisibility of inputs. This has been a problem in some studies especially where lumpy technology is being modelled. In the modelling exercise of Chapters 6 and 7, however, there is no problem in assuming complete divisibility of any input.

2 The Linear Programming Technique: Basic Principles of the Models

Having discussed the range of possible techniques available for evaluating the impact of and demand for credit and summarised the strengths and weaknesses of the selected technique, a brief overview is given of the structure of the models developed and the way they work. The particular formulation of the linear programming problem adopted here, particularly the inclusion of resource-augmenting activities, follows Gotsch and Yusuf.¹⁷

Linear programming is a mathematical programming technique, involving the solution of a series of simultaneous linear equations. One equation, the objective function is optimised (in the models of this chapter, maximised) subject

to a series of constraining equations. There are many texts describing the basic problem and solution, see Vajda¹⁸, for example, for a comprehensive discussion of the technique, or Geary and Spencer¹⁹ for an elementary agricultural application.

Generally in agricultural applications, either farm income is maximised or operating costs are minimised. The coefficients in the objective function are monetary values : net revenues of the different crop activities and sometimes costs of hiring activities. The coefficients in the constraint equations are, on the other hand, physical input coefficients. The activities, which are the variables in the models, are generally cropping activities; a ten variable model, for example, representing a choice of ten different crop types. Each variable is the area under a particular crop. Resource-augmenting variables may also be included (as here) such as tractor or labour hiring. The solution to the programming problem involves adjusting the values of each variable until a configuration of variables is reached at which the left-hand-side value in the objective function is optimised (here P is maximised), subject to the constraint equations. As cropping activity variables generate revenue, resource augmenting activity variables generate costs.

The elements of the models presented in the following sections are schematized in Figure 6.1.

As the revenue-earning units of activity which form the

elements of the objective function (area under a series of different crop types) are pushed up to maximise income, so the resource-using activities which are the elements in the constraint equations also rise. The latter cannot be pushed up beyond the limiting right-hand-side values to which they are related by a negative inequality.

There are, however, resource-augmenting activities found in the constraint equations, such as tractor and labour-hiring, which allow resource use to exceed the right-hand-side values of owned resource levels. Such resource-augmenting activities appear in the objective function as costs to be deducted from the value being maximised. In essence, this is the basic model structure.

Figure 6.1. Schematised Structure of the Linear Programming Models used in the Analysis

Objective Function

$$\begin{array}{r}
 \boxed{\text{Maximise P}} = \frac{\boxed{\text{Revenue-earning activities}}}{X} - \frac{\boxed{\text{Resource-augmenting activities}}}{X} \\
 \boxed{\text{Value output coefficients of revenue-earning activities}} \qquad \boxed{\text{Cost coefficients of resource-augmenting activities}}
 \end{array}$$

-----Subject to -----

$$\frac{\boxed{\text{Revenue-earning activities}}}{X} - \boxed{\text{Resource-augmenting activities}} \leq \boxed{\text{Fixed level of owned resources}}$$

$\boxed{\text{Resource input coefficients of revenue-earning activities}}$

The whole point of the exercise is to derive the optimal mix

of farm activities; optimal with respect to resources-owned and costs and prices of inputs and outputs. The optimal mix of activities (farm plan) gives the optimal net farm incomes, which is of more interest than the farm plan per se in this particular study. The optimal farm plan and income can be derived under any number of assumptions about resource availability. Both will change, for example, as savings or capital borrowing limits (right-hand-side values in the capital constraint equations) are changed.

3 Data : Survey 1

The linear programming analysis is based on a survey undertaken by the author in conjunction with the BAAC in 1982. The survey was designed to serve the needs of both a general socio-economic exploratory study and a series of technical analyses including the LP exercises presented here. ²⁰Through the use of a questionnaire and schedules, data were collected which included opinion-oriented responses and more detailed farm-economy variables. A compressed version of the English translation of the questionnaire is found in Appendix 1.

The survey covered 1500 farmers in 5 provinces in the North-East of Thailand. The North-East, though homogeneous in many respects, has a number of distinct agro-ecological regions and is formally divided into 5 agro-economic zones. Within each zone there is a broad consistency of pattern in land form, climate and agriculture. The five provinces were selected to be broadly representative of the five agro-economic zones, one province in each zone. The provinces

are : Mahasarakham, Nakhon Phanom, Ubon, Sisaket and Nakhorn Ratchasima (Korat).

Two districts (Amphurs) were selected in each province. Selected districts had to be in the list of the Thai government's designated 'poverty districts'²¹ and had to have an absence of any special projects, a range of crops similar to the province as a whole, and a level of BAAC activity similar to the region as a whole.²²

Three villages were then selected randomly within each district to give 30 villages in 10 districts. Within each village, a random sample of 50 farmers was selected, using as a sampling frame, the headman's list of families in the village.

It is a multi-stage design, therefore, with statistical inference only strictly possible to the population of the 30 villages or to the population of any one village or group of villages. In a less rigorous sense, by selective sampling, the sample can broadly be considered representative of the poverty districts of the North-Eastern region of Thailand.

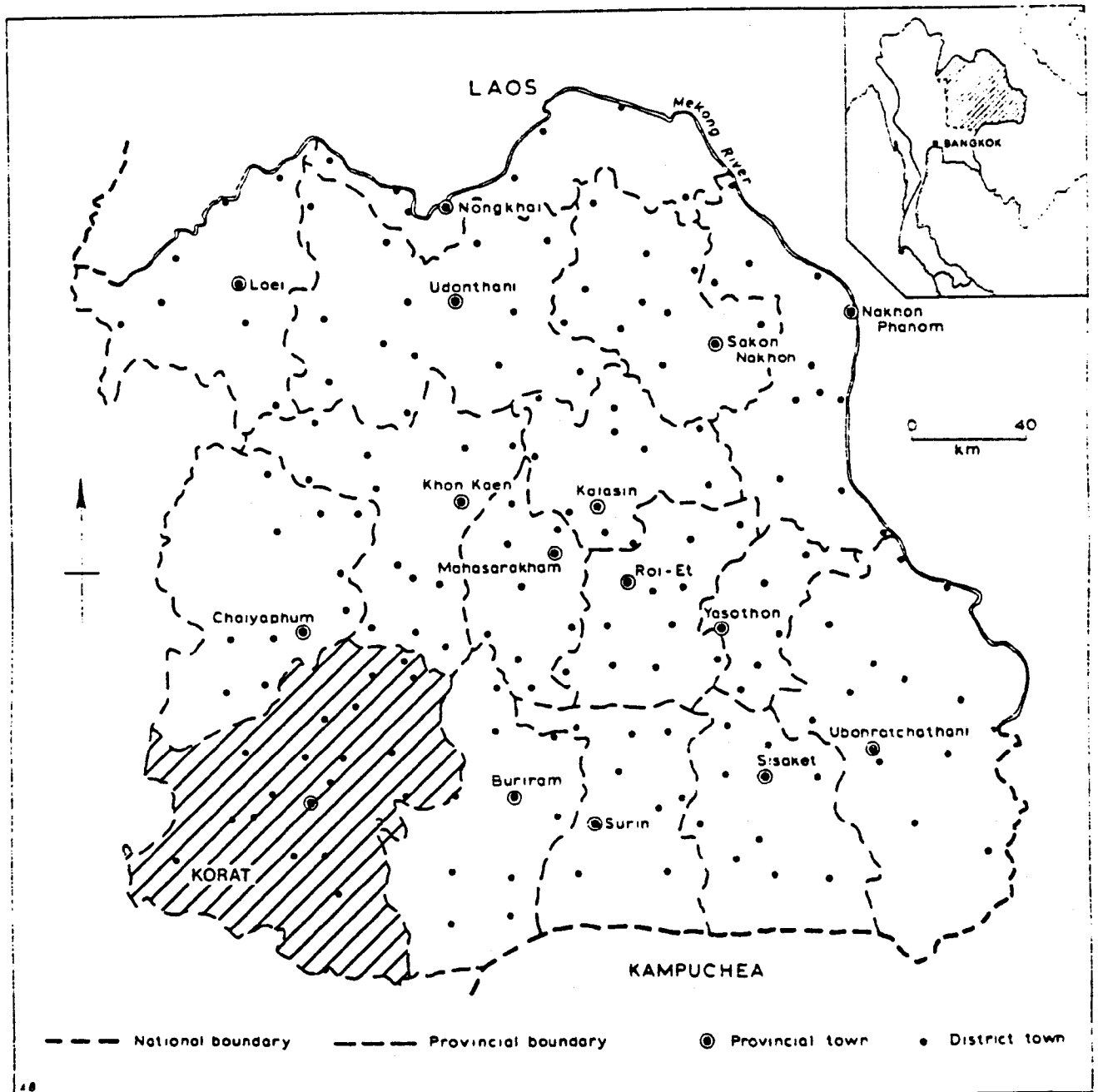
The survey was undertaken during the months of November and December 1982, and collected income and expenditure and physical input and output data for the crop-year 1981/82. X Trained field credit officers from North-Eastern branches of the BAAC were employed as interviewers. This, it is hoped, has helped minimise the problems of data inaccuracy which are inevitable when recording farm-economy data for small producers who keep few written records; interviewers had

daily experience of working with the sort of farmers being interviewed.

Since there are significant differences in agriculture between the 5 agro-economic zones (differences in crop-types, technology and yields, for example), there are problems in defining a model farm for the whole region (though when making broad comparisons with other regions, there may be a case for defining a model North-Eastern farm). The idea of a model or representative farm makes more sense at the provincial level. Choosing an even smaller spatial-scale, such as the district or village, is likely to further enhance the representativeness of a model farm. This would cause problems of small sub-sample sizes at calibration however and would not fit in so well with the analysis in Chapter 8 which focuses on the provincial level.

For these reasons, data for just one province out of the 5 covered by the survey, are used in the analysis which follows. Repetition of the analysis for the remaining four provinces would have extended the scope of the study but would have been beyond the scope of a thesis. The province of Korat (Nakhon Rachasima) is selected as the focus of analysis. Its selection rather than any of the other 4 provinces was basically arbitrary, although the more widespread crop-diversification in Korat makes a linear programming analysis somewhat more appropriate there than it would be for a province in which mono-culture is more dominant.

Figure 6.2 The North-East of Thailand indicating the Survey province



4 The Models

(a) Summary of the models used

A set of four single-period models and a multi-period model are developed, all reflecting the same basic farm enterprise. One single period model is first developed to represent the basic farm enterprise in the study area (equations 6.1 to 6.79). During the course of analysis, the parameters of this basic model are then adjusted to produce four model farms, associated with four sub-samples within the main survey. The four models represent :

1. a representative BAAC farm;
2. a representative independent farm;
3. a representative independent farm which borrowed for production in the survey year;
4. a representative independent farm which did not borrow for production in the survey year.

Each is used at a different stage in the analysis in Chapter 7 to derive optimal net-farm income levels for each model farm type, and to look at changes in income when certain constraints (capital constraints) are varied parametrically. Each models farm activity over a single crop year from May to April. The multi-period model is calibrated to represent an independent farm. It models farm activity over a planning period of five crop years, 1977/78 to 1981/82. It is, therefore, like 5 duplications of the single-period model of a representative independent farm (No.2 above). Each

year's activities are linked together by capital constraints which make working capital in year t , a function of income in year $t-1$. Although it may help to conceptualise the multi-period model as being like 5 single year models, it differs in two important respects. First, the values of the revenue and cost coefficients are different for each of the 5 years, having been estimated in money terms and then adjusted to their 1977 real value. Second, solutions are not produced for each year, but rather the complete 5-year problem is solved in a single exercise. The objective-function to be maximised contains all the revenue-earning and resource-augmenting activities for the whole 5-year period.

(b) Development of the single-period models

Something needs to be said to justify the development of a series of models on the basis of a single basic model calibration. The matrix of input and output coefficients remains the same for all models. This matrix can be considered to be the basic model. The 4 different single-period models differ from each other only with respect to their resource-endowment parameters.

It is important, first of all, to clarify exactly how to interpret the figures output by the models (optimal borrowing amounts and shadow prices of credit, for example). They are deduced values and it is a deduced demand that is presented because they are products of a

deductive mathematical model. The deductive model is, however, inductively arrived at, its structure and parameters having been determined by representative values from survey data (mean input and output coefficients, modal crop varieties and technologies and representative levels of resource endowments).

Assuming that the behavioural assumptions built into the models reflect the pattern of reality, the demand schedules and optimal credit values can be taken as representative of farms in the survey villages.

Input and output coefficients have been calibrated on the basis of the whole sample, or strictly speaking, on the basis of a number of sub-samples within the whole sample. Each different crop is grown by a different sub-sample of farms. This means that the input and output coefficients for crop x will be calibrated on a different sub-sample from the coefficients for crop y. Modal crop types have been selected for inclusion in the model, together with modal technologies.

The basic model cannot, therefore, be described as representative in a strict statistical way, but rather representative through careful design and selection of components. This allows the basic model to be used not only for the sample as a whole, but for sub-samples within it, by the adjustment of its parameters to represent more precisely those sub-samples.

To adjust the resource-endowment parameters to produce 4 different single-period models is, therefore, not to contravene laws of statistical representativeness, but to extend the principles on which the basic whole-sample model has itself been built (careful design and selection).

The production of the four models (representing 4 sub-samples) from a single basic model by adjustment of certain parameters can be rationalised in two ways:

- (a) for each of the four models, the basic model is being adjusted to more closely represent a particular sub-sample. Since the basic model for the whole sample (itself calibrated on a number of different sub-samples) is taken as representative of the whole sample, it can also be taken as representative of any particular sub-sample. Although this is true, it will make it even more representative of the sub-sample if important parameters are adjusted. The input-output coefficients of the basic whole-sample model are, therefore, taken as representative of each of the four sub-samples, while resource parameters are re-set for each, producing four different models;
- (b) the parameters of the basic whole-sample model are being varied to answer the question: what would be the solution if the representative farm for the whole survey area had parameters (resource profiles) more like sub-sample x? This is no

different from any parametric linear programming exercise; the alternative parameter values here taking their meaning from the resource characteristics of particular sub-samples of farms, rather than from alternative pricing policies or other such variables.

(c) Normative or Positive Models?

The question of whether the models' output should be interpreted normatively or positively is an important one and will arise in the discussion of results. Do the models prescribe or describe? A few initial comments can be made at this stage. They will describe if farmers are operating according to their implicit behavioural assumptions, and prescribe for those who are not. The models have been so designed to reflect what might be expected to be reasonable peasant behaviour. To the extent, however, that farmers do not profit-maximise subject to safety-first considerations, the models not so much describe as prescribe. They prescribe the optimal farm plans that should be adopted and the income levels that could be attained if farmers were to behave in the manner which the models assume.

There is much usefulness in both a positive and normative model. It is just as important, for example, for a lending institution to know what a farmer can produce under certain assumptions, as it is for it to know what he does produce. Some attempt is made in

Chapter 7 to assess whether model results should be interpreted normatively or positively.

In the following section, the basic structure of the four single-period models is presented in algebraic form. The series of equations is the same for each single-period model; it is the values on the right-hand-side of the constraint equations which are changed to represent the four different farm types. There then follows a more detailed discussion of the separate elements within the model, defining the variables and showing how the model deals with land, labour (human, animal and machine) and capital.

B Single Period Model

1 Description of the Model's Elements: its mathematical structure

Mathematically, the problem is as follows :

(a) The Objective Function

$$\text{Maximise } P = F_X - F_L - F_T - F_W - F_K \quad (6.1)$$

$$= \sum_i s_i X_i - \sum_m d_m L_m - \sum_m e_m T_m - \sum_m f_m W_m - gK \quad (6.2)$$

Where : P = net farm revenue (baht);

s_i = net revenue per rai of the i 'th crop (baht/rai);

X_i = area of the i 'th crop (rai);

d_m = cost of hiring man labour in the m 'th month (baht/day);

L_m = days of hired man-labour in the m 'th month;

e_m = cost of hiring one hour of tractor power in the m'th month (baht/hour);

T_m = tractor-hours hired in the m'th month;

f_m = cost of hiring one hour of walking-tractor power in the m'th month (baht/hour);

W_m = walking-tractor hours hired in the m'th month (baht/hour);

g = cost of borrowed capital (annual interest rate); and

K = level of borrowed capital (baht)

The objective function is maximised subject to the constraints set out in the following sections (Equations 6.3 to 6.79).

(b) Land Constraint Set

Paddy Land :

$$\sum_i h_{i,1} X_{i,1} \leq M_1 \quad (6.3)$$

$$\sum_i h_{i,m} X_{i,m} \leq M_m \quad (6.4 \text{ to } 6.13)$$

$$\sum_i h_{i,12} X_{i,12} \leq M_{12} \quad (6.14)$$

$i = 1 \text{ to } 8$

Upland :

$$\sum_i h_{i,1} X_{i,1} \leq N_1 \quad (6.15)$$

$$\sum_i h_{i,m} X_{i,m} \leq N_m \quad (6.16 \text{ to } 6.25)$$

$$\sum_i h_{i,12} X_{i,12} \leq N_{12} \quad (6.26)$$

$i = 9 \text{ to } 12$

Subsistence paddy land :

$$\sum_i h_i X_i \geq Q \quad (6.27)$$

$$i = 1 \text{ to } 8$$

Where :

M_m = paddy land available in month m (rai);

N_m = upland available in month m (rai);

Q = minimum area of paddy land required to produce subsistence rice for a representative farm family (rai);

$h_{i,m}$ = land required for each rai of crop i in month m ($= 1$ for each month in which land is required for crop i); and

$X_{i,m}$ = area of crop i in month m (rai)

Equations (6.3) to (6.14) and (6.15) to (6.26) are sets of twelve constraints ($m = 1$ to 12), one constraint for each month of the year for paddy land and one for each month for upland.

(c) Labour Constraint Set

$$\sum_i k_{i,1} X_{i,1} - L_1 \leq E_1 \quad (6.28)$$

$$\sum_i k_{i,m} X_{i,m} - L_m \leq E_m \quad (6.29 \text{ to } 6.38)$$

$$\sum_i k_{i,12} X_{i,12} - L_{12} \leq E_{12} \quad (6.39)$$

A set of 12 constraints, one for each month ($m = 1$ to 12), where :

$k_{i,m}$ = labour requirement of one rai of crop i in month m (man days);

E_m = man days of family labour available in month m ;

L_m = man days of hired labour in month m ; and

$X_{i,m}$ = area of crop i in month m (rai)

(d) **Big-Tractor Constraint Set**

$$\sum_i \ell_{i,1} X_{i,1} - T_1 \leq R_1 \quad (6.40)$$

$$\sum_i \ell_{i,m} X_{i,m} - T_m \leq R_m \quad (6.41 \text{ to } 6.50)$$

$$\sum_i \ell_{i,12} X_{i,12} - T_{12} \leq R_{12} \quad (6.51)$$

A set of 12 constraints ($m = 1$ to 12), one for each month, where :

$\ell_{i,m}$ = big-tractor hours required by one rai of crop i in month m ;

$X_{i,m}$ = area of crop i in month m (rai);

T_m = big-tractor hours hired in month m

R_m = big-tractor hours owned in month m ($= 0$)

(e) **Walking-Tractor Constraint Set**

$$\sum_i p_{i,1} X_{i,1} - W_1 \leq G_1 \quad (6.52)$$

$$\sum_i p_{i,m} X_{i,m} - W_m \leq G_m \quad (6.53 \text{ to } 6.62)$$

$$\sum_i p_{i,12} X_{i,12} - W_{12} \leq G_{12} \quad (6.63)$$

A set of 12 constraints, one for each month ($m = 1$ to 12) where :

$p_{i,m}$ = walking-tractor hours required by one rai of crop i in month m ;

$X_{i,m}$ = area of crop i in month m (rai);

W_m = walking-tractor hours hired in month m ; and

G_m = walking-tractor hours owned in month m ($= 0$)

(f) Buffalo Constraint Set

$$\sum_i q_{i,1} X_{i,1} \leq H_1 \quad (6.64)$$

$$\sum_i q_{i,m} X_{i,m} \leq H_m \quad (6.65 \text{ to } 6.74)$$

$$\sum_i q_{i,12} X_{i,12} \leq H_{12} \quad (6.75)$$

A set of 12 constraints, one for each month ($m = 1$ to 12) where :

$q_{i,m}$ = buffalo days required by one rai of crop i in month m ;

$X_{i,m}$ = area of crop i in month m (rai), and

H_m = owned buffalo days available in month m .

(g) Capital Constraint Set

$$\sum_i c_i X_i - K \leq I - \epsilon \quad (6.76)$$

and

$$K \leq J \quad (6.77)$$

where :

J = borrowing limit (baht);

c_i = capital requirements of one rai of crop i (baht);

X_i = area of crop i (rai);

K = level of borrowed capital (baht);

I = owned capital at the start of the crop period (baht); and

ϵ = durable-capital replacement (baht).

2 Discussion of the Model's Elements

(a) The Objective Function

The objectives of peasant farmers in LDCs have been the subject of much debate. More specifically, there has been a quest for an appropriate algorithm with which to represent, in the process of planning and modelling, a generalised pattern of peasant farmer decision-making.²³ The earliest views regarded peasants as backward and unresponsive to increases in economic incentives.²⁴ It was hypothesised that peasant families had an income target at which consumption and re-investment needs would be met. Attempts to raise production above the target-level would meet with failure. Reduced production might even result if higher prices, for example, allowed the target income to be reached with less output (the notion of the backward-bending supply curve).

This view gave way to the idea of the peasant as a profit-maximiser. Schultz was the first major proponent, drawing on production function analysis to show that allocative efficiency on peasant farms could not be improved (marginal value products were reported to be equal to marginal factor costs in the Indian village upon which he made his case).²⁵ This pure profit-maximiser hypothesis, though gaining wide appeal during the 1960s, produced a strong reaction. A comprehensive criticism was given by Lipton²⁶ who argued that the notion of the profit-maximising peasant

was untenable conceptually, definitionally and empirically. Lipton's alternative was the idea of the optimising peasant, operating rationally within a set of constraints. Although he recognised the importance of cultural, traditional, religious and educational constraints, he tended to elevate the environmental constraint and the issue of risk to the most important position. The peasant farmer, Lipton suggests, does not maximise profit in the short-run because that would soon lead to disaster at the hands of an unpredictable environment and unpredictable prices.²⁷ Rather he maximises profit in the long run by minimising risk in the short run; he operates his farm in such a way as to keep his family fed and in business, which frequently means refraining from adopting the most profitable farm plan.

It has become common practice in farm-level studies of the peasant economy, to adopt a decision-making algorithm which maximises profit subject to certain non-maximising constraints. To cite some linear programming examples, Naseem, in a study of Pakistani farmers²⁸ specifies an objective function which maximises profit but is subject to a minimum subsistence crop production constraint. The farmer is assumed to produce his family's subsistence requirements even if this is not the most profitable in money terms, and only after having done that, to select the most profitable activities for the rest of his

land. Three Thai studies using the same device are the farm-household LP models constructed for typical farms in the Northern province of Chiang Mai and the two North Eastern provinces of Khon Kaen and Roi Et.²⁹ In a paper which introduces that series of modelling exercises, Priebprom et.al. comment that "(the evidence from the literature) and the author's experience in conducting other research on Thai farmers suggest a combined goal of profit maximization subject to security constraints of subsistence food production and minimum family living expenditures".³⁰

The objective function in this study (equation 6.2) is, therefore, specified as a maximisation problem, maximising net revenue minus the cost of labour, tractor and capital hiring activities. The profit-maximising behaviour is assumed to be constrained by three factors which are built into the model in constraint equations 6.3 to 6.39. First, the model farm has to produce a minimum area of paddy to cover the subsistence needs of the farm family (see Section B.2(d) on the land constraint set). Second, paddy land and upland are considered non-interchangeable in the short term. This models a traditional preference for paddy production irrespective of the relative profitability of the two types of crop (see Section B.2(d)). Third, family labour is not costed in the LP matrix. This, in one sense, models the traditional attitude towards family labour in which family farm

production activities are given priority irrespective of the marginal value productivity of labour (see Section B.2(e) on the labour constraint set).

(b) Revenue-Generating Activities

There are 12 crop activities in the model, reflecting the dominant crops and associated technologies in the survey (Table 6.1 lists the crop types and number of farmers involved). The choice is between 8 types of paddy production, kenaf, maize, sorghum and cassava. Non-glutinous rice is the only type of rice grown and it is planted at two different dates: June and July. Both early and late varieties are produced with or without fertilizer and using either buffalo or walking tractor in land preparation. The upland crops have no variations in technology; all are produced without fertilizer using a big tractor.

Crop Activities

- X_1 Early planted non-glutinous rice with fertilizer, using walking tractor for land preparation;
- X_2 Early planted non-glutinous rice with fertilizer, using buffalo;
- X_3 Early planted non-glutinous rice, no fertilizer, using walking tractor;
- X_4 Early planted non-glutinous rice, no fertilizer, using buffalo;

- X₅ Late planted non-glutinous rice, fertilizer using walking tractor;
- X₆ Late planted non-glutinous rice, fertilizer, using buffalo;
- X₇ Late planted non-glutinous rice, no fertilizer, using walking tractor;
- X₈ Late planted non-glutinous rice, no fertilizer, using buffalo;
- X₉ Cassava, spring planted, no fertilizer, using big tractor;
- X₁₀ Maize, April planted, no fertilizer, using big tractor;
- X₁₁ Kenaf, April planted, no fertilizer, using big tractor;
- X₁₂ Sorghum, September planted, no fertilizer, using big tractor;

(c) Resource Augmenting Activities

The farm may hire-in resources of 4 kinds to supplement those owned, and 3 of these are broken down into 12 monthly hiring-in activities. The fourth, capital, is conceptualised as a single annual activity.

Activities :

L₁ to L₁₂ are 12 monthly labour-hiring activities

T₁ to T₁₂ are 12 monthly big-tractor-hiring activities

W_1 to W_{12} are 12 monthly walking-tractor activities is K is the annual production-credit borrowing activity.

Together these 2 activity sets comprise the variables of the objective function. Altogether there are 49 variables or 49 columns in the LP matrix.

The revenue-generating activities are pre-fixed with positive coefficients: net revenues per rai for respective crops. The resource-augmenting activities have negative coefficients: factor prices per rai for respective resources.

(d) Land Constraints

The right-hand-side of the land constraint is different for each of the four single-period models reflecting the land endowment of the sub-sample being modelled. It is also subject to parametric variation in analysing the trade-off of credit and land. But for each model's base solution, total land available for crops is taken as the mean value of land reported as being 'owned and usable' in the survey. 'Owned' means that the farmer has any one of four types of ownership certificate, and 'usable' means that the land is developed and was suitable for crop cultivation in the survey year. This measure of land available excludes undeveloped land, rented-in land and land too dry or otherwise unsuitable for production in the survey year. Undeveloped land cannot be considered available for crop production in the short-term, and it is the short-term which is being

modelled.

Using a measure which excludes developed land that was not wet enough or otherwise unsuitable for production, effectively builds into the model uncertainty caused by the North-East's unpredictable climate. It has already been noted that farmers frequently cannot plant all of their land because of late rains which leave upper slopes too dry. The 'available land' variable used in the model assumes that some owned land will be unuseable for this reason and reflects, therefore, an average realistic level of land availability given that some lies idle for environmental reasons.

As for the exclusion of rented land in the 'available land' variable, renting is not common in the North-East in general and this is true of Korat (only 3% of all land in the Korat survey was rented-in). No land-augmenting activities appear in the model therefore.

The mean level of 'owned and usable' land in each of the four sub-samples becomes the overall land constraint for each respective model. The independent-farmer model, for example, assumes that 14.9 rai is available for crop production. Land is not homogeneous, however, and falls broadly into the two categories of paddy land and upland. Separate constraint sets are required for both types of land since the two types are effectively two independent resources. Generally, it can be assumed that the two

types of land are non-interchangeable, and it is commonly believed that farmers will tend not to put paddy land under non-rice crops. Each of the models, therefore, uses the respective mean survey levels of paddy and upland 'owned and usable' land as the right-hand-side values in separate sets of constraints for paddy land and upland.³¹ In the independent farmer model, for example, paddy land is limited to 8.1 rai and upland to 6.8 rai. These limits are imposed for each month and, therefore, constrain each monthly choice of activities.

The land constraint set is completed with a subsistence or safety-first constraint. Paddy production must not fall below 3.2 rai in any of the models in order to ensure sufficient paddy for subsistence consumption and for next year's seed. This figure equals the mean weight of paddy consumed and kept for seed (in thang) divided by the average yield per rai (Korat).

$$\frac{68.1}{21.3} = 3.2$$

(e) Labour Constraints

Labour availability is set equal to the number of family workers multiplied by the number of days a worker can work in each period. Since there is a different labour constraint for each month, the period equals one month, and an adult member is available for a maximum of 30 days per period. However, not all of a worker's time can be diverted to economic activity, so

this figure needs to be reduced by the amount of time during a month spent on non-economic activities. In the absence of any primary data for the survey area on time allocation, past studies have to be drawn upon. The farm-household model of a khon kaen farm by Priebprom (1980) used a mean factor of .8 to reduce total hours available to total work hours.

Children are assumed to be available for 2 hours per day for 30 days per period, or .25 of a day, assuming there are 8 hours in an adult working day.

The average number of adult members (excluding permanently non-agricultural workers) per household was 3.26, and the average number of children per household was 2.24.

The calculation then becomes :

Adults	:	$3.26 \times 30 \times .8$	=	78.24
Children	:	$2.24 \times 30 \times .25$	=	16.8
Total days available in one month			=	----- 95.04 (man/days) -----

Family labour can be supplemented with hired labour which is paid for at the survey level mean wage rate of 26.2 baht/day. There is no limit on the amount of hired labour that can be used.

Exchange labour, though a feature of Korat and the rest of North-East Thailand, is not modelled since exchange

labour inputs and outputs for a single farm are thought to balance within the important activity periods of the crop year.³²

Labour constraints remain the same for all four single-period models because of the similarity in labour endowments between each of the four sub-samples.

Family labour is not costed, following many similar programming studies.³³ This effectively models the traditional priority given to family-farm labour activities. Although off-farm employment is important in Thai peasant farm-households, it is generally sought in the off-peak periods when demand for family labour on the farm is low.³⁴ As for non-farm, household based activities such as basket making and other cottage industries, there is some indication that these give rise to lower returns to family labour than farm activities and, again, are not engaged in at the expense of farm activities.³⁵ To cost family labour would imply that should the marginal value productivity of labour inputs fall below the imputed cost (wage), family members would employ their labour elsewhere. Since this does not seem to be the case, family labour is conceptualised as a 'free' resource.

(f) Traction Constraints

Two buffaloes are available for land preparation, which over 30 days gives 60 buffalo/days per period. (Two is the modal number of buffalo owned). There is no

buffalo hiring. Exchange buffalo labour is treated in the same way as exchange human labour.

No tractors are owned but two types can be hired. A big tractor (a four-wheeled tractor over 45 hp) can be hired for 224.2 baht/hour, and a walking tractor (a two-wheeled machine operated by a man on foot) for 80.8 baht/hour which are the mean price levels from the survey. As with family labour, traction constraints are the same for all models.

(g) Capital Constraints

Finance for investment in the model's crop year is available from two sources: owned capital and borrowed capital.

- (a) Owned capital at the start of the year. This represents savings from the previous crop year, available for purchasing inputs in the modelled year. For the independent-farm model, for example, savings equals 1270 baht (median level of beginning-of-year savings in the survey year for independent korat farmers). Savings at the beginning of the crop year are a function of total income in the previous year (farm and non-farm income), plus any other owned capital. The amount does not include subsistence rice kept for family consumption. It does include the imputed value of rice kept from last year for seed in the following year, since seed costs appear as a cost of

production in the model. Consumption is financed by consumption credit during the growing season which supplements subsistence rice kept over from last year's harvest;

- (b) Borrowed Capital. Capital can be borrowed to supplement savings, with a payback period of one year. This gives rise to the general constraint form :

$$\sum_i c_i X_i \leq S+K \quad (6.78)$$

where: c_i = the total capital requirement of one rai of crop i (baht);

X_i = area of crop i (rai);

S = savings carried over from last crop year (baht); and

K = capital borrowed in this crop year (baht).

Both the interest rate and the capital borrowing limit are varied parametrically in the analysis. The interest rate facing BAAC borrowers is a standard 14% per annum compared to an average annual rate of 26% for independent farmers. Borrowing limits in the analysis are set between zero (representing no credit available) and max, where max is either the maximum amount of credit that the model farm can absorb given its resource and technical constraints or simply a high number.

The general form of the borrowing-limit constraint is :

$$K \leq J \quad (6.79)$$

where : K = capital borrowed this crop year, and

J = a limit (in baht) representing either an effective supply limit in the informal credit market or a non-price rationing limit in the formal market.

Apart from the internally generated crop-production costs, there is one other cost element in this constraint: durable-capital replacement cost. This value is derived from the survey data and becomes a negative on the right-hand-side of the capital constraint. It amounts to a summed annual depreciation value for the capital goods found on the typical farm represented by the model.

3 Calibration: principal cropping activities in the Korat survey area and their enterprise budgets

This completes the discussion of the structure and individual elements of the basic single-period model. Having designed the model, the next stage is to calibrate it. This entails finding values for all the parameters in the foregoing equations. These values come from survey data and are best presented in the form of farm enterprise budgets. The enterprise budgets present input and output coefficients, for each different crop activity (revenue-earning activity X_i). They are representative figures (means) for the sub-sample of farmers who produced that particular crop-type in Survey 1.

In this section, therefore, farm enterprise budgets are presented by way of summarising the calibration results. Tables 6.2 to 6.13 present the enterprise budgets for crop activities X_1 to X_{12} . The figures in the tables are the coefficients which make up the body of the linear programming matrix. The right-hand-side values in the matrix (resource constraints) were discussed in general in Section B.2 of this Chapter. They are presented specifically for each of the four single-period models in Chapter 7.

Before presenting the enterprise budgets a summary is given of the principal cropping activities found in the survey area and incorporated into the model.

In the short-run, land banded for paddy production and upland used for non-paddy crops are considered as fixed and non-interchangeable areas.

On the paddy land (lowland), non-glutinous rice is grown for both consumption and sales. It may be planted in either June or July, and is harvested and threshed between November and January. At both of the planting times, the paddy crop may be grown, with or without chemical fertilizer. Preparation of paddy land can be undertaken using either family buffalo or hired walking tractor. There are no irrigation facilities and only one wet-season crop of rice can be produced in the year.

On the upland area a choice exists between four crops. Cassava can be grown between April and March, staying in the

ground for a complete year. Kenaf can also be planted in April and this is harvested in November. Maize is grown between May and August, and Sorghum between September and January. None of these upland crops is produced with chemical fertilizer, and weeding is the only cultivation activity while the crop is in the ground. By growing maize and sorghum, in succession, there is a possibility for double cropping within the rainy season.

Crops selected for the model are crops grown by more than 10 farmers in the sample of 300. Crops left out because of small numbers were various varieties of beans (red, mung) and vegetable, upland rice and glutinous rice. Table 6.1 presents the number of farms association with each crop/technology type in the survey.

Taking into account the tractor technology predominant in the area, the rice crops were further each broken down into buffalo or walking tractor categories. Very few farmers used buffalo or walking tractor for ploughing their upland land, so the model gives no choice of tractor for non-rice crops.

Enterprise budgets are laid out in the following tables :

Table 6.1 Number of survey farms planting each major crop type

	No. of Farms
Early non-glutinous rice, fertilized	46
Early non-glutinous rice, unfertilized	37
Late non-glutinous rice, fertilized	22
Late non-glutinous rice, unfertilized	21
Cassava	155
Kenaf	53
Maize	87
Sorghum	42

Source : Survey 1

Table 6.2 Enterprise Budget for Crop X₁ : Early Non-Glutinous Rice, Fertilised (traction = tractor)

Labour inputs :

Period	Activity	Man Days	Tractor Hours
(June) 3	Activity and land preparation	10.53	11.19
4	Land preparation, transplanting, planting, fertilizing	2.91	2.35
5	Weeding	.69	
8	Harvest	6.25	
9	Harvest, threshing	1.16	
10	Threshing, winnowing	.21	

Operating costs : 93.27 (fertilizer, seed transportation to market, excluding tractor and labour costs)

Yield : 22.51 thang/rai Price : 29.6 baht/thang
 Gross revenue/rai: 666.17 baht/rai
 Net revenue/rai: 572.9 baht/rai

Source : Survey 1

Table 6.3 Crop X₂ :Enterprise Budget for Early Non-Glutinous Rice, Fertilized (Traction = buffalo)

Labour inputs :

Period	Activity	Man Days	Buffalo Days
3	Nursery and land preparation	12.33	6.47
4	Land preparation, trans-planting, fertilizing	3.61	1.29
5	Weeding	.85	
8	Harvest	6.25	
9	Harvest, threshing	1.6	
10	Threshing, winnowing	.21	

Operating costs : 93.27 (fertilizer, seed, transportation to market, excluding labour costs)

Yield per rai: 22.51 thang/rai Price : 29.6 baht/thang
 Gross revenue/rai: 666.17
 Net revenue/rai: 572.9

Source : Survey 1

Table 6.4 Enterprise Budget for Crop X₃ : Early Non-Glutinous Rice, Unfertilized (traction = walking tractor)

Labour inputs :

Period	Activity	Man Days	Tractor Hours
3	Nursery and land preparation	10.53	11.19
4	Land preparation, trans-planting	2.74	2.35
5	Weeding	.63	
8	Harvest	3.77	
9	Harvest, threshing	.97	
10	Threshing, winnowing	.13	

Operating costs : 31.55 baht/rai (seed, transportation to market, excluding tractor or labour costs)

Yield : 16.6 thang/rai Price : 29.6 baht/thang
 Gross revenue/rai: 523.05 baht/rai
 Net revenue/rai: 491.5 baht/rai

Source : Survey 1

Table 6.7 Enterprise Budget for Crop X₆ : Late Non-Glutinous Rice, Fertilized (traction = buffalo)

Labour inputs :

Period	Activity	Man days	Buffalo Days
4	Nursery, land preparation	16.9	11.48
5	Land preparation, trans-planting	3.65	1.66
6	Weeding	1.6	
9	Harvest	9.13	
10	Harvest, threshing, winnowing	2.61	

Operating costs : 98.22 baht/rai (fertilizer, seed, transportation, excludes tractor and labour costs)

Yield : 28.4 thang/rai Price : 29.6 baht/thang
 Gross revenue/rai: 840.52 baht/rai
 Net revenue/rai: 742.3 baht/rai

Source : Survey 1

Table 6.8 Enterprise Budget for Crop X₇ : Late Non-Glutinous Rice, Unfertilized (traction = walking tractor)

Labour inputs :

Period	Activity	Man Days	Tractor Hours
4	Nursery, land preparation	6.58	4.6
5	Land preparation, trans-planting	2.19	2.54
6	Weeding	.82	
9	Harvest	4.57	
10	Harvest, threshing, winnowing	1.3	

Operating costs : 26.99 baht/rai

Yield : 17.41 thang/rai Price : 29.6 baht/thang
 Gross revenue/rai: 505.811 baht/rai
 Net revenue/rai: 488.4 baht/rai

Source : Survey 1

Table 6.5 Enterprise Budget for Crop X₄ : Early Non-Glutinous Rice, Unfertilized (Traction = buffalo)

Labour inputs :

Period	Activity	Man Days	Buffalo Days
3	Nursery, land preparation	12.33	6.47
4	Land Preparation, trans-planting	3.44	1.29
5	Weeding	.79	
8	Harvest	3.77	
9	Harvest, threshing	.97	
10	Threshing, winnowing	.13	

Operating costs : 31.55 baht/rai (seed, transportation, excludes labour costs)

Yield : 16.6 thang/rai Price : 29.6 baht/thang
 Gross revenue/rai: 523.05 baht/rai
 Net revenue/rai: 491.5 baht/rai

Source : Survey 1

Table 6.6 Enterprise Budget for Crop X₅ : Late Non-Glutinous Rice, Fertilized (traction = walking tractor)

Labour inputs :

Period	Activity	Man Days	Tractor Hours
4	Nursery, land preparation	6.58	4.6
5	Land preparation, trans-planting, fertilizer	2.19	2.54
6	Weeding	1.05	
9	Harvest	9.13	
10	Harvest, threshing, winnowing	2.61	

Operating costs : 98.22 baht/rai (fertilizer, seed, transportation, excludes tractor and labour costs)

Yield : 28.4 thang/rai Price : 29.6 baht/thang
 Gross revenue/rai: 840.52 baht/rai
 Net revenue/rai: 742.3 baht/rai

Source : Survey 1

Table 6.9 Enterprise Budget for Crop X₈ : Late Non-Glutinous Rice, Unfertilized (traction = buffalo)

Labour inputs :

Period	Activity	Man Days	Buffalo Days
4	Nursery, land preparation	16.9	11.48
5	Land preparation, trans-planting	3.65	1.16
6	Weeding	1.36	
9	Harvesting	4.57	
10	Harvest, threshing, winnowing	1.3	

Operating costs : 26.99 baht/rai

Yield : 17.41 thang/rai Price : 29.6 baht/thang
 Gross revenue/rai: 505.81 baht/rai
 Net revenue/rai: 488.4 baht/rai

Source : Survey 1

Table 6.10 Enterprise Budget for Crop X₉ : Cassava (traction = big tractor)

Labour inputs :

Period	Activity	Man Days	Tractor Hours
1	Land preparation, planting	3.29	.799
2	Planting, crop care	1.97	
4	Crop care	.81	
12	Harvesting	4.69	

Operating costs : 126.54 baht/rai (plants, transportation, excludes tractor and labour costs)

Yield : 1412.9 kg/rai Price : .7 baht/kg
 Gross revenue/rai: 989.04 baht/rai
 Net revenue/rai: 862.5 baht/rai

Source : Survey 1

Table 6.11 Enterprise Budget for Crop X₁₀ : Maize (traction = big tractor)

Labour inputs :

Period	Activity	Man Days	Tractor Hours
2	Land preparation, planting	2.34	.799
3	Crop care, planting	.93	
4	Crop care	.06	
5	Harvesting	2.96	

Operating costs : 19.89 baht/rai (seed, transportation, excludes tractor and labour costs)

Yield : 143.42 (263.6) kg/rai Price : 2.26 (2.43) baht/kg
 Gross revenue rai: 324.49 (640.55) baht/rai
 Net revenue/rai: 304.6 (620.66) baht/rai

(figures in parenthesis equal mean yield and prices over 5 years from published agricultural statistics)³⁶

Source : Survey 1

Table 6.12 Enterprise Budget for Crop X₁₁ : Kenaf (traction = big tractor)

Labour inputs :

Period	Activity	Man Days	Tractor Hours
1	Land preparation, planting	3.31	.799
2	Planting, crop care	1.86	
4	Crop care	.14	
7	Harvest	5.99	
8	Harvest, retting, drying	1.96	

Operating costs : 29.5 baht/rai (seed, transportation, excludes tractor and labour costs)

Yield : 190.64 kg/rai Price : 4.24 baht/kg
 Gross revenue/rai: 808.38 baht/rai
 Net revenue/rai: 778.88 baht/rai

Source : Survey 1

**Table 6.13 Enterprise Budget for Crop X₁₂ : Sorghum
(traction = big tractor)**

Labour inputs :

Period	Activity	Man Days	Tractor Hours
6	Land preparation, planting, crop care	.36	.61
10	Harvesting	2.97	

Operating costs : 22.81 baht/rai (seed, transport, excludes tractor and labour costs)

Yield : 218.37 kg/rai Price : 2.19 baht/kg
 Gross revenue/rai: 480.41 baht/rai
 Net revenue/rai: 457.6 baht/rai

Source : Survey 1

Inserting the relevant coefficients from Tables 6.2 to 6.13 into equations 6.1 to 6.77 completes the basic operational model. Before moving to the results achieved by running the models, we have first to present the structure of the multi-period model.

C Multi-Period Linear Programming Model

To investigate the contribution of credit to farm growth over time, the same basic model has been extended to cover five yearly periods.

There are 3 additional features in this multi-period model:

- (a) the treatment of capital is different, since it is through the capital constraints that the 5 periods are linked;
- (b) the parameters of the objective function are discounted to present value, and

(c) all costs and revenues are converted to real value at $t = 1$.

1. Capital Constraints

As with the single-period model, capital is available both from savings and from credit. Here, however, it is only in the first year ($t = 1$) that savings enter the model as a constant, generated externally (from survey data). In subsequent periods, savings are generated endogenously, as a function of farm income; savings available for investment in period t are a linear function of net revenues in period $t - 1$:

$$Y_t = S_{t-1} = \alpha \sum_i s_{i,t-1} X_{i,t-1} + \alpha Z_{t-1} \quad (6.80)$$

where : Z_{t-1} = net non-farm and livestock income in period $t-1$ (baht);

Y_t = limit on investment in period t if no capital is borrowed (baht);

S_{t-1} = savings from period $t-1$ (baht);

α = marginal propensity to save (MPS);

$s_{i,t-1}$ = net revenue coefficient of crop i in period $t-1$ (baht/rai); and

$X_{i,t-1}$ = area of crop i in period $t-1$ (rai).

A value for α , the MPS, was derived from the survey data (korat) using end-of-year savings and total net income (all sources). Median values rather than means were used (because of a highly skewed income distribution) giving a value of 11%.

11% of total net income to the farm household is therefore assumed to be carried over to the next year and to be available for purchasing inputs at the

beginning of the year.

Two additional capital components are included in the multi-period model, reflecting inputs to the farm-household economy not generated by the model, non-farm income and livestock income. A function of these values are dealt with as constants and appear summed together with the one other externally derived capital element, durable-capital replacement, on the right-hand side of the capital constraints. It is assumed that a certain net income from non-farm activities and from livestock enters the farm-household each year, denoted by Z .

It is assumed that all savings at the beginning of the crop-year are available for investment in the farm. The inclusion of an externally derived non-farm income variable makes each period of the multi-period model consistent with the single period model where savings at the start of the year are a function of farm and non-farm income.

Bringing together the expressions for capital generation and capital use, the annual capital constraint becomes, for $t = 2$ to $t = 5$,

$$\sum_i \beta_{i,t} X_{i,t} - \alpha \sum_i s_{i,t-1} X_{i,t-1} - K_t \leq \alpha Z_{t-1} - D_t \quad (6.81)$$

where : $\beta_{i,t}$ = total capital requirement of crop i in period t (including interest) (baht/rai);

$X_{i,t}$ = area of crop i in period t (rai);

- α = MPS;
 $s_{i,t-1}$ = net revenue coefficient of crop i in period $t-1$ (baht/rai);
 K_t = capital borrowed in period t (baht);
 Z_{t-1} = net non-farm and livestock income in period $t-1$ (baht); and
 D_t = durable-capital replacement in period t

2. Discounted Objective Function Coefficients

The multi-period model extends over the period 1977/78 to 1981/82. The basic input and output coefficients come from the survey and are the same as in the single-period model. The cost and price parameters have been arrived at in 3 ways. For the 5th period, survey values are used, being the best estimate of 1981/82 actual cost and prices for the province. For periods 1 to 4, however, costs have been projected backwards on the basis of the trends in average variable costs of production in Korat, over the 5-year period. Crop prices and yields in year 1 to 4 have been set at their actual provincial levels according to agricultural statistical records. All costs and prices are adjusted to their 1978 real value,³⁷ and the flow of costs and revenues are discounted to their present value at the beginning of year 1 to account for the time preference of capital.³⁸

The practice of first deflating into real terms the cost and revenue flow, and discounting the real net revenues, is standard recommended practice, when price inflation is significant,³⁹ and is obviously a necessity when annual incomes are of interest. It is sometimes suggested,

however, that cash flows should be forecasted in monetary terms.⁴⁰ The rationale in those cases, however, is generally in terms of corporation tax and capital investment grants which makes the suggestion inapplicable to the problem of small farm investment. The need for comparable annual incomes calls for the use of real values.

Discounting all cost and revenue coefficients is necessary (a) to arrive at a single, compressed value, summarising the net return over five years (the value to be maximised), and (b) to enable comparison of annual income figures between any two years.

All revenue coefficients ($s_{i,t}$), capital coefficients ($c_{i,t}$) and prices of hired inputs ($e_{m,t}$, $f_{m,t}$, $d_{m,t}$ and g_t) are discounted using the prevailing market interest rate of 7%.

3. Model Structure

The multi-period model takes the following form :

(a) Objective Function

$$\begin{aligned} \text{Max. } P = & \sum_i \sum_t \frac{s_{i,t}}{(1+r)^{t-1}} X_{i,t} - \sum_m \sum_t \frac{d_{m,t}}{(1+r)^{t-1}} L_{m,t} \\ & - \sum_m \sum_t \frac{e_{m,t}}{(1+r)^{t-1}} T_{m,t} - \sum_m \sum_t \frac{f_{m,t}}{(1+r)^{t-1}} W_{m,t} \\ & - \sum_t \gamma_t K_t \end{aligned}$$

(6.82)

Where : P = the value to be maximised : net present value of net farm income over five years (baht);

$s_{i,t}$ = net revenue per rai of crop i in year t (baht/rai);

$X_{i,t}$ = area of crop i in year t (rai);

r = market interest rate;

$d_{m,t}$ = cost of hiring one man day of hired labour in month m of year t (baht/day);

$L_{m,t}$ = man-days of hired labour in month m of year t ;

$e_{m,t}$ = cost of hiring one hour of big tractor in month m of year t (baht/hour);

$T_{m,t}$ = hours of hired tractor in month m of year t ;

$f_{m,t}$ = cost of hiring one hour of walking tractor in month m of year t (baht/hour);

$W_{m,t}$ = hours of hired walking tractor in month m of year t ;

γ_t = cost of borrowed capital in year t (interest rate); and

K_t = borrowed capital in year t (baht)

The objective function is maximised subject to the constraints set out in the following sections.

(b) Land Constraint Set

Paddy land :

$$\sum_i h_{i,1,1} X_{i,1,1} \leq M_{1,1} \quad (6.83)$$

$$\sum_i h_{i,m,t} X_{i,m,t} \leq M_{m,t} \quad (6.84 \text{ to } 6.141)$$

$$\sum_i h_{i,12,5} X_{i,12,5} \leq M_{12,5} \quad (6.142)$$

$i = 1 \text{ to } 8$

A set of 60 constraints where :

$h_{i,m,t}$ = land required for each rai of paddy crop i in month m and year t (rai);

$X_{i,m,t}$ = area of paddy crop i in month m and year t (rai); and

$M_{m,t}$ = paddy land available in month m and year t (rai)

Upland :

$$\sum_i h_{i,1,1} X_{i,1,1} \leq N_{1,1} \quad (6.143)$$

$$\sum_i h_{i,m,t} X_{i,m,t} \leq N_{m,t} \quad (6.144 \text{ to } 6.201)$$

$$\sum_i h_{i,12,5} X_{i,12,5} \leq N_{12,5} \quad (6.202)$$

$i = 9 \text{ to } 12$

A set of 60 constraints where :

$h_{i,m,t}$ = land required for each rai of upland crop i in month m and year t (rai);

$X_{i,m,t}$ = area of upland crop i in month and year t (rai);

$N_{m,t}$ = upland area available in month m and year t (rai)

Subsistence paddy land :

$$\sum_i h_{i,1} X_{i,1} \leq Q_1 \quad (6.203)$$

$$\sum_i h_{i,t} X_{i,t} \leq Q_t \quad (6.204 \text{ to } 6.206)$$

$$\sum_i h_{i,5} X_{i,5} \leq Q_5 \quad (6.207)$$

$i = 1 \text{ to } 8$

A set of 5 constraints where :

$h_{i,t}$ = land required for each rai of paddy crop in year t (rai);

$X_{i,t}$ = area of paddy crop in year t (rai); and

Q_t = minimum paddy area necessary for family subsistence in year t (rai)

(c) Labour Constraint Set

$$\sum_i k_{i,1,1} X_{i,1,1} - L_{1,1} \leq E_{1,1} \quad (6.208)$$

$$\sum_i k_{i,m,t} X_{i,m,t} - L_{m,t} \leq E_{m,t} \quad (6.209 \text{ to } 6.266)$$

$$\sum_i k_{i,12,5} X_{i,12,5} - L_{12,5} \leq E_{12,5} \quad (6.267)$$

A set of 60 constraints where :

$k_{i,m,t}$ = Labour requirement of one rai of crop i in month of year t (days);

$X_{m,t}$ = area of crop i in month m of year t (rai);

$L_{m,t}$ = hired labour in month m of year t (man days); and

$E_{m,t}$ = family-labour available in month m of year t (man days)

(d) Big-Tractor Constraints :

$$\sum_i \ell_{i,1,1} X_{i,1,1} - T_{1,1} \leq F_{1,1} \quad (6.268)$$

$$\sum_i \ell_{i,m,t} X_{i,m,t} - T_{m,t} \leq F_{m,t} \quad (6.269 \text{ to } 6.326)$$

$$\sum_i \ell_{i,12,5} X_{i,12,5} - T_{12,5} \leq F_{12,5} \quad (6.327)$$

A set of 60 constraints where :

$\ell_{i,m,t}$ = big-tractor-hours required by one rai of crop i in month m of year t;

$X_{i,m,t}$ = area of crop i in month m of year t (rai);

$T_{m,t}$ = big-tractor-hours hired in month m of year t ; and

$F_{m,t}$ = big-tractor-hours owned in month m of year t (= 0)

(e) Walking-Tractor Constraints

$$\sum_i p_{i,1,1} X_{i,1,1} - W_{1,1} \leq G_{1,1} \quad (6.328)$$

$$\sum_i p_{i,m,t} X_{i,m,t} - W_{m,t} \leq G_{m,t} \quad (6.329 \text{ to } 6.386)$$

$$\sum_i p_{i,12,5} X_{i,12,5} - W_{12,5} \leq G_{12,5} \quad (6.387)$$

A set of 60 constraints where :

$p_{i,m,t}$ = walking-tractor-hours required by one rai of crop i in month m of year t ;

$X_{i,m,t}$ = area of crop i in month m of year t (rai);

$W_{m,t}$ = walking-tractor-hours hired in month m of year t ; and

$G_{m,t}$ = walking-tractor-hours owned in month m of year t (= 0)

(f) Buffalo Constraints

$$\sum_i q_{i,1,1} X_{i,1,1} \leq H_{1,1} \quad (6.388)$$

$$\sum_i q_{i,m,t} X_{i,m,t} \leq H_{m,t} \quad (6.389 \text{ to } 6.446)$$

$$\sum_i q_{i,12,5} X_{i,12,5} \leq H_{12,5} \quad (6.447)$$

A set of 60 constraints where :

$q_{i,m,t}$ = buffalo-days required by one rai of crop i in month m of year

$X_{i,m,t}$ = area of crop i in month m of year t (rai); and

$H_{m,t}$ = buffalo-days owned in month m of year t .

(g) Capital Constraints

For $t = 1$:

$$\sum_i \frac{c_{i,t}}{i} X_{i,t} + \sum_m \frac{d_{m,t}}{m} L_{m,t} + \sum_m \frac{e_{m,t}}{m} T_{m,t} + \sum_m \frac{f_{m,t}}{m} W_{m,t} - K_t \leq I - \epsilon \quad (6.448)$$

And for $t = 2$, to $t = 5$:

$$\begin{aligned} & \sum_i \frac{c_{i,2}}{(1+r)^1} X_{i,2} + \sum_m \frac{d_{m,1}}{(1+r)^0} L_{m,1} + \sum_m \frac{e_{m,1}}{(1+r)^0} T_{m,1} \\ & + \sum_m \frac{f_{m,1}}{(1+r)^0} W_{m,1} + \frac{\gamma_1 K_1}{(1+r)^0} - \alpha \sum_i \frac{s_{i,1}}{(1+r)^0} X_{i,1} \\ & - K_2 \leq \delta Z_1 - \epsilon_1 \end{aligned} \quad (6.449)$$

$$\begin{aligned} & \sum_i \frac{c_{i,t}}{(1+r)^{t-1}} X_{i,t} + \sum_m \frac{d_{m,t-1}}{(1+r)^{t-2}} L_{m,t-1} + \sum_m \frac{e_{m,t-1}}{(1+r)^{t-2}} T_{m,t-1} \\ & + \sum_m \frac{f_{m,t-1}}{(1+r)^{t-2}} W_{m,t-1} + \frac{\gamma_{t-1} K_{t-1}}{(1+r)^{t-2}} - \alpha \sum_i \frac{c_{i,t-1}}{(1+r)^{t-2}} X_{i,t-1} \\ & - K_t \leq \delta Z_{t-1} - \epsilon_t \end{aligned} \quad (6.450 \text{ to } 6.451)$$

$$\begin{aligned} & \sum_i \frac{c_{i,5}}{(1+r)^3} X_{i,3} + \sum_m \frac{d_{m,4}}{(1+r)^3} L_{m,4} + \sum_m \frac{e_{m,4}}{(1+r)^3} T_{m,4} \\ & + \sum_m \frac{f_{m,4}}{(1+r)^3} W_{m,4} + \frac{\gamma_4 K_4}{(1+r)^3} - \alpha \sum_i \frac{c_{i,4}}{(1+r)^3} X_{i,4} \\ & - K_5 \leq \delta Z_4 - \epsilon_4 \end{aligned} \quad (6.452)$$

A set of four constraints where :

- $c_{i,t}$ = capital requirements of one rai of crop i in year t (baht);
- $X_{i,t}$ = area of crop i in year t (rai)
- $d_{m,t-1}$ = cost of one man-day of hired labour in month m and year t (baht/day);
- $L_{m,t-1}$ = man-days of hired labour in month m of year $t-1$;
- $e_{m,t-1}$ = cost of hiring one hour of big tractor in month m of year $t-1$ (baht/hour);
- $T_{m,t-1}$ = hours of big tractor hired in month m of year $t-1$;
- $f_{m,t-1}$ = cost of hiring one hour of walking tractor in month m of year $t-1$ (baht/hour);
- $W_{m,t-1}$ = hours of walking tractor hired in month m of year $t-1$;
- γ_{t-1} = cost of borrowed capital in year $t-1$ (interest rate);
- K_{t-1} = amount of borrowed capital in year $t-1$ (baht);
- γ = marginal propensity to save;
- $s_{i,t-1}$ = net revenue per rai from crop i in year $t-1$ (baht/rai);
- $X_{i,t-1}$ = area of crop i in year $t-1$ (rai);
- K_t = borrowed capital in year t (baht);
- δ = a function of the MPS given by the value of $.5\alpha$;
- Z_{t-1} = net income from non-farm and livestock sources in year $t-1$ (baht);
- ϵ_t = durable-capital replacement in year t (baht); and
- r = market interest-rate.

Annual borrowing is limited constraints identical to equation (6.77) in the single period model :

$$K_1 \leq J_1 \quad (6.453)$$

$$K_t \leq J_t \quad (6.454 \text{ to } 6.456)$$

$$K_5 \leq J_5 \quad (6.457)$$

Where : K_t = capital borrowed in year t (baht); and
 J_t = borrowing limit in year t (baht).

4. Calibration

The calibration of the multi-period model is the same in principle as for the basic single-period model. The values in the farm-enterprise budgets (Tables 6.2 to 6.13) which relate to the survey year 1981/82, are fitted to year 5 (the final year) in the multi-period model, since the model covers the period from 1977/78 to 1981/82. The coefficients in the tables are, however, adjusted to their 1977 values and also discounted to the beginning of 1977 before being entered into the multi-period model. The method used to derive values for the parameters in years 1 to 4 in the model has already been described (Section C.2); published figures are used for prices and yields while costs are estimated backwards on the basis of published trends.

This completes the discussion of the methodology used in the linear-programming analysis. Although the design and calibration of the models can generally be seen as methodological considerations, those exercises generate a

Lot of information about the farm economies being investigated and are in one sense the first stage of results.

It now remains to present the results of running the models in order to answer research questions concerning the demand for credit on the various model farms.

Chapter 6 : Notes and References

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12. Naseem, M., 1974, *op.cit.*, for example, modelled the capital requirements of a sample of Pakistan farmers over 4 annual and 8 seasonal periods
13. See, for example, Schluter, M.G., 1974, *op.cit.*
14. 15 out of the 16 programming studies of credit reviewed in David, C., and Meyer, R., 1979, *op.cit.*, modelled the farm-firm only
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 Priebprom, Somsak, 1980, *op.cit.*; Amnaj, Thiravanich, 1980, **Preliminary Results: Farm Household Model in Roi Et Province**, Working Paper No.27, Rural Off-Farm Employment Assessment Project, Centre for Applied Economic Research, Kasetsart University, Bangkok; Rapeepun, Jaisaard, and Saram Arayarangsarid, 1980, **Preliminary Results of Farm Household Modelling in Chiang Mai**, Working Paper No.14, ROFEA Project, CAER, Kasetsart University, Bangkok
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21. Office of the Prime Minister, 1981, *op.cit.*

22. These criteria were largely determined by the BAAC's anticipated use of the survey
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31. Means are used as the most representative values for resource variables. Savings is the only exception, where medians are used because of the skewed distribution of savings within each sub-sample
32. See, for example, Priebprom, 1980, *op.cit.*
33. See, for example, Gotsch, C.H., and Yusuf, S., 1974, *op.cit.*
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35. This was one finding of the farm-household programming study by Priebprom, S., 1980, *op.cit.*
36. Because of the particularly low survey maize yields, the model was also run with yield and associated revenue set at the average provincial level, using published agricultural statistics. The solutions with survey and published yields are compared in Chapter 7
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38. The discount rate was set at 7% which equals the average rate of interest in the private capital market during the modelling period
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CHAPTER 7 :

EVALUATING THE DEMAND FOR CREDIT : RESULTS

A Introduction

We pick up at this point from the questions raised at the end of Chapter 3 concerning the possible reasons why small farmers tend not to borrow from institutional lenders. This chapter is intended to accomplish two things. First, it is intended to lead to some detailed statements about the demand for credit among the survey farmers, especially small farmers. Second, drawing on the patterns of demand which emerge, it is intended to lead to some conclusions about why small farmers tend not to participate in the institutional credit market.

The models developed in the last chapter will enable us to derive optimal borrowing amounts and associated incomes for different groups of farmers, and to compare these with actual borrowing amounts derived from the survey. Of particular interest will be the comparison for farmers who have no institutional affiliation (independent farmers - here largely synonymous with small farmers). This will give an indication of the degree to which independent farmers currently borrow sub-optimal amounts. Section B and C deal with these issues.

The analysis is then elaborated in Section D bringing in the issue of whether or not independent farmers wish to borrow from an institution. It is a problem for all programming studies to know whether to interpret results essentially as description or prescription. If independent farmers borrow low amounts, is it

because of a credit shortage (in which case, the models are descriptive) or is it because they do not wish to borrow more (in which case, the models are prescriptive)? A measure of a farmer's demand for institution credit facilities is used in Section D as an indicator of the extent to which independent farmers face a supply shortage; farmers wanting to register with a credit institution are assumed to face supply problems in the informal market. A number of tests are carried out in Section D to validate this indicator. In pursuing the validation issue, crude tests are made of two of the research hypotheses presented at the end of Chapter 3: is it because of high real borrowing costs, or because of risk to consumption credit that small farmers tend not to borrow from institutions?

Having quantified the demand for credit in Section C and drawn some conclusions about the importance of a credit supply shortage in Section D, there follows in Section E an enumeration of some specific disadvantages faced by independent farmers, as a result of operating outside of the institutional credit market.

Before proceeding, it is necessary to make a distinction between demand for credit and demand for institutional credit. A farmer may have need for credit, but not want to borrow on the formal market. Alternatively, a farmer may have no need for more credit, but nevertheless want to switch to an institutional lender.

Before anything can be said about demand for institutional credit, we must first know something about the pattern of demand for credit in general. This is the starting point. If it can be

shown that under their current capital-supply situation, farmers still demand additional credit, then we know that the introduction of institutional credit will have a potential volume effect. If this is so, we know that it is not because of sufficiency of existing supply that farmers do not borrow formally. We then want to know why farmers do not borrow from the formal market to make up for the shortage of the volume of credit. This could be, for example, because of the high borrowing cost, the risk to consumption credit or the lender's rationing procedures.

If there is no demand for additional capital because current supplies are sufficient, we have some evidence that the lack of formal borrowing is related to a low potential demand. This lack of demand for additional credit would not, on its own, be sufficient to prove a lack of demand for institutional credit, however, since farmers may (a) prefer to switch to institutional sources from existing sources because of the lower price; (b) may want to use institutional credit as a substitute for savings; or (c) while not displaying a demand for more credit at the moment, may simply wish to have the privilege of being registered with a formal credit institution.

The first question examined then, asks whether small farmers need additional supplies of borrowed capital, and if so, how much they need.

The single-period LP model is used to quantify the relationship between capital input (especially borrowed capital) and output, and to derive optimal levels of credit which the model farm can

absorb. The results give estimates of the potential or latent demand for credit. The issue of demand for institutional credit facilities is taken up in a subsequent section.

B The Impact of Credit on Farm-Plans: optimal plans as credit availability is varied

As a necessary preliminary to the discussion on the relationship between credit and revenues, the following section describes the way in which optimal farm-plans change as certain parameters are varied. This is intended to follow on from the more general description of the North-East region's agriculture given in Chapter 5 and to provide a context for the more specific parametric analyses presented later in this chapter. The description of the pattern of changes in farm plans has been produced by running the models in an exploratory fashion, systematically varying important parameters and recording the patterns in the optimal solutions.

The following farm-plans describe what happens when credit is varied in both single and multi-period models.

The farmer with no credit available for production expenses can use only what he has saved in cash or in kind from the previous year. He is able to grow almost as much paddy as he can, given his family labour supply. It is the labour which acts as the initial constraint on expansion of paddy production, unless paddy land area is small enough to become a constraint before labour days are exhausted. Lacking the capital, he cannot hire labour to supplement family labour. With no credit, the farmer can grow

some fertilized paddy, but a good half still remains unfertilised¹ and buffalo power is used for preparation of land for both types of paddy crop.

Since upland and paddy land are considered in the short and medium term to be non-interchangeable, the 2 crop categories do not compete for land; only for labour, traction and capital.²

As more capital becomes available through borrowing, the first activity to increase is kenaf production. This is because of kenaf's comparatively good net-revenue coefficient and yet its low capital requirements compared to cassava. Kenaf rai expand with more credit until sufficient credit is available for all the upland area to be planted under kenaf. Over a certain capital threshold when kenaf production becomes possible, expansion of kenaf rai requires some reduction of fertilized paddy; the marginal revenue from putting unused upland area to kenaf is greater than the incremental revenue gained by substituting fertilized for non-fertilized paddy. Paddy area actually falls slightly, as resources are diverted to kenaf. At the point when all upland is used for kenaf, production can no longer increase extensively. Capital deepening³ occurs as some of the early unfertilized paddy is replaced by fertilized paddy (still using buffalo for land preparation). With greater capital inflow all paddy becomes fertilized and continues to increase towards the maximum area subject to labour constraints. Tractor hiring accompanies the expansion of upland crops.

Cassava begins to appear on the upland area when capital supply increases above the threshold which allows for the relatively

high costs of tractor hiring and transportation to market involved in cassava production. With more capital available, more kenaf is switched to cassava and again there is some reduction in paddy area. When cassava area has reached a certain point, labour begins to be hired to supplement family labour. Hired labour facilitates expansion of paddy production, to make up for the labour resources diverted from paddy to upland crops. Paddy area planted increases to a point where available buffalo power becomes a constraint.

The optimal farm plan, using as much credit as possible, therefore involves just three crop types: cassava, early and late fertilized paddy. With lower borrowing-limits, it variously involves combinations of fertilized and unfertilized paddy, kenaf and cassava.

Paddy prepared by walking tractor never appears in the solution for the single-period model, since the small area of paddy land left unproductive would have to be worked almost entirely using hired resources of labour and walking tractor. The unit costs involved are greater than the expected net revenues (marginal cost (MC) > marginal revenue (MR)).

There are 2 upland crops which do not appear in the solution: maize and sorghum. Their appearance in the survey farms may lead to doubt about the model's representative validity. The explanation of their absence in the model's solution lies, however, in the question of yields, and the model is found to fairly accurately reflect reality.

Maize yields facing farmers in the survey were very low due to

locally severe drought, with an average of 143 kg/rai, compared to an average korat yield of 334 kg/rai for the same year. Entering the lower (survey) yield in the model, maize became very uncompetitive compared to both cassava and kenaf. Its uncompetitiveness also resulted in the absence of sorghum from the solution, since sorghum is only grown with maize. On its own, sorghum cannot compete with cassava or kenaf, or with maize. It is, however, grown in rotation with maize, being planted in September after the August maize harvest. In this way, the maize/sorghum plan competes with an all cassava or an all kenaf upland production plan. The survey maize yield was so low that neither maize nor maize/sorghum could compete with the other two crops. By incrementing the maize net revenue coefficient upwards, we can see what happens if maize yields are nearer the provincial mean level. At the point when the maize/sorghum summed net revenue exceeds that of cassava, the place of cassava in the solution is taken by maize-followed-by-sorghum and cassava does not appear at all. This illustrates their competitive relationship, and the complementary relationship between sorghum and maize.

The model farm either produces all cassava, or all maize/sorghum on its upland area, depending on the relative profitability of the two alternatives. Kenaf is not competitive in the same way with any of the upland crops. With maize yield at the higher level, kenaf remains an option for the farmer with insufficient capital to invest in either cassava or maize/sorghum.

Parametising credit in a model with an upward adjusted maize

revenue, kenaf is the first upland crop to expand as capital inflow increases and expands until all upland area is used. At that point, maize/sorghum begins to replace some kenaf area, the three crops being produced together until sufficient capital is available to plant all the upland to maize/sorghum. This is the same pattern displayed by kenaf and cassava when maize is at the lower yield.

This helps explain the cropping pattern observed in the survey (and gives evidence to the model's goodness-of-fit). All of the survey's 42 sorghum growers planted maize before their sorghum crop. On the other hand, no farmer planted sorghum, maize and cassava together (though 8 farmers planted cassava and maize). This is what we would expect if cassava and maize/sorghum are competitive, and sorghum and maize are complimentary. Kenaf was planted along side both maize/sorghum and cassava in the survey.

C Measuring the Demand for Credit

In the following, a distinction is made between 2 generalised farm-types: an independent farm and a farm that has access to BAAC credit facilities, (the first two of the four single-period models listed in Section A.4 of Chapter 6). The two model farm-types differ in terms of their land and owned-capital resources (Table 7.1), since there are significant differences between the BAAC and independent farm groups in the survey with respect to these resources. Since all other resources show no great variation between the groups, these are kept at the whole-survey level for both farm types.

Apart from land and savings, therefore, the two models are essentially the same. The implicit assumption here is that BAAC and independent farms are essentially similar, existing side by side, and facing the same production possibilities, costs and revenues. For the purpose of looking at demand for credit, they differ only in terms of capital and land.

Table 7.1 Resource Profiles for a Model BAAC and Independent Farm

	Total land (rai)	Paddy land (rai)	Upland (rai)	Savings at start of crop year (baht)
Independent farm	14.9	8.1	6.8	1,384
BAAC farm	30	13.9	16.1	3,714

Source : Survey 1

1. Single-Period Solutions for an Independent Farm

With credit availability set as unlimited (K has no upper bound, or J is set at a very high level in Equation 6.79), an optimal farm plan is produced which gives the pattern of activities and resource employment when borrowing is not a constraint (Table 7.2).

Three types of crop are grown; early and late paddy, both of medium technology (fertilized and using buffalo), and cassava. All upland is devoted to cassava and all usable land is brought into production. The optimal amount of credit that a farm with these resources can use is 1,472.37 baht.

Table 7.2 Solution for an Independent Farm with Unlimited and Survey Levels of Borrowing

	Unlimited	Survey Level
Early paddy, F,T		
" " F,B	3.60*	
" " UF,T		
" " UF,B		3.24
Late paddy, F,T		
" " F,B	4.50	4.86
" " UF,T		
" " UF,B		
Cassava	6.80	
Kenaf		5.20
Maize		
Sorghum		
Total Area	14.90	13.30
Cropping Intensity (%)	100.00	89.28
Big-Tractor-hours hired	5.43	4.16
Walking-Tractor-hours hired		
Hired Labour days		
Credit (baht)	1,472.37	281.00
Objective (baht)	9,667.26	8,247.41
Shadow price of credit (bht/bht)	0.00	2.62

Note : F = fertilized
 UF = unfertilized
 T = walking tractor
 B = buffalo
 * all crop figures in rai

Source : LP Model Solutions

In order to estimate the degree of demand for credit for survey independent farmers, the figure is compared to the representative actual borrowing level during the survey year. The mean level of production loan taken was 281 baht, a figure considerably lower than the optimal loan size produced by the model. Table 7.2 also shows the solution for a model independent farm at a mean survey level of borrowing. Though this low mean figure gives some idea of the level of borrowing, it conceals the real pattern of borrowing which is highly skewed. Out of the 217 independent

farmers, only 29, or 13%, took a production loan in the survey crop year, while the other 87% borrowed nothing for production. The median becomes a better representative borrowing level for the group as a whole, and this equals zero. However, it is perhaps most useful to consider the independent farmers as two groups, one which borrowed for production and one which did not. Splitting the independent farmers into two groups like this means that it is no longer possible to use the optimal borrowing level from the whole-group model as the one with which to compare actual borrowing levels. This is because that model assumes overall levels of land and savings which may be different from the resource profiles of the 2 sub-groups. Separate models are, therefore, constructed to represent the two sub-groups more closely than does the whole-group model (the last two of the four single-period models listed in Section A.4 of Chapter 6).

2. Single-Period Solutions for a Borrowing and Non-Borrowing Independent Farm

As with the division into independent and BAAC farmers, it is only the resources of land and savings which differ significantly between the 2 sub-groups, so all other resources are set the same for both groups. The 2 model farm types representing the 188 non-borrowing independent farmers and the 29 borrowing farmers have resource profiles as set out in Table 7.3. All other resources are as in the basic model as presented in Chapter 6.

Table 7.3 Resource Profiles for a Model Borrowing and Non-Borrowing Independent Farm

	Total land (rai)	Paddy land (rai)	Upland (rai)	Savings at beginning of crop year (baht)
Non-borrowing Independent farm	14.03	7.72	6.31	1,454.9
Borrowing Independent farm	21.04	11.14	9.90	1,020.3

Source : Survey 1

Table 7.4 Solution for a Non-Borrowing Independent Farm, with unlimited and survey levels borrowing

	Unlimited	Survey Level
Early paddy F,T		
" " F,B	3.09	
" " UF,T		
" " UF,B		2.81
Late paddy F,T		
" " F,B	4.63	4.91
" " UF,T		
" " UF,B		
Cassava	6.31	
Kenaf		4.24
Maize		
Sorghum		
Total Area	14.03	11.96
Cropping Intensity %	100.00	85.25
Big-Tractor-hours	5.04	3.39
Walking-Tractor-hours		
Hired Labour days		
Credit (Baht)	1,216.90	0.00
Objective (Baht)	9,203.44	7,567.04
Shadow price of credit (bht/bht)	00.00	2.62

Source : LP Model Solutions

Table 7.5 Solution for a Borrowing Independent Farm, with unlimited and survey levels borrowing

	Unlimited	Survey Level
Early paddy F,T		
" " F,B	7.63	7.14
" " UF,T		
" " UF,B		
Late paddy F,T		
" " F,B	3.50	3.99
" " UF,T		
" " UF,B		
Cassava	9.90	
Kenaf		9.90
Maize		
Sorghum		
Total Area	21.03	21.03
Cropping Intensity %	100.00	100.00
Big Tractor hours	7.91	7.91
Walking Tractor hours		
Hired Labour days		
Credit (baht)	3,062.29	2,103.45
Objective (baht)	12,943.83	12,448.58
Shadow price of credit (bht/bht)	0.00	1.02

Source : LP Model Solutions

We have seen that the mean borrowing level is considerably lower than optimal for independent farmers as a whole. What of the two sub-groups, the borrowers and the non-borrowers? The borrowers in the survey have a mean borrowing level of 2103.45 baht, while the equivalent figure for non-borrowers is zero. Solutions are presented in Tables 7.4 and 7.5 for the models representing the two groups. The models have been run with borrowing set to the respective mean survey values (0 and 2103.45) and the respective solutions for unlimited borrowing are shown alongside.

Looking first at the non-borrower (Table 7.4) and the whole group (Table 7.2) models together (since the whole group

model largely reflects the majority of non-borrowers), a comparison of solutions with survey and unlimited levels of borrowing reveals the following. The solutions with survey credit levels have lower objectives (net farm incomes), they produce less profitable crops and have lower levels of technology and capital intensity. Thus, with less capital, fertilized early-paddy is replaced by unfertilized early-paddy, and cassava is replaced by the less capital-intensive and lower priced kenaf. All available capital is used up and the difference between optimal and actual borrowing is 1216.9 baht.

The shadow price⁴ of borrowed capital is high at 2.62 for both non-borrowers and whole-group models. One additional baht borrowed would produce a return of 2.62 baht, a 262% rate of return. This high shadow price is a measure of the scarcity value of borrowed capital and indicates a strong positive demand for credit among independent farmers as a whole group, and among the 87% who did not borrow in particular. The positive demand indicated by high shadow prices, at this stage of the discussion, have to be interpreted as latent demand since we have not yet established whether or not farmers operating with these low levels of credit wish to borrow more.

The same comparison for independent farmers who did borrow (Table 7.5) reveals a similar but not so striking pattern. With the survey level of borrowing, there is a very small substitution of non-fertilized for fertilized paddy, and

kenaf replaces cassava, the area of upland crops slightly decreasing as it does for the non-borrowers. The survey-level solution is a lower technology solution with a less profitable upland crop, but is nearer to the optimal than for the non-borrowers survey-level solution. The difference in borrowing between actual and optimal credit is 958.84 baht, and the shadow price of credit at survey borrowing level is 1.02. We conclude that the independent farmers who did borrow, partially satisfied their demand for capital, borrowing 2,1104 baht of the optimal 3,062 baht, but that demand still remains positive though not so high as for non-borrowers.

Before extending the analysis to include the demand for institutional credit, the analysis above is repeated for BAAC farmers, to make a comparison of credit demand between farmers with and without access to institutional credit.

3 Single-Period Solutions for a BAAC Farm

Table 7.6 presents the solutions for the BAAC model run with unlimited credit availability, and with a borrowing limit equal to the mean loan size of surveyed BAAC farmers (5,568 baht).

The two solutions are the same because the survey borrowing level exceeds the optimal. If the negative difference between actual and optimal borrowing for independent farmers indicates sub-optimal borrowing, what does a positive difference mean? Super-optimal borrowing makes no sense if the model is well-fitted. The explanation

Table 7.6 Solution for a Model BAAC Farm with Unlimited and Survey-Levels of Borrowing

	Unlimited	Survey Level (5568 baht)
Early paddy: F.T		
" " F.B	9.27	9.27
" " UF.T		
" " UF.B		
Late paddy: F.T		
" " F.B	4.18	4.18
" " UF.T		
" " UF.B		
Cassava	16.09	16.09
Kenaf		
Maize		
Sorghum		
Total Area	29.54	29.54
Cropping Intensity (%)	98.51 ⁵	98.51
Big-Tractor-hours	12.86	12.86
Walking-Tractor-hours		
Hired Labour days	41.90	41.90
Credit (baht)	3,579.24	3,579.24
Objective (baht)	17,818.13	17,818.13
Shadow price credit (baht/baht)	0.00	0.00
Slack credit (baht)	0.00	1,988.76
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Source : LP Model Solutions

lies in the substitution effect of borrowing. The model assumes that savings at the beginning of the production year are all invested in farm production. If only a part of savings were used, the optimal borrowing level in the solution would rise because there would be less owned capital to cover production expenses. The positive difference of Table 7.6 indicates that BAAC farmers borrowed 1,989 baht beyond what would have been necessary if all savings were used. Looked at another way, invested savings were reduced by 1,989 baht and credit increased by that

amount. The slack credit value in Column 2 of Table 7.6 therefore gives an indication of the degree to which BAAC farmers substituted credit for savings.

This explanation is supported by the relationship between agricultural expenses and production loans for the survey BAAC farms. The average production loan plus the average savings together come to well above the average level of agricultural expenses. The only reasonable explanation for this pattern in the survey data is that loans substitute for savings.

Far from facing a capital shortage in the farm, the BAAC clients employ optimal amounts of capital and are in a position where they can reduce the proportion of their savings invested in the farm, by borrowing high amounts to substitute savings.⁶

D Interpreting the Demand for Credit

1 Normative or Positive Interpretation of Model Results?

The conclusion from the previous section is that BAAC farmers employ capital at optimal levels, while independent farmers, using all their savings and not borrowing as much as they need, employ sub-optimal amounts. What this means for farm income is that under current technology, BAAC farmers have more or less reached the best income levels possible for them. On the other hand, independent farmers could achieve higher farm-incomes if they used more credit.

Up to this point, it has not been necessary to draw the

distinction between the normative and positive interpretation of the LP model results. Very simply, the difference is this: considered **normatively**, the high shadow-prices of credit for independent farmers indicate only a latent demand. They tell us how the farmer would value additional credit if he were to operate in an optimal fashion, according to the model's assumptions. This latent demand may or may not be potential demand, depending on whether or not farmers approximate to those behavioural assumptions (depending on whether or not they want to increase their borrowing). If a farmer does not want to optimise production in this sense, demand remains latent and he cannot, strictly speaking, be said to demand more credit even though his farm could absorb it.

Considered as a positive model, the high shadow-prices of credit indicate not only a high potential-demand for credit, but also a supply shortage. If farmers are indeed behaving according to the model's assumptions, sub-optimal borrowing cannot be explained by contrary assumptions regarding behaviour, and must lie in a limited ability to borrow. In this case, the survey level of borrowing can be regarded as an indication of the degree of supply constraint; as an effective borrowing-limit. Borrowing independent-farmers with an average loan of 2,103 baht can be assumed to face an effective borrowing-limit of that amount, if indeed they desire to borrow more than that amount.

In the following section, a number of tests are made to determine whether the results of the LP models should be interpreted normatively or positively. Essentially, the question under investigation is to what degree do independent farmers face a credit supply shortage? The LP models suggest that they do if farmers are operating optimally according to the models' assumptions. In this section, we are answering the question not with measures of demand derived from the models, but with measures of demand expressed by the interviewed farmers. If independent farmers tend to express a need for additional credit, we have some justification for interpreting the model results positively. If, on the other hand, they tend to be satisfied with current levels of borrowing and production, the results have to be taken as normative.

Firstly, the degree of expressed shortage of supply is measured using the expressed demand for institutional credit facilities as an indicator. Secondly, there are two series of tests, which attempt to validate this measure of supply shortage. The first series of tests evaluates the validity of the assumption that farmers wanting institutional credit facilities face a credit supply shortage. The second series of tests evaluate the validity of the converse assumption: that farmers not wanting institutional credit facilities face no credit supply shortage. A distinction is made in the discussion between group A farmers (those who want to register with a credit institution) and group B (those who do not want to).

2 Measuring the Importance of Credit Supply Shortage using Demand for Institutional Credit Facilities as an Indicator

In order to make some estimation of the relative importance of supply shortage vis a vis lack of incentive to borrow, independent farmers were asked whether or not they would want to register with a credit institution if they had the chance. Out of 217 independent farmers, 170 (or 78%) wanted to register with a credit institution. This is made up of 77% wanting to register with BAAC and 1% wanting to register with a cooperative.

Assuming the desire to register with a credit institution and the dissatisfaction with existing credit sources are related, this measure can be used as an indication of numbers who face some degree of supply constraint.

Certain qualifications are necessary, however. Those who responded positively will include farmers who want to become clients of an institution for a variety of reasons. This may be because of low interest rates, the possibility of larger loans, greater reliability or other reasons such as prestige. It becomes necessary to determine how many respondents wanted institutional credit facilities because of the inadequacy of their existing credit supply.

It is possible to make a number of approximate tests of the relative importance of supply-shortage as a factor behind the expressed desire to register. This amounts to testing the validity of using that expressed desire as an indicator of credit-shortage.

3 Testing the Validity of using Demand for Institutional Credit Facilities as an Indicator of Credit Supply Shortage

(a) Validating the assumption that farmers wanting institutional credit face a credit shortage: the most important anticipated benefits of registration

In a separate question, farmers were asked what they thought were the most important anticipated benefits of registration with the BAAC. The responses of farmers who wanted to register listed under first and second most important benefits, are given in Table 7.7.

Table 7.7 Reasons for Wanting to Register with a Credit Institution, for a Sample of 170 Independent Farmers desiring Institutional Registration

Reason	1st most important reason		2nd most important reason	
	frequency	%	frequency	%
1. Cheaper Loans	112	(65.9)	26	(15.3)
2. Larger Loans	17	(10.0)	24	(14.0)
3. Quicker Service	4	(2.4)	38	(22.4)
4. More reliable service	24	(14.0)	54	(31.8)
5. Advice	1	(0.6)	2	(1.2)
6. Others (e.g. prestige, savings)	12	(7.1)	26	(15.3)
	170	(100)	170	(100)

Source : Survey 1

The responses can be grouped into 2 categories: those that can be related to the need for more, or more timely credit (1-4) and those that cannot (5,6). Cheaper loans enable larger loans to be borrowed for a

given price, and so response (1) is just as much an indication of supply shortage as response (2). A supply shortage ensues not just through lack of availability of credit sources, but also through lack of timely supply, and this is a commonly reported problem among Thai farmers. The 'quicker service' and 'more reliable service' responses, therefore, can equally be associated with supply constraints.

Supply-shortage related responses were named as the most important by 92% of the farmers who wanted to register, and as the 2nd most important by 84%.

The indication is clearly that independent farmers wanting to register with an institution, want to do so largely because of problems in credit supply in the non-institutional credit market.

**(b) Validating the assumption that farmers wanting institutional credit face a credit supply shortage :
Reasons for not registering so far**

A second test is provided by the results of a question, which asked independent farmers why they had not registered with BAAC so far. Responses are set out in Table 7.8. Only response (4) in Table 7.8 indicates a lack of demand for credit, while all of the others are compatible with the proposition that these farmers want to register because of credit supply problems (though we can say nothing about response (6)). Some evidence is provided for the assertion that it is because of supply problems that the farmers want to register, by

the large percentage (74%) who have not given response (4) as the most important. As for the 26% who said they hadn't registered so far because they had no need for credit, this suggests, (since they do not normally appear to face a capital shortage), that their desire to register does not indicate a capital supply shortage.

This would be the most conservative interpretation. However, we are not obliged to make this interpretation since it could well be that although a lack of demand has kept the 26% of farmers from applying for registration in the past, at the time of survey, they did in fact want the credit facilities offered by a credit institution. Indeed, we are forced to make the latter interpretation if the 2 tests above are considered together: although 26% said that they hadn't registered to date because of lack of demand for capital, 92% indicated that they want to register now because of the benefits that will accrue in relation to borrowing.

Table 7.8 The most important reason for not registering with BAAC so far, for a sample of 170 independent farmers desiring institutional registration

Reason	Frequency	%
1. Uncertain about the procedure	70	(41.2)
2. Never been invited	35	(20.6)
3. Difficulty in dealing with officials	14	(8.2)
4. No need for production credit	44	(25.9)
5. Risk of losing normal supply of consumption credit	1	(0.6)
6. Other	6	(3.5)
	170	(100)

Source : Survey 1

We can conclude that a large majority (92%) of independent farmers who want to register with an institution, want to because of the benefit it will give them with respect to borrowing. This, in turn, implies that they face some degree of supply constraint in the private credit market: high interest rates, smaller loans, lack of timeliness or unreliability. The reasons why they have not registered in the past are quite compatible with the reasons why they want to register now, except for 26%, most of whom appear now to have expressed a demand for credit facilities.

Multiplying the proportion of independent farmers who want to register with an institution (78%) by the proportion of those wanting to register, who want to do

so because of borrowing benefits (92%), it can be stated that 72% of independent farmers appear to want to register because of some degree of credit shortage.

Can we now conclude that for 72% of independent farmers the result of the LP analysis can be interpreted positively? What can be said with the greatest caution is that for this sub-group there is no evidence against interpreting the model results positively. They appear to have credit supply problems and, therefore, their sub-optimal use of credit, and related sub-optimal production can be put down at least partly to capital shortage. We do not know what other reasons might be causing sub-optimal use of credit, but the evidence is at least consistent with the hypothesis expressed in the LP model which makes sub-optimality a result of capital shortage.

As for the 28% who do not appear to need the credit services of an institution at all, or who wanted them primarily for reasons other than capital shortage, do we have to interpret the LP analysis normatively for them? Certainly if they have no problem of credit supply, the model does not describe them well, but has to be seen as prescribing for them. Two sets of hypotheses can be tested, however, before we can conclude that the group does not face a credit supply shortage.

- (c) Validating the assumption that farmers not wanting institutional credit face no supply-shortage: risk to consumption credit and high borrowing costs as disincentives to register

It may be that the 22% who did not want to register with an institution at all, still face a credit supply shortage but do not want to participate in the formal market for other reasons.

Two such reasons were identified as being of possible theoretical importance in Chapter 3. The first suggests that small farmers tend not to borrow formally because registration with an institution would risk the loss of their normal consumption-credit sources. The second suggests that their tendency not to borrow formally is related to the high total costs of borrowing from an institution.

A test is made separately for each hypothesis. The measurements are crude, but the tests give some indication of whether either or both of the hypotheses are likely to be of any importance in the survey farmers' decision to want to register or not.

The testing of the hypotheses involves using responses to two questions put to farmers regarding borrowing from a credit institution. The first asked farmers whether they thought there were significant costs of borrowing from an institution in addition to interest charges. The second asked them whether they thought that borrowing farm-credit from an institution would

risk the loss of their normal supplies of credit for consumption.

A two-sample difference of proportions Z-test is used to test each hypothesis. The principle involved is to test whether the proportion of farmers scoring positively on the disincentive measure is higher in the sub-sample who did not wish to register than in the sub-sample who did want to register. For the borrowing-cost hypothesis, for example, the proportion of farmers who consider total borrowing-costs to be significantly higher than interest costs is compared between the two groups. This proportion is expected to be higher for the group of respondents who did not want to register (group B).

The tests are set out formally in Appendix 2 with some detailed discussion. The results are summarised in the following :

Borrowing-cost hypothesis

Fail to reject the null hypothesis 1_0 : no difference between group A and B farmers with respect to the proportion of farmers who consider total borrowing-costs to be significantly higher than interest costs ($P = .95$).

Risk to consumption-credit hypothesis

Reject the null hypothesis 2_0 : no difference between Group A and B farmers with respect to the proportion of farmers who consider that registering with a credit

institution will risk losing their normal source of consumption credit ($P = .99$).

Failing to reject hypothesis 1_0 leads to the conclusion that recognition of total borrowing costs is not important in explaining attitude towards registration; respondents wanting to register are as likely to recognise the full costs as respondents who do not want to register.

Rejection of hypothesis 2_0 , on the other hand, leads to the counter-intuitive conclusion that farmers wanting to register are more likely to recognise the risk of losing consumption credit supplies (see Appendix 1 for a full discussion).

The overall conclusion from the tests is that neither 'disincentive factors' are associated with a decision not to want to register. What does emerge is that farmers who do want to register have given the full costs of borrowing, (including risk to consumption credit), greater consideration. The proportion of farmers responding to the two questions with a 'don't know', was far less for group A than group B. Those who want to register have considered the implications, (some 29% think that consumption credit lines will be risked, and some 37% think that there are significant borrowing costs above interest charges),⁷ but they nevertheless wish to register.

We can conclude that although farmers are to some degree aware of these factors, there is no evidence that they have an influence on a farmer's decision to want to participate in the formal credit market.

Two things have been achieved by these tests. Firstly, the hypotheses which state that high total borrowing costs and risk of losing consumption-credit sources are important factors behind a lack of demand by small farmers for institutional credit, cannot now be accepted. With respect to the overall thesis being presented, we have failed to accept two of the demand-side hypotheses concerning small-farmers participating in the formal credit market (Chapter 3).

Secondly, with respect to the interpretation of the LP model results, as normative or positive, there is no evidence to suggest that group B farmers do in fact face a capital shortage, inspite of their lack of desire to register. It cannot, however, be said with certainty that they do not face a capital shortage. (If the tests had supported the original research hypotheses, there would have been some evidence for the assertion that group B farmers might, in fact, face a capital shortage, but that they do not want institutional credit for reasons of cost and risk of losing consumption credit). We know now that these two theoretically important factors are unimportant in the decision not to want to register. We can, therefore,

hypothesise with greater confidence that they have made this decision because they do not need more working capital.

- (d) **Validating the assumption that farmers not wanting institutional credit face no credit supply shortage: more favourable resource endowments means lower demand for credit**

There is one more set of tests necessary before we can say with maximum confidence possible that the LP model results should be interpreted normatively for group B farmers. We need to make certain that group A and group B farmers do not differ significantly with respect to resource endowments. We need to be able to reject the assertion that group B farmers do not want to register with a credit institution because they are already borrowing at, or near to, optimal levels. This could be the case if group B farmers tended strongly to be located in the upper ranges of the distribution of savings or loan-size variables among independent farmers as a whole, or possibly in the lower ranges of the distribution of land-area variables (it was average measures on these variables that were used for the independent farm model).

The more important resource endowments are therefore compared between group A and group B farmers. The models are fairly insensitive to variations on buffalo and family-labour endowments where land area is small, as shown by the non-positive shadow prices for these resources.⁸ Although shadow prices are high for

tractors, practically all farmers hire, and no tractor ownership is included in the models so that it is not necessary to test the variation on this variable. The resources to which the model is sensitive, those with positive shadow-prices, are land and owned and borrowed capital. Table 7.9 gives the average values on these three variables for group A and group B independent farmers, and independent farmers as a whole.

For each of the resources in Table 7.9, the difference between group A and B farmers would suggest that, if anything, group B farmers had the greater shortage of capital: group B farmers' paddy and upland areas were larger and their beginning-of-year savings and average production-loan were smaller. There is no evidence, therefore, to support the hypothesis that group B farmers do not want to register because they already have an optimal supply of funds. It can be concluded that attitude towards registration is not related to production levels. The implication is that those not wanting to register may be satisfied with low levels of production.

(e) Validating the assumption that farmers not wanting institutional credit face no credit supply shortage: reasons for not registering so far

If it is true that group B farmers tend to be satisfied with low production, we would expect to find for them that the lack of desire for production credit was an important reason for not having registered before with BAAC. Table 7.10 shows the responses to the question

Table 7.9 : Resource Profiles for Group A and B Independent Farmers and Independent Farmers as a whole

	ALL Independent Farmers	Group A (want to register with an institution)	Group B (don't want to register with an institution)	Significance of difference between Group A and B means (t values)*
Paddy Land (mean)	8.1	8.0	8.7	(.354)
Upland (mean)	6.8	6.5	8.0	(.859)
Savings at beginning of survey year (median)	1384	1443	1170	-
Production loan in survey year (mean)	281	327	117	(.953)
Production loan in survey year (median)	0	0	0	

Source : Survey 1

Note : * none of the difference of means are significant at 90% probability

concerning reasons for not registering so far, together with group A responses for comparison.

Table 7.10 Reasons for not registering with BAAC so far by Group A and Group B independent farmers

Reason	Group A (wishing to register)		Group B (not wishing to register)	
	Frequency	%	Frequency	%
1. Uncertain about the procedure	70	(41.2)	7	(14.9)
2. Never been invited	35	(20.6)	4	(8.5)
3. Difficulty in dealing with officials	14	(8.2)	2	(4.3)
4. No need for production credit	44	(25.9)	30	(63.8)
5. Risk of losing normal supply of consumption credit	1	(0.6)	0	(0.0)
6. Other	6	(3.5)	4	(8.5)
	170	(100)	47	(100)

Source : Survey 1

In group B, the most common response was, as expected, response (4): a lack of felt need for production credit (63.8%). This is significantly different from the next most frequent response, response (1) (14.9%) ($P = .01$ difference tested by constructing confidence intervals around the two proportions). The most important response for group A by comparison was an uncertainty about the procedure for registering, which again is significantly different from the next most important response ($P = .01$).

The lack of need for production credit can also be said to be a significantly more important reason for not registering to date for group B, compared to group A ($P = .01$ using a 2 sample difference of proportions Z test, with H_0 : Proportion in group A giving response 4 = proportion in group B giving response 4).

Group B's attitude towards production, credit, and institutional credit facilities therefore have to be related to knowledge and incentive factors; either they do not want to increase production above present levels, or they are not aware of the production possibilities which face them. For these farmers, the LP model results must be interpreted normatively; their farms can absorb more capital and expand production, but although current borrowing is very low they do not wish to have a regular source of institutional credit.

4. Conclusion

For group A farmers there is no evidence to suggest that sub-optimal employment of credit is not due to capital shortage. For group B, on the other hand, there is such evidence: they did not want institutional credit facilities at the time of the survey, even though they had more land, had less savings, and used less informal credit; their lack of desire for institutional credit was not related to attitudes towards formal borrowing costs or risk of losing consumption credit (both reasons would have made a lack of demand for institutional credit still compatible with a

production capital shortage); and the most important reason for not registering to date was a lack of demand for production capital. The implication is that the employment of sub-optimal quantities of credit is related to capital shortage for some three-quarters of the survey's independent farmers, while for the other quarter it must be related to factors under in the general category of incentive/knowledge.

It becomes safe, therefore, to regard the survey levels of borrowing as effective borrowing limits facing the independent farmers. Independent farmers who borrow, borrowing an average of 2014 baht, can in general be assumed to face an effective borrowing limit of that amount. Survey levels of borrowing are used in this way in the following section to illustrate some of the disadvantages faced by a farmer who does not have access to institutional credit.

E Implications of the demand for credit with respect to farm-income, in the face of a supply shortage: some disadvantages facing a farmer without access to institutional credit

The independent farmer faces disadvantages when compared to the client of a credit institution. The disadvantages are greater to the extent that he faces a shortage of funds to borrow in the non-institutional market. In the following, four particular disadvantages facing those farmers in the survey who are not registered with an institution are quantified, using parametric linear programming analysis. Four different model farms feature in the analysis: independent, borrowing independent, non-borrowing independent and BAAC farms.

1. **Income forfeited through the disadvantageous volume and price of credit**

(a) **Income forfeited through low levels of borrowing**

This is what was termed, in Chapter 2, the volume effect (or strictly speaking, the converse of that effect). When a limited volume of credit is available to a farm, its income-earning power is reduced. It was noted in Chapter 2 that the effect of credit on income can be itemised into three: a volume effect and two kinds of price effect P1 and P2. In the case of an independent farmer operating with sub-optimal credit, a volume effect is assumed to occur when he is given access to institutional credit. Conversely, that volume effect measures the income he forfeits through not being able to borrow from an institution.

The volume effect is examined in this section, viewed as income forfeited through borrowing at suboptimal levels in the non-institutional market. No account is initially taken of differences in the price of credit (interest rate). We simply look at the effect on income of borrowing below the optimum. The interest rate is kept at a constant 26% per annum, which is the mean annual or annual equivalent rate for non-institutional borrowers in Survey 1.

The effect of a lower interest rate (price-effect P2) is examined in the next section, and then both volume and P2 effect are put together to show the total income

forfeited by an independent farmer through operating independently of the BAAC.

The linear programming analysis has been extended to produce demand schedules. These are used to illustrate the influence of the volume effect on the survey's independent farmers.

The schedules are derived by parameterising the right-hand-side (RHS) of the credit constraints in the models. In other words, the borrowing limit J in equation 6.79 is varied. The RHS is increased from zero until the model basis changes.⁹ In the interval between changes in the basis, the marginal value productivity of credit (MVP_c) remains constant because of the linearity assumptions of the model. As the RHS is increased, there is a series of changes in the basis until an optimal credit level and associated income level is reached. At each change, MVP_c will drop, and because of the linearity assumptions it will descend in steps.

The net-income to be maximised in the objective function is net of interest on borrowed capital and therefore MVP_c values are also net of interest. For this reason, the optimal borrowing level in the schedules is the point at which $MVP_c = 0$. In the plotted curves, it is the point at which the demand curve intersects with the horizontal axis. At that point, additional profit produced by a marginal unit of

credit, taking interest into account, equals zero. For gross MVP_c , the interest rate is simply added to MVP_c (net of interest) values.

Table 7.11 presents the demand schedules for independent and BAAC farmers, showing MVP_c and net farm income associated with each level of credit. Each different credit value represents a change in the model's basis. Because of the simplicity of the farm, there are not many such changes and, therefore, not many points on the schedule. Credit values are the points at which MVP_c changes as credit changes. MVP_c changes whenever the activity set in the solutions change; hence the odd steps in credit values.

Table 7.11 Credit Demand Schedules for an independent and a BAAC farm

	Credit	MVP_c	Net Farm Income
Independent Farm	1,472	0.00	9,667.26
	814	0.52	9,327.56
	730	1.02	9,242.09
	615	1.06	9,119.48
	0	2.62	7,512.69
BAAC Farm	3,579	0.00	17,818.13
	2,874	0.13	17,725.22
	2,238	0.41	17,466.73
	760	0.44	16,811.73
	294	1.06	16,317.42
	223	2.01	16,175.40
	0	2.72	15,570.24

Source : LP Model Solutions

Figures 7.1 and 7.2 plot MVP_c against credit for the two model farms, producing downward-sloping demand curves. The explanation of the pattern of the curves

lies in the relationship between capital and the other resources on the farm. At low credit-levels, some of the land, human labour and buffalo labour resources lie idle because of a lack of working capital. Credit is, therefore, a highly complementary resource and additional units allow these idle resources to be brought into production. MVP_c values are high, each increment of capital producing a high return as redundant resources are made productive. As these resources are progressively brought into use, however, they approach their extensive margin. Production can no longer be increased by extending non-capital resources because there are no more lying idle. At this point, capital-deepening begins as resources are hired-in and more capital-intensive technologies are employed. MVP_c s at this stage are falling because an increasing quantity of capital is required to generate a given increase in production. Finally, the capital input needed to increase production becomes so high that the cost of borrowing an extra unit of credit exceeds the return and MVP_c s become negative. This determines the optimal level of borrowing.

It is the shaded area of Figure 7.1 that is of interest here, representing that part of the demand curve lying to the right of the survey level of borrowing X_1 . It is that part of the demand curve which is inaccessible to the farmer who employs no more than 281 baht of credit. The income forfeited equals the area under

that section of the curve and totals 1,420 baht.

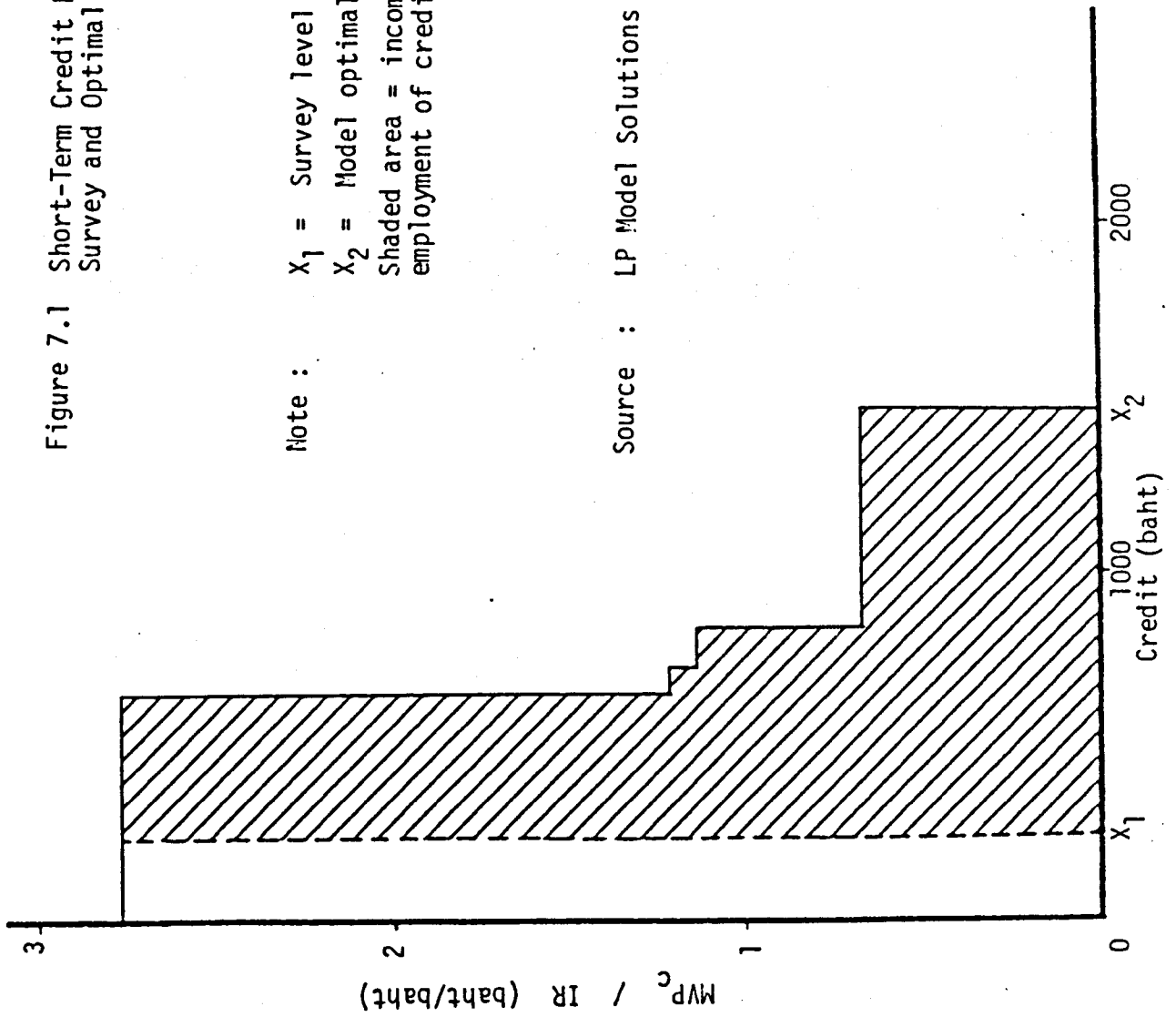
Figure 7.2 by contrast has no such area to the right of X_1 . The model BAAC farmer employs credit well to the right of the intersection of demand and supply curves (the institutional supply-curve here represented by the horizontal axis). No income is forfeited as it is for the independent farm, through sub-optimal employment of credit. On the contrary, the distance $X_1 - X_2$ represents credit employed above the optimum. As discussed already, this can be taken as a measure of the substitution of credit for savings, since the model assumes all savings to be invested. If savings were reduced in the model to reflect the practice of survey BAAC farmers of using credit to release some of their savings for expenditure other than annual production costs, then the survey level of borrowing would approximate the model's optimum level.

Figures 7.3 and 7.4 present similar demand-curves for borrowing and non-borrowing independent farms. Both use sub-optimal amounts of credit as we have seen, and therefore both curves have a shaded area representing forfeited income. The borrowing independent farmer, borrowing 2103 baht, falls short of the optimal net-farm income by only 495 baht (Figure 7.3). The non-borrowing independent farm, on the other hand, forfeits income equal to the complete area under the curve on Figure 7.4, which amounts to 1,636 baht.

Figure 7.1 Short-Term Credit Demand Curve for an Independent Farm showing Survey and Optimal Levels of Borrowing

Note : X_1 = Survey level of borrowing (mean) = 281 baht
 X_2 = Model optimal level of borrowing = 1,472 baht
 Shaded area = income forfeited through sub-optimal employment of credit = 1,420 baht

Source : LP Model Solutions



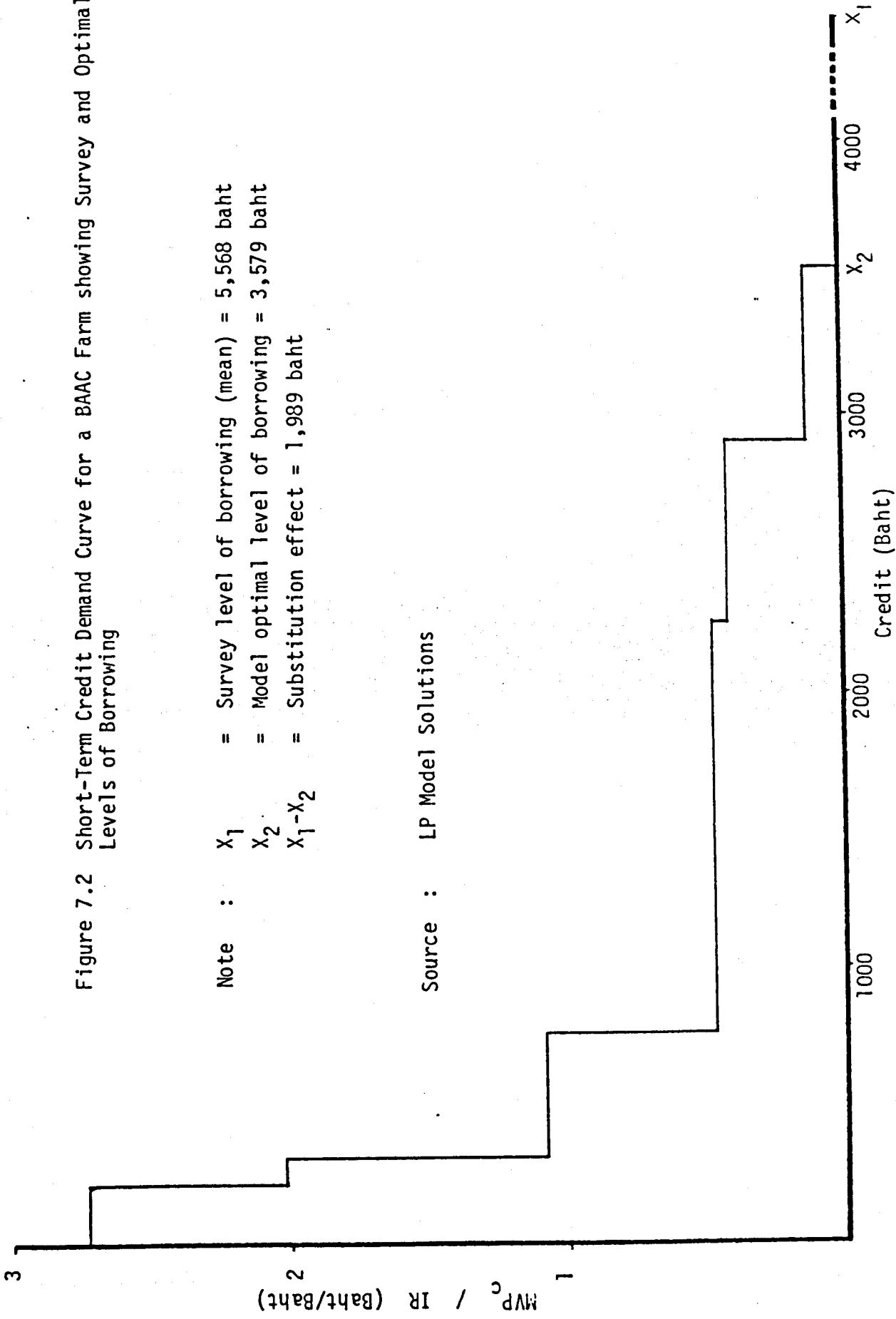


Figure 7.2 Short-Term Credit Demand Curve for a BAAC Farm showing Survey and Optimal Levels of Borrowing

Note : X_1 = Survey level of borrowing (mean) = 5,568 baht
 X_2 = Model optimal level of borrowing = 3,579 baht
 $X_1 - X_2$ = Substitution effect = 1,989 baht

Source : LP Model Solutions

Figure 7.3 Short-Term Credit Demand Curve for a Borrowing Independent Farm, showing Survey and Optimal Levels of Borrowing

Note : X_1 = Survey level of borrowing = 2,103 baht
 X_2 = Model optimal level of borrowing = 3,062 baht
 Shaded area = income forfeited through sub-optimal employment of credit = 495 baht

Source : LP Model Solutions

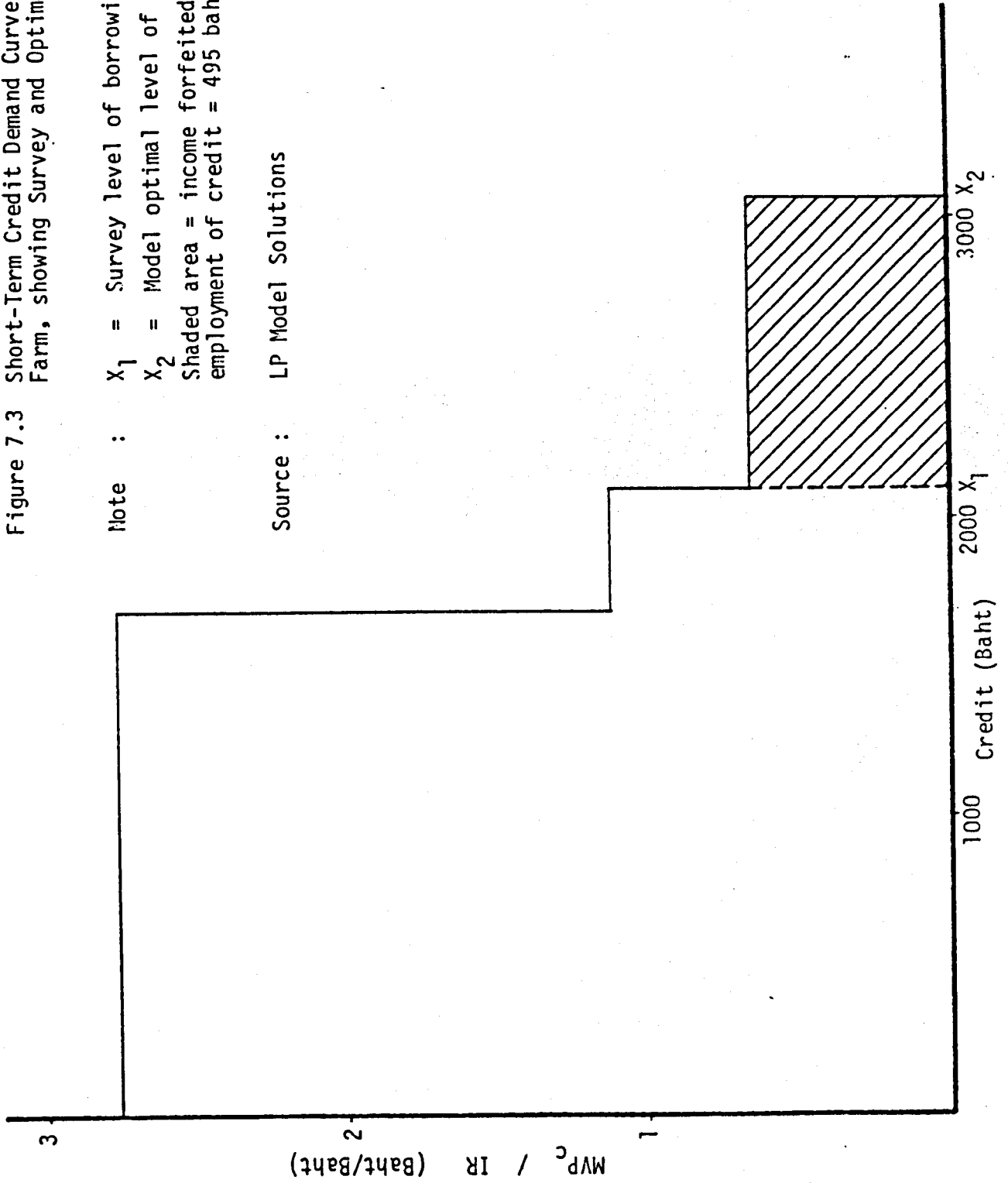
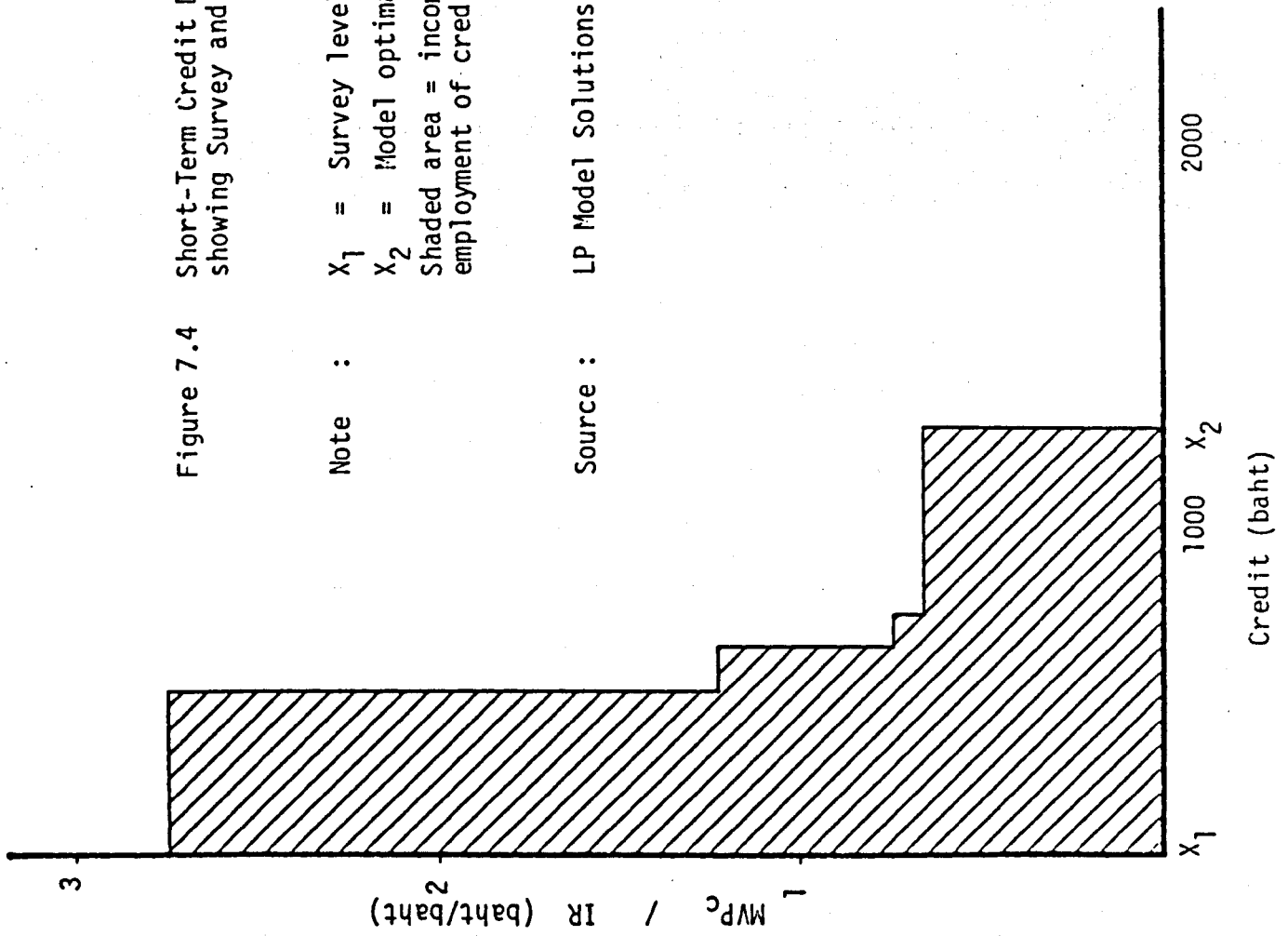


Figure 7.4 Short-Term Credit Demand Curve for a Non-Borrowing Independent Farm showing Survey and Optimal Levels of Borrowing

Note : X_1 = Survey level of borrowing (mean) = 0 baht
 X_2 = Model optimal level of borrowing = 1,217 baht
 Shaded area = income forfeited through sub-optimal employment of credit = 1,636 baht

Source : LP Model Solutions



If, as has been evidenced, independent farmers' sub-optimal use of credit is related to a shortage of supply (and the survey borrowing levels are therefore taken as effective borrowing limits), then the income reductions illustrated in Figures 7.1, 7.3 and 7.4 can be regarded as annual farm income lost due to credit shortage.

(b) Income forfeited through higher interest rates

Without access to subsidised institutional credit, a farmer loses out not only through a shortage of funds to borrow, but also through paying more for what he does borrow. This is the price effect P2: the effect on income of borrowing a given amount at a higher price. The borrowing independent-farmer paid an average annual interest rate of 26%. This compares with the 14% flat rate faced by BAAC clients.

The effect can be measured by varying g (the cost coefficient of borrowed capital) in equation 6.2 and drawing two stepped demand-curves alongside each other: one for MVP_c net of interest at 14%, and the other for MVP_c net of interest at 26%. Presented this way, the difference in area between the two curves equals the income difference due to different interest rates. Figure 7.6 illustrates this using curves associated with the borrowing independent-farm model. The P2 effect is given by the shaded area between the two curves and equals 252 baht. For the independent farmer

using no credit (the typical survey farmer), the P2 effect equals zero and the volume effect equals the total area under the curve in Figure 7.4.

The effect of a higher interest rate is not great for the small farmer because of the small amounts of credit involved. This is one factor behind the low elasticity of demand for borrowed capital frequently observed among small farmers. Figure 7.5 plots the relationship between optimal net farm income (unlimited credit available) and annual interest rate, for the borrowing independent-farm model. The slope is shallow and small changes in interest rate such as the 12% difference between the survey's average market rate and the institutional rate, make little difference to income. It is only when the rate becomes very high that interest charges become significant. At 70% per annum, for example, the interest charge in the optimal solution for the borrowing independent farm model, equals 2,143.6 baht, which is 15.6% of net farm income (net of all expenses except interest).

(c) Total income forfeited : the relationship between volume and price effects

If the borrowing independent-farmer were to be given access to BAAC credit, his income would increase by the shaded area in Figure 7.6 (252 baht) due to lower interest rates, and by the hatched area (613 baht) due to an increased volume of borrowing.¹⁰ The total effect as measured by the model's output therefore

equals volume effect + P2 effect.

The total effect for the all-independent-farmer model is given in Figure 7.7. The shaded area to the right of the demand-curve D1 equals income forfeited through a restricted supply of credit outside of the institutional market, and the shaded area above D1 equals income forfeited through a higher interest rate.

A limitation of Figures 7.1 to 7.4 is that they only show two of the three component effects of credit on income: they illustrate and measure the volume and P2 price effect, but not the P1 price effect (defined in Chapter 2 as the change in the volume of credit used due to a change in the price of credit). The P1 effect, in this case, would be the reduced volume of credit associated with the higher non-institutional rate of interest. This is obscured in Figures 7.1 to 7.4, however, by the stepped-nature of the demand curves. As we have seen, the curves are stepped because MVP_c s are derived under linearity assumptions. If MVP_c s were to fall continuously rather than discontinuously, then a falling of the interest rate (vertical axis) of any amount, would bring about a shift in the equilibrium point to the right, and a commensurate increase in the volume of credit. Since MVP_c s fall in steps, however, there can be a change in interest rate without there being an associated change in volume of credit. This is true so long as the range over which the interest rate changes remains in that

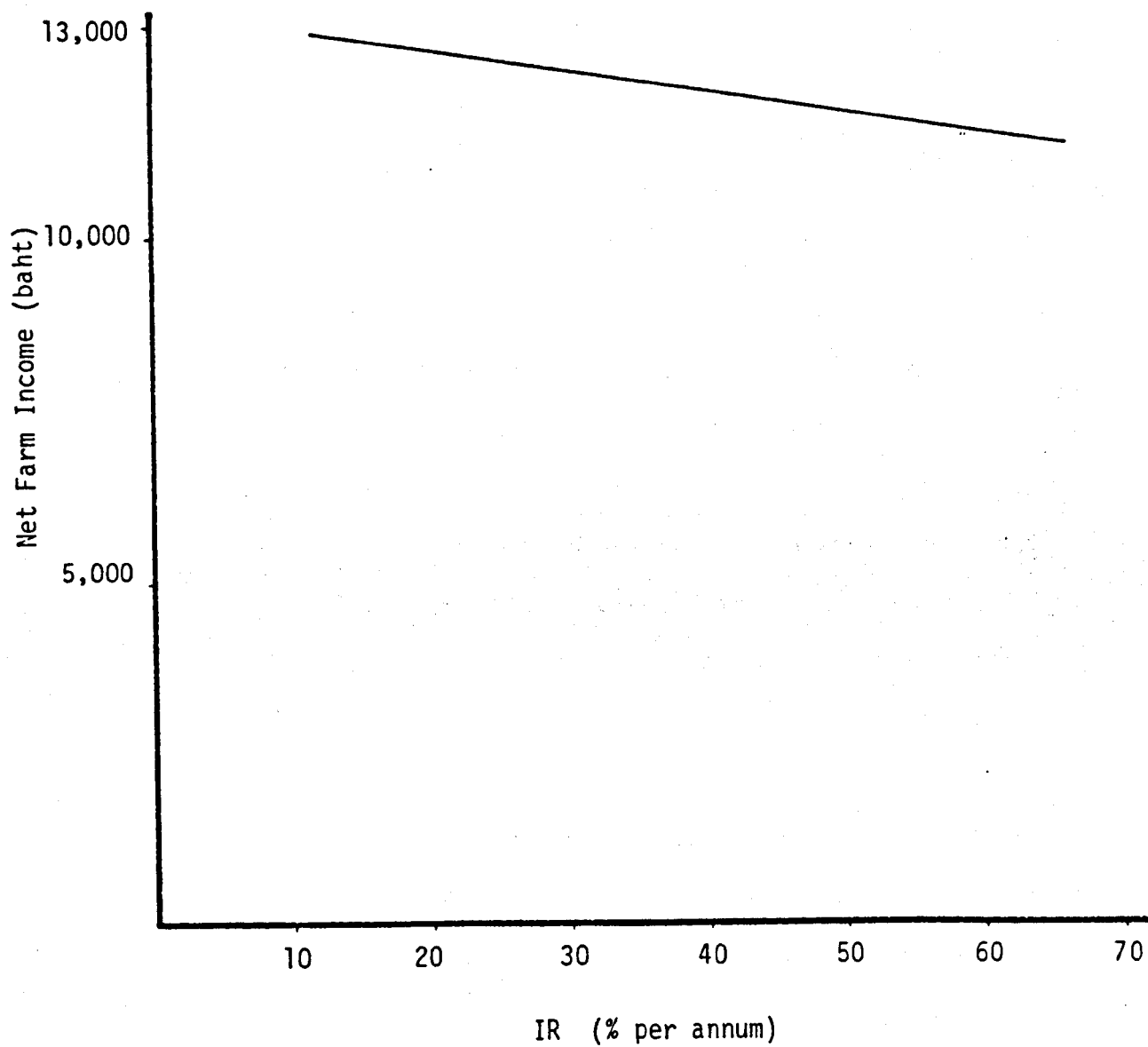


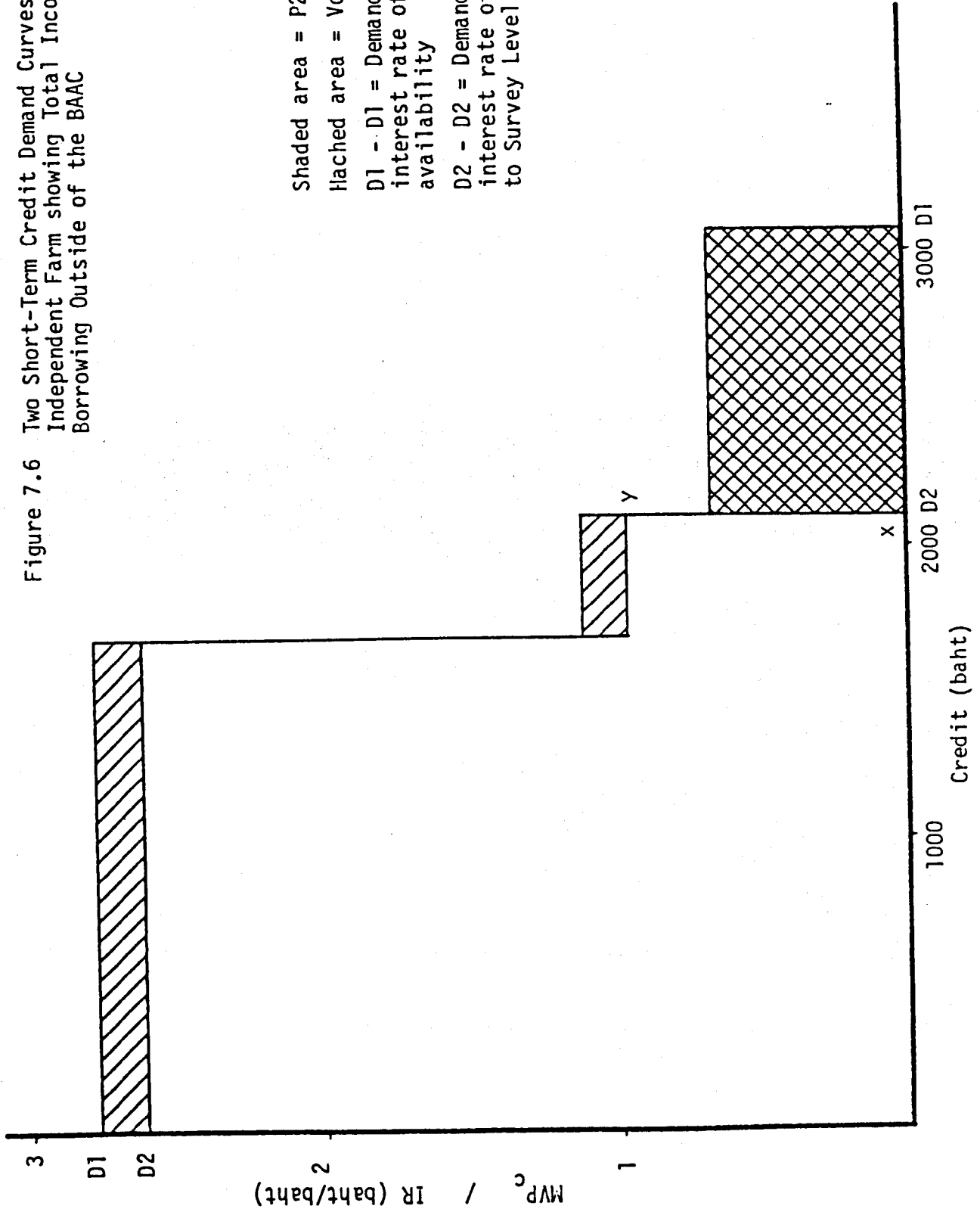
Figure 7.5 The Effect of Interest Rate on Annual Net Farm Income for a Borrowing Independent Farm

Source : LP Model Solutions

part of the vertical axis corresponding to a single vertical step on the demand curve. In Figure 7.6, for example, the interest rate can move between X and Y on the curve D2 without effecting a change in the volume of credit along the horizontal axis. It will be noted that the 12% difference between institutional and non-institutional rates (a distance of .12 on the vertical axis) is not great enough to cause a shift in the equilibrium point in Figure 7.6.

Figure 7.8 presents stylised demand and supply curves to illustrate the P1 and P2 price effects and the volume effect and the relationship between the three. The diagram does not give precise measurements as do Figures 7.1 to 7.4, since its curves are approximations, having been fitted to the stepped curves produced by the LP models. D1 and D2 are the stylised demand-curves for BAAC and independent farmers respectively, fitted to the schedules in Table 7.11. S_I is the institutional supply-curve and represents a constant rate of 14% for all loan sizes. S_M is the market supply-curve and is hypothetical. In order to juxtapose demand and supply curves, the demand curves have been fitted to MVP_C s not net of interest (MVP_C net + IR).

Figure 7.6 Two Short-Term Credit Demand Curves for a Borrowing Independent Farm showing Total Income Forfeited through Borrowing Outside of the BAAC



Shaded area = P2 effect = 252 baht

Hatched area = Volume effect = 613 baht

D1 - D1 = Demand curve assuming an annual interest rate of 14% and unlimited credit availability

D2 - D2 = Demand curve assuming an annual interest rate of 26% and credit limited to Survey Level

Figure 7.7 Two Short-Term Credit Demand Curves for an Independent Farm showing Total Income Forfeited through Borrowing Outside of the BAAC

Shaded area = P2 + volume effect = 1,597 baht

D1 - D1 = Demand curve assuming an annual interest rate of 14% and Unlimited Credit Availability

D2 - D2 = Demand curve assuming an annual interest rate of 26% and credit limited to survey level

Source : LP Model Solutions

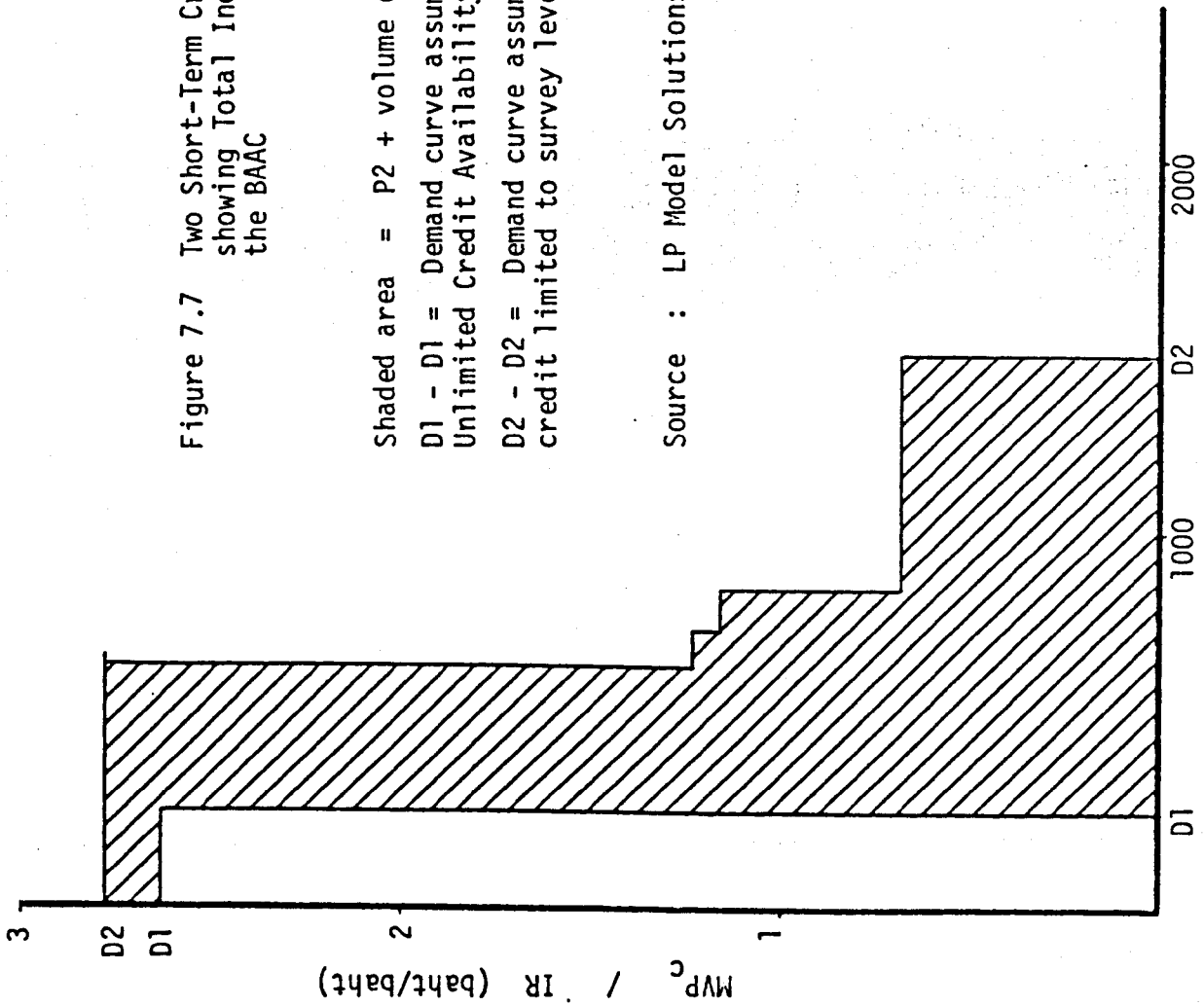
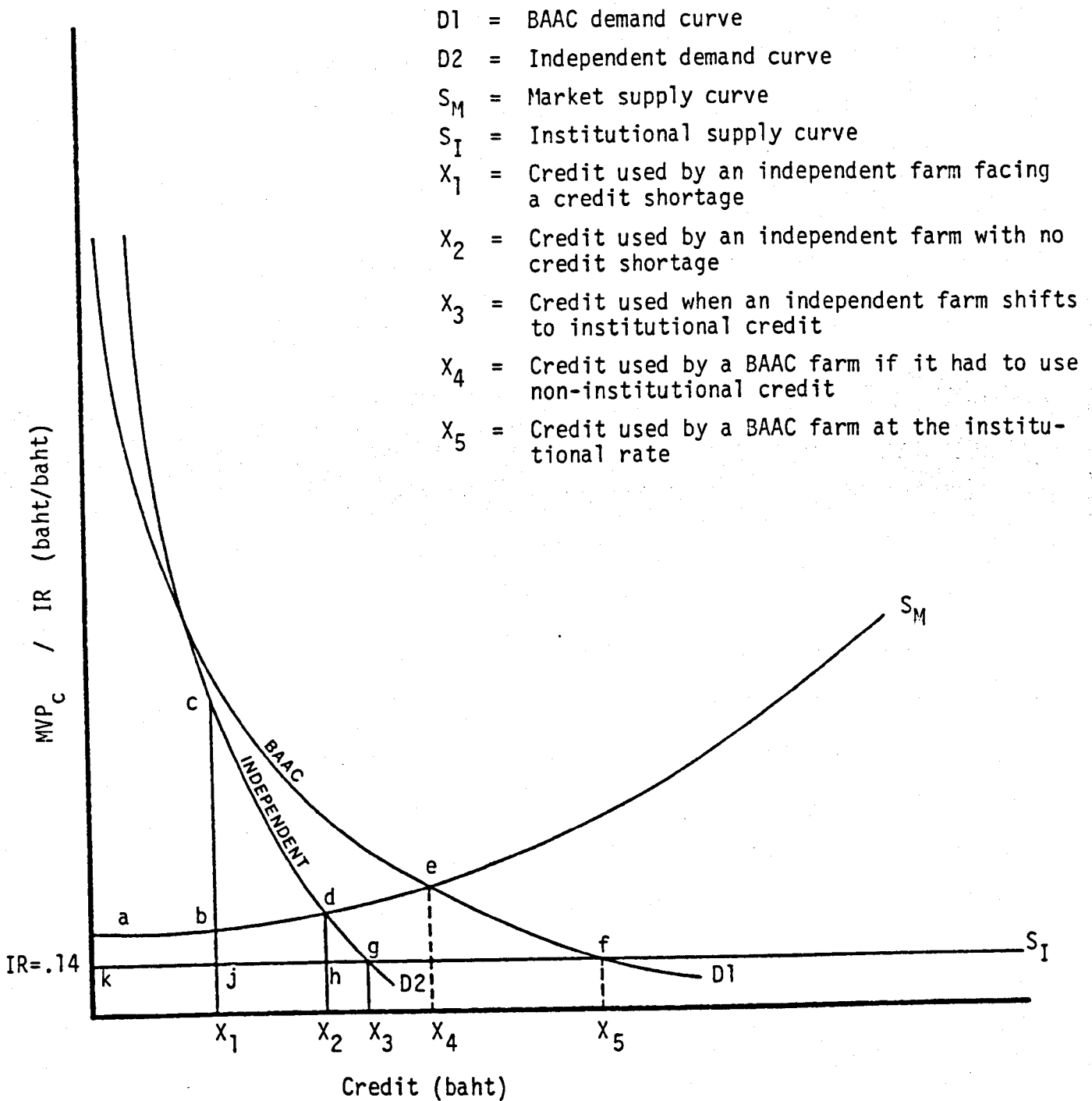


Figure 7.8 Stylised Short-Term Credit Demand and Supply Curves for a BAAC and an Independent Farm showing the Volume and Price Effects of a Shift in the Supply Curve



- $D1$ = BAAC demand curve
- $D2$ = Independent demand curve
- S_M = Market supply curve
- S_I = Institutional supply curve
- X_1 = Credit used by an independent farm facing a credit shortage
- X_2 = Credit used by an independent farm with no credit shortage
- X_3 = Credit used when an independent farm shifts to institutional credit
- X_4 = Credit used by a BAAC farm if it had to use non-institutional credit
- X_5 = Credit used by a BAAC farm at the institutional rate

For the independent farmer facing an interest rate of 26%, optimal credit equals X_2 in Figure 7.8. If that farmer were to be given access to the lower BAAC rate, optimal credit would move to X_3 and his income increases by $adgk$. The P2 price effect component of this total increase is given by $adhk$ and the P1 price effect component, by dgh . There is no volume effect because we have assumed the independent farmer starts off by borrowing X_2 , which means he faces no volume restriction in the non-institutional market. The only volume increase he experiences, therefore, is that allowed by the cheaper price of credit (dgh).

The survey independent farmers, however, cannot borrow all that they demand (X_2) because of imperfections in the non-institutional market. Let's say that they are effectively limited to X_1 baht of credit. Access to BAAC credit then results in the following income increases: $abjk$ (P2 effect), $cdhj$ (volume effect), and dgh (P1 effect). Although the income represented by the complete area cgj is, strictly speaking, all due to a removal of volume restriction, dgh could not have been reached in the non-institutional market. Conceptually, it can still be looked upon as a P1 effect.

These changes in income associated with a shift from S_m to S_1 represent the income forfeited by farmers without access to the BAAC credit. Looked at another way, BAAC

farmers gain by operating on S_I rather than on S_M . The BAAC farmers' equilibrium level of borrowing is X_5 . A shift to the market supply curve would mean for them a drop to X_4 baht of credit, and a fall in income equal to the area $aefk$.

Table 7.12 summarises the total income forfeited through operating outside of the institutional credit market for the three model farms representing: borrowing independent farmers, non-borrowing independent farmers and independent farmers as a whole.

Table 7.12 Income forfeited by independent farmers through lack of access to BAAC credit

	Independent Farm	Borrowing Independent Farm	Non-Borrowing Independent Farm
Income forfeited through low levels of borrowing (volume effect) (baht)	1,563	613	1,782
Income forfeited through higher interest rate (P2 effect) (baht)	34	252	0
Total income forfeited (Volume + P2 effect) (baht)	1,597	865	1,782

Source : LP Model Solutions

2 Income forfeited overtime through the impact of credit shortage on farm growth

(a) Use of the multi-period model

Another kind of disadvantage facing the independent farmer is the lower growth rate he is able to sustain over time because of his credit shortage. If income produced and not spent in one year (savings) is available for investment in the next year, farmer X, producing more than farmer Y in year 1 will, *ceteris parabis*, have more to invest in year 2. He will, consequently, experience a higher growth rate over the two years assuming a similar marginal propensity to save for both farmers. Other things being equal, access to credit will place a farmer in the position of farmer X compared to a similar farmer who has little or no access to credit. The availability of credit enables greater production in year 1 and more savings for investment in year 2.

The multi-period linear programming model developed in Chapter 6 is used to show the degree of disadvantage faced in this respect by an independent farmer over the five year period 1977/78. Solutions are derived for the model independent farm at various levels of credit constraint. As with the single-period parametric analysis, the J's in equations 6.453 and 6.457 are adjusted, this time in regular steps of 200 baht. The multi-period solution gives optimal income distribution over the 5 years. By totalling each annual pattern of

costs and revenues, annual net farm incomes are arrived at. Each year, the optimal farm plan will change due to the changing relationships between costs and revenues and due to the annual variations in capital availability.

Table 7.13 sets out net farm income over the 5-year period. The growth patterns represent optimal growth in annual net farm incomes assuming farmers have some knowledge about trends in prices and costs. In terms of the structure of the model, the farm's resources are distributed over the 5 years in a pattern which is optimal with respect to the costs and revenues faced each year. The figures in Table 7.13 are real incomes (at 1977 prices) discounted to present value at the beginning of year 1. Table 7.14 presents optimal farm plans over time for two of the solutions in Table 7.13. These illustrate the changes in production which give rise to the income patterns. Farm plans are given for solutions with zero and 200 baht of credit. The first represents a survey independent-farm borrowing at modal level (zero baht), and the second represents a survey farm borrowing at around the mean level (164 baht in 1977 prices).

(b) The pattern of change in farm income

Table 7.13 displays a pattern over time similar to the pattern for the single-period model as credit was varied. Moving from year 1 to year 5, generally two things happen: cropping intensity increases as more

Table 7.13 : Net Farm Income and Cropping Intensity for an Independent Farm over 5 Years with Varying Levels of Credit Availability

Annual Credit Availability (baht)	Net Farm Income (baht)					Cropping Intensity (%)				
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 1	Year 2	Year 3	Year 4	Year 5
0	4,432	3,520	3,780	4,743	4,420	71.9	62.0	65.8	76.0	86.6
200	5,322	4,254	5,039	6,695	4,840	79.9	72.3	75.4	91.9	100
400	6,212	4,929	6,296	8,291	4,961	87.9	82.7	84.9	100	100
600	7,101	5,604	7,553	8,431	4,965	95.9	93.1	94.5	100	100
800	7,941	6,156	8,587	8,451	4,967	100	100	100	100	100
1,000	8,379	6,206	9,037	8,458	4,968	100	100	100	100	100
1,200	8,379	6,206	9,048	8,458	4,968	100	100	100	100	100

Source : LP Model Solutions

Table 7.14 : Optimal Farm Plans over 5 Years for an Independent Farm with Zero and 200 Baht Credit Availability

		Year 1	Year 2	Year 3	Year 4	Year 5	Year 1	Year 2	Year 3	Year 4	Year 5
		Credit = 0									
Early Paddy	F,T (rai)*	3.26	3.24	3.24	3.30	3.24	3.33	3.30	3.29	3.44	3.45
	F,B										
	UF,T										
	UF,B										
Late Paddy	F,T		4.86			4.86					4.65
	F,B							4.8			
	UF,T										
	UF,B	4.84		4.86	4.80		4.77		4.81	4.66	
Cassava		2.62	1.14	1.70	3.23		3.81	2.68	3.13	5.59	3.88
Kenaf						4.80					2.92
Maize											
Sorghum											
Total Area		10.72	9.24	9.80	11.33	12.90	11.91	10.78	11.23	13.69	14.9
Cropping inten-											
sity (%)		71.90	62.00	65.80	76.00	86.60	79.90	72.30	75.40	91.90	100.00
Big trac. hours		2.09	0.91	1.36	2.58	3.83	3.05	2.14	2.50	4.47	5.43
Walk.trac. hours											
Hired labour days											
Credit (baht)		0	0	0	0	0	200	200	200	200	200
Shadow price of											
credit (bht/bht)		2.75	7.21	10.76	3.87	6.28	0.65	5.71	9.48	3.67	6.13
Objective (baht)		4,432	3,520	3,780	4,743	4,420	5,322	4,254	5,039	6,695	4,840
Grand objective											
(baht)		20,895				26,150					

Note : *all crops in rai

Source : LP Model Solutions

Land is brought into production and intensification increases. Both trends are due to an increase in capital supply over time through the growth of savings. Neither trend is as clear cut as in the single-period model when credit was varied, because of the fluctuation over time of real income-earning opportunity due to changes in real net revenues. Examples of irregularities in the trends are firstly, a fall in cropping intensity from year 1 to year 2, due to the joint effect of a rise in costs and limited capital; and secondly, a substitution of fertilized for non-fertilized paddy unexpectedly early on in the 5-year period due to the relatively low value of cassava in year 2.

A two-fold pattern emerges from Table 7.13. For lower credit levels, incomes fall from year 1 to year 2, rise from year 2 to 4, and fall again in year 5. For higher credit levels (> 800 baht), incomes fall from year 1 to year 2, rise from year 2 to 3, and then fall again in years 4 and 5.

This pattern, which may seem to conflict with the expected growth-enhancing effect of credit, is easily explained by the complicating effect of fluctuating real net-revenues over time. Since price and costs have been both deflated to 1977 values and discounted to net present value, any net-revenue coefficient which does not inflate at a rate equal to, or greater than

the deflation-plus-discount rate, will be falling in real terms. Over the five-year period, the net value per rai for some crops fell consistently, while for other crops it varied widely.

Among upland crops, the model is most sensitive to the price of cassava (since it is the most profitable). A great variation in cassava price over the period represented by the model leads to very different income-earning opportunities in each year. This means that even with an unlimited source of credit and an optimal level of production each year, annual income will fluctuate according to the net value of crops in each year.

In examining the influence of credit on farm growth, it is therefore necessary to distinguish between two influences on annual income change : (a) Changes in capital supply, and (b) changes in net crop value.

The pattern of income change associated with the unlimited-credit solution is entirely the result of price and cost changes between years. It is by comparing this pattern with patterns for solutions with less credit available that we see the influence of credit over time.

The fall between years one and two for all credit levels is explained primarily by a fall in cassava price. The price fall is large enough to outweigh any growth effect associated with an increase in capital

supply in year 2 over year 1, and, therefore, income drops for all solutions.

Between years 2 and 3, incomes rise for all credit levels and it is here that the effect of credit on farm-growth is seen most clearly. The rise in income is associated with a large increase in cassava price. For the solutions with less credit (up to 800 baht) this upward trend continues into the fourth year, while for solutions with more credit there is a decline. The explanation for the difference in trend lies in the difference in resource utilization between farms with greater and lesser amounts of credit. At low credit levels, owned resources are left idle and production and income are well below the optimum. The carried-over surplus between years, however, allows expansion of production in each successive year, allowing income to push progressively upwards towards the optimal as capital input increases. This happens over years 2, 3 and 4 for solutions with credit up to 600 baht in Table 7.13. As long as there is a sufficient gap between a particular solution's income in year 3, and the optimal income (unlimited credit) in year 3, then income can continue to rise into year 4 as production expands through expansion in capital input. When income has been pushed far enough upwards in year 3, however, reaching or approaching the optimum, it necessarily has to fall from year 3 into year 4 because real net-revenues are falling between those two years. The

effect of expansion through increased capital input is overridden by the effect of falling real net-revenues because capital input cannot expand any further, having reached the optimum.

The cropping intensities shown in Table 7.14 support this explanation of trends in annual income. Where intensities are below 100%, annual income is below the optimum. The upward trend in incomes over years 2 to 4 for solutions below 600 baht is attributable to increasing annual cropping intensities. More capital is available in each successive year, enabling idle resources to be brought into production and more available land to be farmed. For these solutions, growth in real income in years 2 to 3 is due to more land being farmed in addition to rising product prices. In years 3 to 4, however, the growth is due entirely to more land being farmed since real net-revenues are actually falling.

Resources are pushed towards their extensive margin over time, as they were as credit was increased in the single-period model. For solutions over 600 baht, this is reached by year 4 when it is no longer possible to sustain an income growth which is greater than the decline due to falling real net-revenues by bringing unused owned resources into production. Capital deepening allows some continued growth, for example by the increase in fertilized paddy and the expanded use

of tractor for land preparation, but it is smaller in magnitude than the depressing effects of falling prices. When production land stops expanding, real incomes fall if overall real net-revenues are falling.

Finally, between years 4 and 5, real incomes fall for all credit levels due to a severe drop in cassava price. Although cropping intensity for the farm with no credit continues to rise between these two years due to progressively greater capital availability, the marginal increase in land planted is not great enough to compensate for the fall in prices. The income drop between years 4 and 5 is steeper for the farm with unlimited credit availability, since it was planting more cassava in year 4 than farms with less credit and, therefore, felt a greater impact of the price-fall.

(c) Credit and farm growth

What can be concluded about the impact of credit on the growth of the survey independent farms during these five years? The principle of larger credit inputs generating greater growth is most clearly demonstrated between years 2 and 4, and particularly between years 2 and 3. Between years 2 and 3 the farm with unlimited credit moves from 6,206 baht to 9,048 baht, an annual growth of 2,842 baht or 46 per cent. The comparable figures for a farm without credit are 3,520 moving to 3,780 baht, an increase of 260 baht or 7 per cent.

Because the effect of a drop in real net-revenues between years 3 and 4 is counteracted by the income-expanding effect of capital input growth for solutions with 600 baht or less, there is sustained growth between years 2 and 4 (Figure 7.9). Comparing incomes in years 2 and 4, all solutions where credit is greater than zero experience greater growth than the zero credit solution (Table 7.13).

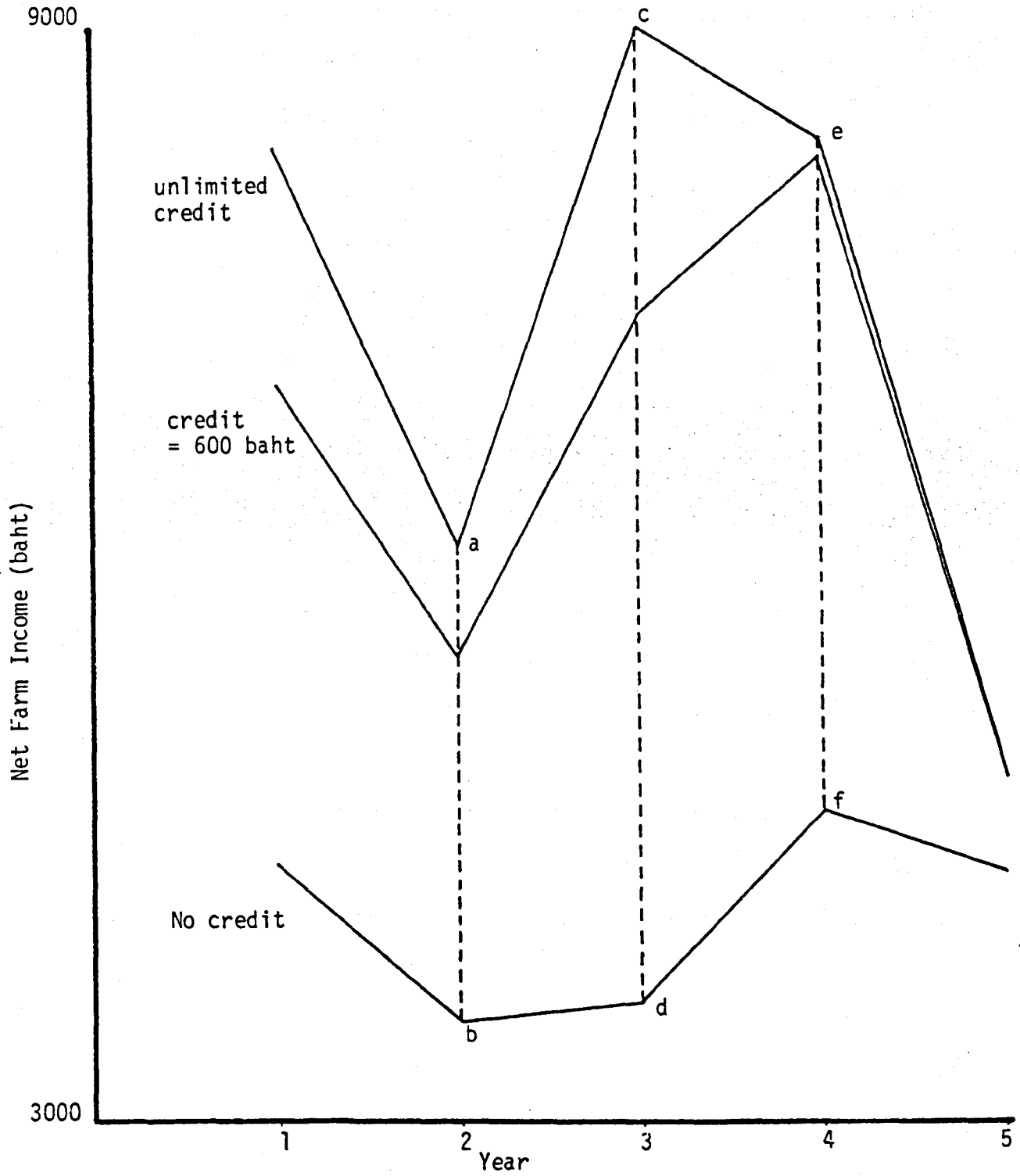
Comparing solutions with and without credit, between years other than 2 and 3, the solutions without credit experience either a greater positive growth (years 3 to 4) or a lesser negative growth (years 1 to 2 and 4 to 5).

It is obviously misleading to talk purely in terms of rates and direction of change in income since the farm with credit is clearly better off, having in every year, a higher income than the farm with less or no credit. What can be concluded is that where real net-revenues are increasing (as between years 2 and 3), there occurs the expected compounding effect of credit on income growth. Where real net-revenues are falling, however, credit does not have this compounding effect. In fact, because the price fall in year 5 is so drastic, incomes for farms with and without credit are brought down to a very similar level.

The pattern that emerges over time is, for the farm with credit: a more peaked variation in annual net-farm

Figure 7.9 Annual Net Farm Income over Five Years for an Independent Farm with Three Different Levels of Credit

Source : LP Model Solutions



income, with both greater increases and decreases. When prices rise, farms with credit are in a better position to take advantage of increased income-earning potential and experience more rapid growth.

There are four things that can be concluded in summarising the influence of credit on farm incomes during the period 1977/78 to 1981/82:

- (a) when real net incomes are rising, income growth is accentuated in the farm with credit compared to the farm without;
- (b) the same can be said when real net revenues are falling slowly (between years 3 and 4, for example). Income growth for the farm with credit is either equal to or greater than the farm without. This is so for any level of credit;
- (c) when real net-revenues are increasing, or decreasing slowly, income disparity broadens between farms with and without credit or between farms with greater or less amounts of credit. Disparity CD (5,268 baht) is greater than disparity AB (2,686 baht) in Figure 7.9. Income disparity can increase between two years, even when growth rates are equal. Comparing incomes in years 4 and 2, the growth experienced by farms with zero and unlimited credit is 35% and 36%, respectively. Although the rates are roughly equal, the increase in disparity is still

positive; distance EF (3,714 baht) is greater than distance AB (2,686 baht) in Figure 7.9;

- (d) whatever the direction and rate of growth between any two particular years, the farm with more credit reaches a higher net farm income in each year and sustains a higher average annual income over the whole 5-year period. Average annual income over 5 years is 7,412 baht with unlimited credit and 4,179 baht with no credit.

3 The trade-off between land and credit

To complete the section on the disadvantages facing the farmer who has no access to institutional credit, we examine the nature of the trade-off between two factors of production: land and capital. It is clear from the forgoing analysis that an increase in the employment of capital leads to production and income rises for the independent farmer. The analysis has also shown that land is the most productive factor for the survey farmers and that an increase in holding size therefore leads to a sharp increase in farm income. There are at least three reasons why it is unlikely that independent farmers can raise their earning potential by expanding their production area. First, as already noted, renting of land is relatively uncommon in the North-East of Thailand. Second, small capital-short farmers, with access only to non-institutional lenders and with uncertain land title deeds, are unlikely to be able to purchase new land in order to expand production. Third, as discussed in Chapter 4, the production land frontier has been reached in

Thailand as a whole, and there are very few opportunities left to expand into virgin territory.

Given this inability to expand income through acquiring more land, it is of some interest to ask the question: to what extent can land-short independent farmers compensate for a shortage of land by raising the capital intensity of their farm production? By employing more capital, a farmer with only X rai should be able to achieve an income similar to the income he would derive from a farm of X + Y rai. In this way, credit can be seen as compensating the small farmer for his poor land endowment. Figure 7.10 quantifies this trade-off between credit and land. The curves presented are just three out of an infinite number of isoquant¹¹ curves derived from the independent-farm single-period LP model. Each relates to a different level of farm income and joins all the different combinations of land and capital which yield the same output (in value terms). The curves are derived by parameterising both the land and capital constraints. The joint value of M_m and N_m (for $m = 1$ to 12) in equations 6.3 to 6.26, is incremented in steps of 200 baht. At each step (change in production area) the borrowing limit J in equation 6.79 is varied to give a range of credit levels and associated net farm incomes for each level of production area. Land available for production is increased in steps of 1 rai, keeping the proportion of paddy to upland the same as in the base solution for an independent farmer (8.1 : 6.8, see Section B.2 of Chapter 6). It is then an easy matter to trace any particular

income level through each successive step in production area, and calculate the credit value associated with that income at each production area value. The resulting pairs of values from which the iso-quant curves are plotted are presented in Table 7.15. The values in the body of the table are the amounts which need to be borrowed at each level of production area, in order to achieve the net-farm income specified at the left of each row.

We can conclude from the results that there is a significant trade-off between land and borrowed capital. The middle iso-quant in Figure 7.10, for example, shows that the same income can be achieved by farmers with 14 and 24 rai. By borrowing 1,313 baht, the farmer with only 14 rai can reach the same income as a farmer with 24 rai who borrows 103 baht. Figure 7.10 also shows that by employing credit, smaller farmers can reach incomes higher than larger farmers if the latter only borrow small amounts.¹² A farmer with 16 rai, for example, can reach the highest of the three iso-quant in Figure 7.10 (10,272 baht) by borrowing 1,693 baht. By comparison, the income of the larger farmer with 24 rai will be lower than 10,272 baht if he borrows any less than around 520 baht. For example, if he borrows 103 baht his income will be 9,182 baht and 8,092 baht if he borrows nothing.

The consequence of these results for the small farmer without access to institutional credit is straightforward. The previous sections in this chapter have indicated that independent farmers face a credit supply shortage in the

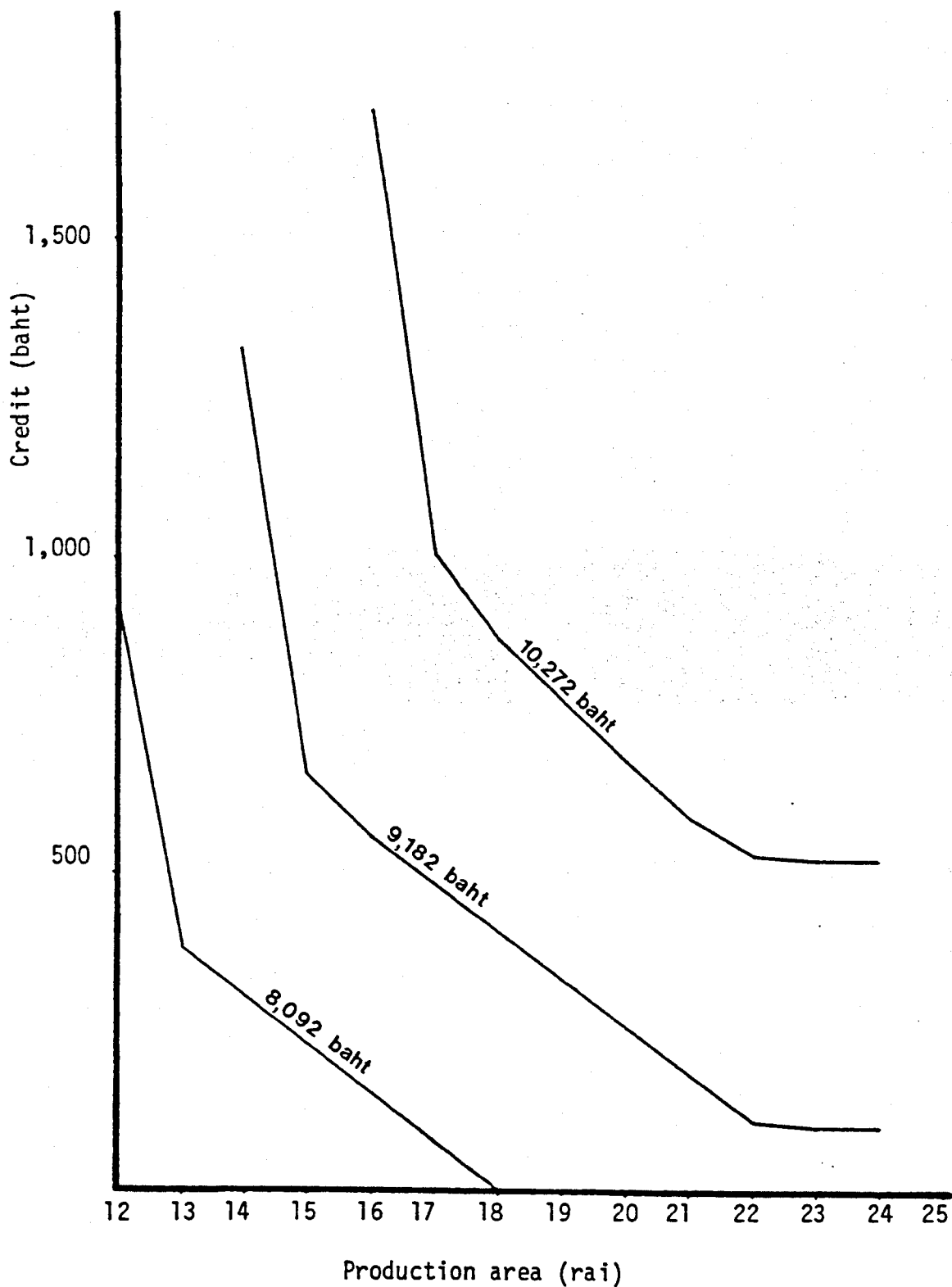
Table 7.15 Combinations of Land and Credit which yield the same Value of Output for a Model Independent Farm (showing three different values of output)

Value of Output (net farm income in baht)	Production Area (rai)												
	12	13	14	15	16	17	18	19	20	21	22	23	24
8,092	933*	383	302	321	140	61	0	0	0	0	0	0	0
9,182	-	-	1,313	641	558	478	398	318	239	159	103	103	103
10,272	-	-	-	-	1,693	974	815	736	656	576	522	522	522

Note : *figures in the table are the amounts which need to be borrowed at each level of production area in order to achieve the net-farm income specified at the left of each row

Source : LP Model Solutions

Figure 7.10 Trade-Off between Credit and Production Land for an Independent Farm at Three Levels of Net Farm Income



Source : LP Model Solutions

non-institutional market. This means that the farmers most in need of additional resources to compensate for their small land holdings do not, in general, have access to such compensation. They could reach the income levels of larger farms by raising the capital intensity of their production, but cannot while they remain outside of the institutional credit market.

F Conclusion

This chapter has attempted to make some statements about the demand for credit among farmers in the survey area. The comparison of survey borrowing levels with optimal borrowing levels in Section C, indicated that independent farmers use sub-optimal amounts of credit. Farmers registered with BAAC by comparison, borrow at a level above the model's optimum, suggesting that they substitute some credit for savings, releasing savings for other uses.

This pattern suggests that farmers operating outside of the institutional credit market face a shortage of capital supply, while institutional borrowers face no such shortage.

It could be, however, that the independent farmers' sub-optimal employment of credit is due to behavioural factors rather than supply shortage (if that is the case, the models are normative not positive).

The parallel analysis of demand for institutional credit facilities in Section D throws light on this issue, helping us to

interpret the model results positively rather than normatively. A majority of independent farmers, it is found, wish to register with a credit institution. This is taken to indicate a dissatisfaction with credit supply in the informal market and, therefore, supportive of the assertion that the independent farmers' sub-optimal borrowing is related to a supply shortage.

A number of tests are made, however, to check the validity of using demand for institutional credit as an indicator of credit supply shortage. It is found, for the majority of independent farmers who wished to register, that there is evidence to suggest that they face a credit shortage and that there is no evidence to suggest that they do not face a credit shortage.

For the minority who did not want to register, there is evidence that their decision is not related to a better credit supply. It must, therefore, be related to factors such as lack of incentive or knowledge with respect to increased production.

For the majority of independent farmers, therefore, it can safely be assumed that they face some degree of credit shortage. The LP model results can therefore be interpreted positively for independent farmers as a whole. They have been shown to use sub-optimal amounts of credit (Section C) and they appear to face a credit shortage in the informal market (Section D). It can be assumed, with some confidence, that the one is related to the other; limited borrowing is associated with credit shortage rather than non-progressive behaviour.

Having established this, the credit shortage is shown to put the

independent farmer in a disadvantaged position in a number of ways. His disadvantage is greater because of the higher price he has to pay for his limited supply of credit. A representative independent farm forfeits 1,597 baht (equal to 19% of his current farm-income) by not having access to BAAC credit, assuming that the latter would allow him to borrow up to the optimum and at a lower price.

Furthermore, a credit shortage leads to inhibited farm growth. Section E2 shows that between crop years 1978/79 and 1979/80, an independent farm with no credit (the modal survey farm) experienced only a 7 per cent growth in net-farm income. If unlimited production credit were available to that farm (which would be the case if the farmer became a BAAC client), the growth rate over the same period would have been 46 per cent. The shortage of credit not only inhibits the growth of the independent farm, it means that the small farmer cannot compensate for his small production area by raising capital intensity.

Having made these statements about the demand for credit among survey farmers, we are in a position to make some conclusions about the reasons for the lack of participation of small farmers in the institutional credit market.

We can reject the hypothesis which states that small farmers tend not to borrow from institutions because they have no need for additional credit. It has been shown in this chapter that independent farms could productively employ a significantly greater volume of credit. It has also been shown that most

farmers recognise this and express a desire to borrow from an institution.

The chapter also produced evidence to test the importance of two other demand-side hypotheses presented in Chapter 3. We can reject the hypothesis which states that small farmers tend not to borrow from institutions because of the high total costs of borrowing. An equal proportion of farmers wanting to register and not wanting to register with an institution were aware of these total costs.

We can also reject the hypothesis which states that small farmers tend not to borrow from institutions because of the risk to their normal consumption credit lines. The proportion of farmers recognising this risk was not found to be greater among the group who did not wish to register with an institution.

It is clear from the available evidence that the tendency of small farmers not to participate in the institutional credit market, cannot be explained primarily by demand-side considerations.

The next chapter, therefore, turns to an examination of the supply-side. By investigating the rationing procedures of a credit institution, it seeks to make some statements about the way in which, and the degree to which, small farmers are prevented from entering the institutional market.

Chapter 7 : Notes and References

1. The models make the simplifying assumption that farmers choose between no chemical fertilizer and fertilizer applied at a rate which is representative of all farmers in the survey who used chemical fertilizer.
2. In the long term, there may be some competition between rice and other crops for paddy land. In the rapid expansion of non-rice crops during the 1970s, it was largely cleared upland area rather than converted paddy land which was involved. Competition is likely to become more important now, however, with the exhaustion of frontier land.
3. 'Capital deepening' in this context refers to the increase in capital intensity in farm production.
4. 'Shadow price' refers to the scarcity value of an input and is measured here by the input's marginal value product (MVP), which equals the unit change in net revenue associated with a unit change in the input.
5. Optimal cropping intensity is less than 100% due to the limiting animal traction constraints.
6. There are a number of reasons why farmers should prefer to borrow for farm investment rather than use savings, even though borrowing incurs interest charges. For example, a farmer may have alternative uses for his savings which give him a higher return than the farm investment. Alternatively, he may retain his savings as a risk-management strategy, to protect himself against consumption crises.
7. See Appendix 2, Tables A2.1 and A2.2.
8. Resources that are a constraint on production have positive shadow-prices. Changes in the level of such resources will lead to changes in optimal production and revenue. The lower the shadow-price, the less marked will be the effect of a given change in resource availability on production.
9. The 'model basis' refers to the combinations of activities (variables in the LP matrix) in the objective function. Whenever the combination of crop types and resource-hiring activities changes, the basis is said to change.
10. The hatched area (the V2 effect) corresponds to an additional volume of credit borrowed at the lower rate of 14% interest.
11. For a definition of the concept of the iso-quant or iso-product curve, see, for example, Ritson, C., 1977, **Agricultural Economics: Principles and Policy**, Granada, London

12. The comparison is between farms that differ only with respect to size of production area. All other resource parameters are held constant. If the larger independent farmers were to have more savings than the smaller farmers, they would still be able to reach higher incomes with only a limited amount of credit. The discussion in Section D2 of this chapter, however, suggests that there is no systematic relationship between production area and savings for independent farmers.

CHAPTER 8 :

SUPPLY-SIDE RATIONING

A Introduction

Chapters 6 and 7 showed that there is a proven demand for credit among survey one's independent farmers. The analysis there led to the conclusion that it is unlikely to be for reasons of lack of demand that small farmers are underrepresented in the portfolios of formal credit institutions. In this chapter, we investigate the importance of supply-side rationing as a cause of that underrepresentation. On the basis of the findings of Chapter 7, it is expected that rationing will prove to be important in this issue. The analysis confines itself to rationing practiced by the BAAC.

The chapter is divided into four. Drawing on concepts introduced in Chapter 3, Section A provides a context for the rest of the analysis by discussing the various forms of credit rationing practiced by BAAC. By defining two types of rationing, the section develops the idea of rationing credit by excluding certain individuals from client status (rationing-out).

The rest of the chapter is taken up with a formal analysis of BAAC's rationing-out criteria, employing a multi-variate probability technique. There are three parts to this analysis. Section B attempts to identify the precise criteria involved in selecting acceptable farmers for client status. It does this by finding the farm-profile variables which together are the best predictors of the outcome of the application decision (accept or

reject).

Section C extends the analysis to estimate, for the poverty districts in Korat Province, North-East Thailand, the total number of independent farmers who want to register with BAAC and can be classed 'acceptable' and the total number who want to register but are classed 'unacceptable' for client status. This is achieved by repeating the procedure of Section B, to derive a model which can classify Survey 1 farmers into the two categories on the basis of certain farm profile variables. This gives us important information about the extent to which farmers are denied access to institutional credit through BAAC rationing procedures.

Section D extends the analysis even further to estimate the critical values on the most important discriminating farm economy variables. It determines at what level on these variables is a farmer more likely to be rejected than accepted when he applies to become a BAAC client. These critical values are then compared with optimal farm incomes derived by the linear programming models in Chapter 7. This comparison enables something to be said about the regressive effect of the rationing-out procedure on the income-earning potential of small farmers.

Section B deals only with the supply-side issue of the effective decision criteria. Sections C and D bring together a supply-side analysis of the rationing decision with the demand-side analysis of Chapter 7.

B Two Types of Credit Rationing

1 Rationing: Loans to Clients

(a) Introduction

BAAC rationing procedures can be examined under two headings: (a) rationing of loans to clients through the use of loan ceilings, security requirements and related regulations, and (b) rationing of client-status through the registration procedure. Under the first, rationing occurs when clients are lent less than they demand; under the second, rationing takes the form of denying to certain farmers, the right to borrow. This chapter is largely concerned with (b). This section, however, examines the extent to which (a) occurs among survey one's BAAC clients. The analysis therefore pertains only to the Korat branch of the BAAC and the conclusions drawn may not be true for other provincial branches. The importance of this first section to the overall thesis is its conclusion that, from the evidence in Korat province, once a farmer has become a client he is, in general, able to borrow as much short-term credit as he can prove he needs.¹ This makes the distinction between a BAAC client and an independent farmer, a distinction between farmers with an effectively unlimited² and a very limited credit availability.

Rationing credit to clients can be looked at under the three main types of loan disbursed by the BAAC. Most

attention is paid to the short-term loan category.

(b) Long and Medium-Term Loans

The amount of credit loaned to finance a long-term farm investment project is determined on the basis of the long-term credit requirement of the proposed investment, the borrower's income and his ability to repay. Normally this figure may not exceed 5 million baht.³ A further restriction is put on the loan-size by the requirement that the borrower must have a minimum equity in the project of 20 per cent.⁴ Such loans must normally be secured by the mortgage of property valued at not less than twice the value of the proposed loan.⁵

Loans for medium-term investments are determined on the basis of the credit-requirement of the applicant's farm-plan, his income, ability to repay and his past repayment performance. A ceiling is given jointly for medium and short-term loans: the maximum value of all outstanding medium and short-term loans must not exceed 1 million baht.⁶ Medium-term loans must normally be secured with either mortgaged property of at least twice the loan value or with the signatures of two other BAAC clients. In the latter case, the loan cannot exceed 30,000 baht.

(c) Short-Term Loans

Restrictions put on short-term borrowing can be

usefully considered under the headings of quota limit, sanctioned crops, loan ceiling and legal limit (see Chapter 3.)

(i) **Quota Limit.** Although it is not designed into BAAC regulations, there is some degree of quota allocation of credit in practice. This involves the use of standard costs per rai for different farm inputs in loan-evaluation. Standard costs are either estimated provincially at branch level, or compiled centrally using survey data and given to branches as guidelines.⁷ Such quota devices are, however, flexible and are not regulated in the formal sense. If cost guidelines are close to actual local costs, then it seems unlikely that this management practice causes any effective rationing.

In evaluating a loan application, there is no limit on the proportion of total production costs covered by the loan. Subject to any standard cost guidelines used by the evaluating bank officer, a loan may be made to cover up to 100% of production costs as long as that figure does not exceed 60% of marketable value. The standard costs per rai then become the effective quotas of credit allocated.

(ii) **Sanctioned Crops.** In the North-East, it is only in the case of sugar-cane that credit rationing occurs through crop sanctioning. A BAAC client may only borrow for sugar-cane production if he is a registered

sugar-cane farmer. This may well result in effective rationing for smaller farmers in sugar-cane areas who could expand cane production with the use of more credit, but who are not eligible to become registered growers. For the most part of the region, however, including Korat province, where sugar-cane is not important, it appears that farmers can borrow for whatever crops they wish so long as they can show that their proposed investment looks reasonably viable.

(iii) **Ceiling.** A short-term loan for main crop production is limited to 30,000 baht and is determined on the basis of the applicant's credit requirement for his farm plan and his past repayment record.⁵ A client may also borrow up to 30,000 baht for a subsidiary crop, but as already noted, the joint amounts of all short-term and medium-term loans which are secured by joint liability, must not be greater than 30,000 baht.

(iv) **Legal Limit.** In addition to the ceiling limit, a client may not borrow in excess of 60% of the estimated value of his marketable surplus. This is equivalent to the legal limit in Ladman's study⁸ and is designed to prevent abuse of the credit system. The figure of 60% is an arbitrary estimate of a reasonable credit-requirement and ensures that a farmer has a reasonable margin after repayment of the loan. Theoretically, this figure is further divided so that roughly 50% of marketable value is the limit for production expenses and 10% of marketable value, the limit for consumption

expenses. The latter recognises that consumption by family labour can rightly be considered a genuine agricultural expense. In practice, a straight 60% limit for all production expenses is more often applied, and in some special circumstances BAAC branches can operate a limit of 80%.

(d) Testing the Effectiveness of these Rationing Practices

It is possible to test how important these rationing practices are in restricting the supply of credit to BAAC clients by building the rationing criteria into a linear programming model and comparing the solution with the solution for a model with no credit rationing. If the model which includes the rationing limits produces a lower net farm income than the unlimited credit model, then it can be concluded that the rationing procedure effectively rations loans to clients. This test is made separately for two of the rationing practices named above.

(i) Quota Limits. Since the standard costs guidelines are flexible and are anyway designed to reflect the true costs to the farmer in different localities, it is not necessary or possible to apply a formal test for this type of rationing. It can be assumed that an applicant, other things being in his favour, can borrow as large a percentage of production costs as he wishes and that his loan is evaluated using cost estimates roughly the same as the costs he will face.

(ii) **Sanctioned Crops.** Similarly, no test is necessary for the effect of crop sanctioning for Korat borrowers, since sugar-cane is not an important field-crop in that province.⁹

(iii) **Ceiling.** To test the effect of the loan ceiling, the single-period LP model for a representative BAAC farm was run, setting the borrowing limit to 30,000 baht. The capital borrowing constraint (Equation 6.77) becomes :

$$K < 30,000 \quad (8.1)$$

The results, which are of course already known from the analysis in Chapter 7, are set out in Table 8.1.

Table 8.1 The effect of loan ceiling on borrowing and net farm income for a BAAC farm in the Korat survey area

	No Ceiling	Ceiling = 30,000 baht
Optimal Credit (baht)	3,579.24	3,579.24
Objective (net farm income) (baht)	17,818.13	17,818.13

Source : LP Model Solutions

It can be concluded that for the model BAAC farm in Korat, the amount of credit required is far below the ceiling imposed by regulation and that, therefore, the 30,000 baht ceiling does not result in credit rationing for the average client.

(iv) **Legal Limit.** To test the effect of the 60% legal limit, the same LP model was run with a credit constraint modified to set the maximum borrowing limit K , equal to 60% of the value of marketable surplus. Equation 6.77 becomes

$$K \leq \alpha \sum_{i=1}^{12} s_i X_i + .6 \sum_{i=13}^{16} s_i X_i \quad (8.2)$$

Where : s_i = net revenue per rai of the i 'th crop

X_i = area of the i 'th crop (rai);

X_1 to X_{12} = paddy crops;

X_{13} to X_{16} = upland crops;

K = borrowing limit (baht); and

α = the legal limit (60%) multiplied by the proportion of paddy production assumed to be marketed (15%) = .09

The results are set out in Table 8.2.

Table 8.2 The Effect of the 60% Legal Limit on Borrowing and Net Farm Income for a BAAC farm in the Korat Survey Area

	No legal Limit	Legal Limit = 60% of marketable sur- plus
Optimal Credit	3,579.24	3,579.24
Objective (net farm income)	17,818.13	17,818.13

Source : LP Model Solutions

Again, it can be concluded that for the average BAAC client in Korat, the 60% rule does not constitute an

effective restriction on borrowing. His optimal credit requirement comes to less than 60% of his marketable surplus.

From these two tests, it can be concluded that a typical BAAC client in Korat, other things being in his favour (such as repayment record), can borrow as much as he can prove he can use.¹¹

2 Rationing: the registration procedure

(a) Introduction to the Analysis in Sections B & D

To be eligible for BAAC credit a farmer must first become formally registered as a BAAC client. In practice, this involves a prospective client having to make an application to the district branch which is then evaluated by a district credit officer and ratified at provincial branch level. The qualifications of a person who may be accepted as a registered client are defined in BAAC regulations and include the following points :¹²

1. he must be of Thai nationality;
2. he must be 20 years of age or over;
3. he must be a farmer;
4. he must have sufficient farm experience or training in the field of agriculture;
5. he must have been a permanent resident and operating his major agricultural enterprise within any operating area of the branch to

- which he is applying for a successive period of not less than one year;
6. he must normally produce an annual marketable surplus of agricultural products in reasonably sufficient value;
 7. he must be honest, known to have a good reputation, industrious and thrifty;
 8. he must not be of unsound mind or mental infirmity;
 9. he must not be a bankrupt or an insolvent;
 10. he must not have been expelled by an BAAC branch.

On the basis of these criteria, and particularly Point 6 (regulation 4(6)), an applicant is either accepted or rejected. If all other points are in his favour, the decision will rest on how he is evaluated against Point 6; he must have a farm enterprise of 'sufficient' size.

Having established that there is no credit rationing in the case of the average client, if there is any supply-side restriction of BAAC credit to Korat farmers, it must operate at the stage of registration. This can still be considered as credit rationing in the sense that farmers are rationed out of the institutional market.

Rationing-out in its broadest sense takes 3 forms: two active and one passive. Under BAAC

regulations, a farmer is required to meet certain criteria before being allowed to register. If he is deemed not to qualify on this basis, he cannot receive BAAC credit. This is the first type of active rationing-out. The second occurs not through bank regulation but through the operation of farmer groups. Since a farmer has to join a joint-liability farmer group in order to register as a client, and since the leaders of such groups make the decision as to who may join, it is likely that some farmers are rationed-out of the BAAC by the decision of farmer-group leaders.¹³ The passive type of rationing-out occurs when a lack of promotion, education or publicising the invitation to register in certain areas or among certain types of farmer, effectively rations BAAC credit to a chosen sector of the population.

The analysis presented in the remainder of this chapter focuses on the first of these, rationing-out through regulation, and attempts to identify the effective criteria used in rationing-out farmers at the registration stage. The criteria used by BAAC officers in evaluating an application for registration are obviously critical in the active rationing-out process.

Data relating to these criteria have been collected in a second survey of farmers in Korat.

The source of data this time, is BAAC records rather than a questionnaire survey. The survey (Survey 2), which is described in the following, forms the basis of the analysis in the rest of the chapter.

(b) Data: Survey 2

A survey was undertaken in February 1983 to collect profile data for a sample of farmers who had been successful and a sample who had been unsuccessful in applying to register with the BAAC. Data were taken from the form completed by applicants when making their application,¹⁴ (reproduced in Appendix 3).

A stratified systematic sample design was used in each of four provinces within the North-East of Thailand to sample around 300 farmers from each province, with equal numbers of accepted and rejected farmers.

The sampling frame comprised the list of all registration applicants during the year April 1981 to March 1982. Since the number accepted exceeded the number rejected in each province, different sampling proportions were used to produce equal numbers in both categories. There are four resultant samples, one for each province, each a systematic sample of all farmers who applied to register with BAAC during the year 1981/82,

stratified by the accepted/rejected decision. The analysis presented here uses only the sample taken from Korat province.

(c) The Extent of Rationing-Out

Table 8.3 presents the population statistics for the total number of applicants, the numbers accepted and the numbers rejected for the four provinces during the year 1981/82.

Table 8.3 Number of Applicants rejected and accepted by Province

Province	Applications	Accepted	Rejected	Percent Rejected
Nakon Panom	3,113	2,538	575	18.5
Ubon	3,007	2,486	521	17.3
Sisaket	2,324	1,878	446	19.2
Korat	3,997	3,289	708	17.7

Source : Survey 2

There is a very consistent pattern across the four provinces with an average of about 18% of all applicants rejected. We may conclude that 'active' rationing-out is of some importance in each province.

C Searching for the Effective Rationing Criteria

1 Methodology

(a) The Problem and an Appropriate Technique for its Solution

To register as a BAAC client, a farmer is required to give information about himself and his family, his assets, liabilities, farm and off-farm income, farm and household expenses, and other production details. In addition, his performance on a number of qualitative indicators is assessed by a bank officer. On the basis of this information, he is either accepted as a client or rejected.

The regulations indicate that marketable surplus should be the most critical variable, other factors being equal. The criteria used in practice, however, are less clear. When a selection of BAAC officers at various levels of seniority were asked to identify the most important decision criteria, no consistent answer was forthcoming. Responses included the following: marketable surplus, total net-income (farm + non farm), gross farm-income, net farm income, and agricultural production expenses.

In order to be able to (a) make an evaluation of the rationing-out procedure, and (b) estimate the number of independent farmers in Korat who are eligible for registration, we need to analyse the decision-making

process and to derive a more precise set of decision criteria.

In this problem, we are interested in the decision to accept or reject a farmer applying for registration. This is a simple dichotomous variable. We are also interested in relating this decision to certain characteristics of the applicant farmer. Some of these characteristics are amenable to continuous-level measurement, others only to ordinal or dichotomous-level measurement. These features of the problem make it a classic case for the application of multiple discriminant analysis (MDA).

MDA is a modification of the general linear model which was first employed in the biological sciences as a classification technique. Its use in other areas, such as market research and finance, has now become well established and several credit studies have used some form of MDA.

MDA is a reformulation of the basic linear model such that the dependent variable can be dichotomous without contravening the assumptions of collinearity and homoscedasticity¹⁶. The dichotomous variable to be explained is membership of one, two or more categories or classes, and the object is to predict group membership on the basis of a number of independent variables. Independent variables are linearly related to the dichotomous group membership variable.

An MDA will find the set of independent variables which best discriminate between two groups of known membership. On the basis of the best discriminating variables, the model can then be used to classify individuals for whom group membership is not known.

A summary of the technique including definition of the linear discriminate function and related classification functions is found in Appendix 4.

The advantages of a multi-variate rather than a univariate technique lie in the completeness of information used. The influence of all important discriminating variables can be taken into account. This gives more complete knowledge about the variation in the dependent variable and produces a more reliable classification than the classification which makes use of only one variable to predict group membership. In a univariate classification, discriminating variables can be taken only one at a time, concealing the influence of those variables on each other and reducing the discriminating power.

Linear MDA is used in preference to non linear MDA because of the greater clarity in interpreting the linear discriminant coefficients. With non-linear techniques, the relative contribution of each variable is more difficult to determine.¹⁷ While MDA is the technique chosen here, it is recognised that other multi-variate probability techniques such as logit or

probit analysis could equally well have been employed. MDA was used in preference to these techniques because of its established use in credit studies and because of ease of access to a suitable programme.

(b) Definition of the Group Variable in the Discriminant Model

Credit studies which have used MDA have typically used the technique to predict credit-worthiness defined as good or bad repayment performance.¹⁸ Individuals are divided into groups with good and bad performance and group membership is predicted by a series of theoretically important profile variables.

Here, it is again credit worthiness that is being predicted, but defined not in terms of repayment performance but in terms of a credit officer's assessment of credit worthiness. We are interested in predicting the BAAC's decision as to which farmers are acceptable for client status.

There are a number of ways in which the analysis could be designed. In its simplest form, group membership (rejected/accepted) could be predicted by selected profile variables on the basis of all farmers in the survey. To do this would, however, involve ignoring an important variable in the data set, namely a decision code, indicating the main reason why the farmer was rejected. An analysis which had not somehow taken this variable into account would have lower predictive

ability and would not make full use of the information available.

Since the income-related variables are of greatest theoretical importance in the rationing-out process, the analysis limits itself to predicting group membership on the basis of the sub-sample who were rejected primarily for income reasons. Farmers who were rejected primarily for non-income reasons such as old age, poor health, poor reputation, lack of farming experience or already being a client of another institution, are left out of the analysis. The rationale for doing this is that a more accurate understanding of the income-related reasons for rejection is of greater importance than a less accurate understanding of the way all profile variables influence the decision to accept or reject. An analysis which used the whole sample (ignoring the 'reason for rejection' code) would produce a less-accurate model because farmers of all income levels are rejected for the non-income reasons and it is income-related variables which are of greatest importance. To omit farmers who were rejected for non-income reasons, in effect controls for disturbances in the analysis of the income-related criteria used in the rationing-out process.

The group variable, therefore, becomes "accepted" or "rejected" following the sampling procedure, but with only those rejected on the basis of regulation

4(6) (marketable surplus too low) included in the "rejected" group.¹⁹ The effective sample-size is reduced by excluding applicants rejected for reasons other than Regulation 4(6), to 233 applicant farmers. Of these, 164 were accepted and 69 rejected.

The objective of the MDA analysis can be expressed in terms of an hypothesis :

h_1 : The division of applicants into those accepted and those rejected because of low income, can be explained by a set of discriminating variables ($X_1 \dots X_n$).

The testing of this hypothesis will demonstrate which are the effective criteria used in rationing-out farmers of below a certain level of farm enterprise.

(c) Definition of the Discriminating Variables

Data from the registration application form were condensed into two groups of variables: farm/household economy and performance-evaluation variables. The latter are in binary form since farmers are evaluated as either good or bad on these variables. All discriminating variables are listed in Table 8.4 together with their expected relationship with the group variable.

The farm/household economy variables are all interval-level measurements in units of either area (rai) or money (baht). The various income and expense composite-variables represent theoretically important criteria

which could possibly be used to evaluate an applicant's credit worthiness. It is expected that the higher the score on these variables, the higher the discriminant score (Z) and the higher the probability of falling into the "accepted" group.

The performance variables enter the discriminant equation as dummy variables since they are ordinal measurements in binary form. Farmers are evaluated as either good or bad on these variables. The failure to meet normality assumptions in the case of the dichotomous variables is not important since the optimality of a linear discriminant function is insensitive to the normality of discriminating variables. It is less robust with respect to the assumption of equality of variance-covariance matrices.²⁰ Since all the performance variables have a score of 1 or 2, where 1 = good and 2 = bad, we expect negative relationships with the discriminant score.

Table 8.4 Discriminating Variables and their Expected Relationship with the Discriminant Score Z

Farm/Household Economy	Expected Relationship with Z
Land owned	+
Effective production-area	+
Total assets	+
Agricultural expenses	+

Normal production-loan value	+
Marketable surplus (crop)	+
Marketable surplus (crop & livestock)	+
Farm income net of farm expenses	+
Farm income net of farm & household expenses	+
Total income net of household expenses	+
Total income net of farm & household expenses	+
Performance	
Cooperation	-
Loan repayment performance	-
Reputation	-
Diligence and industriousness	-
Effort made to improve farm practice	-
Thriftiness and ability to accumulate savings	-
Health	-
Family cooperation on farm	-
Understanding of BAAC regulations	-

(d) Derivation of Discriminant Function

The sample is divided into two groups: 'accepted' (Group 1) and 'rejected' (Group 2). The analysis could go ahead on this basis finding the best set of variables to discriminate between the two halves of the sample. The proper validation of the model, however, requires further sub-division of the sample. Two sub-samples are required, each containing a mix of Group 1 and Group 2 farmers. One sub-sample is used for

calibration of the function and the other for validation. The validation procedure is explained in more detail in the next section. The sample is split into calibration and validation sub-samples according to 3 alternative methods: (a) selecting for the calibration sub-sample every other case in the whole sample,¹⁷ starting with Case No.1; (b) selecting every other case starting with Case No.2, and (c) random selection of 50% of cases from the whole sample.

These 3 methods of sub-division produce 4 replications: SC1 and SV2 refer to the same sub-sample (used alternatively for calibration and validation), SC2 and SV1 refer to a second sub-sample, and SC3 and SV3 are the two sub-samples produced by the random division of the whole sample into 2. Table 8.5 shows how the replications are used. SC1 is validated on SV1, SC2 on SV2, and SC3 on SV3. There is a symmetrical relationship between the first two pairs since $SC1 = SV2$ and $SC2 = SV1$.

In the first stage of analysis, we are interested only in the best discriminant variables and their relative contributions to the discriminant score. In this stage, for each of the three calibration sub-samples, 6 discriminant functions are produced. The first function incorporates all possible discriminating variables, and the others incorporate a selection of variables according to 5 different criteria for exclusion in a step-wise MDA. The step-wise procedure

Table 8.5 Replications used for Alternative Discriminant Models

Calibration Sub-Sample	Validation Sub-Sample		
	(SV2) Odd Cases Only	(SV1) Even Cases Only	(SV3) Random
(SC1) Odd Cases Only		X	
(SC2) Even Cases Only	X		
(SC3) Random			X

which produces the best-fit model is used for the subsequent analysis. The difference in goodness-of-fit between the model using all variables and the model using selected variables, provides a check on the degree to which the exclusion of statistically unimportant discriminators affects the predictive capability of the model.

The second stage of analysis involves classification of independent farmers from Survey 1 into accepted and rejected categories. Since there are no performance variables for these farmers, the classification must be made on the basis of a function which incorporates farm/household economy variables only. Six functions are derived as in the first stage, the difference being the exclusion of performance indicators.

(e) **Model Validity**

The object of MDA and, therefore, the test of goodness-of-fit, is to correctly re-classify as many cases as possible. A set of weighted predictor variables is used in the discriminant function, to best divide the sample into two a-priori groupings with known membership. The test of how well this has been done is to re-classify cases, using the derived function, and see how many are correctly classified into their actual and known groups. The goodness-of-fit statistic, therefore becomes the percentage of cases correctly classified. This is analogous to the measure of variance-explained in regression analysis (r^2). The object there is to explain as much variance in the dependent variable as possible. In interpreting goodness-of-fit in regression analysis, there is a problem of upward bias in the r^2 value caused by testing the model on the same set of data upon which it has been calibrated. The r^2 value is, of course, correct for the sample, but as an estimate of the model's goodness of fit to the population, it is bound to be too high for two reasons :

- (a) due to inevitable sampling errors, the model calibrated on the sample will fit the sample better than the population;
- (b) this is compounded in the process of independent variable selection (the search for the model which gives the best fit). Choosing the best-fit out of a range of alternative models also means choosing

the model most closely reflecting the peculiarities of the sample.

In regression analysis, the computation of r^2 can be easily modified to allow for the upward bias. The solution is not so straightforward in MDA, although the problem is the same. Sampling and search bias tends to produce an artificially high percentage of correctly classified cases if calibration and validation are performed on the same sample.

Frank, Massy and Morrison²¹ suggest either a second sample or a split sample be used to validate a discriminant function model. Here, as already indicated, a split-sample method is used, 3 sub-samples alternatively being used for model calibration (Table 8.5). Each consists of half of the whole sample and contain proportional numbers of Group 1 and 2 farmers. The models calibrated on SC1, SC2 and SC3 are validated on SV1, SV2 and SV3, respectively. The goodness-of-fit statistic for the SC1 model, for example, becomes the proportion of SV1 cases correctly classified using the SC1-calibrated discriminant function. This percentage gives the best unbiased estimate of the model's goodness-of-fit with respect to the population.

2 Calibration of the Empirical Model

Table 8.6 presents the goodness-of-fit statistics for a direct and a step-wise model calibrated on each of three replications.²² The step-wise models represented in the

table are the best-fitting models, having tried 5 different step-wise procedures. The procedure which produced the best fit for each of the three replications was that which selects variables on the basis of the minimum residual variance at each step. The table is therefore a summary of results from 18 models; for each calibration sub-sample there were run 5 step-wise models with the best one being selected, and one direct model (where there is no selective exclusion of independent variables).

Table 8.6 Goodness-of-Fit Statistics for a Step-Wise and Direct MDA Model for each of three Sub-Samples

Calibration Sub-Sample	Step-Wise		Direct	
	Internal ¹	External ²	Internal	External
SC1	87.0%	81.2%	84.0%	77.8%
SC2	85.2%	75.7%	86.1%	77.5%
SC3	90.3%	75.4%	86.0%	80.2%

Note : 1 Internal = internal goodness of fit = the percentage of correctly classified cases when reclassifying the cases in the calibration sub-sample itself;

2 External = external goodness of fit = the percentage of correctly classified cases when reclassifying the cases in the independent validation sub-sample.

Source : MDA Model Output

Three observations can be made about Table 8.6. First, the difference between internal and external classification accuracies indicates the amount of bias in the internal percentage. All external percentages are lower than corresponding internal percentages as expected. It is the

external goodness-of-fit statistics which are used to select the best model since they are free from sample and search bias. Second, it is not possible to say that either step-wise or direct methods generally produce more accurate re-classifications; although accuracy is lost by selecting variables in the case of the SC2 and SC3 models, the opposite is true of the SC1 model. The cost in terms of accuracy, of the gains in efficiency and analytical power associated with a step-wise model are not high for SC2 and SC3 and are negative for SC1. Third, the SC1 model can be selected as the best model to use for further analysis on the basis of its superior external classification accuracy of 81.2% correctly classified cases.

Table 8.7 lists the discriminating variables included in the SC1 model along with their respective means for Group 1 and Group 2 farmers, and the significance of the difference of means. On a univariate level, three of the six variables differ significantly between the two groups at the 0.1 level: net farm income, assets and diligence are all significant univariate discriminators. This gives the first indication of the most important variables upon which individuals are divided into two groups, and a univariate model based on any of them is likely to have good predictive ability. However, the discriminant function, using all six variables, will have a greater predictive ability.

We would expect there to be some relationship between the variables which are important on a univariate level and the

ranking of variables in terms of their importance as discriminators in the multi-variate discriminant model. The discriminant scores, unstandardised and standardised, are presented in Table 8.8. Standardised scores, analogous to

Table 8.7 Discriminating Variables included in the Best-Fitting Model with their Respective Mean Values for Groups 1 and 2

Discriminating Variable	Group 1 (accept)	Group 2 (reject)	Univariate F ratio
Farm income net farm expenses	20,910.2	6,514.3	33.12 *
Assets	85,447.1	33,854.8	5.66 *
Cooperation	1.071	1.000	2.19
Loan Repayment Performance	1.177	1.180	0.16 10^{-4}
Diligence	1.056	1.276	10.16 *
Normal Production Loan Value	1,538.0	679.3	1.91

Note : * Significant at P = .01

Source : MDA Model Output

β coefficients in multiple regression analysis, indicate the relative importance of a variable to the discriminant score. The higher a standardised discriminant coefficient, the greater the contribution of that particular variable to the function's overall discriminating ability. Table 8.8 ranks variables according to their standardised discriminant function coefficients.

Two of the signs in the function are not as predicted: a

Table 8.8 Best-Fit Discriminant Model selecting from Economy and Performance Variables

Discriminating Variable	Unstandardised Coefficient	Standardised Coefficient	Rank	Cumulative variance Explained	Cumulative Proportion of Model's Total Discriminating Power
Farm income net farm expenses	0.6862 10^{-4}	0.7789	1	0.2861	0.7063
Diligence	-1.5593	-0.4872	2	0.3219	0.7946
Cooperation	1.7954	0.3909	3	0.3651	0.9013
Loan Repayment Performance	0.8717	0.2759	4	0.3793	0.9363
Assets	0.2432 10^{-5}	0.2393	5	0.3928	0.9696
Normal Loan Value	0.8116 10^{-4}	0.2288	6	0.4051	1.0000
Constant	-2.5910				

Source : MDA Model Output

worse performance on cooperation and loan repayment indicators contribute positively to the probability of an individual being found in Group 1 (accepted). This can be interpreted in at least four alternative ways. (a) Farmers with poorer performance on these indicators are favoured in the decision to accept or reject; (b) the indicators are in themselves unimportant to the decision, but are related inversely to some other variable which is important but is not included in the list of variables from which discriminators were selected (the inclusion of these two variables with unexpected signs would, in this case, be spurious); (c) measurement error due to an unreliable scale of measurement giving rise to a spurious result; and (d) sampling error giving rise to a spurious result.

Alternative (a) makes little sense and can be rejected without further discussion. Alternative (b) requires the existence of an important discriminating variable (or variables) outside of the group listed in Table 8.4 and related to loan repayment performance and cooperation performance. The contribution of the two variables cannot be explained by their relationship with any of the other variables in the table, because their inclusion through the step-wise procedure means that they contribute additional and unique explanation of the variance in the dependent variable. It is possible that certain personality variables, not assessed on the registration form, could be important here. Perhaps farmers with a more aggressive attitude towards wanting to register are seen as less co-

operative (they may be more evasive in answering certain questions, for example), have a worse loan repayment performance (poor performance with other creditors may make registration with BAAC more of a necessity) and yet are more likely to be accepted (they will tend to make more of a case for themselves than a farmer with a less aggressive attitude).

Alternative (c) is quite possible given the crude ordinal measurement of these variables. A good/bad dichotomous measurement is unlikely to be very reliable over time for one credit officer and even less likely to be reliable between credit officers. However, we would expect to see a broad relationship between a poor performance rating and the decision to reject, however crude the measurement.

Alternative (d) is, perhaps, the most likely. Given that the measurement is crude, it could well be that the Group 1 and Group 2 population means are similar for these two variables (though we would expect Group 1 means to be lower). The closer together the group means, the more we would expect to find in the sampling distribution, samples in which there are more 'bad' rated cases in the 'accepted' group than in the 'rejected' group. This is so even if a 'bad' rating on these variables tends to be related to a 'rejected' decision for the population as a whole. A discriminant function calibrated on such a sample would give unexpected signs on these variables.

Table 8.6 indicates that there is indeed sampling and search

bias in the model, since there is a large reduction of 5.8 percentage points in classification accuracy when the SC1 model is validated against a second sample (external validation). Put another way, sample and search bias is associated with a 5.8% upward bias in the classification accuracy. If the cooperation and loan repayment performance variables feature in the discriminant function because of sampling error, it can be expected that their removal from the function will reduce the gap between internal and external goodness of fit. This amounts to testing the influence of these two variables on the value of the bias indicator in the discriminant functions.

We would also expect the internal percentage of correctly classified cases to fall when two significant discriminators are excluded from the analysis. To make the test, the model in Table 8.8 was re-run using a step-wise (minimum residual variance) procedure and selecting from variables listed in Table 8.7, excluding 'cooperation' and 'loan repayment performance'. The hypothesis being tested is :

$$H_1 : P_1 < P_2$$

Where P_1 = the difference between internal and external classification accuracy for the model with the two variables excluded, and P_2 = the difference between internal and external classification accuracy for the model with the two variables included. P_1 and P_2 are indicators of search and sampling bias. Table 8.9 shows that the test results support the hypothesis.

Removal of the two suspect variables results in a model which has a lower bias indicator (the difference of 1.6% between internal and external goodness-of-fit suggests that the model is a very reliable estimate of the population discriminant function).

Table 8.9 Goodness-of-Fit of the Best Fit Model, with and without 'Cooperation' and 'Loan Repayment' Variables

Model	Internal Validation	External Validation	Difference (bias indicator)
Step-wise, including 'cooperation' and 'loan repayment performance'	87.0%	81.2%	5.8% = P ₂
Step-wise, excluding 'cooperation' and 'loan repayment performance'	86.0%	84.4%	1.6% = P ₁

Source : MDA Model Output

In removing these variables, a more accurate function has been produced. The external goodness-of-fit statistic is 84.4% compared to 81.2% in the original model. The revised and superior model is presented in Table 8.10 and forms the basis of subsequent discussion.

3 Discussion of the Revised Model

As expected, the most important discriminator is an income variable. Net farm income²³ accounts for 82% of the model's total discriminating power (Table 8.10, Column 6). However, this particular income variable is not the one we would have

expected to be the most important. According to BAAC regulations, it is marketable surplus²⁴ that should be the best discriminator. The appearance of net farm income and the absence of all other income variables in the function means that net farm income is the income variable which alone explains the largest amount of variance in the group variable. Marketable surplus would, of course, explain some variance on its own, but the variance explained by net-farm income includes the variance explained by marketable surplus plus more. Net farm income, having been selected in the first step of the step-wise procedure, left no more variance to be explained by any of the other income-related variables.

The emergence of net farm income as the best discriminator between accepted and rejected farmers, is an important result since it indicates that the effective decision criterion differs from the criterion specified in the regulations. The implications are, in fact, progressive as far as small-farmer access to BAAC is concerned. The use of marketable surplus as the primary decision criterion would tend to favour farmers already producing at a significant level above subsistence requirements. Farmers, perhaps desiring fuller participation in the cash economy, but presently producing only a small marketable surplus are penalised. The net farm income variable, however, is derived by valuation of total products, whether marketed or not. The evidence is that BAAC credit officers tend to accept an applicant if the difference between the total

monetary cost and total value of his production is sufficiently high, even if the current proportion which is marketed may be low.

In terms of the discriminant function, the difference between the variance explained by marketable surplus and the variance explained by net farm income, represents the degree to which the division between Groups 1 and 2 can be better explained by differences in net farm income. This implies that for a certain proportion of cases, the division into Groups 1 and 2 can be explained by net farm income but not by marketable surplus. For that proportion of cases, average marketable surplus is not significantly different between accepted and rejected farmers, while net farm income is significantly higher among the accepted group.

Having said that net farm income is a more progressive decision criterion than marketable surplus, a qualification needs to be made. A lender institution must ensure that its borrowers are able to use their loans productively according to the stated purpose of borrowing. This is vital for the institution's commercial viability. The BAAC can, therefore, be expected to lend only to applicants who are farmers producing a positive net-value on a regular basis. The size of the normal net-value of production that will make an applicant acceptable is, however, a different question. With no credit shortage in the informal market, a low net farm income can perhaps correctly be interpreted as an indication of an unprogressive or unindustrious farmer;

of a non-viable client. Where non-institutional credit is short, however, a low net farm income may reflect insufficient working capital. It may also be that those farmers who apply to register with BAAC are those who have particularly felt the constraints imposed by such a credit shortage; hence their desire to borrow from an institution.

It is commercially and developmentally regressive to refuse access to credit to a farmer who wants to expand his farm enterprise beyond the level to which he has been constrained outside of the institutional credit market. He could expand output if he had greater access to working capital, but he is denied that access because his previous levels of output are too low to make him eligible.

Diligence²⁵ is the second most important discriminator. Diligence and net farm income together account for 92% of the model's discriminating power. It is related to the dependent variable with the expected negative sign; the poorer performance with respect to a farmer's diligence and industriousness, the lower his chance of being accepted. This makes sense theoretically since a farmer's attitude towards his farm enterprise will have consequences for both the productivity of his loan and his reliability as a debtor.

While the appearance in the model of normal loan value and assets variables is understandable in terms of a lender's decision, it is somewhat regressive in the context of lending to small-scale peasant farmers. Since all farmers

Table 8.10 Best-Fit Discriminant Model, selecting from Economy and Performance Variables and Modified to Reduce Sampling Bias

Discriminating Variable	Unstandardised Coefficient	Standardised Coefficient	Rank	Cumulative Variance explained	Cumulative Proportion of Model's Total Discriminating Power
Farm income net farm expenses	0.6871 10^{-4}	0.7799	1	0.2868	0.8164
Diligence	-1.2833	-0.4010	2	0.3219	0.9163
Normal Loan Value	0.1028 10^{-3}	0.2898	3	0.3409	0.9704
Assets	0.2185 10^{-5}	0.2149	4	0.3513	1.0000
Constant	0.8516 10^{-3}				

Source : MDA Model Output

who become clients are required to join a farmer's credit group for the purpose of securing loans by group liability, there is no reason why assets should be important in the decision whether or not to accept a farmer who applies to become a client.

If independent farmers faced an unlimited supply of suitably priced credit in the non-institutional market, 'normal loan value' could perhaps be used as an indicator of industriousness and progressiveness. The analysis in Chapter 7, however, suggests that the low amounts of credit used by independent farmers in Korat province is related to a supply shortage. Under these circumstances, the justification of using normal loan value as one important criterion in the decision to accept or reject, is weakened and is a regressive practice.

What can be said about the variables which did not appear in the discriminant function? The absence of any other income-related variables has already been discussed. Statistically, none of the other variables offer significant additional explanation of variance in the dependent variable. This does not mean that in themselves they offer no explanation on a univariate basis or on some alternative multi-variate basis. Rather, any explanation they might give is subsumed under the superior explanation given by the variables selected in the discriminant function. Thus, while health or farm expenses may explain some of the variance in the independent variable, it is the same

variance that is explained by the variables that were selected and the latter were able to explain more in addition.

If we are interested in deriving a classification scheme which models the decision process, then we can ignore the non-selected variables. Though they may have discriminating power, they do not help classify a new individual because their discriminating power is duplicated and exceeded by the superior discriminators that were selected.

4 Model Accuracy

(a) Testing the Significance of the Discriminant Function

The discriminant function is defined as the set of weights which best separates the two groups so as to maximise within-group clustering around the group centroid as well as maximising distance between the two centroids. The success of this separation can be measured by the Mahalanobis D^2 statistic, a measurement of the generalised distance between two group centroids. The D^2 statistic is easily transformed to an F statistic to test the significance of the distance.²⁶ The modified function in Table 8.10 produced an F value of 10.811. Since 10.811 is greater than F crit at the .01 level with 95 degrees of freedom, we can conclude that the function produces a significant separation between accepted and rejected cases.

(b) Classification Accuracy

A statistically significant separation between group centroids does not tell us how well the model does what it is meant to do, namely to correctly classify individuals into groups according to certain profile variables. The measure of classification accuracy (percentage correctly classified) has already been used to select the best model. Here, the method of deriving and testing the statistic is elaborated and the error components analysed.

The first stage is to construct a classification table of the form presented in Table 8.11.²⁷

Table 8.11 Generalised Classification Table

		Predicted Classification		
		Group 1	Group 2	
Actual classification	Group 1	$N_{1,1}$	$N_{1,2}$	N_1
	Group 2	$N_{2,1}$	$N_{2,2}$	N_2
		N_1	N_2	

Note :

$N_{i,j}$ = the number of cases actually in group i classified by the model as group j .

The proportion of cases correctly classified (P_C) is given by :

$$P_c = \frac{N_{1,1} + N_{2,2}}{N_1 + N_2} \quad (8.3)$$

Source : Cooley, W.W., and Lohnes, P.R., 1962, p.279

The classification table for the best-fit discriminant model (the model presented in Table 8.10) is given in Table 8.12. It relates to the model's external validation; the reclassification of cases in the validation sub-sample (SV1).

In order to test the significance of P_c in Table 8.12, it is first necessary to know what percentage would be classified correctly by chance even if the discriminant function had no discriminating power. Having done that, the difference between the chance correct classification and the actual correct classification can be tested using a t-test.

If the two groups were of equal size, the chance proportion of correct classifications would be 0.5. If all cases were classified as accepted, for example, we would have correctly classified 50% of them merely because that is the proportion of cases actually in the 'accepted' group. That 50% success rate is completely unrelated to the accuracy of any discriminant function since it can be achieved by classifying all cases into one group.

Table 8.12 Classification Table for the Best-Fit Discriminant Model

		Predicted Classification		
		Accepted	Rejected	
Actual Classification	Accepted	76 (92.7%)	6 (7.3%)	82
	Rejected	13 (32.5%)	27 (67.5%)	40
		89	33	122

$$P_C = \frac{76 + 27}{122} = 0.844 \quad (8.4)$$

When the groups are of unequal size, the proportion correctly classified by chance (P_{CH}) is given by the expression:²⁸

$$P_{CH} = \alpha^2 + (1 - \alpha)^2 \quad (8.5)$$

where : α = the proportion of cases in group 1; and
 $1 - \alpha$ = the proportion of cases in group 2.

when $N_1 = 82$ and $N_2 = 40$, $\alpha = .672$ and $1 - \alpha = .328$, $P_{CH} = .559$

To test the significance of P_C in Table 28, the following t-test is set up :

$$t = \frac{P_C - P_{CH}}{\hat{\sigma}_{PCH}} \quad (8.6)$$

$$\text{where } \hat{\sigma}_{PCH} = \sqrt{\frac{P_{CH}(1-P_{CH})}{N_1 + N_2}} \quad (8.7)$$

$\hat{\sigma}_{PCH}$ = estimate of the standard error of the population proportion of cases correctly classified by chance.

Inserting the values for P_C and P_{CH} derived above :

$$t = \frac{.844 - .559}{.045} = 6.3 \quad (8.8)$$

This value of t is significant at the highest level and it can be concluded that the proportion of cases reclassified correctly by the model is significantly greater than that expected by chance.

From the classification table, we know how the overall statistic of 84.4% correct classifications is made up. Cases actually in Group 2 but classified in Group 1 can be thought of as Type I errors. They should have been rejected but have been accepted.²⁹ On the other hand, cases in Group 1 but classified as Group 2 have been wrongly rejected and can be considered Type II errors.

Type I error in Table 8.12 is 32.5%, and Type II error is 7.3%. If the model were to be used to classify ungrouped farmers into those acceptable and those unacceptable, the risk of classifying as acceptable, farmers who are not really acceptable is greater than the risk of classifying as unacceptable, farmers who are.³⁰

From a developmental point of view, this relationship

between Type I and Type II errors is acceptable since it means that a greater number of smaller farmers will be classified as acceptable. From a commercial point of view, however, it is probably desirable to minimise Type I errors.

Table 8.13 summarises the measures of validation. The model produces both a significant separation between group centroids and a significant percentage of correctly classified cases. The null hypothesis that the discriminating variables cannot discriminate between groups has to be rejected and we conclude that the model (a) successfully reveals which are the **important profile variables** in the decision to accept or reject a registration applicant, and (b) could be validly used to **predict the most likely group membership** of ungrouped farmers; (in actual fact, when it comes to classifying Survey 1 independent farmers into 'accepted' or 'rejected' groups in Section D of this chapter, a different model will have to be used because of the absence of performance indicator variables in Survey 1).

Table 8.13 Summary of Validation Statistics for the Best-Fit Discriminant Model

Distance between group centroids :

DF	F	Significance
4,95	10.811	0.0000

Classification accuracy :

Type I error	Type II error	P_{CH}	P_C	t	DF	Significance
32.5%	7.3%	.0559	0.844	6.3	120	0.0000

D Estimation of the Numbers of Independent Farmers in Korat's Poverty Districts who can be classified as Eligible and Ineligible for BAAC Client Status

1 Introduction

The analysis in Chapter 7 suggests that demand for institutional credit facilities is high among independent farmers in the poverty districts of Korat. 78% of Survey One's independent farmers expressed a desire to register with a credit institution. This indicates the level of potential demand for client status but says nothing about how many potential clients there are among the independent farmers. Many of the farmers who want to register may not in fact be eligible. In the present section, an estimate is made (a) of the number of independent farmers in Korat poverty districts who both want to register and would be eligible under the existing decision-making practice, and (b) of the number of independent farmers in Korat who wish to register but would be ineligible under existing decision-making practice. This is achieved by applying a discriminant function similar to the one derived in Section C, to the sample of independent farmers in Survey 1 who expressed a desire to register with a credit institution.

This exercise therefore approaches the following question:

given the currently effective criteria employed in the decision to accept or reject an applicant for registration, how many farmers are there in the Korat poverty districts who would become BAAC clients if they were given the chance to apply for registration? The estimate is of numbers rationed-out on the basis of their income and does not include those who are ineligible for other reasons such as age or health. The estimation procedure involves the following steps :

1. estimation of the proportion of Korat poverty district farmers who are independent;
2. estimation of the proportion of independent farmers who want to register with BAAC;
3. estimation of the proportion of independent farmers wanting to register who are unacceptable for reasons other than income (ill health, old age etc.)
- 4a. estimation of the proportion of independent farmers wishing to register who have a higher probability of being accepted than rejected;
- 4b. estimation of the proportion of independent farmers wanting to register who have a higher probability of being rejected than accepted.
5. multiplication of the total farmer population figure for Korat poverty districts by the resultant proportions to get the final estimates.

2 The Classification Model

Since a discriminant function based on Survey 2 will be used to classify farmers in Survey 1, it must only contain variables for which there are comparable values in the two surveys. The model presented in Table 8.10 contains performance variables which are unique to Survey 2 and it cannot therefore be used to classify farmers in Survey 1. It is, therefore, necessary to produce a model which includes only variables found in both surveys. The list of variables from which the best discriminators are to be selected is given below :

- effective production-area (rai)
- agricultural expenses (baht)
- normal production-loan value (baht)
- marketable surplus (baht)
- marketable surplus (crop and livestock) (baht)
- farm income net farm expenses (baht)
- farm income net household expenses (baht)
- total income net all expenses (baht)

Following the procedure adopted in selecting the first model, three alternative models were produced using a step-wise procedure, each calibrated on a different sub-sample and validated on a second sub-sample. The model based on sub-sample SC2 emerged as the best fit with a classification accuracy of 83.8% (significant at $P = 0.0000$). This is the model used in the following analysis.

Table 8.14 shows that two variables were selected as significant discriminators: 'net farm income' and 'effective production-area'. The predictive accuracy of these two discriminators is even higher than that of the first model where variables were selected from all possible discriminators including performance ratings. We cannot strictly compare the two models since each is based on a different sub-sample. We do know, however, from Table 8.6 that the all-variable model based on SC2 (disregarded in the choice of the first model because of SC1's superiority), had an external classification accuracy of 75.7%, considerably lower than the 83.8% accuracy of SC2's two-variable model. That the model which selected from a more complete range of discriminators has a lower classification accuracy may seem a counter-intuitive result.

The explanation lies in the difference between the criteria used for variable selection in the step-wise MDA and the criteria used for expressing classification accuracy. Table 8.14 compares residual variance with classification accuracy for the two models calibrated on sub-sample SC2. Model 1 is the model selected from the full range of possible discriminators (listed in Table 8.4) and Model 2 selects from the reduced range of 8 farm economy variables listed above.

Table 8.14 Comparison of Residual Variance with Classification Accuracy for Two Models Calibrated on Sub-Sample SC2

	Residual Variance	Classification Accuracy
Model 1	0.4418	75.7%
(selected from all discriminators)		
Model 2	0.6486	83.8%
(selected from reduced range of discriminators)		

Source : MDA Model Output

The principle illustrated in Table 8.14 is that although Model 1 explains more variance in the dependent variable than Model 2, its external classification accuracy is not so good. The smaller residual variance of Model 1, explains why Model 1 rather than Model 2 was selected from the full range of variables by the step-wise procedure even though Model 2 is more reliable.³¹

Table 8.15 presents the model used in the estimation exercise. Net farm income and effective production-area are the variables which together give the best discrimination. Alongside the discriminant function are presented the classification functions which are used to classify ungrouped independent farmers as 'accepted' or 'rejected' (see Appendix 2 for a definition of classification functions in MDA).

Table 8.15 Discriminant and Classification Functions used in Estimating the Number of Eligible and Ineligible Independent Farmers in Korat Poverty Districts

	Discriminant Function		Classification Function 1 (Accepted)	Classification Function 2 (Rejected)
	Unstandardised	Standardised		
Net farm income	0.7835 10-4	0.8610	0.1163 10-3	0.9749 10-6
Effective production-area	0.1516 10-1	0.2739	0.1005	0.7814 10-1
Constant	-1.9042	-3.7143	-2.2218	
F ratio	25.72			
Significance	0.000			

Source : MDA Model Output

3 Estimation Procedure

First, four separate probabilities are defined :

P_1 = Probability of a Korat farmer being an independent farmer

P_2 = Probability of an independent farmer wishing to register with BAAC

P_3 = Probability of an independent farmer who wishes to register, being ineligible for reasons not related to the size of his farm enterprise

P_4 = Probability of an independent farmer wishing to register being classified as eligible/ineligible according to his weighted scores on the net farm income and production-land variables.

Having estimated probabilities P_1 to P_4 , a resultant probability P_5 can be defined as :

$$P_5 = (P_1)(P_2)(1-P_3)(P_4) \quad (8.9)$$

= probability of a farmer in the poverty districts of Korat wishing to register and being eligible for client status

P_1 is calculated from Survey 1 data by dividing the number of farmers who were not members of any credit institution (N_1) by the total number of farmers in the sample (N_2) :

$$\frac{N_1}{N_2} = \frac{217}{300} = .7233 \quad (8.10)$$

Since members of cooperatives, farmers associations and commercial banks are excluded from N_1 , the final estimate will relate purely to farmers without institutional attachment and will not include members of another institution who want to register as BAAC clients.

P_2 is calculated using the response to the question in Survey 1 which asked farmers whether they wanted to register with BAAC. The number responding positively (N_3) is divided by the total number of independent farmers (N_2):

$$\frac{N_3}{N_2} = \frac{168}{217} = .7742 \quad (8.11)$$

P_3 is calculated from Survey 2 data using the 'reason for rejection' variable (a single code entered onto the registration application form by a credit officer, summarising the reason for rejecting the applicant). Two stages are necessary here. First, the proportion of all rejected farmers rejected for 'other reasons' ($P_{3,1}$) is calculated with a confidence interval, by dividing the number rejected for 'other reasons' (N_4) by the total number of rejected farmers in the sample (N_5). Second, the population number of rejected farmers in Korat during the survey period³² (N_6)³³ is multiplied by $P_{3,1}$ to give an estimate of the total number of farmers rejected for 'other reasons' (N_7). This estimate is then divided by the population total number of registration applicants (N_8) to get P_3 . N_7 and N_8 are population parameters.

$$P_{3,1} = \frac{N_4}{N_5} = \frac{79}{143} = .552 \pm 1.96 \sqrt{\frac{.552 \cdot .448}{143}} \quad 34$$

$$= .552 \pm 0.0815 \quad (P = .05) \quad (8.12)$$

$$N_7 = (P_{3,1})(N_6) = (708)(.552) = 390.8 \quad (8.13)$$

N_7 lies within a 95% confidence range of 333.1 to 448.5.

Therefore

$$P_3 = \frac{N_7}{N_8} = \frac{390.8}{3,997} = 0.0978 \quad (8.14)$$

P_3 lies within a 95% confidence range of 0.0833 and 0.1122.

$(1-P_3)$, the proportion used in the calculation of P_5 , therefore equals 0.9022 with a 95% confidence range of 0.8878 to 0.9167.

The calculation of P_4 involves the classification of Survey 1's 168 independent farmers who wanted to register with BAAC using the classification functions in Table 8.15. A classification score is computed on both of the functions for each of the 168 farmers. A farmer is assigned to the group (accepted or rejected) for which he has the highest classification score. The results of the classification produced are presented in Table 8.16.

Table 8.16 Results of Classifying Survey One's Independent Farmers who wish to register with BAAC, into 'accepted' or 'rejected' categories

No. of Cases	
$C_{\text{accept}} > C_{\text{reject}}$	19
$C_{\text{reject}} > C_{\text{accept}}$	149
	168
C_{accept}	= classification score on Classification Function 1
C_{reject}	= classification score on Classification Function 2

P_4 can then be calculated by dividing the number of farmers classified as 'accepted' by the total number of farmers wanting to register in the sample :

$$P_4 = \frac{19}{168} = 0.1131 \quad (8.15)$$

P_5 can now be calculated by finding the product of P_1 , P_2 , $(1-P_3)$ and P_4 . In the following, both the point and interval P_5 estimates are calculated; the low interval estimate through multiplying together the low estimates of P_1 to P_4 , and the high interval estimate by multiplying together the high estimates of P_1 to P_4 . The calculation is made first to find the number of eligible farmers.

Point	Low	High
$P_1 = 0.7233 \pm 1.96 \sqrt{\frac{.7233 \cdot 2767}{300}} = \pm 0.0506$	0.6727	0.7739 (8.16)
$P_2 = 0.7742 \pm 1.96 \sqrt{\frac{.7742 \cdot 2258}{217}} = \pm 0.0556$	0.7186	0.8298 (8.17)
$(1-P_3) = 0.9022$	0.8878	0.9167 (8.18)
$P_4 = 0.1131 \pm 1.96 \sqrt{\frac{.1131 \cdot .8869}{168}} = \pm 0.0479$	0.0652	0.1610 (8.19)
<hr/>		
$P_5 = 0.0571$ with a range of	0.0280 to 0.0948 (8.20)	

The final stage in the estimation involves multiplying P_5 by the total population of farmers in Korat's poverty districts. This figure is estimated from the Agricultural

Census of Thailand.³⁵ The most recent agricultural census was made in 1978 so a projected figure has to be used for 1981/82. Using a simple linear trend between 1963 and 1978 agricultural census figures, the total number of farm holdings in the poverty districts of Korat in 1981 is estimated at 101,758. The final estimate of the number of eligible farmers is given in Table 8.17a.

The calculations are repeated to estimate the number of independent farmers in the poverty districts of Korat who wish to register, but are ineligible. The only proportion that has to be changed in the calculations above is P_4 . This becomes 0.8869 instead of 0.1131. The results are presented in Table 33b. There are an estimated 51,408 independent farmers in Korat poverty districts who wish to become BAAC clients. Of these, 5,810 have greater probability of being accepted and 45,598 have the greater probability of being rejected if they were to apply to register.

4 Discussion of the Classification Results

Two things can be concluded from this classification exercise. First, a very high proportion of Survey 1's independent farmers who wanted to register with BAAC were classified as 'rejected' by the discriminant model. The exercise can be considered, in one sense, to be a simulation of the process of Survey One's independent farmers, applying to register as BAAC clients. 168 wished to register and can be considered as the 'applicants'. Of these, only 19 (11%) were 'accepted' after applying the model of the

Table 8.17a Estimated Number of Independent Farmers in the Poverty Districts of Korat who wish to register with BAAC and who are eligible for Client Status

	Point	Low	High
Probability of a Korat poverty district farmer being an independent farmer who desires BAAC client status and is eligible (P ₅)	0.0571	0.0280	0.0948
Number of farm holdings in Korat poverty districts	101,758	-	-
Estimated number of independent farmers who wish to register and are eligible	5,810	2,849	9,647

Table 8.17b Estimated Number of Independent Farmers in the Poverty Districts of Korat who wish to Register with BAAC, but are ineligible for Client Status

	Point	Low	High
Probability of a Korat poverty district farmer being an independent farmer who desires BAAC client status and is ineligible (1-P ₅)	0.4481	0.3601	0.5503
Number of farm holdings in Korat poverty districts	101,758	-	-
Estimated number of independent farmers who wish to register and are ineligible	45,598	36,643	55,997

effective decision-process (the classification functions). We can conclude that the majority (89%) of the independent farmers in Survey 1 who do want to participate in the institutional credit market, would be prevented from doing so if they were actually to apply to become clients. **89%**

are effectively rationed-out in the simulated application process.

The estimated population figures for the Korat poverty areas indicate the size of the problem. Under existing rationing practices some 45,598 farmers in these districts are excluded from the services of Thailand's major rural credit programme. This is very strong evidence in support of the hypothesis which states that small farmers tend not to borrow from institutions because of supply-side restrictions.

Second, though the majority were rejected, 11% of the survey independent farmers wishing to register were 'accepted' in the classification. Table 8.17a indicates that there is a significant number of independent farmers in the Korat poverty districts who can be considered acceptable. They can be thought of as potential clients since they both wish to register and are eligible. In 1980, there were 31,437 farm-holders registered with the Korat branch of BAAC.³⁶ The figures in Table 8.17 suggest that an 18.5% increase in clientel is possible by further expansion in the poverty districts.

It is, of course, true that the 'accepted' farmers are the more well endowed among Survey 1's independent farmers. It nevertheless remains an important finding that an estimated 5,810 farmers in Korat's poverty districts are currently operating independently, but both wish to register and are eligible to become clients.

For these farmers, their lack of participation in the institutional credit market is neither due to lack of demand nor rationing-out. The lack of institutional borrowing here, appears to be a result of lack of opportunity to register with an institution. If there are farmers who wish to register and have the right qualifications to be accepted, it must be a lack of opportunity which prevents them from becoming clients. Table 7.10 in Chapter 7 supports this assertion, indicating that a majority of Survey One's independent farmers had not yet become BAAC clients due to reasons relating to knowledge about the bank and its application procedures.

E The Effect of Rationing-Out on Farm Income

1 Introduction

The results of the MDA analysis can be brought together with the output from the LP models to illustrate the effect of credit rationing on farm income. If the critical values on the discriminating variables derived by MDA can be compared with the optimal income patterns produced by the LP models with and without credit, it will be possible to say something about the regressive effects of denying BAAC credit to farmers below a certain level of farm enterprise. Farmers above and below the critical values in the registration decision will face different income earning possibilities because of their differential access to credit.

The analysis involves 4 steps :

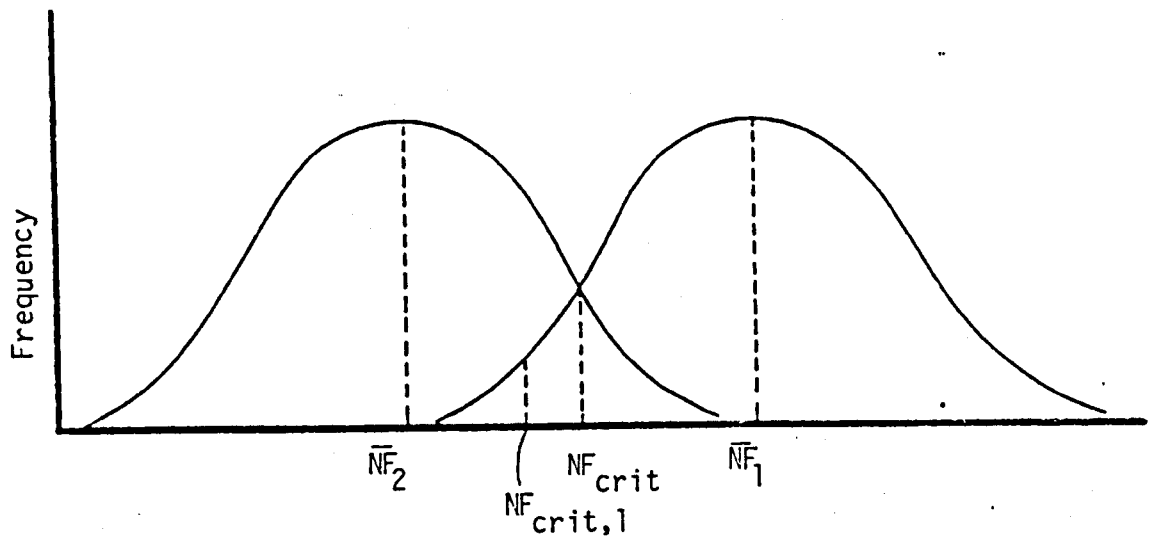
1. Computing the critical values on the important discriminators.
2. Producing a schedule of **critical** net farm income as a function of production area using the MDA model.
3. Producing a schedule of **optimal** net farm income as a function of production area using the LP models.
4. Plotting together the two schedules produced in 2 and 3.

Since the MDA model with the highest predictive accuracy is the model presented in Table 8.15, including just two discriminators, this will be used in the analysis. This also turns out to be the most suitable model for comparison with the LP model output, since its two independent variables (net farm income and production land), are directly comparable with two of the three important parameters in the LP model (the third being credit).

2 Finding the Critical Value on the Most Important Discriminator

Having found that net farm income is the most important discriminator, it is necessary to evaluate the level of net farm income which effectively separates the 'accepted' and 'rejected' groups. This amounts to finding the value, call it NF_{crit} , above which $P_1 > P_2$ and below which $P_2 > P_1$ where P_1 = the probability of being in Group 1 (accepted) and P_2 = the probability of being in Group 2 (rejected).

Figure 8.1 Graphical Definition of Critical Net Farm Income on a Univariate Basis



Note : \bar{NF}_1 = mean net farm income for Group 1 (accepted)

\bar{NF}_2 = mean net farm income for Group 2 (rejected)

NF_{crit} = critical net farm income where $P_1 = P_2$

On a univariate level, the problem is easily expressed graphically (Figure 8.1). Assuming equal variance and equal size for Groups 1 and 2, NF_{crit} lies at the intersection of the two distributions of net farm income :

$$NF_{crit} = \frac{\overline{NF}_1 - \overline{NF}_2}{2} \quad (8.21)$$

where : NF_{crit} = critical net farm income; and
 \overline{NF}_1 and \overline{NF}_2 = mean net farm incomes for Groups 1 and 2 respectively

In the multi-variate space which the discriminant function represents, NF_{crit} can be conveniently found using the classification functions in Table 8.15. In terms of Figure 8.1, this entails considering the distributions of the net farm income variable, weighted by classification coefficients.

A problem arises from the unequal sizes of the 'accepted' and 'rejected' subsamples. It will be seen from Figure 8.1 that in 2 dimensions, if Group 1 is larger than Group 2 (as it is in this analysis), NF_{crit} will move to the left to say, $NF_{crit,1}$, even if $S_1 = S_2$.³⁷ If farmers were classified on a strictly univariate basis, the use of NF_{crit} rather than $NF_{crit,1}$ would misallocate a certain proportion since those coming between NF_{crit} and $NF_{crit,1}$ would in fact have a higher probability of being in Group 1 because of Group 1's larger size. There is a higher prior probability of being in Group 1.

This problem has been dealt with by entering a weighting factor into the discriminant function model which weights according to the relative sizes of Groups 1 and 2. By the addition of this constant, the classification functions take account of the higher prior-probability of an individual

being in Group 1 due to N_1 being larger than N_2 .³⁸

The two classification functions for the model are set out below.

Group 1 (accept) :

$$C_1 = - 3.7143 + 0.1163 \cdot 10^{-3}NF + 0.1005 PA \quad (8.22)$$

Group 2 (reject) :

$$C_2 = - 2.2218 + 0.9749 \cdot 10^{-6}NF + 0.7814 \cdot 10^{-1}PA \quad (8.23)$$

where : C_1 = the classification score for Group 1;

C_2 = the classification score for Group 2;

NF = net farm income (baht); and

PA = production area (rai)

The classification rule is : classify into Group 1 if $C_1 > C_2$ and classify into Group 2 if $C_2 > C_1$. C_{crit} can be defined as the classification score for which an individual has an equal chance of being in Groups 1 and 2, and occurs when $C_1 = C_2$. Hence, an individual is marginal with respect to the two groups when $C_{crit} = C_1 = C_2$. C_{crit} is found, therefore, by equating the two functions. Hence :

$$C_{crit} = -3.7143 + 0.1163 \cdot 10^{-3}NF + 0.1005 PA = 2.2218 + 0.9749 \cdot 10^{-6}NF + 0.7814 \cdot 10^{-1}PA \quad (8.24)$$

To find the critical value of net farm income we have to do two things : (a) find a suitable value for PA to be held constant, and (b) solve equation 8.24 for NF.

It is not immediately obvious which value to use for PA in solving for NF. What in fact is being done in the equation

is to ask the question : above or below what value of net farm income is a farmer likely to be placed in one group rather than the other, assuming he has a certain value on variable PA?

It is proposed that the value to use for PA is the value which on a univariate level does not prejudice an individual toward either group. This is the mid-point between the Group 1 and Group 2 PA means. Strictly speaking, the relative sizes of Groups 1 and 2 should be taken into account, since, as has been noted, a difference in the size of groups effects the univariate critical value. However, the mid point can be used as the best simple estimate of the true critical value of PA.

The following equation solves the equated classification functions for net farm income, assuming a PA value which places a farmer approximately between Groups (PA = 33.67 rai).

$$NF_{crit} = \frac{1.4924 - (0.02231 \ 33.67)}{1.1535 \ 10^{-4}} = 6,425.85 \quad (8.25)$$

It can be concluded that an applicant who is marginal on the basis of his production area faces a critical net farm income of 6,425.85 baht. Below this income, he is more likely to be rejected than accepted.

3 Schedule of Critical Net Farm Income against Production Area (MDA Output)

The figure of 6,425.85 is only one point on a continuum which varies as PA changes. Generalising the equation above to :

$$NF_{crit} = \frac{1.4924 - (0.02231 PA)}{1.1535 \cdot 10^{-4}} \quad (8.26)$$

a schedule of values for NF_{crit} and PA can be derived giving the variation in NF_{crit} as PA changes. Table 8.18 presents the schedule for PA = 10 rai to PA = 40 rai at 2 rai intervals.

Table 8.18 Schedule of Critical Net Farm Income (NF_{crit}) against Production Area (PA)

PA (rai)	NF_{crit} (baht)	PA (rai)	NF_{crit} (baht)
10	11,004	26	7,909
12	10,617	28	7,523
14	10,230	30	7,136
16	9,844	32	6,749
18	9,457	34	6,362
20	9,070	36	5,975
22	8,683	38	5,588
24	8,296	40	5,202

Note : NF_{crit} = critical net farm income from the MDA model presented in Table 8.15

Source : MDA Model Output

4 Schedule of Optimal Net Farm Income against PA (LP Output)

The LP analysis in Chapter 7 indicated that land is a highly productive factor in the model farm's economy. Optimal farm income will therefore increase significantly as production area increases. To produce a schedule of net farm income, the land constraints on the independent farm single-period LP model are varied, increasing the land available for production in steps. Paddy land and upland are kept at constant (survey level) proportions at each step. As production land increases, it is assumed that all other resources remain constant. This is consistent with the survey data for all resources except savings. Buffalo and family labour variables in the survey remain roughly constant over a range of farm areas. Savings show some variation with farm area but it is not a consistent relationship, and savings cannot be said to be related in a systematic way to production area.³⁹

Two schedules of net farm income have been derived; the borrowing limit J in the model's credit constraints (equation 6.77) is set at a very high figure for one, and zero for the other. The former represents a farmer with access to unlimited credit, and the latter represents a typical independent farmer with no source of production credit. Table 8.19 sets out the schedules for a range of PA values from 10 to 40 rai in steps of 2.5 rai.

5 Relationship between Critical Income Schedule and Income-Probability Curves

Figure 8.2 plots a section of the negative-sloping NF_{crit} schedule (from Table 8.18) alongside a section of the two NF schedules (from Table 8.19). The diagram illustrates the effect of BAAC's effective rationing-criteria on farm income for farms with a range of land areas. It can be divided into three sections.

For $PA < a$ (around 15.25 rai), a farmer has a greater probability of being rejected than of being accepted, whether he is, at the time of applying for registration, operating without credit or operating with optimal credit. (Both NF_1 and NF_2 schedules are below the NF_{crit} schedule). For such a farmer, his farm cannot support levels of production necessary to bring him up to NF_{crit} . In terms of BAAC's evaluation, he is not a viable borrower.

For $PA > b$ (around 21.5 rai) a farmer is more likely to be accepted than rejected whether or not he uses credit at the time of applying to register. Operating sub-optimally without credit, net farm income is still sufficient to place him above NF_{crit} . (Both NF_1 and NF_2 schedules are above the NF_{crit} schedule).

For a farmer located in the region where $a < PA < b$, the most likely outcome of the registration decision depends on how much credit he uses at the time of application. Using no credit, a farmer in this region is always more likely to be rejected since his appropriate schedule is NF_2 , and NF_2 is below NF_{crit} between points a and b .

Table 8.19 Schedule of Optimal Net Farm Incomes (NF) against Production Area (PA)

PA (Rai)	NF No Credit (Baht)	NF Unlimited Credit (Baht)
10.0	6,467	6,972
12.5	7,001	8,360
15.0	7,536	9,721
17.5	8,064	11,083
20.0	8,589	12,444
22.5	8,915	13,409
25.0	8,915	14,074
27.5	8,915	14,732
30.0	8,915	15,390
32.5	8,915	16,048
35.0	8,915	16,706
37.5	8,915	17,363
40.0	8,915	18,021

Note : NF = optimal net farm income from LP model

PA = Production Area

Source : LP Model Solutions

The diagram indicates that the more credit being used at the time of application, the more likely it is that a farmer with PA between a and b rai, will be accepted. If he employs sufficient credit to place NF above NF_{crit} , the likelihood of acceptance is greater than 0.5.

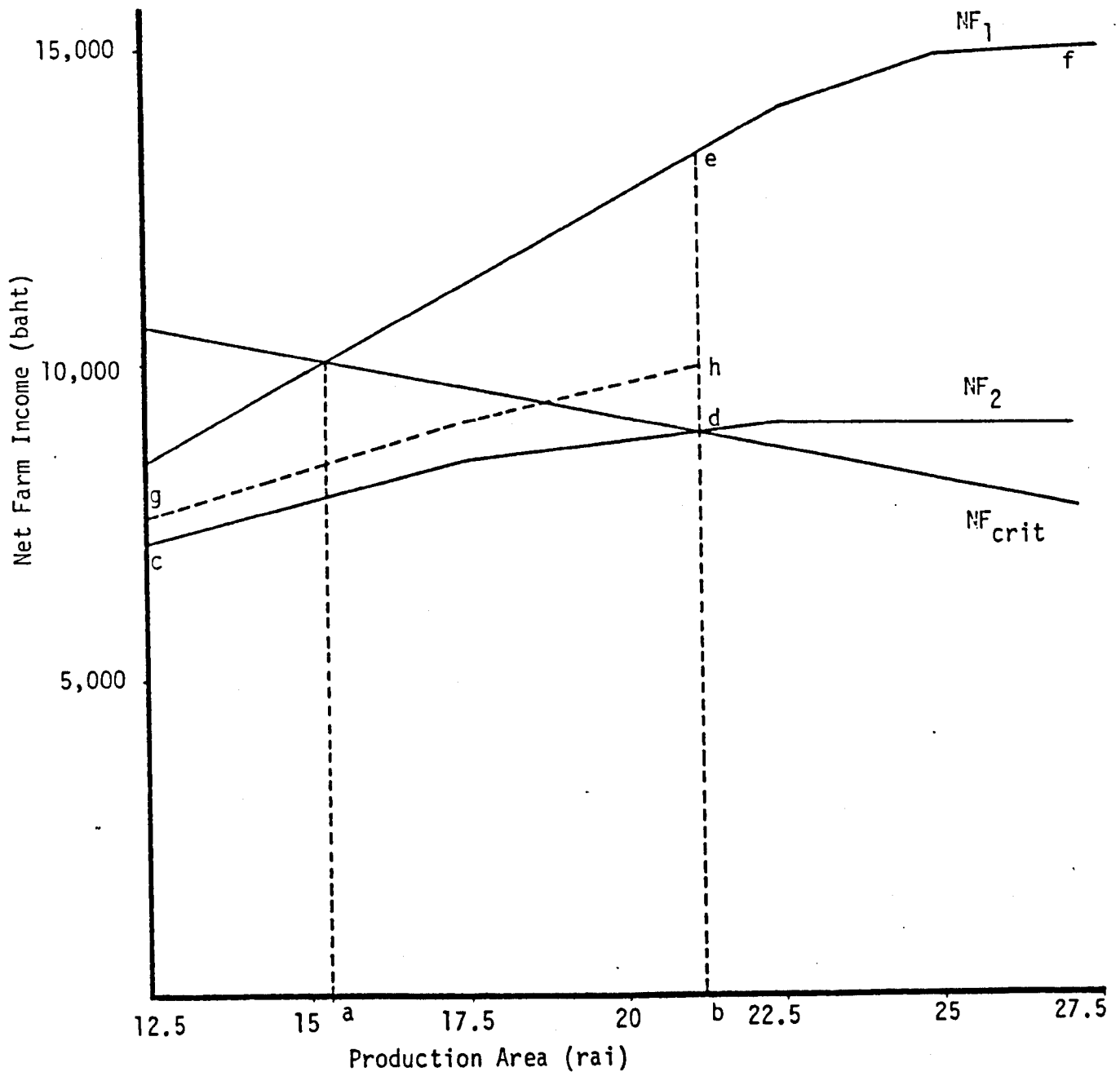
This might seem to imply that the probability of acceptance is related to normal loan size at the time of application. This assertion is, in fact, supported by the MDA model presented in Table 8.10. 'Normal loan size' was included as a significant discriminator. However, it was not of great importance compared with 'net farm income' and 'diligence' (see Table 8.10) and it did not appear at all in the model in Table 8.15.

There are two reasons why 'normal loan size' should either not appear in the MDA model or appear only as a relatively less important discriminator; (a) a majority of independent farmers do not usually use a production loan (out of Survey 1's independent farmers, 87% did not borrow for production). This would mean that most farmers with PA between a and b rai have a NF value below NF_{crit} , and the relationship between normal loan value reported at the time of application and probability of acceptance breaks down; (b) if the relationship were to hold for farms with PA between a and b rai, but not for the rest of the PA range (as suggested by the diagram), then even if it was strongly observed for the limited range, it might only be weakly observed over the complete range.

Summarising the effect of NF_{crit} on the income-earning potential of a typical independent Korat farmer, a line can be drawn along NF_2 in Figure 8.2 until the point where NF_2 intersects with NF_{crit} , at which point income schedule NF_1 becomes attainable. BAAC's effective rationing-criteria, represented by the MDA model, therefore, give rise to the

Figure 8.2 The Effect on Income-Earning Potential of the 'Rationing-Out' Decision

Note : NF_1 = optimal income possibility curve for an independent farmer with access to unlimited credit
 NF_2 = optimal income possibility curve for a typical independent farmer with no access to credit
 NF_{crit} = critical net farm income curve. Farmers with net farm incomes below this curve have a greater probability of being rejected than accepted as BAAC clients



Source : LP Model Solutions and MDA Model Output

locus of optimal income possibilities $cdef$ (Figure 8.2). This holds for farmers who employ no credit at the time of application. For farmers who employ some, but not optimal amounts of credit at the time of application, their discontinuous schedule will be more like $ghef$.

For production areas up to 21.5 rai, income possibility is given by cd while for PA's over 21.5 rai, with access to BAAC credit, income possibility is given by ef . Figure 8.2 should be interpreted in probabilistic terms; the discontinuity de separates the function ef (which is more likely to be faced by farms with a production area greater than b rai), from the function cd (which is more likely to be faced by farms with less than b rai).

The diagram enables something to be said about the equity of making a decision to accept or reject an applicant on the basis of his existing income, when an effective credit shortage prevails in the non-institutional credit market.

If it is effectively the size of farm enterprise measured by net farm income which makes a farmer an acceptable or unacceptable client, then farmers in the region between $PA = a$ and $PA = b$, are potentially acceptable. They would become acceptable if, in fact, they were permitted to register as clients for they could then borrow as much as can be used and move to NF_1 from NF_2 so that $NF > NF_{crit}$.

This suggests that there is a marginal group of farmers who would become acceptable clients if their predicted, rather than present, income were to be considered. If present farm

income is constrained by the lack of quick, reliable and suitably priced production credit sources, then it seems unsatisfactory to evaluate a farmer's suitability on the basis of present farm income. It is unsatisfactory both from the lender's and borrower's point of view; the bank loses interest revenue from farmers who would have become acceptable once they had started borrowing, and the farmer remains constrained to a sub-optimal level of production by lack of capital. In the case of registered clients applying for an annual loan, it is the post-investment revenue that is taken into account in judging the acceptable size of loan to be made. Fewer small farmers would be excluded from BAAC credit if registration-applications of marginal farmers (as defined above) were similarly evaluated on the basis of post-investment, estimated revenues.

F Conclusion

A number of statements can be made which draw together the results of the analysis in this chapter.

Through investigating the ways in which BAAC rations its credit, Section A concluded that if there is any supply-side rationing it must be at the stage at which farmers apply to become bank clients. There is little evidence of rationing to clients and rationing, therefore, takes the form of rationing farmers out of the portfolio.

Sections B, C and D examined this process using multiple-discriminant function models. Section B identified the effective

criteria used in the Korat branch of BAAC to select eligible farmers at the registration stage. Out of twenty variables representing the information available to a bank officer at the time of making a decision (Table 8.4), four are selected by the best-fit MDA model. The four variables and their respective weights (Table 8.10) represent the best estimate of the way in which the rationing-out decision is effectively made. Net-farm income turns out to be the single most important variable rather than the expected marketable surplus variable. Diligence, normal loan value and assets are the other three in that order of importance.

In order to examine the consequences of the rationing-out decision for Korat farmers, Section C constructed another MDA model using only income, expense and land variables and used it to classify into 'accepted' or 'rejected', the independent farmers in Survey 1 who wished to register with BAAC. On the basis of this classification, it was estimated that there are 45,598 farmers in Korat who would like to become BAAC clients but who are ineligible under present decision-making criteria. This number represents roughly 80% of all those independent farmers in Korat who wish to register with BAAC. The size of the rationing-out problem is very large and it can be concluded that of the independent farmers who do wish to participate in the institutional credit market, most would be prevented from doing so if they were to try, by supply-side rationing practices.

On the other hand, there is still a large absolute number of independent farmers who would be eligible if they applied (Table

8.17b). This shows the importance of the lack of opportunity as a factor preventing farmers from borrowing from institutions.

Having shown that most independent farmers are effectively excluded from BAAC subsidised credit facilities, Section D goes on to evaluate the consequence of this exclusion with respect to the income-earning potential of a representative independent farm. It is found that farmers in the sub-sample of Survey 2 upon which the MDA model was calibrated face a critical net-farm income value of 6,425.85 baht. Below this, a farmer is more likely to be rejected than accepted. The critical income value varies with the size of the farm's production area, giving rise to a critical income schedule. Assuming independent farmers face a shortage of funds to borrow and BAAC clients can borrow all they need, the result is a discontinuous income-possibility curve with farmers below the critical income schedule facing a lower curve than farmers above. There is a category of farmers who can be considered marginal; they would become 'eligible' for client status if they had access to more credit, but they are being denied the access to that credit.

Chapter 8 : Notes and References

1. This is true 'in general', not in every case, because the analysis which looks at the match of credit demand and supply, uses representative levels of demand. The very large BAAC clients may well be constrained by the imposed loan ceilings. It is likely, however, that they are also in a better position than the average client to obtain extra funds elsewhere, being economically and politically more powerful.
2. An 'unlimited' credit supply means that a farmer can, in general, borrow as much as his farm will absorb. He obviously will not be permitted to borrow more than the cost of farm inputs in his annual production plan.
3. BAAC, 1982, Regulation 25, BAAC, Bangkok, English Translation (Article 20, p.10)
4. Ibid (Article 16, p.8)
5. Ibid (Article 23, p.12)
6. BAAC, 1982, Regulation 7, BAAC, Bangkok, English Translation (Article 17, p.8)
7. See for example, BAAC, 1982, Cost of Production Survey 1982, BAAC, Bangkok. This survey enumerated standardised costs of production per rai for major crops in each of the districts where BAAC operates
8. Ladman, J., 1974, op.cit.
9. In 1978, only 730 rai were planted to sugar-cane in Korat province out of the 2,090,614 rai reported as being under field crops or vegetables in the 1978 Agricultural Census. NSO, 1978, op.cit., NSO, Bangkok
10. Surveyed paddy farmers in Korat province marketed an average of 15% of their total paddy production.
11. This may not be true in other provinces. For example, Lightfoot found in the North-Eastern province of Khon Kaen, that it was common for clients to receive only a proportion of the loan they had applied for (Lightfoot, R.P., 1984, Personal Communication). This, however, seemed to be due to the practice of the Khon Kaen branch of imposing arbitrary ceilings below the regulated 30,000 baht. In Korat, there appears to be no such practice.
12. BAAC, Regulation 7, BAAC, Bangkok (Article 4, pp.2-4)
13. This assertion is, as yet, unresearched.
14. BAAC, Loan Form No.89(2), BAAC, Bangkok

15. See for example, Altman, E.I., Schlosser, M., Margaine, M., and Vernimmen, P., 1974, Financial and Statistical Analysis for Commercial Loan Evaluation: A French Experience, in **Journal of Financial and Quantitative Analysis**, Vol. No. (pp.195-214); and Clemente, Jr., D.A., 1980, Prediction of Agricultural Loan Repayment Performance, in **Philippine Review of Economics and Business**, Vol.17, Nos.1 and 2 (pp.31-60)
16. For an introductory discussion of the basic linear discriminant function model, see for example :
King, L.J., 1969, **Statistical Analysis in Geography**, Prentice-Hall, New York (Chapter 8);
Maher, P.M., 1976, **Computational Methods of Multivariate Analysis in Physical Geography**, Wiley, London. For a more comprehensive discussion, see Cooley, W.W. and Lohnes, P.R., 1962, **Multivariate Procedures for the Behavioural Sciences**, Wiley, London (Chapter 6); and Tatsuoka, M.M., 1971, **Multivariate Analysis**, Wiley, London (Chapters 6 and 8)
17. Morrison, D.G., Discriminant Analysis, in Ferber, R., 1974 (Ed.), **Handbook of Marketing Research**, McGraw-Hill, London (Chapter 8)
18. See for example, the two MDA studies already referred to :
Altman, E.I., et.al., 1974, *op.cit.*; and Clemente, Jr., D.A., 1980, *op.cit.*
19. The only income-related reason for non-eligibility in BAAC Regulation 7, is point No.6 on Page 363 of this chapter, which states that an eligible farmer must have an annual marketable surplus of sufficient value. The decision-making credit officers write down Regulation 4(6) as the reason for rejection, whatever the real income-related basis of their evaluation (total net income, net farm income etc.,)
20. Morrison, D.G., 1974, *op.cit.*
21. Frank, R.E., Massy, W.F., and Morrison, D.G., 1965, Bias in Multiple Discriminant Analysis, in **Journal of Marketing Research**, Vol.2, Aug. (pp.250-259)
22. Only one half of the randomly split sample is used for calibration.
23. Net Farm Income = Gross value of all types of farm production (either actual marketed value or imputed value of production not sold), minus all farm expenses (variable costs only)
24. Marketable Surplus = value of that part of a farmer's production which is sold (rather than consumed or kept for seed)
25. Diligence, as assessed by a credit officer at the time of application for registration, refers to a farmer's industriousness in his farm activity
26. Morrison, D.G., 1974, *op.cit*

27. Cooley, W.W., and Lohnes, P.R., 1962, *op.cit.* (p.279)
28. Morrison, D.G., 1974, *op.cit.*
29. For a discussion of Type 1 and Type II errors, see Blalock, H.M., 1972, *op.cit.* (Chapter 10)
30. This assumes, of course, the actual classification is a correct one (correct from a commercial-decision point of view). Type I and II errors measure the Model's deviation from this 'correct' classification. The question of how just, consistent or reasonable the actual 'correct' classifications are, is not the issue here; that issue is touched upon in Section E of this chapter.
31. This happens because the process of searching for the best model in MDA, is an incremental one and there is no rule for selecting the best out of the very large number of alternative combinations of discriminators. It is possible only to set rules for searching systematically through a given list of variables to optimise the discriminant function according to chosen criteria. Each different combination of discriminators will have a different predictive accuracy, which is not known until the model has been constructed. It is not possible to optimise the function using the criterion of maximum predictive accuracy, since that is a measure which is external, not internal, to the model.
32. April 1981 to March 1982
33. Population figures for total numbers of applicants and rejected applicants in Korat during the survey period come from BAAC, Korat branch records
34. Confidence intervals are estimated using normal tables because N's are large. For a discussion of the construction of confidence intervals around proportions, see Blalock, H.M., 1972, *op.cit.* (Chapter 12)
35. NSO, 1978, *op.cit.*; and NSO, 1963, **Agricultural Census of Thailand 1963**, NSO, Bangkok
36. BAAC records, 1983
37. S_1 and S_2 are the sample standard deviations for Groups 1 and 2, respectively
38. A discussion of this procedure is found in Cooley, W.W., and Lohnes, P.R., 1971, **Multivariate Data Analysis**, Wiley, New York (Chapter 10)
39. Thus, for example, borrowing independent farmers had both a larger average production area and a lower level of savings than non-borrowing independent farmers, while BAAC farmers had higher levels of both production area and savings than independent farmers as a whole.

CHAPTER 9 :

CONCLUSION

We started off in the first chapter by introducing the theme of rural credit in the context of a general discussion about trends in development planning in LDCs. The notions of 'bi-modal' and 'uni-modal' development strategies were introduced and it was suggested that there is a tendency for policies and programmes of a bi-modal nature to persist. The rest of the thesis followed through this theme with respect to the performance of rural credit programmes, specifically examining why it is that small farmers tend not to participate in programmes often nominally designed to serve them.

A number of possible explanations for large farmer bias in credit programmes were identified. Considering demand-side (borrower) behaviour, it was hypothesised that small farmers do not tend to use institutional credit

- (a) because of a low demand associated with a lack of suitable investment opportunities and/or a sufficiency of existing finance;
- (b) because they consider that becoming an institutional client may jeopardise their vital supply of consumption credit; and
- (d) because the perceived total costs of borrowing are too high.

Considering supply-side behaviour, the hypothesised explanations relate to

- (a) the high unit cost of disbursing a given amount of funds in small packages;
- (b) the greater risk of lending to small farmers; and
- (c) discrimination against small farmers by those who directly or

indirectly control access to institutional credit such as local village elites.

Before investigating those hypotheses in the context of the case study of Thai farmers, the client profile of the North-Eastern branches of BAAC was examined. This tells us the degree to which large farmer bias is a feature of Thailand's major rural credit agency. Using data pertaining to the number of farmers in certain farm-size categories from both a survey of BAAC clients and the agricultural census, probabilities of being a BAAC client were computed for each category. The results led to the conclusion that small farmers are significantly under-represented among BAAC clients; the probability of being a BAAC client is significantly lower for smaller farmers. Of the farmers in the modal size-category of the North-East (10-20 rai), only 8.2% ($\pm 0.7\%$) are BAAC clients. By comparison, the larger farmers in the region are well served, 45.1% ($\pm 3.7\%$) of farmers with holdings of between 50-80 rai are clients.

To begin to understand the reasons behind this pattern and to be able to explore some of its consequences, short-term credit demand was estimated for a series of representative farms by developing a set of linear programming models. A representative independent farm¹ was found to have a high demand for annual production credit, with a shadow price of credit of 2.62 baht/baht. Credit scarcity on the small independent farm in the survey area is such that an additional unit of borrowed capital will produce a 262% net return. By comparison, a representative BAAC farm had a shadow price of credit of zero. While for the independent farm a comparison of optimal and survey level borrowing indicated a credit shortage, for the BAAC farm, the same comparison indicated that BAAC farmers substitute credit for

savings. These results show that in general, independent farms have the capacity to absorb a substantial increase in working capital before reaching an optimum level of production.

It would be quite normal in a programming study of this nature to assume that the models adequately represent reality and to assume therefore that these results can be interpreted positively rather than normatively. A positive interpretation of the high shadow prices implies a credit supply shortage. An attempt is made however to justify making such an interpretation. Questionnaire responses were examined which give an indication of the degree to which independent farmers express a demand for institutional credit. The results of this analysis support a positive interpretation of the LP results. Out of 217 independent farmers, 170 or 78% wished to register with a credit institution. Of those 170, 92% named as the most important reason for wishing to register, responses related to problems with their existing supply of non-institutional credit. Since a substantial majority of independent farmers appear to face problems of credit supply and wish to have an alternative (institutional) source, the survey borrowing levels may be taken as representing effective supply constraints and the models' demand estimates can be interpreted positively. In general, independent farmers can absorb additional credit on the farm and wish to gain access to a more ready supply of credit from an institution.

From this evidence, it seems unlikely that a lack of investment opportunity or a sufficiency of funds can explain why small farmers do not participate in the institutional credit market.

When subjected to a crude test, the two other hypotheses relating to

demand-side behaviour were both rejected. There was no significant difference between the sub-sample who wished to register with an institution and the sub-sample who did not, with respect to the proportion of farmers who recognised that institutional credit involves significant costs additional to interest. There is no evidence from this test therefore to support the assertion that there is an association between perceived total costs of borrowing from an institution and lack of desire to borrow from an institutional source.

Similarly a test of the difference between the two sub-groups with respect to the proportion considering that institutional borrowing would risk the loss of normal consumption credit supplies, gave no evidence for the third demand-side hypothesis. There was in fact, contrary to the hypothesis, a significant positive association between a recognition of this risk and a desire to borrow.

Having failed to support any of the borrower-behaviour explanations for the small farmers' tendency not to use institutional credit, the analysis focused on the behaviour of the BAAC in rationing its credit. A number of procedures were identified by which a lender may ration funds to its clients. These were maximum loan ceilings; a limit restricting loan size to a certain percentage of marketable surplus; the restriction of loans to sanctioned crops only; and the use of standard credit quotas in evaluating a loan proposal. Crop sanctioning and credit quotas are unimportant methods of rationing in the survey area's BAAC branch. The effectiveness of the other two measures was tested by setting the capital constraint in the LP model to the limits implied by each rationing device. It was found that neither the loan ceiling nor the legal limit represented an effective

constraint on production for the model BAAC farm; the borrowing limit in both cases was higher than the model farm's optimal credit requirement. This leads to the conclusion that in the survey area there is, in general, no effective rationing of short-term credit to BAAC clients; once a client, a farmer may effectively borrow as much for annual production as he can prove can be profitably invested. If credit is rationed at all therefore, it must be through the use of restrictive eligibility criteria in the process of client selection.

An indication of the importance of this type of rationing is gained by examining the numbers of rejected registration applicants in four BAAC branches. An average of approximately 18% of all applicants were rejected. This tells us something about the consequences of restrictive eligibility only for those farmers who actually applied for registration. An analysis of the eligibility criteria used, however, permits us to go further than this and examine the consequences for all small farmers whether or not they have applied.

By running a series of multiple discriminant analysis models, an attempt was made to predict the registration decision (accept/reject) on the basis of selected farmer-profile variables. A significant discriminant function was produced which also had a high goodness-of-fit statistic when validated against a second sample. The significant discriminating variables were found to be net farm income (farm income net farm expenses), an indicator of the farmer's diligence, normal loan value and assets. Net farm income was by far the most important variable, explaining 82% of the ^{explained} variance in the group variable (rejected/accepted). This is a significant finding since the BAAC regulations suggest that marketable surplus should be the most important discriminating farm income variable. The effective use of

net farm income rather than marketable surplus is in fact a progressive move, since it means that farmers are evaluated on the basis of what they could possibly market rather than their normal marketable surplus (which may be constrained, among other things, by a lack of working capital due to credit shortage).

As expected, therefore, small farmers are systematically rationed out of the BAAC's portfolio on the basis of the size of their farm activity. Farmers with insufficient net farm income tend to be rejected if they apply to register as clients.

Having identified the most important discriminating variable it is of interest to estimate the critical value of that variable below which farmers tend to be rejected. This problem has been approached in two ways. First, it is possible, without deriving a precise income figure, to get an indication of the level of critical income relative to the general income level among independent farmers. This has been achieved by using a discriminant function, calibrated on the survey of rejected/accepted applicants (Survey 2) to classify those farmers from Survey 1 who are independent and wish to register with BAAC. The classification exercise leads to the conclusion that under existing decision criteria, 89% of these independent farmers from Survey 1 would be rejected should they apply to become clients.

To emphasise the size of the rationing out problem, the population number of independent farmers wishing to register who are ineligible is estimated for the poverty districts of Korat province. From the estimation exercise, it is concluded that there are approximately 45,598 small farmers who are effectively excluded from BAAC credit; they wish to become clients of a credit institution but are judged

ineligible by virtue of the size of their farming operation. This evidence supports the assertion that small farmers tend not to participate in rural credit programmes because of the behaviour of lender institutions.

The second method of examining the critical net farm income level is to derive a precise figure through solving the classification functions for the critical income variable. The result is a critical net farm income value of 6,426 baht. Assuming a marginal production-area (one which will not prejudice a farmer towards either rejection or acceptance), farmers with an income below this figure have a greater probability of being rejected than accepted. The classification exercise shows that this effectively excludes a substantial majority of farmers in the survey area who are not yet BAAC clients.

Having concluded that the lender's rationing behaviour is more important than borrower behaviour in keeping small farmers out of the BAAC portfolio, it is of considerable interest to measure the regressive consequences of rationing with respect to the income of the small farmer. Farm income lost as a result of credit supply shortage was measured for a series of independent farm models over a single production year. Right hand side values on the credit constraint were varied to achieve these measurements and linear demand curves drawn to illustrate them graphically. The basic model independent farm was found to forfeit a total of 1,597 baht through operating outside of the BAAC. This equals the difference between the optimal income reached with an unlimited institutional credit supply and optimal income reached with a limited non-institutional credit supply. The

total is composed of 1,563 baht forfeited because of the limited volume of credit available on the non-institutional market and 34 baht forfeited because of the higher non-institutional interest rate. For the small-scale farmer, the potential benefits of a lower interest rate in the institutional market are small compared to the potential benefits of an expanded supply of credit.

Rationing small farmers out of the lending institution's portfolio has regressive consequences not only for annual production and income, but also for the growth of the farm. By modelling farm growth over 5 years using a multi-period LP model, it was found that in the years when product prices were inflating, a modest restriction in credit availability significantly reduced the growth rate (measured by the change in net income over two successive years). Between the years 1978/79 and 1979/80, with unlimited credit available, the model farm borrowed 1,200 baht annually and experienced a growth in net farm income of 46 per cent. With no credit available the growth rate was only 7 per cent. A small farmer excluded from BAAC credit is therefore doubly disadvantaged; his income earning potential in any given year is constrained and the growth rate he is able to sustain compares unfavourably with the borrowing farmer. One result of this is a widening income differential between those with and those without access to institutional credit.

The income disadvantage faced by the independent farm has been presented in another way. With only a limited amount of land resources, capital becomes an important compensatory factor. By employing 1,313 baht of credit for example, a 14 rai holding can produce the same income as a 24 rai holding employing 103 baht of credit. Without access to institutional credit, a farmer is denied

the opportunity to compensate for his small holding by raising land productivity through intensification.

There is one other way in which the income disadvantage of the independent farmer has been presented, and this permits some statements to be made about possible adjustments to BAAC's eligibility criteria. Two optimal income possibility schedules were plotted, showing net farm income against production area; one for a farm with limited credit availability and the other for a farm with an unlimited credit-supply. Alongside these was plotted a schedule of critical net farm income, showing the income level below which a farmer is more likely to be rejected than accepted as a BAAC client. The critical income changes with size of farm holding (production area). It is apparent from this figure that farms with a production area of between 15.25 and 21.5 rai are ineligible if they use little or no credit, but would become eligible if they could borrow more. This suggests that a marginal group of farmers exists who would become eligible if their predicted rather than present income were considered when evaluating their credit worthiness. A significant proportion of the 45,598 independent farmers desiring institutional credit but who are ineligible, could become eligible if indeed they had access to sufficient capital. It has been suggested that most independent farmers face credit supply problems in the non-institutional market. If this is the case, then it should not be supposed that the sub-optimal incomes associated with the low level of borrowing of this marginal group are satisfactory to the farmers themselves. There is every reason to believe that if institutional credit were made available to them, they would borrow up to the optimum and thereby achieve an income which makes them acceptable risks.

The forgoing discussion summarises the most important results of the analyses with respect to the research objectives set out at the end of the first chapter. The primary objective stated there was to identify why small farmers tend not to participate in institutional credit programmes. For the case study area the evidence suggests that there are two important reasons. A lack of demand, it appears, is not one of them. The first important reason, as we have seen, is the restrictive eligibility criteria operated by the BAAC. Only a fraction of the small farmers in the survey area would in fact be eligible if they were to apply to become clients. There is evidence of an additional barrier however. While the proportion of Survey One's independent farmers wishing to register and classified as eligible was only 11.3%, the proportion of actual applicants who were accepted averaged at approximately 82% in the four provinces for which population statistics were reported. This suggests that the group of farmers who actually applied for registration have substantially different characteristics to the independent farmers surveyed. Put another way, small farmers are not only underrepresented among BAAC clients, but also among the group of farmers who apply for registration. There must be reasons why small farmers tend not to apply for registration even though most of them express a desire to register when asked. An explanation is suggested by the responses to the question put to independent farmers asking why they had not registered with BAAC so far. Out of the 170 independent farmers wishing to register, 105 (62%) gave as the most important reason, their uncertainty about the procedure or the lack of any invitation to register. A further 8.2% said that it was because of the difficulty they face in dealing with officials. A problem of communication

obviously exists. A substantial group of farmers seems to be bypassed by the bank, not even having the opportunity to apply to become clients. This helps explain why there are an estimated 10,782 independent farmers in Korat's poverty districts who both wish to become clients and are eligible. For this group, their failure to borrow from BAAC can be due only to a lack of opportunity.

There are two important possible explanations behind this pattern which have been referred to briefly in earlier discussion. First, the lack of opportunity to register may be due to a lack of promotion of bank facilities among small farmers and a failure to extend to them the invitation to apply for client status. Second, it may be that the barrier lies not just with a lack of promotion but with the action of locally powerful villagers in restricting the small farmer's opportunity to apply for registration.² There is reason to believe that both may be of some importance. Of significance here is the way in which the invitation to apply for registration is extended to Thai farmers. The BAAC have an active programme of promotion; reaching new villages through visits of bank officers and reaching a mass audience through broadcast on local radio for example. The bank follows a policy of expanding both the size of its clientele and its geographical coverage of the Kingdom's rural areas. The recent rates of growth in the number of clients and the number of new offices witnesses to the success of the bank's efforts in this direction. The coverage of the bank's publicity is not complete however and we cannot therefore rule out inadequate promotion as a barrier to small farmer registration. At the level of the individual farmer however it is not so much the bank's own promotional efforts that are important but the actions of existing clients, especially the leaders of client groups

(joint-liability groups). Since the bank cannot approach individual farmers to solicit applications, the most common method of expanding into a new village is to identify a suitable candidate for group leadership, frequently the headman, and to leave him to select the farmers who will join his group.³ Similarly with expansion of existing groups, there is every possibility for the exercise of discrimination since new members have to be acceptable to a majority of existing members. This rule is likely to work against a small farmer's attempt to join an existing group. One may suppose that an existing group of more prosperous farmers will not be favourably disposed towards entering into a joint-liability contract with a farmer whose business is less secure than their own. In a survey of BAAC clients in a North-Eastern province, Lightfoot⁴ found that one client group leader insisted that all members of his group should be land owners. This was a group, not a BAAC, policy and although it stands against the spirit of joint-liability groups, there is nothing to prevent leaders or groups using their own explicit or implicit eligibility criteria in this way.

There is little more that can be said about this issue without further research. The research in this thesis permits a summary conclusion to be drawn along the following lines. Independent farmers in the survey area display a positive demand for additional short-term production credit, measured both by a high marginal value product for credit and a high proportion of farmers expressing a desire to register with a credit institution. This demand remains unmet however, because of restrictive practices of those effectively in control of the supply of institutional credit. This happens at two stages. First, there is a lack of opportunity for the independent farmer to apply for

registration. It has been suggested that this might be due as much to the discriminating activity of existing clients as to a lack of promotional effort by the bank itself. Second, and in some respects more critically, when a farmer does apply for registration his suitability is evaluated in such a way that a large majority of independent farmers in the survey area would be rejected. This suggests two areas in which policy recommendations can be made and two areas for further research.

Policy Recommendations

(a) The BAAC should consider ways in which it can maximise the opportunity for small farmers to apply to become clients. This will involve maintaining and extending its current efforts to promote its services among the rural masses. It should also seek to develop means of minimising the opportunity for existing groups or leaders of new groups to discriminate against small farmers. This may take the form of establishing regulations concerning the criteria to be used by groups in selecting new members; of monitoring that selection procedure; or of more direct participation by bank staff in the formation of groups.

A recent paper produced by the BAAC⁵ outlined an experimental programme which introduces both a more intensive form of publicity and a more direct control over group membership. It proposed that a sample of existing joint-liability groups be required to incorporate a small number of farmers who in normal circumstances may not be considered eligible. The success of the small farmer's investments and repayments would be carefully monitored. The result of the experiment should give an indication of the feasibility of a policy which aims to achieve

by regulation, a more balanced and equitable composition of client groups.

- (b) There is little point in encouraging small farmers to apply for registration and encouraging existing client groups to accept them if they face a high probability of being refused client status on the basis of the scale of their farming activity. The BAAC should therefore consider ways in which it can adjust the effective criteria by which it evaluates the suitability of prospective clients. The most obvious approach is to lower the critical net farm income level above which farmers are considered to be viable clients. This is problematic in that a bank officer's decision to reject an applicant on the basis of income, is not made by a simple comparison of the farmer's income with a single pre-determined figure. The critical income referred to in the analysis is a probabilistic figure; farmers are more likely to be rejected if they fall below it. It would therefore be difficult to design a policy to effect the reduction in the critical income level by a desired increment. However, as with the experimental programme referred to above, it is feasible to instruct bank branches more generally to give client status to farmers who would normally be considered too small.

A second approach is to consider how applicants could be evaluated on the basis of post-investment farm income (potential income) rather than normal farm income. To make this adjustment would not necessarily mean a lowering of the critical net farm income level. It would simply mean a recognition of the fact that normal farm incomes are frequently constrained by the lack

of working capital and that many small farmers may achieve 'satisfactory' incomes once they have access to BAAC credit.

A third type of adjustment of the evaluation criteria would involve a move from the current emphasis on net-farm income to an emphasis on repayment potential. Lightfoot and Fox⁶ have demonstrated that there is no significant positive relationship between loan repayment performance and farm size. If this is so, the case for making an a priori judgement on the basis of size of farm income is weakened; the default cost component in the lending cost function will not necessarily increase with an expansion in loans to small farmers. An approach that has been used elsewhere is to assess a farmer's likely loan repayment performance on the basis of a probability function which takes into consideration a series of profile variables. The decision to accept or reject an applicant farmer would then be related to his probable repayment rating.

Further Research.

These policy proposals call for further research in two particular areas :

- (a) Since one of the conditions of registration with BAAC is that farmers should be accepted into membership of a joint-liability group, the process by which farmer groups are formed is of great interest. To the author's knowledge there has been no systematic research into the dynamics of these groups in Thailand. Questions which need investigating are, for example : how did existing clients join their client group; do groups actively seek to expand their membership and, if so, how do they do this; how

common is it for independent farmers to have, at some time, sought the acceptance of a group as a preliminary to making a formal application for BAAC registration; and to what degree are client groups characterised by relationships other than the contractual relationship formally created by the group? Answers to questions such as these requiring research of a social-anthropological nature, would take the research of this thesis a step further. Here we have investigated in some detail the activity of the lender in excluding small farmers from the institutional credit for which they have a demand; an investigation into the dynamics of joint liability groups would in the same way expand our understanding of the way in which small farmers are prevented from applying for registration in the first place.

- (b) There is a need for research into alternative methods of evaluating the credit-worthiness of prospective clients. A research proposal which proceeds logically from the findings of this thesis is summarised in the following paragraphs.

In order to be able to predict repayment performance on the basis of information submitted by a farmer when applying for registration, a probability function such as that produced by MDA, logit or probit analysis, would be calibrated on a sample of clients with known repayment performance. Repayment performance would become the ordinal dependent variable, predicted by a series of independent profile variables. On the basis of such a model, a farmer applying for registration would be given a probable repayment performance rating. It is likely that the group of farmers accepted as clients using this method would be

different from the group accepted under existing evaluation criteria. To evaluate the success of this method of client selection, it would be compared, in an experiment, with the existing method on the basis of certain performance indicators. One obvious indicator is actual repayment-performance. A random controlled test could be designed, in which the two evaluation methods are applied to two samples of applicant farmers. The test statistic would be the proportion of each sample defaulting and could be measured for the two groups at the first due date, in the March following the initiation of the experiment. The research hypothesis being tested would be $H_1 : P_{inc} = P_{rep}$, where P_{inc} and P_{rep} are the proportions of defaulters respectively in the group evaluated by the existing (net farm income) method and in the group evaluated by predicted repayment performance. Failure to reject the hypothesis would mean that the new method, which potentially allows more small farmers to become clients, results in no significant increase in lending cost in terms of defaulted loans. An experimental research design of this nature would go some way to solving the major policy problem identified in this thesis; the situation in which capital short, small-scale farmers have a proven demand for additional credit with which to expand the scale of production but are denied access to the subsidised credit of the government's rural credit programme by the programme's restrictive eligibility criteria.

Chapter 9 : Notes and References

1. As defined earlier in the thesis, an independent farm is a farm which operates outside of the institutional credit market. Most independent farmers are also small-scale farmers and the sample of independent farmers used in the analysis can therefore also be considered a sample of small farmers.
2. This hypothesis was listed in Chapter 3 as one of the supply-side explanations for the lack of participation of small farmers in the institutional credit market.
3. As explained in Chapter 8, BAAC clients have to be members of a joint-liability group. This means that a prospective client has to gain acceptance with an existing group or form, with others, a new group before being allowed to register.
4. Lightfoot, R.P., 1984, personal communication
5. BAAC, 1982, Credit for Subsistence Farmers in the Poverty Areas of the North and North-East, BAAC, Bangkok
6. Lightfoot, R.P., and Fox, J., 1983, *op.cit.*

APPENDIX 1: Schedules and Questionnaire for Survey 1

Identification

Name Questionnaire Number
 House Number BAAC Registration Number
 Village Number Cooperative Registration No.
 Tambon Farmer Assoc. Registration No.
 Amphur Commercial Bank memberY/N
 Province Independent FarmerY/N

1 Details of persons normally living in household between
 April 1981 and March 1982

No.	Name	Age	Sex	Main Occupation	Working on Farm		
					Regular	Sometimes	Never
1							
2							
3							
4							
5							
6							
7							
8							

Education of household-head

Number of persons under ten years of age

3 Agricultural inputs: paddy production (crop year April 1981-March 1982)

A Nursery preparation and planting
A.1 Labour

Persons	Month				Month				Month				
	10 days	10 days	10 days	10 days	10 days	10 days	10 days	10 days	10 days	10 days	10 days	10 days	TOTAL
1													
2													
3													
4													
5													

GRAND TOTAL

(Enter number of man-days in boxes)

Wage (baht/day)
 Total wage expense (baht)
 Total man-days (man-days)
 Total hired man-days (man-days)
 * Adult family labour = 1; child family labour = 2; exchange labour = 3; hired labour = 4

A.2 Traction Buffalo

Month			Month			Month		
10 days	10 days	10 days	10 days	10 days	10 days	10 days	10 days	10 days

All buffalo days

Number of owned
Buffalo used

Number of hired
Buffalo used

Area ploughed (rai)
 Total buffalo-days (buffalo-days)
 Total hired buffalo-days (buffalo-days)

Tractor

		7 days													
		24 hrs	24 hrs	24 hrs	24 hrs	24 hrs	24 hrs								TOTAL
owned															
hired															

GRAND TOTAL

Type of Tractor*

Area ploughed (tractor-hours)

Total hired tractor-hours (tractor-hours)

* owned big tractor (> 60 h.p.) = 1

owned small tractor (< 60 h.p.) = 2

hired big tractor = 3

hired small tractor = 4

owned walking tractor = 5

hired walking tractor = 6

other = 7

Summary

Type of traction	Rate of hire	Total cost of hired traction	Total traction days/ hours	Total fuel expenses (baht)	Total hired traction days/hours
Buffalo (baht/day) (baht) (buff-days)	 (buff-days)
Tractor (baht/rai) (baht) (trac-hours) (baht) (trac-hours)

A.3 Seed used

Item	Glutinous		Non-glutinous	
	Traditional	New	Traditional	New
Quantity (thang)				
Value (baht)				
Price if bought (baht)				
Nursery area (rai)				
Total area transplanted (rai)				
Month bought				
Name of seed				

B Land preparation and transplanting of paddy

B.1 Labour (as A.1)

B.2 Traction (as A.2)

B.3

Paddy area cultivated and seed used

	Glutinous		Non-glutinous	
	Traditional	New	Traditional	New
Area cultivated (rai)				
Total area (rai)	⏟		⏟	

C Fertilizer Use

C. 1 Labour (See Table over)

C. 1 Labour

Persons Type of Labour*	First Application			Second Application			Third Application					
	Month	10 days	10 days	Total	Month	10 days	10 days	Total	Month	10 days	10 days	Total

GRAND TOTAL GRAND TOTAL GRAND TOTAL
 (Man-days)

Wage (baht)
 Total wage expense (baht)
 Total man-days (man-days)
 Total hired man-days (man-days)

*Adult family labour = 1; child family labour = 2; exchange labour = 3; hired labour = 4

C.2 Fertilizer used

Item	First Application	Second Application	Third Application
Quantity (kg)			
Area fertilized (rai)			
Value (baht)			
Month bought			

C.3 Fertilizer distribution

Item	Glutinous		Non-glutinous	
	Traditional	New	Traditional	New
Quantity (kg)				
Total (kg)				

D Insecticide and weeding

D.1 Labour (as C.1)

D.2 Value of insecticide (baht)

Month purchased

E Harvesting, bundling, threshing and winnowing

E.1 Labour (as A.1)

E.2 Area harvested

Item	Glutinous		Non-glutinous	
	Traditional	New	Traditional	New
Area harvested (rai)				
Total area (rai)				

4 Other crop production (crop year April 1981-March 1982)

A Land preparation

A.1 Labour (as 3 A.1)

A.2 Traction (as 3 A.2)

B Planting

B.1 Labour (as 3 B.1)

B.2 Seed

Item	Amount/month
Quantity (kg)	
Value (baht)	
Price if purchased (baht)	
Month purchased	
Area cultivated (rai)	

Type of seed

Traditional

New

Traditional/New mixed

Don't know

C Fertilizer

C.1 Labour (as 3 C.1)

C.2 Fertilizer used (as 3 C.2)

D Insecticide and weeding

D.1 Labour (as 3 D.1)

D.2 Value of insecticide (as 3 D.2)

E Harvest

E.1 Labour (as 3 A.1)

E.2 Area harvested

Total area harvested (rai)

5 Other crop production: Crop 2. Name of crop
(As for 4)

6 Other crop production: Crop 3. Name of crop
(As for 4)

7 Other crop production: Crop 4. Name of crop
(As for 4)

8 Production and marketing details

Type of crop	Harvested area (rai)	Yield (kg/rai)	Quantity kept for consumption (kg)	Quantity kept for seed (kg)	Quantity sold (kg)	Month sold	Before or after harvest (B/A)	Purchaser	Marketing expenses (baht)	Price (baht/kg)	Total income (baht)
Glut. Transplanted paddy					1*						
					2						
					3						
Non Glut.					1						
					2						
					3						
Other crops					1						
					2						
1					1						
					2						
2					1						
					2						
3					1						
					2						
4					1						
					2						
5					1						
					2						

* 1, 2 and 3 indicates first, second and third sale

9 Working Livestock

Animal Number	No. of years owned	Purchase value (baht)	Value now (baht)	Feeding expenditure April 1981-March 1982 (baht)	Value of food grown on farm	Other expenditures	Income from services hired out	Remarks
1								
2								
3								
4								
5								
6								

10 Other livestock

Item	No. of units sold	Income from sale of livestock (baht)	Income from animal products (baht)	No. of units consumed	Value of units consumed (baht)	Value of units purchased (baht)	No. of units produced on farm	Value of units produced (baht)	Feeding expenditure from April 1981-March 1982 (baht)	Other expenditures eg medicine April 1981-March 1982 (baht)	Value of feed grown on farm April 1981-March 1982 (baht)
Pigs (April 1981-March 1982)											
Chickens (April 1981-March 1982)											
Ducks (April 1981-March 1982)											
Buffalo/cow (non-working) (April 1981-March 1982)											

11 Other sources of income (April 1981-March 1982)

11.1 Wage income

Trip number and person who made it	Type of work	Place of work*	Period from/to month month	Total cost of transport to place of work (baht)	Total living cost away from farm (baht)	Total wage (baht)	Net income sent to farm household (baht)
1							
2							
3							
4							
5							
6							

* same village = 1
 other village = 2
 town = 3 (write name of town)

11.2 Income from other sources (April 1981-March 1982)

Item	Income (baht)	Expenditure (baht)	Net income (baht)
Trading			
Fruit production			
Fishing			
Interest on loans			
Rental of land or property			
Rental of equipment other than draft animals			
Remittances from relatives			
Pension			
Minor crops not listed in sections 3-7			
Other			

12 Farm equipment (owned at time of survey)

Item	Possess or not Y/N	No. of years owned	Value when purchased (baht)	Present value (baht)	Maintenance costs (April 1981-March 1982) (baht)
Big tractor (>60 hp)					
Small tractor (<60 hp)					
Walking tractor					
Threshing equipment					
Winnowing equipment					
Spraying equipment					
Vehicle					
Plough					
Water pump					

Continued on next page

12 Farm Equipment (Continued)

Item	Possess or not Y/N	No. of years owned	Value when purchased (baht)	Present value (baht)	Maintenance costs (April 1981-March 1982) (baht)
Miscellaneous items worth less than 500 baht					
Barn					
Pen					
Others					

13 Equipment on hire purchase

Item	Possess or not Y/N	No. of months possessed	Down payment (baht)	Value of each repayment (baht)	Total repayments including interest (baht)	Total interest (baht)	Repaid to date (baht)	Present value of item (baht)	Maintenance costs April 1981- March 1982 (baht)
Big tractor									
Small tractor									
Walking tractor									
Threshing equipment									
Winnowing equipment									
Spraying equipment									
Vehicle									
Plough									
Water pump									
Barn									
Pen									
Miscellaneous items worth less than 500 bt.									
Others									

14 Household durables

Item	Items owned			Items on hire-purchase							
	No. of years owned	Value when purchased (baht)	Present value (baht)	No. of months possessed	Down payment (baht)	Value of each repayment (baht)	Total repayments including interest (baht)	Total interest (baht)	Repaid to date (baht)	Present value (baht)	Maintenance costs April 1981-March 1982 (baht)
Car											
Motorcycle											
Bicycle											
Sewing machine											
Radio											
Television											
Generator											
Refrigerator											
Electric rice-cooker											
Electric iron											
Clock											
Tape-recorder											
Furniture											
Other											

15 Household expenditures (April 1981-March 1982)

Item	Weekly estimate (baht)	Monthly estimate (baht)	Annual estimate (baht)	
			Normal year	Last year
Food				
Clothing				
Medical				
Education				
Transportation				
Charity				
Other				

Questions for all farmers

17 A What are the most important agricultural improvements you could make to increase your farm income? _____

B What are the most important obstacles to increasing farm income? _____

C Is short-term production credit sufficient to realise the changes stated in B?

sufficient

not sufficient. Reason _____

short-term production credit is not important for these changes. Reason _____

D Is long-term credit sufficient to realise the changes stated in B?

sufficient

not sufficient. Reason _____

long-term credit is not important for these changes. Reason _____

E At the start of the last agricultural year (before land preparation) how much savings did you possess? _____ baht.

F How much savings do you possess now? _____ baht.

18 Benefits of BAAC services

For BAAC clients, ask: what are the 3 most important benefits of BAAC (enter 1st, 2nd or 3rd in the brackets).

For independent farmers, ask: what do you think are the most important potential benefits of BAAC (1st, 2nd, 3rd)?

Cheaper loans

Larger loans

Quicker service

More reliable service

Advice (farm management)

Other _____

19 Agricultural extension

A How many times did an extension officer visit your farm or hold a meeting, which you attended, in the past 2 years? _____

B What are the most important benefits of the agricultural extension officer?

Advice on borrowing sources and procedures

Advice on new agricultural techniques for existing crops

Advice on marketing

Advice on crop diversification

Free fertilizer and/or insecticide

No important benefits

C Out of the benefits listed in B, what is the

1st most important _____

2nd most important _____

D In general, do you consider the advice from the extension officer:

very useful

not so useful

not useful at all

E If you received advice from an extension officer, did you get it:

directly from the extension officer

via a neighbour who had received direct advice from the extension officer

20 Consumption loans

A Did you borrow money last crop year for consumption items (such as ceremonies, education, medical, food etc)

Yes

No

B Is borrowing for consumption:

Very important

Not so important

Not important at all

Questions for clients of BAAC and commercial banks only

21 Advice from BAAC

- A Have you ever had any of the following types of advice from a BAAC officer? (Tick if Yes)

Advice on new agricultural techniques (existing crops)

Advice on marketing

Advice on crop diversification

Advice on longer-term agricultural investments

Other.

- B Out of the types of advice in A, what is the

1st most important

2nd most important

- C In general, do you consider the advice from BAAC officers:

Very useful

Not so useful

Not useful at all

- D Did borrowing from BAAC involve much extra time and expenditure (for example in travelling to the Amphur or Changwat office, entertaining officers on your farm, or taking days off farm work during busy periods)?

much extra time and costs

Not much

- E How many visits did you make last crop year to the BAAC office?
-

Questions asked to clients of BAAC and commercial banks and cooperative members who received a loan last year

22 Frequency of visits from bank officers

A Last year, how many times did a BAAC officer visit you? _____

B Last year, how many times did a bank or cooperative officer visit you? _____

23 Adequacy of production loan last financial year

A Was your short-term production loan from a financial institution sufficient for production expenses last year?

Sufficient

Not sufficient

B If you had received a larger short-term production loan last year, name two items which the loan would have helped purchase

Name of crop or livestock in which the larger loan would have been invested

C If you did not receive a large enough short-term production loan last year, please indicate the reason why.

Applied for more but received less than the amount requested

Did not ask for all that was needed because of fear of refusal

Underestimated my production expenses

Insufficient security

(Enter 1, 2 and 3 for the 1st, 2nd and 3rd most important responses)

D What value of loan would have been sufficient for your short-term production expenses last year? _____ baht

E What value of short-term production loan did you apply for last year? _____ baht

F What value of short-term production loan did you receive last year? _____ baht

Questions asked to clients of BAAC and commercial banks and cooperative members who did not receive a short-term production loan last year

24 Reasons for not receiving a short-term production loan last year

Why did you not receive a short-term production loan from a financial institution last year? (Tick each response that is applicable and enter 1, 2 and 3 for the 1st, 2nd and 3rd most important if more than one was important).

able to get a loan more rapidly from another source

Costs of negotiating an institutional loan too high

Lower rate of interest from another source

No need for production loan last production year

Applied for loan but was refused

Did not apply for loan because of fear of refusal

25 Alternative actions to institutional borrowing

In the absence of a short-term production loan from an institution, did you:

take a loan from another source?

use your own savings?

decrease production expenses?

(Enter 1, 2 and 3 for the 1st, 2nd and 3rd most important alternatives)

Questions asked to independent farmers (farmers not registered with a lending institution)

26 Agricultural credit

A Did you have sufficient funds for production expenses last year?

Sufficient

Insufficient

(If 'Insufficient', proceed to B, C and D of question 26)

B If not sufficient, how much credit could you have used? _____ baht

C Name 2 important items which would have been purchased by this loan

Name of crops or livestock in which the loan would have been invested

27 Registration with an institution

A Have you ever applied to register as a BAAC client?

Yes

No

B Have you ever applied to register as a commercial bank client or cooperative member?

Yes

No

C If you had the opportunity, would you want to register with a credit institution? State your preference (agricultural cooperative, BAAC, commercial bank, farmers' association)?

Institution: _____

Reason: _____

28 Registration with BAAC

A Would registering with BAAC risk the loss of your normal supply of consumption credit?

Yes

No

Don't know

B Would borrowing from BAAC involve a significant amount of expense in addition to interest charges?

Yes

No

Don't know

C What are your reasons for not registering with BAAC so far? (Tick the responses which are important and enter 1, 2 and 3 for the 1st, 2nd and 3rd most important reasons)

Uncertain about the procedure

Never been invited

Difficulty in dealing with officials

No need for production credit

Risk of losing normal supply of consumption credit

Other _____

Appendix 2

Two-Sample Difference of Proportions Z-Test

Two-sample difference of proportions Z-test. The principle involved is to test whether the proportion of farmers scoring positively on the disincentive measure is higher in the sub-sample who did not wish to register than in the sub-sample who did wish to register. For the borrowing cost hypothesis for example, the proportion of farmers who consider total borrowing costs to be significantly higher than interest costs compared between the two groups. Four variables need to be defined :

P_1 = The proportion of independent farmers **wishing** to register who consider total borrowing costs to be significantly higher than interest rates

P_2 = The proportion of independent farmers **not wishing** to register who consider total borrowing costs to be significantly higher than interest costs

P_3 = The proportion of independent farmers **wishing** to register who consider that registration would risk loosing their normal source of consumption credit

P_4 = The proportion of Independent Farmers **not wishing** to register who considered that registration would risk loosing their normal source of consumption credit

The subscripts V and S refer to the population and sample proportion.

The hypotheses are expressed as follows :

Null hypothesis 1_0 : $P_{1,V} = P_{2,V}$

Research hypothesis 1_1 : $P_{1,V} < P_{2,V}$

Null hypothesis 2_0 : $P_{3,V} = P_{4,V}$

Research hypothesis 2_1 : $P_{3,V} < P_{4,V}$

The test is set out algebraically for Hypothesis 1 as follows :

$$Z = \frac{(P_{1,S} - P_{2,S}) - 0}{\hat{\sigma}_{P_{1,V} - P_{2,V}}} \quad (A2.1)$$

where :

$$\hat{\sigma}_{P_{1,V} - P_{2,V}} = \hat{\sigma} \sqrt{\frac{N_1 + N_2}{N_1 N_2}} \quad (A2.2)$$

an unbiased estimate of the standard error ;

$$\hat{\sigma} = \sqrt{\hat{P}_{1,V} \hat{P}_{2,N}} \quad (A2.3)$$

an unbiased estimate of the population σ ;

$$\hat{P}_{1,V} = \frac{N_1 P_{1,S} + N_2 P_{2,S}}{N_1 + N_2} \quad (A2.3)$$

an unbiased estimate of the population proportion taken as a weighted average of the sample proportions; and

$$\hat{P}_{2,V} = 1 - \frac{N_1 P_{1,S} + N_2 P_{2,S}}{N_1 + N_2} \quad (A2.5)$$

an unbiased estimate of the second population proportion which equals $P_{1,V}$ subtracted from unity

Hypothesis 1

$P_{1,S} = .365$, $P_{2,S} = .255$, $N_1 = 170$, $N_2 = 47$. We find that $P_{2,S} < P_{1,S}$; a result that does not conform to the research hypothesis H_1 . It appears that there is no positive relationship between a recognition of the total costs of formal-sector borrowing and a farmer's decision not to register with an institution. On the contrary, if there is a significant relationship it would appear to be the other way round; a recognition of the full costs of borrowing is more common among farmers wanting to register.

Either a second research hypothesis has to be set up to the effect that $P_{2,V} < P_{1,V}$ and a one-tailed test used, or a directional research hypothesis has to be replaced by one which simply hypothesises a significant difference between $P_{2,S}$ and $P_{1,2}$ and a two-tailed test performed.

Using a one-tailed test and the alternative $H_1 : P_{2,S} < P_{1,S}$

$$z = \frac{(.365 - .255) - 0}{.078} = 1.41 \quad (\text{A2.6})$$

The probability of obtaining a z value of this size by chance if $P_{1,V} = P_{2,V}$ is .157. Using a 95% confidence level, the null hypothesis cannot therefore be rejected as $.157 > .05$. We conclude that there is no significant difference between the 2 groups with respect to attitude towards the total cost of borrowing from a formal credit institution.

Hypothesis 2

$$P_{3,S} = .288, P_{4,S} = .02, N_1 = 170 \text{ and } N_2 = 47$$

Again, the relationship between the 2 probabilities is contrary to that expected, and it appears that a recognition of the risk to consumption credit lines involved in registering with an institution is related more to a decision to register, than not to register. As before, a second research hypothesis ($P_{3,V} > P_{4,V}$) is implied by using a one-tailed test.

$$z = \frac{(.288 - .02) - 0}{.069} = 3.884 \quad (\text{A2.7})$$

The probability of obtaining a z value this large by chance is .00007,

and we can reject the null hypothesis with the highest level of confidence.

The conclusion presents a problem for the theory concerning the influence of the consumption credit-resource risk-factor on participation in the formal credit market.

Some explanation is given by considering the complete range of responses to the questions asked to farmers on this issue. Though responses were dichotomised into positive or not positive for the purpose of the above tests, actual responses included a 'not sure' category, and the distribution over the 3 categories is given in Table A2.1.

Table A2.1 : Response to the Question: would registering with a Formal Credit Institution risk the loss of your normal supply of consumption credit?

Response	GroupA (farmers wanting to register)		Group B (farmers not wanting to register)	
	Frequency	(%)	Frequency	(%)
Yes	49	(28.8)	1	(2.1)
No	94	(55.3)	19	(40.4)
Not sure	27	(15.9)	27	(57.5)
	170	(100)	47	(100)

Source : Survey 1

Table A2.2 : Response to the Question: Are there significant borrowing costs above interest charges, involved in borrowing from a credit institution?

Response	Group A (Farmers wanting to register)		Group B (Farmers not wanting to register)	
	Frequency	(%)	Frequency	(%)
Yes	62	(36.5)	12	(25.5)
No	89	(52.4)	7	(14.9)
Not sure	19	(11.1)	28	(59.6)
	170	(100)	47	(100)

Source : Survey 1

The negative difference between Groups A and B on the 'yes' response does not correspond to a positive difference on the 'no' response. A higher proportion of Group A farmers responded both positively and negatively in comparison to Group B.

This pattern is due to the greater proportion of Group B farmers responding with 'not sure'. It may seem that this invalidates the dichotous variable tests above, since some of the 'not sure' respondents may, if they become sure, decide to respond positively, and from this point of view could be missing cases as far as the test is concerned. However, the theory behind the original research hypothesis was that an awareness of risk to consumption credit helps explain why farmers do not want to register with a credit institution. What the uncommitted farmers might think if they were to consider the issue is not strictly relevant therefore, and those without an opinion can be considered, with those who responded negatively, as farmers for whom the issue of consumption credit loss is not important in their decision not to want to register.

The pattern in Table A2.1 suggests that more farmers who want to register have given consideration to the implications of registering, and most have formed an opinion on this particular issue.

The same pattern is found with the responses to the borrowing-cost question (Table A2.2), and serves to emphasise the unimportance of these two issues in the decision to want to register or not. Not only do the tests fail to give evidence in support of their hypothesised influence on the registration decision, but we find that the group that has given these factors greater consideration is Group A.

BANK FOR AGRICULTURE AND AGRICULTURAL COOPERATIVES

Branch

APPLICATION FOR REGISTRATION AS A BAAC CLIENT

Under Regulation No.

Group No. Registration No.

Address

Date

To: The Branch Manager,

Branch

Bank for Agriculture & Agricultural Cooperatives

I hereby apply for registration as a branch client and declare the following statements to be true and correct:

- 1 Name of Applicant
- Born Age Nationality
- Level of Education
- 2 Name of Father Name of Mother
- Name of Spouse Marriage Registered at
- District Office; Marriage Certificate
- Registration No. Dated
- 3 Number of Persons in Household (Male Female)
- Number of Persons able to practise agriculture
- 4 Permanent Address
- Resident since
- 5 My agricultural enterprise is (type of farm(s)),
located at since
- 6 I am currently a client or member of (Name and

address of Agricultural Cooperative, Farmers Association, Commercial Bank etc) whose office is located at

7 Explanation of any involvement in legal suit or litigation
 (if applicable)

8 Main Assets (Estimated total value baht)

9 Farm Land (home plot, paddy land, land planted in field crops, land planted in trees and vines, permanent pasture, woodlot etc)

Type of Landholding	Type of Landholding Title (No.....Dated.....)	Title Holder's Name	Location of Landholding	Area of Land	Method of Irrigation	Value (Baht)

Remarks:

B Farm Buildings

Type	Size (Metre)	Material Used in Construction				General Condition	Current Value (Baht)
		Pillars	Floor	Walls	Roof		
House							
Storage							
Total							

C Farm Machinery & Equipment

Type	General Condition	Current Value (Baht)
Total		

Remarks:

.....

D Draught Animals and Breeding Stock

Type	Draught Animals		Breeding Stock	
	Number	Value	Number	Value
Total				

9 Main Liabilities (Total Baht)

Case No.	Name and Address of Creditor	Loan Taken Out on (Date)	Collateral	Reason for taking out loan	Amount Borrowed	Current Debt	
						Principal	Interest
Total							

11 Off Farm Income

(For the same period as specified in Item 10 above)

	Baht
	<u>Baht</u>
Total	<u><u>Baht</u></u>

12 Expenditures

(For the same period as specified in Item 10 above)

A Operating Expenses

- (1) Crop Production (Labour, Seeds, Fertilizer, Chemicals and other farm supplies) Baht
- (2) Poultry Production (Stock, Feed, Labour, Chemicals) Baht
- (3) Livestock Production (Stock, Feed, Labour, Chemicals) Baht
- (4) Aqua Culture Production (Stock, Feed, Labour) Baht
- (5) Other Production (specify) (.....) Baht
- (6) Other Expenses (.....) Baht

B Household Expenses

- (1) Food Baht
- (2) Clothing Baht
- (3) Medical Care Baht
- (4) Education Baht
- (5) Other (personal necessities, travelling, merit-making etc) Baht

	Total	<u><u>Baht</u></u>
--	-------	--------------------

During the previous production year, farm income was above normal

below normal due to

Normal farm income should be approximately Baht.

During the same production year, expenditures were above normal

below normal due to

Normal expenditures should be approximately Baht.

13 Cash borrowings and purchases on credit for farm and household purposes normally amount to approximately Baht, in any production year.

14 In the event that this application is approved, I promise to sign the Branch client register within such time as is specified by the Branch Manager. Furthermore, I agree to abide by the Rules and Regulations of the Bank, and any resolutions deriving from meetings of the client group with whom I am registered.

Signature of Applicant

Witness (if signature is in form of thumb-print)

Witness (if signature is in form of thumb-print)

Bank Officer's Remarks

Very Good Good Fair Poor

- 1 Cooperation received from Applicant
- 2 Credit repayment history
- 3 Reputation of Applicant
- 4 Industriousness of Applicant
- 5 Efforts made to improve farm practice
- 6 Thriftiness and ability to accumulate savings
- 7 Applicant's health
- 8 Assistance received from members of Applicant's household in farm enterprise

Appendix 4

Summary of Linear Multiple Discriminant Analysis

Technically, the numerical values on the independent variables are weighted to produce a single discriminant score Z , such that Z values will be at one end of a continuum for Group 1, and the other end for Group 2. The weights in the discriminant function are derived by maximising the ratio of between-group to within-group variance-covariance for independent (discriminating) variables. An individual can be assigned to the most likely group on the basis of his discriminant score since there will be a cut-off Z value above which membership of Group 1 is more likely than membership of Group 2. That cut-off point is the intersection of the distributions of discriminant scores for each group.

Algebraically the problem looks like multiple regression analysis :

$$Z_i = b_0 + b_1X_{1,i} + b_2X_{2,i} + \dots + b_nX_{n,i} \quad (\text{A.3.1})$$

where Z_i = the discriminant score for the i 'th individual

b_j = the discriminant coefficient for the j 'th variable

$X_{j,i}$ = the score on the j 'th discriminating variable for the i 'th individual

The b_j 's are analogous to regression coefficients. When standardised, like β coefficients in MRA, they give the relative contribution of each independent variable to the equation's total explanation of the dependent variable.

To classify an individual into one or other group, the following rule is set up :

If $Z_j > Z_{crit}$, classify into Group 1

If $Z_j < Z_{crit}$, classify into Group 2

Where Z_{crit} = the critical discriminant score above which probability of membership in Group 1 is greater than the probability of membership in Group 2.

Under certain assumptions about the distribution of discriminating variables, classification functions can be derived from the discriminant function. These re-formulate the same problem so that instead of producing a Z score which is compared with a critical value, the dependent variable is a function of the probability of group membership. One classification function is produced for each group. To classify an individual, his scores on the discriminating variables are entered into each function and the individual is assigned to the group associated with the function which gives the highest classification score. The classification procedure then becomes :

$$C_1 = \lambda_0 + \lambda_1 X_{1,i} + \lambda_2 X_{2,i} + \dots + \lambda_n X_{n,i} \quad (A.3.2)$$

$$C_2 = \lambda_0 + \lambda_1 X_{1,i} + \lambda_2 X_{2,i} + \dots + \lambda_n X_{n,i} \quad (A.3.3)$$

If $C_1 > C_2$, classify into Group 1

If $C_2 > C_1$, classify into Group 2

where C_1 = classification score for Group 1

C_2 = classification score for Group 2

λ_j = classification coefficient for the j'th discriminating variable

$X_{j,i}$ = score on the j'th discriminating variable for the i'th individual

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