AN EXPLORATORY STUDY OF FACTORS AFFECTING FARM CAPITAL FORMATION: CENTRAL LUZON, PHILIPPINES

by

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A sub-thesis submitted in partial fulfilment of the requirements for the degree of Master of Agricultural Development Economics in the Australian National University

October, 1978
DECLARATION

Except where otherwise indicated, this dissertation is my own work.

Minda Camacho Mangabat
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ABSTRACT

Private capital formation or investment in agriculture is to a large extent influenced by economic, social and institutional factors. An attempt has been made in this study to investigate and quantify the effects of some economic and other factors which may have influenced the capital formed on rice farms in the Central Luzon Region, Philippines. The study is based on cross-sectional data of a sample of 324 farms. The data pertain to the crop year July 1, 1973 to June 30, 1974. Since data were available for only one time period, a short-term farm investment model was formulated instead of a dynamic investment model. The identification and measurement of the variables in the conceptual model were also determined by the constraints imposed by these data.

Based on investment theory and results of empirical studies, it was the a priori belief in this study that the private investment on the farms would be a function of internal finance (e.g. income and savings) and of external finance (e.g. credit). It was also the belief that other factors characteristic of the farms/farm families may have an influence on the investments undertaken by farmers. These other factors are, namely, size of holding, household size, adoption of new farm practices and farm tenure. It was hypothesised that size of holding, income, savings, credit, and adoption of new farm practices would have a positive influence on farm investment. On the other hand, household size, and farm tenure were expected to have either a positive or negative influence on farm investment.

It was also assumed that net investment and each of the above-mentioned factors associated with it have a linear relationship and that
the farm investment function used was a single independent relationship. The technique of ordinary least squares was utilised in the estimation of the investment function.

Results of the regression analysis were largely theoretically consistent and statistically dependable even though the data used were only cross-sectional. As hypothesised earlier, the estimated marginal investment coefficients for the size of holding, income, savings, credit, and adoption of new farm practices variables were positive and significantly different from zero except for savings. On the other hand, household size and tenurial status other than owner operator had negative coefficients. The general possible implications of these findings were also stated.
CONTENTS

ACKNOWLEDGEMENTS iii

ABSTRACT v

LIST OF TABLES ix

LIST OF FIGURES x

GLOSSARY xi

CHAPTER

1 INTRODUCTION 1

1.1 Rationale of the Study 1

1.2 Objectives and Scope 4

1.3 The Study Area 5

1.3.1 Resource Situation 8

i Climatic Conditions 8

ii Land Resources 8

iii Irrigation Facilities 9

iv Credit Facilities 9

1.3.2 Farm Organisational Structure 9

i Tenure 9

ii Number of Farms 10

1.4 Organisation of the Study 10

2 THE DATA, CONCEPTS AND ESTIMATION OF FARM CAPITAL FORMATION 14

2.1 Source of Data, Sampling Technique and Survey Procedure 14

2.2 Nature of the Data 15

2.3 The Concept and Measurement of Capital in Agriculture 16

2.3.1 The Meaning of Capital in Agriculture 16

2.3.2 Valuation of Capital 19

i Retrospective Method 20

ii Prospective Method 20
<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.4 Estimation of Capital Formation</td>
<td>20</td>
</tr>
<tr>
<td>2.4.1 Two Approaches</td>
<td>20</td>
</tr>
<tr>
<td>i Inventory or Commodity Flow</td>
<td>21</td>
</tr>
<tr>
<td>ii Expenditure</td>
<td>21</td>
</tr>
<tr>
<td>3 CORRELATES OF INVESTMENT - A REVIEW OF LITERATURE</td>
<td>29</td>
</tr>
<tr>
<td>3.1 A Review of Econometric Investment Studies</td>
<td>29</td>
</tr>
<tr>
<td>3.1.1 The Flexible Accelerator Model</td>
<td>29</td>
</tr>
<tr>
<td>3.1.2 The Flexible Accelerator Model and Replacement Investment</td>
<td>31</td>
</tr>
<tr>
<td>3.1.3 The Flexible Accelerator Model and Its Application in Agriculture</td>
<td>33</td>
</tr>
<tr>
<td>3.1.4 The Residual Funds Model</td>
<td>33</td>
</tr>
<tr>
<td>3.1.5 A Combined Accelerator-Residual Funds Model</td>
<td>36</td>
</tr>
<tr>
<td>3.2 A Review of Other Investment Studies</td>
<td>42</td>
</tr>
<tr>
<td>3.3 Summary</td>
<td>45</td>
</tr>
<tr>
<td>4 EMPIRICAL FARM INVESTMENT FUNCTION</td>
<td>47</td>
</tr>
<tr>
<td>4.1 Model Specification</td>
<td>47</td>
</tr>
<tr>
<td>4.1.1 The Model</td>
<td>48</td>
</tr>
<tr>
<td>4.1.2 Measurement of the Conceptual Variables</td>
<td>51</td>
</tr>
<tr>
<td>4.1.3 Estimation Technique</td>
<td>56</td>
</tr>
<tr>
<td>4.2 Results and Discussion</td>
<td>57</td>
</tr>
<tr>
<td>4.2.1 The Summary Statistics</td>
<td>57</td>
</tr>
<tr>
<td>4.2.2 Estimated Coefficients for Factors of Investment</td>
<td>61</td>
</tr>
<tr>
<td>4.3 Summary</td>
<td>72</td>
</tr>
<tr>
<td>5 SUMMARY AND CONCLUSIONS</td>
<td>73</td>
</tr>
<tr>
<td>APPENDIX A: Components of Farm Capital in Agriculture, Philippines</td>
<td>83</td>
</tr>
<tr>
<td>APPENDIX B: Gross Investment, Capital Consumption Allowances, and Net Investment</td>
<td>84</td>
</tr>
<tr>
<td>APPENDIX C: The Questionnaire</td>
<td>89</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>105</td>
</tr>
</tbody>
</table>
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Percentage Contribution of Various Regions to Total palay (rough rice) Production, Philippines, 1970-1974</td>
<td>7</td>
</tr>
<tr>
<td>1.2</td>
<td>Ratio Between the Net Income of Owner-Operators, Lessees and Tenants, Central Luzon Region, 1963-1969</td>
<td>11</td>
</tr>
<tr>
<td>1.3</td>
<td>Number of Farms by Size and Provinces in Central Luzon Region, Philippines, 1960 and 1971 Census of Agriculture</td>
<td>12</td>
</tr>
<tr>
<td>2.1</td>
<td>Land Values Per Hectare, Central Luzon Region, Philippines, 1973</td>
<td>21</td>
</tr>
<tr>
<td>2.2</td>
<td>Capital Formation on the Sample Rice Farms, by Type of Capital Formed, Central Luzon Region, Crop Year 1973-1974</td>
<td>27</td>
</tr>
<tr>
<td>3.1</td>
<td>Factors Associated With Private Investment of Farms - A Summary</td>
<td>45</td>
</tr>
<tr>
<td>4.1</td>
<td>Scores For Each Land Tenure Dummy Variable</td>
<td>56</td>
</tr>
<tr>
<td>4.2</td>
<td>Estimated Coefficients of the Investment Function</td>
<td>58</td>
</tr>
<tr>
<td>4.3</td>
<td>Matrix of Correlation Coefficients Between the Variables</td>
<td>62</td>
</tr>
<tr>
<td>4.4</td>
<td>Estimated Mean Values of Farm Investment by Categories of Tenure and by Adoption/Non-Adoption of New Farm Practices</td>
<td>71</td>
</tr>
<tr>
<td>Figure</td>
<td>Title</td>
<td>Page</td>
</tr>
<tr>
<td>--------</td>
<td>----------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>1.1</td>
<td>The Central Plain of Luzon</td>
<td>6</td>
</tr>
<tr>
<td>3.1</td>
<td>The Interrelationship Between Income, Savings and Farm Capital Formation</td>
<td>43</td>
</tr>
<tr>
<td>4.1</td>
<td>The Relationship Between Net Farm Investment and Size of Holding</td>
<td>64</td>
</tr>
<tr>
<td>4.2</td>
<td>The Relationship Between Net Farm Investment and Income</td>
<td>65</td>
</tr>
<tr>
<td>4.3</td>
<td>The Relationship Between Net Farm Investment and Credit</td>
<td>68</td>
</tr>
<tr>
<td>4.4</td>
<td>The Relationship Between Net Farm Investment and Household Size</td>
<td>69</td>
</tr>
</tbody>
</table>
GLOSSARY

P = pesos, the Philippine Currency
Exchange Rate in 1973 is $US1 = P6.74

Palay = rough rice

Barrio = village

Carabao = water buffalo
1.1 Rationale for the Study

Agriculture is usually the dominant sector of the economy in the less developed countries (LDCs). As such, it is generally accepted that agricultural development has an important place in the overall economic growth and development of the LDCs. This has been dramatically emphasised, among others, by Rostow (1963) in the stages of economic growth theory. Agricultural development is a complex process and it involves a large number of sustained and integrated measures. Capital formation is one of the important elements in bringing about agricultural development.

Capital generally refers to the stock of goods not devoted to immediate consumption but used in future productive purposes. Capital formation or investment would then represent the accumulation of additional stock of capital resources to the already existing stock of capital. In agriculture, capital formation may be generated both by the public and private corporate and private non-corporate sectors. Government outlays on irrigation projects, rural roads, credit, extension education, research, technology and other social overheads would constitute public corporate investment in the agricultural sector, while private corporate investment would pertain to the agricultural loans extended by the private financial institutions, and the supply of agricultural inputs, such as fertilisers, chemicals and machines by the private firms. Non-corporate or private capital formation in agriculture, which is the
subject of this study, generally refers to the investments made by individual farmers on their farms. Such private capital formation may be in the form of planting tree crops, opening up new land for cultivation, improvement of the existing farm land, construction of storage and other farm buildings, the purchase of agricultural tools, implements, draught animals and the like.

While the importance of public and private corporate investments in the process of agricultural development has long been recognised, the role of private capital formation in agriculture or farm investment also needs to be emphasised. Farm investment is one of the major determinants of growth in farm productivity as well as a vehicle for technological change. Increased farm productivity as a result of technological improvement would lead both to an increase of food supply to the rural and industrial (urban) sectors and to increases in farm incomes. Increased farm incomes in turn may generate an increase in demand for consumer goods and for capital items like farm machinery, chemicals and fertilisers - the factors of higher productivity - supplied by the industrial sector. In short, an environment of rising real income in agriculture, rooted in increased productivity through farm investment, among other measures, may contribute to the development of the agricultural sector itself and also to an overall economic growth.

It becomes imperative, therefore, to facilitate appropriate types of private farm investment through effective policy formulation. But before effective policies can be formulated for such an encouragement, the process and mechanism of farm investment should first be understood. However, owing to the limited research on this subject, the present understanding of this process is highly
inadequate. As Campbell (1959, p. 93) puts it in the context of the farm-firm "...the subject of capital formation has, in the past been one of the most neglected aspects of agricultural economics." This is especially so in the case of the LDCs. In the words of Levi (1977, p. 247):

"It goes without saying that economists have made much of the need for, and mechanism of, capital formation in the process of economic development, but hardly any have looked at capital formation - and in particular, rural capital formation - as it actually occurs in developing countries."

This may partly be due to the lack of adequate and reliable time series data required for analysing the private capital formation in agriculture in these countries. Hence, there are no time series studies. An important exception, however, is a study of farm capital formation in India by Shukla (1965). But she also had to use approximations to cover the gaps and unsuitability of the available time series data. But even cross sectional studies are few, e.g., by Firth (1964), by Shastri (1965), by Prasad (1969), by Bhati et al (1972), by Bal, Bal and Singh (1974), and they are mostly on Indian agriculture.

In the Philippines, research on the processes underlying private farm capital formation has so far also been inadequate. Studies made on farm investment have only partially dealt with the subject. For example, the case studies by Sacay et al (1956), De Guzman (1964) and Sandoval (1964), have focused on income, technological change and tenure, respectively, and their effects on capital accumulation.

The first nationwide survey on private capital formation in agriculture was undertaken in 1956 by the Philippines Bureau of Agricultural Economics. Its reference period was confined to one
crop year only, i.e., July 1, 1955 to June 30, 1956, and its objective was limited to an estimation of the amounts of gross and net capital formed in agriculture. The main contribution of this pioneering study, nevertheless, was the development and actual application of concepts and definitions, methods and techniques of obtaining information on private investment in agriculture. In 1974, a second nationwide survey on farm capital formation was undertaken again by the Bureau. Although the data collected in the second survey were also confined to only one crop year, namely, CY 1973-74, it was an improvement over the earlier survey in the sense that, aside from estimating the amounts of gross and net capital formed in agriculture, it also incorporated in the survey questionnaire a set of relevant factors which may have affected capital formation at the farm level. Based on the cross sectional data of this second survey, the present study attempts to explore the factors associated with farm capital formation. This key aspect of capital formation has important policy implications and it has so far not been investigated in Philippine agriculture.

1.2 Objectives and Scope

The general purpose of this study is to contribute to the understanding of capital formation at the farm level in the Central Luzon Region of the Philippines. Since research resources were limited and capital formation is a complex topic, the objectives of this study are kept modest. Specifically, this study only aims to:

(1) estimate the amount of capital formed on farms located in the above mentioned region; and

(2) investigate selected economic and other factors associated with capital formation at the farm level.
The scope of this study is confined to the farming sector of the Central Luzon Region of the Philippines. It pertains mainly to rice farms which predominate in the region. The sample rice farms were relatively small holdings ranging from 0.35 hectare to 7 hectares. Data on the sample farms, as mentioned earlier, refer to only one crop year, July 1, 1973 to June 30, 1974. Ideally, time series data are required for understanding complex private investment behaviour. Since such data are unavailable, and the study is based on cross sectional data only, this study is to be regarded as exploratory in its nature. Nevertheless, it is hoped that the results of the study will be of some use not only for policy purposes but also for further research in this subject area.

A brief profile of the study area is given below to provide a background for the empirical analysis presented in Chapter 4.

1.3 The Study Area

Central Luzon Region is the largest contiguous area of lowlands in the Philippines. As shown in Figure 1.1, it is comprised of six provinces: Bataan, Bulacan, Nueva Ecija, Pampanga, Tarlac and Zambales. This region is ranked as one of the most important agricultural areas in the country. It normally produces one-fifth of the nation's rice, the staple food in the country (Table 1.1) and one-fifth of the nation's sugar exports.

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1 A detailed description of the agro-economic features of the region is found, among others, in Philippines Bureau of Agricultural Economics (1974).

2 At present, the Philippines is subdivided into eleven regions. A region is composed of several provinces. A province is made up of a number of municipalities or towns, and each municipality is in turn made up of a few or many barrios (villages).
FIGURE 1.1
THE CENTRAL PLAIN OF LUZON, PHILIPPINES

TABLE 1.1

PERCENTAGE CONTRIBUTION OF VARIOUS REGIONS TO
TOTAL PALAY (ROUGH RICE) PRODUCTION, PHILIPPINES, 1970-1974

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<td>Philippines</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
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<tr>
<td>I Ilocos</td>
<td>13.1</td>
<td>12.9</td>
<td>13.5</td>
<td>10.4</td>
<td>10.3</td>
</tr>
<tr>
<td>II Cagayan Valley</td>
<td>10.6</td>
<td>13.7</td>
<td>13.6</td>
<td>13.5</td>
<td>12.2</td>
</tr>
<tr>
<td>III Central Luzon</td>
<td>20.6</td>
<td>20.3</td>
<td>13.8</td>
<td>19.3</td>
<td>21.0</td>
</tr>
<tr>
<td>IV Southern Tagalog</td>
<td>10.6</td>
<td>10.9</td>
<td>10.5</td>
<td>12.6</td>
<td>11.2</td>
</tr>
<tr>
<td>V Bicol</td>
<td>10.4</td>
<td>6.9</td>
<td>10.9</td>
<td>10.1</td>
<td>9.7</td>
</tr>
<tr>
<td>VI Western Visayas</td>
<td>11.1</td>
<td>11.7</td>
<td>11.6</td>
<td>12.5</td>
<td>12.4</td>
</tr>
<tr>
<td>VII Central Visayas</td>
<td>1.6</td>
<td>2.1</td>
<td>2.2</td>
<td>2.1</td>
<td>2.2</td>
</tr>
<tr>
<td>VIII Eastern Visayas</td>
<td>4.2</td>
<td>4.8</td>
<td>4.3</td>
<td>4.2</td>
<td>3.7</td>
</tr>
<tr>
<td>IX Western Mindanao</td>
<td>4.1</td>
<td>2.5</td>
<td>2.6</td>
<td>3.2</td>
<td>4.2</td>
</tr>
<tr>
<td>X Northern Mindanao</td>
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<td>6.0</td>
<td>6.0</td>
<td>3.5</td>
<td>4.6</td>
</tr>
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<td>XI Southern Mindanao</td>
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<td>8.2</td>
<td>11.0</td>
<td>8.6</td>
<td>8.5</td>
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Note: Based on production data from the Bureau of Agricultural Economics.
Central Luzon is classified as a high income region. According to a survey of family income and expenditures undertaken by the Philippines Bureau of Census and Statistics in 1971 (in ILO 1974), the median income of farm households for the region was P2,514,\(^1\) which was greater than the median income of P1,783 of farm households for the whole country.

1.3.1 Resource Situation

Climatic Conditions. The climate in the region is predominantly dry, with at most six dry months. The average annual rainfall of the region is 2,510.3 mm. Precipitation is strongly seasonal which places a severe restriction on the agriculture of the region. This is particularly true with lowland rice cultivation which requires a relatively large supply of water throughout its growing period. Rice land can be of little use for raising crops during the dry season unless it is provided with irrigation.

Land Resources. Land classification estimates made by the Bureau of Soils in 1973 indicated that Central Luzon had a total area of 1,709,700 hectares suitable for agriculture. Of this total area, 78 percent was the existing agricultural area, and the remaining 22 percent was unused gross potential agricultural land. Some of this latter land has a slope of more than 30 percent and is therefore not strictly cultivable\(^2\) (ILO 1974). Of the total cultivated area of the region, 83 percent is planted with rice, and about 5.4 percent with sugarcane. The other crops planted are corn, fruits, tobacco and cassava.

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1 $\text{US1.00} = \text{The exchange rate in 1973 was P6.74.}$

2 Slope is the inclination of the land surface and reflects a difference in elevation between two horizontal points. Areas fit for agricultural utilisation are those fields that are level, undulating, rolling and moderately hilly, those within the slope categories 0 to 30.
Irrigation Facilities. Irrigation is a key element in the agriculture of the region. More recent data are unavailable but in 1972, there were 6,412 irrigation systems in the region servicing some 318,800 hectares of cropland. Of the total hectarage under irrigation, 39.2 percent were serviced by pumps while 60.8 percent were serviced by gravity systems. Expansion of irrigation facilities is continuous. For example, the Four Year Development Plan for the Philippines for fiscal years 1972-1975 provided for several irrigation projects in the provinces of Pampanga and Nueva Ecija which would regulate water for the integrated operation of existing irrigation systems and additional areas in the region.

Credit Facilities. The expanded agricultural programme of the government and the substantial increases in the prices of agricultural inputs require a much greater amount of agricultural credit. As of 1970, there were over 127 credit institutions in Central Luzon, composed of branches of government lending agencies like the Philippine National Bank, Development Bank of the Philippines, Agricultural Credit Administration, and private lending institutions like rural banks. Aside from these, the other sources of credit in the region are private individuals, e.g., relatives, landlords, friends and merchants.

1.3.2 Farm Organisational Structure

Tenure. The landlord and tenant system is a noticeable feature throughout the region. Nevertheless, the Land Reform which took effect in 1963 has done a great deal in substituting leasehold tenure for share-tenancy. The ILO Study (1974) reported that out of the 218.9 thousand tenanted farmers in the region in 1972, about 69.9 percent have become reform leaseholders\(^1\), whereas 11.2 percent

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1 Share tenants and leaseholders whose rents were reduced to a level below the market rate are referred to as "reform leaseholders".
were unconverted lessees, so that if the few amortising owners are ignored the proportion under share-tenancy was the residual of 18.9 percent. The same study indicated farmers' preference for ownership of land for cultivation over leasehold, and leasehold over share-tenancy. The preference for ownership is due to the relatively higher average income generated from this kind of tenure (Table 1.2). An owner-operator's mean income in Central Luzon was estimated by the ILO Study to be 1.4 times greater than that of a reform leaseholder i.e. between 40 and 60 percent greater than that of a market leaseholder; and by 2.3 times greater than that of a share-tenant.

Number of Farms. The farm size (area) distribution for the region and the changes in it between the years 1960 and 1971 are given in Table 1.3. The data give some indication of the structural change occurring in agriculture in the region. For the region as a whole, the number of farms had decreased by one percent. The decrease mostly occurred in the 5 hectares - and - over size of farms. The observed decline in their number can be traced to the (1) fragmentation of lands through inheritance, (2) effect of the Land Reform Act of 1963, whereby the shift from tenancy to leasehold operations was accentuated, (3) labour force movement from the farming to the urban areas, and (4) the boom in the real estate transactions leading to breakdown of larger farms (BCS 1973).

1.4 The Organisation of the Study

The particulars of the sample and data, the concepts and measurement of capital, and the estimation of farm capital formed are described in Chapter 2. This is followed in Chapter 3 by a review of farm investment studies and a survey of investment models.
<table>
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<th>Year</th>
<th>Owner to Lessee</th>
<th>Owner to Share Tenant</th>
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<tr>
<td>Central Luzon 2</td>
<td></td>
<td></td>
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<tr>
<td>1963/65</td>
<td>1.334</td>
<td>1.610</td>
</tr>
<tr>
<td>1967/68</td>
<td>1.726</td>
<td>2.807</td>
</tr>
<tr>
<td>1968/69</td>
<td>1.102</td>
<td>2.515</td>
</tr>
<tr>
<td>Mean</td>
<td>1.39</td>
<td>2.31</td>
</tr>
</tbody>
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1 Net income is the value of the sum of palay sold, palay consumed, and the difference between the value of the farmer's palay stock at the beginning of the semester period and that at the end of the same period less costs of fertiliser and farm chemicals.


### TABLE 1.3

**NUMBER OF FARMS BY SIZE AND PROVINCES IN CENTRAL LUZON REGION, PHILIPPINES, 1960 AND 1971 CENSUS OF AGRICULTURE**

| Region/Province | Number of Farms | Percent Change |  |
|-----------------|-----------------|----------------|
|                 | Total           | Less than 5 has. | 5 has. and over | All Farms | Less than 5 has. | 5 has. and over |
| Central Luzon   | 171,571 | 169,595 | 151,170 | 150,995 | 20,401 | 18,600 | -1 | - | -1 |
| 1 Bataan        | 6,874 | 8,206 | 5,442 | 6,835 | 1,432 | 1,371 | 19 | 26 | -4 |
| 2 Bulacan       | 31,854 | 29,395 | 29,921 | 27,888 | 1,933 | 1,507 | -8 | -7 | -22 |
| 3 Nueva Ecija   | 58,566 | 60,096 | 51,578 | 53,672 | 6,988 | 6,424 | 3 | 4 | -8 |
| 4 Pampanga      | 26,203 | 23,801 | 21,738 | 19,333 | 4,465 | 4,468 | -9 | -11 | 5 |
| 5 Tarlac        | 35,606 | 35,590 | 30,714 | 31,462 | 4,892 | 4,128 | - | 2 | -16 |
| 6 Zambales      | 12,468 | 12,507 | 11,777 | 11,805 | 691 | 702 | - | 2 | 2 |

* Less than one percent

Source: BCS 1973, p.86.
The review and the survey are undertaken primarily to help in the formulation of an analytical model for this study. Specification of the analytical model, estimation techniques used, and the results obtained on factors associated with farm investment are presented in Chapter 4. Finally, Chapter 5 concludes the study highlighting the main findings and their policy implications.
CHAPTER 2
THE DATA, CONCEPTS AND
ESTIMATION OF FARM CAPITAL FORMATION

Studies of capital formation usually encounter several difficulties with respect to concepts, definitions, and problems of measurement. And this study is no exception. The first two sections of this chapter briefly describe the survey procedure, sampling and the source and nature of the data. The third section discusses the concept and measurement of capital as used in this study. The fourth section outlines the methods and concepts underlying the measurement of gross and net farm capital formation, and the estimates of farm capital formation in the region and its composition.

2.1 Source of Data, Sampling Technique and Survey Procedure

The data used in this study were taken from the returns of the second nationwide survey of capital formation at the farm household level undertaken by the Philippines Bureau of Agricultural Economics in 1974. The writer had the opportunity to actively participate in this 1974 survey.

The survey involved a multi-stage sampling technique. First, all provinces which are predominantly agricultural were selected, followed by the selection of sample barangays from a list compiled during the Integrated Agricultural Survey (June 1974 round)\(^1\) of the Bureau. Replacement of sample barangays was resorted to where the peace and

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1 The Integrated Agricultural Survey is undertaken by the Bureau to prepare estimates on current agricultural resources. It includes the listings of sample municipalities, barangays and farmers. The major rounds are conducted in January and June of each year.
order situation in a previously sampled barrio made field survey operations impossible. The last stage was the drawing out of farmer respondents using a systematic random sampling technique. Farm data were gathered by the questionnaire interview method.

A sample comprising 324 farm households, whose main farm activity was rice cultivation in the Central Luzon region, was made available for this study. The sample breakdown for the six provinces comprising the region appears below:

<table>
<thead>
<tr>
<th>Region/Province</th>
<th>No of Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Luzon</td>
<td>324</td>
</tr>
<tr>
<td>1. Bataan</td>
<td>33</td>
</tr>
<tr>
<td>2. Bulacan</td>
<td>55</td>
</tr>
<tr>
<td>3. Nueva Ecija</td>
<td>79</td>
</tr>
<tr>
<td>4. Pampanga</td>
<td>47</td>
</tr>
<tr>
<td>5. Tarlac</td>
<td>70</td>
</tr>
<tr>
<td>6. Zambales</td>
<td>40</td>
</tr>
</tbody>
</table>

2.2 Nature of the Data

Record keeping is not a common practice among the Filipino farmers. Hence, the questionnaire interview method was employed in obtaining the data.¹ This coupled with the fact that the field survey was conducted several months past the reference period, may have resulted in some memory lapse and therefore a bias in the data provided by the farmer respondents. This bias may have some bearings on the accuracy of the data.

The special problems associated with the estimation of capital formation in a predominantly subsistence agriculture may also

¹ Part of the questionnaire relevant to capital formation is found in the Appendix.
have some influence on the data. Labour and traditional materials used in most private construction on farms, such as, farm buildings, were owned and produced by the farmers themselves. Since there did not exist an active market for some of these materials in the relatively traditional agriculture of the region, an element of bias may be involved in value determination of these non-monetised items. Fixed assets newly acquired within the reference period were depreciated for one year using the straight line depreciation approach. It is, however, recognised that the actual depreciation may not have occurred to the extent suggested by this method. This might have resulted in an underestimation of the net capital formation for fixed assets, since net capital formation is arrived at after deducting depreciation from the gross capital formed. On the other hand, the net capital formation for perennial crops may tend to be over-estimated because all expenses incurred in care and improvement were added to the transplanting expenses to form net capital formation. This inaccuracy results in view of the lack of studies that deal on the capacity to produce at various stages of the life span of perennial crops, which would set proper depreciation or appreciation values in determining the current value of perennial crops. Other aspects of the estimation of gross and net capital formation, and depreciation, are dealt with later in the chapter.

2.3 The Concept and Measurement of Capital in Agriculture

2.3.1 The Meaning of Capital in Agriculture

Capital is a concept which has received a great deal of theoretical exploration. It is generally given one of two alternative meanings (Barna 1959). First, it can mean the individual's command over resources in the financial sense (financial capital). Secondly,
it can mean a factor of production (real capital). The term capital is also sometimes used to cover human capital, i.e. investment in skills, education and health (Nurkse 1957).

In the context of capital formation studies in agriculture, capital is usually defined in terms of real capital. Real capital pertains to physical durable assets and inventories. As used in farming, it can be classified into four major types, namely, 1 (1) farmland and farm buildings; (2) implements and machinery; (3) livestock; and (4) stored crops. For the purposes of this study, however, three major types of physical assets have been distinguished. They are as follows: 2

A. Farmland

B. Fixed Assets: constructions and works on the farmland; farm buildings; implements, tools and machinery; and perennial crops.

C. Inventories: livestock, poultry and stored crops.

1 As given in Tostlebe (1957). There are differences of opinion as regards the composition of capital for purposes of estimates. Although Tostlebe includes agricultural land in his definition of "real" or "physical" capital, he excludes it from "reproducible capital". He also includes currency and demand deposits of farmers in his "total capital". Spitze (1961) and Upton (1973), also incorporate land in their concepts of farm capital. Barna (1959), however, excludes land and natural resources in his concept of "real capital" apparently because these are "gifts of nature" and also because of valuation problems. On the other hand, Clark (1957) excludes residential buildings in the computation of capital, but Kuznets (1955) prefers to include them.

2 A detailed composition of each category is found in Appendix A.
The above categories do not include items that are undoubtedly farm capital. In the survey, no account was taken of inventories of other forms of farm capital, such as, farm supplies of chemicals and fertilizers, that farmers may have had on hand. They were omitted because it was assured that their amounts were relatively small and insufficient to warrant estimates for the period under study. Currency and demand deposits held by farmers are a potential source of capital for use in farming. Although information on savings was incorporated in the survey questionnaire, few farmers reported cash savings. This reflected the predominance of subsistence living and the meagre cash earnings on farms. It may also be due to the reluctance of some farmers in revealing their private savings.

On the other hand, questions have been raised as regards the inclusion of farm land and farm dwellings because of the nature of origin in the case of land, and of use in the case of dwellings.

Land is considered a "gift of nature", hence its supply is fixed. Although the physical area is fixed, productive capacity can be increased by means which closely resemble the methods by which farm buildings and equipment are increased, i.e. by the investment of effort and of money to clear, drain, fertilize or irrigate it; to prevent erosion and depletion; or to bring it closer to markets by building roads (Tostlebe 1957). Another reason for including land in the inventory of farm capital is that farm financial operations especially in securing loans are influenced as much by the value of land as by the value of farm buildings and equipment. In view of these considerations, farm land was regarded as a form of capital within this study.

In the case of farm dwellings, it would be very difficult to divide the investment on the basis of use in production and consumption.
The farm dwelling not only provides an abode convenient to the fields of the farmer and his/her family - the main components of the agricultural labour force - but in addition, it frequently serves as a store for farm products, supplies and a place to feed hired labour. Hence, it was deemed appropriate in this study to include the value of the entire farm dwelling as a component of capital. However, by including its full value in farm capital, an overstatement occurs as compared with capital used in industry, where the residences of workers are not included. To correct for this over-estimation, the value of the farm dwelling was included only if it was located within the farm.

2.3.2 Valuation of Capital

After defining the concept of capital in agriculture as adopted in this study, the next aspect concerns the measurement of capital. The problem of measurement arises due to the heterogeneity of the constituents of the capital stock and to other attributes of capital, viz. durability and quality changes resulting from technological progress. In the valuation of the stock of capital, the difficulty lies in the selection of a system of weights (prices) which can be used in aggregating divergent capital goods on the basis of a common unit of measurement. Aukrust and Bjerke (1959) point to the two characteristics of capital, i.e. production costs and earning capacity, which could serve as bases for two alternative methods in the aggregation of capital. These are the retrospective and prospective methods. ¹

¹ Barna (1959) would call these capital by investment effort and by efficiency, respectively. Kirzner (1966), on the other hand, refers to them as backward and forward measures of capital.
Accordingly, in the retrospective method the real measure of capital is the cost of producing it. This implies that current value figures must be deflated with an appropriate cost index, the chief constituents of which are wage rates and the rates of interest and profit. In the prospective method, on the other hand, the value of capital items should reflect their future earning capacity. Valuation should be based on the market prices of the capital items, since these can be taken as an approximation of their earning capacity.

The market value measure of capital has been criticised on the grounds that if a correction in the market value needs to be made in order to adjust for price changes over time, the problem of constructing an index of capital goods prices arises. Market values are useful only if one is interested in the prospective method of measuring capital (Kirzner 1966).

Valuation of capital in this study followed the retrospective method using as deflator the general wholesale price index published by the Central Bank of the Philippines, adjusted for 1973 as the base year.

Land valuation is usually difficult and complex. The problem was resolved in this study by using agricultural land values provided by an independent specialist organisation, namely, the Bureau of Lands, for various crops and provinces in the region. These land values are shown in Table 2.1.

2.4 Estimation of Capital Formation

2.4.1 Two Approaches

In practice, there are two basic approaches to the estimation of capital formation, namely, the "inventory or commodity flow approach", and the "expenditure approach".
TABLE 2.1  
LAND VALUES PER HECTARE, CENTRAL LUZON REGION, PHILIPPINES, 1973  
(in Pesos)  

<table>
<thead>
<tr>
<th>Farm Type</th>
<th>Province</th>
<th>Bataan</th>
<th>Bulacan</th>
<th>Nueva Ecija</th>
<th>Pampanga</th>
<th>Tarlac</th>
<th>Zambales</th>
<th>Regional Average Per Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>I Cultivated</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Riceland</td>
<td>Bataan</td>
<td>2,999</td>
<td>6,750</td>
<td>4,477</td>
<td>4,000</td>
<td>3,383</td>
<td>4,320</td>
<td>4,322</td>
</tr>
<tr>
<td>Cornland</td>
<td>Bulacan</td>
<td>2,604</td>
<td>4,500</td>
<td>3,037</td>
<td>2,000</td>
<td>3,000</td>
<td>2,000</td>
<td>2,857</td>
</tr>
<tr>
<td>Coconut</td>
<td>Nueva Ecija</td>
<td>5,000</td>
<td>1,903</td>
<td></td>
<td></td>
<td></td>
<td>1,500</td>
<td>2,801</td>
</tr>
<tr>
<td>Tobacco</td>
<td>Pampanga</td>
<td>3,330</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3,330</td>
</tr>
<tr>
<td>Vegetable/Rootcrops</td>
<td>Tarlac</td>
<td>5,500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>550</td>
</tr>
<tr>
<td>Fruitland/Orchard</td>
<td>Zambales</td>
<td>1,100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1,100</td>
</tr>
<tr>
<td>Sugar</td>
<td></td>
<td>3,450</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3,450</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2,234</td>
<td>5,417</td>
<td>3,616</td>
<td>3,000</td>
<td>3,192</td>
<td>2,607</td>
<td>3,337</td>
</tr>
<tr>
<td>II Uncultivated</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Virgin land</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pasture, Forest</td>
<td>Bataan</td>
<td>500</td>
<td>500</td>
<td></td>
<td>1,250</td>
<td>625</td>
<td>719</td>
<td></td>
</tr>
<tr>
<td>and Cogon</td>
<td>Bulacan</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>500</td>
<td>500</td>
<td>1,250</td>
<td>625</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* The regional average was used in provinces where land value is not available for a certain farm type.

Source: Bureau of Lands.
The inventory or commodity flow approach was originally developed by Kuznets (1937) in estimating national income for the United States. The former measures the stock of capital at two points of time, the difference between the two magnitudes being the accumulated capital; and the latter measures capital formation by the volume of resources flowing into it, i.e. flow of goods not consumed and invested in capital. According to Shukla (1965), the estimation of capital formation between two periods will be unaffected whether the "stock" or the "flow" method is employed since the nature and magnitude of error in estimation will remain the same. She explains that even if a proper price deflator is utilised in order to adjust for varying prices, the problem of shifting weights cannot be entirely solved. And which one of the two (inventory or commodity) will result in larger estimates of capital formed depends on the movement of relative prices of different goods flowing into the stock of capital. But for these difficulties, the inventory or commodity measures should give identical results and, for theoretical considerations, they do not constitute two alternatives (Shukla 1965).

In the expenditure approach, the estimation of capital formation is made from the expense account of producers. Capital formation estimates include the purchase price, construction costs, major repairs and other expenses which add materially to the value of capital assets, broken down and allocated to labour and materials (Soeharjo 1964).

The application of the inventory or commodity flow approach or the expenditure approach in estimating capital formation in agriculture depends on the type of agriculture in the country concerned. In view of the low degree of monetization in agriculture of the LDCs, the expenditure approach may not be applicable. Hooley (1964) recommends
the use of periodic survey data which operates essentially on an inventory basis with the use of commodity flow to estimate year-to-year changes. Soeharjo (1964), on the other hand, favours the adoption of the combination of both approaches rather than the exclusive use of either. The expenditure approach will provide the best measure when capital formation involves the use of unpaid labour and materials produced by the farmers themselves; the inventory approach will be suitable for capital goods acquired by farmers without using unpaid labour or materials.

A combination of both approaches was employed in this study - the expenditure approach in estimating capital formation for farmland and fixed assets categories; and the inventory approach in estimating change in stocks of livestock, poultry and stored crops.

2.4.2 Depreciation Estimation

Correct estimation of depreciation, or the reduction in the ability of a capital good to contribute to production in the future is important for the precise measurement of net capital formation. But such an estimation poses some problem because of the difficulty in ascertaining quality change in capital assets. Estimates of depreciation, and consequently the estimates of net capital formation, may also differ substantially according to the method of amortisation utilised. Balboa and Fracchia (1959) enumerate two approaches to the estimation of depreciation. One takes into account the probable evolution of market prices for used capital goods, and another is derived from the system of valuation in terms of current production capacity of the capital good. In the former case, the value of capital goods generally tends to decline more rapidly in the early than in the middle years of its useful life. In the latter case, the production capacity
does not decrease rapidly during the early years of useful life but the process of decline may be intensified at later stages.

In Philippine agriculture, reliable prices of used capital goods are not available, nor do studies exist on the evolution of production capacity of capital goods, nor have detailed depreciation estimations been made. Hence, for this study, the simple method of straight-line depreciation was utilised, i.e.

\[
\text{Annual Depreciation} = \frac{\text{Purchase Value}}{\text{Estimated No. of Useful Life, in Years}}
\]

2.4.3 Gross Farm Capital Formation

In the preceding chapter, capital formation or investment was generally defined as additional accumulation of capital resources to the already existing stock of capital. Earlier in this chapter, the concept of capital in agriculture was discussed and farm capital was classified into: farmland, fixed assets and inventories. In investment theory, gross capital formation (or gross investment) is normally observed. Gross farm capital formation, as adopted in this study, represents the following: 1

Farmland:

a. Value of additions to area farmed through purchase, inheritance, etc.

b. Expenditures incurred for permanent improvements such as clearing of land for cultivation, reclamation, etc.

1 Details are found in Appendix B. All forms of additions and capital expenditure, etc. fall within the reference period.

At the present stage of development of agriculture in the Central Luzon region and the country as a whole, the use of unpaid family and exchange labour and own-produced materials by farmers are not uncommon in private constructions on farms. Hence, they are accounted for in the estimates of gross farm capital formation.
Fixed Assets:

a. Value of new acquisitions through purchase, and value of additional constructions.

b. Expenditures on major repairs and alterations, renovations, etc. However, routine cases such as cleaning, adjusting and replacement of shortlived parts were considered current expenditures, and therefore excluded in the estimates.

c. Cost of additional plantings and development of perennial crop plantation.

Inventories:

a. Value of per unit increase in inventories of livestock, poultry and stored crops.

b. Appreciation in value due to natural growth in the case of livestock and poultry.

2.4.4 Net Farm Capital Formation

Although it is gross investment that is normally observed, it is the net change in investment that is of main interest and which investment theory attempts to explain. Thus, capital formation is usually computed on a net basis for the purpose of analysis (Kuznets 1961). Net capital formation is measured after allowances are made for depreciation and other forms of capital consumption allowances.¹

Following the expenditure approach described earlier, net farm capital formation for farmland and fixed assets is gross farm capital formation less decreases in area farmed through sale, etc. (in the case

¹ Conceptually this represents the decline in value of durable capital from wear and tear, obsolescence or accidental damage over any given reference period.
of farmland), less depreciation and other forms of capital consumption allowances (in the case of fixed assets). For livestock, poultry and stored crops, however, the inventory approach is utilised. That is, the net farm capital formation in respect of these items is the net value of physical change for beginning and end inventories for the 1973-74 year.

2.4.5 Estimates of Farm Capital Formation in the Region

For the year covered in this study, the estimated capital formation for the 324 sample farms in the region is presented in Table 2.2. The last column of the table shows the percentage composition of total net investment. Increase in inventories of livestock, poultry and stored crops accounts for 87 percent of total net farm investment. Of these, stored crops in the form of increases in palay stocks account for 82 percent. The meagre contributions of livestock and poultry, 16 and 2 percent respectively, reflect the small scale or backyard form of production of livestock and poultry by the farmers.

Next in importance is investment in fixed assets which account for 12 percent of total net investment for the whole region. Of the items composing fixed assets, farmers invested mostly in implements, tools and machinery as evidenced by the 60 percent contribution to total net investment for fixed assets. Investment in perennial crops is only one percent to total net investment for fixed assets. This is, however, not surprising because the sample farms are predominantly rice farms and do not grow perennial crops.

1 Details are also given in Appendix B.
TABLE 2.2
CAPITAL FORMATION ON THE SAMPLE RICE FARMS BY TYPE OF CAPITAL FORMED, CENTRAL LUZON REGION, CROP YEAR 1973-74
(in Pesos at 1973 prices)

<table>
<thead>
<tr>
<th>Type of Capital</th>
<th>Stock of Capital July 1,1973</th>
<th>Gross *</th>
<th>Capital Consumption Allowances, etc.</th>
<th>Net Capital Investment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Value</td>
<td>Total Value</td>
<td>Total Value</td>
<td>Total Value</td>
</tr>
<tr>
<td>No. of sample farms = 324</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>4,557,015</td>
<td>3,139,841</td>
<td>2,506,031</td>
<td>633,810</td>
</tr>
<tr>
<td>A. FARMLAND</td>
<td>3,457,963</td>
<td>7,477</td>
<td>1,500</td>
<td>5,977</td>
</tr>
<tr>
<td>hectares</td>
<td>802.66</td>
<td>2.50</td>
<td>0.50</td>
<td>2.00</td>
</tr>
<tr>
<td>B. FIXED ASSETS</td>
<td>197,670</td>
<td>100,382</td>
<td>25,685</td>
<td>74,697</td>
</tr>
<tr>
<td>1.Construction and works on the farm</td>
<td>23,314</td>
<td>20,479</td>
<td>2,494</td>
<td>17,985</td>
</tr>
<tr>
<td>2.Farm buildings</td>
<td>11,702</td>
<td>13,354</td>
<td>2,474</td>
<td>10,880</td>
</tr>
<tr>
<td>3. Implements, tools and machinery</td>
<td>156,754</td>
<td>65,699</td>
<td>20,717</td>
<td>44,982</td>
</tr>
<tr>
<td>4.Perennial crop</td>
<td>5,900</td>
<td>850</td>
<td>-</td>
<td>850</td>
</tr>
<tr>
<td>C. INVENTORIES</td>
<td>901,382</td>
<td>3,031,982</td>
<td>2,478,846</td>
<td>553,136</td>
</tr>
<tr>
<td>1.Livestock</td>
<td>781,675</td>
<td>152,611</td>
<td>65,623</td>
<td>86,988</td>
</tr>
<tr>
<td>2.Poultry</td>
<td>22,739</td>
<td>39,488</td>
<td>30,038</td>
<td>9,450</td>
</tr>
<tr>
<td>3.Stored Crops</td>
<td>96,968</td>
<td>2,839,883</td>
<td>2,383,185</td>
<td>456,698</td>
</tr>
</tbody>
</table>

For simplification purposes, the column for ending inventory of capital stock on June 30, 1974, has been omitted from the table. It can be calculated by adding the value of beginning inventory and the net capital investment.

* During the reference period, crop year July 1, 1973 to June 30, 1974.
Investment in farmland accounts for only one percent of total net farm investment. Of the 324 sample farmers, only three farmers reported investment in land. Investment in farmland was in the form of purchase and lease of additional hectarage. Disinvestment in the form of sale of farmland was reported by another farmer.

This chapter has described the survey procedure, sampling technique, source and nature of the data. Discussion in the chapter covered the concepts and measurement of capital in agriculture, and the estimation of the amounts of gross and net capital formed on the sample farms. Finally, a brief description of the composition of net capital formed was also given.
CHAPTER 3

CORRELATES OF INVESTMENT - A REVIEW OF LITERATURE

This chapter surveys selected major investment models and empirical studies in agriculture. The survey is undertaken with the sole aim of canvassing conceptual variables for the farm investment function for this study. The survey is presented in two parts. The first part describes theoretical and empirical models and their main findings. This is followed in the second part with a review of the studies which have commented on the relevance of institutional settings (e.g. land tenure) and other factors to private investment on farms. Finally, based on the studies surveyed, a tabular summary of factors found to have been associated with the farm investment is provided.

3.1 A Review of Econometric Investment Studies

Most empirical work on investment has been in the context of the industrial sector using time series data. A review of econometric studies of industrial sector investment is given, among others, by Meyer and Kuh (1957), Eisner and Strotz (1963) and recently, by Jorgenson (1971). Attempts have been made by agricultural economists to develop farm investment models based on the models formulated in the context of the industrial sector. Some of these are discussed below.

3.1.1 The Flexible Accelerator Model

This model, associated with the names of Chenery (1952) and Koyck (1954), has been the subject of intensive research on investment in recent years. It was derived from the original accelerator model of Clark (1915). The basic difference between the Clark and the Chenery and Koyck models lies in their treatment of the investment adjustment
response coefficient, $\beta$. In the adjustment response, it is assumed that the increase in capital undertaken during year $t$ is some fixed proportion ($\beta$) of the difference between the desired and actual capital stocks. If $\beta$ is equal to unity, the difference between the desired and actual capital stocks will be entirely eliminated within year $t$. On the other hand, if $\beta$ is less than unity, only a fraction of the adjustment will be completed during the year (Hickman 1965).

In the Clark accelerator model, the adjustment coefficient is taken to be unity, implying that actual capital is equal to the desired capital, and net investment is equal to the change in desired capital between $t$ and $t-1$ time periods. Thus,

$$I_{net} = K_t - K_{t-1} = K^* - K^*_{t-1}$$

where, $I_{net} = \text{net investment}$, $K_t = \text{actual capital stock in year } t$, $K_{t-1} = \text{actual capital stock at the end of the previous year}$, $K^*_t = \text{desired capital stock in year } t$, and $K^*_{t-1} = \text{desired capital stock in the previous year}$.

Since at any point in time it is unlikely that actual capital stock may equal the desired capital stock on account of risk and uncertainty, and other reasons, Chenery and Koyck have introduced some modifications to Clark's model to make it more realistic. Their flexible accelerator model centers on the time structure of the investment process, which is characterised by a geometric distributed lag function. Thus, actual capital is a distributed lag function of desired capital with geometrically declining weights. In the distributed lag function, desired capital is suggested by Chenery as being proportional to lagged output. Koyck, on the other hand, has modified the geometric lag distribution in such a way that the first geometric weight may be determined separately, with the successive weights declining
geometrically.

Hence, in the flexible accelerator model, the investment adjustment coefficient $\beta$ is less than unity, which implies that the investment response will be geometrically distributed over a number of years. The net investment of each year is a constant fraction, $1-\beta$, of that of the preceding year $t-1$. This can be represented as:

$$I_{\text{net}} = K_t - K_{t-1} = \beta(K_t^* - K_{t-1}), \ 0<\beta<1$$

The flexible accelerator model of Chenery and Koyck seems to be the point of departure of most investment models. The main difference between these models lies with respect to their determinants of desired level of capital. In alternative models of investment behaviour, desired capital according to Jorgenson (1971) depends on:

1. capacity utilisation represented by the nature of output to capacity, change in output, sales, etc;
2. internal finance variables, e.g. flow of internal funds, the stock of liquid assets, debt capacity and accrued tax liability; and
3. external finance variables, e.g. interest rate, rates of return, stock prices and the market value of the firm.

3.1.2 The Flexible Accelerator Model and Replacement Investment

Alternative models of investment behaviour also differ in their treatment of replacement investment. Replacement investment refers to the purchase of capital goods necessary to replace that portion of capital which has worn out or deteriorated, or become obsolete. The rate of depreciation reflects the rate of deterioration as well as the rate of obsolescence.
In accounting terms, the change in capital stock from one period to another is equal to gross investment less replacement investment. Jorgenson (1971) has noted that the flexible accelerator model provides an explanation of the net change in capital stock but not of gross investment. He therefore suggested the addition of a model of replacement investment into the flexible accelerator model which would provide a complete explanation of the investment behaviour. Utilising a geometric mortality distribution for capital goods in which the replacement is assumed to be proportional to actual capital stock, the change in capital stock is represented by Jorgenson as:

\[ K_t - K_{t-1} = A_t - \delta K_{t-1} \]

where, \( A \) is gross investment and \( \delta \) is the fixed rate of replacement.

By combining the flexible accelerator model of net investment and the geometric model of replacement, Jorgenson developed the following model of investment expenditure:

\[ A_t = \beta(K^*_t - K_{t-1}) + \delta K_{t-1} \]

In the above equation, the adjustment coefficient for replacement investment is equal to unity. The speed of adjustment for gross investment is much more rapid than that for net investment.

According to Hickman (1965), while the stock adjustment mechanism of the flexible accelerator concerns only net investment, replacement investment is not neglected. In the flexible accelerator model current replacement investment is assumed to equal current depreciation on the capital stock. And as long as the depreciation estimates are based on an exponential or declining - balance formula,

---

1 Implies a declining balance formula for depreciation.
depreciation is functionally related to net capital stock. For these considerations, Hickman reasons that net investment regression can be employed to predict gross as well as net investment as long as an exogenous estimate of the depreciation rate is given.

3.1.3 The Flexible Accelerator Model and its Application in Agriculture

Fisher (1974) developed a quarterly model of agricultural investment in Australia by using a flexible accelerator based investment model incorporating the concept of implicit rental price. The model is also based on the Jorgenson theory of gross investment as discussed earlier. By adding a term for replacement investment and specifying a relationship for desired capital stock, Fisher specified gross investment \( I_t \) as a function of output and the change in the implicit rental price of capital services, with a polynomial distribution of the Almon technique:

\[
I_t = bK_{t-1} + \sum_{i=0}^{n_1-1} \frac{\Delta Y_{t-i}}{1+b_{t-1}} + \sum_{i=0}^{n_2-1} \frac{\Delta C_{t-i}}{1+b_{t-1}}
\]

where, \( b = \text{rate of replacement}, \) \( K = \text{actual capital stock}, \) \( Y = \text{output}, \) and \( C = \text{the change in the implicit rental price of capital services}. \)

The results obtained from the regression equation, however, did not substantiate the basic flexible accelerator model. Nevertheless, the change in the implicit rental price variable was found to be significant.

3.1.4 The Residual Funds Model

Campbell (1959) observes that the investment models based on the acceleration principle have little relevance in agriculture where the nature of investment contrasts with that in the industrial sector. He

---

1 The implicit rental price postulates that a firm equates the purchase price of an asset with the present values of all future services (Fisher 1974). The implicit rental price has been used in a number of investment studies in the manufacturing sector. See Jorgenson and Stephenson (1967).

2 See Almon (1965).
argues that in agriculture, production is based on the family unit, such that a great deal of the capital formation is produced through the direct efforts of farmers and requires no financing except to the extent that materials have to be purchased in some cases, e.g. land improvements, fencing, farm buildings. Similarly, when crops and livestock are raised and withheld from sale to increase the existing stock, these do not only mean sacrificing realised income but also require little financing. Further, Campbell believes that even the more sophisticated explanation of investment involving risk, uncertainty and expectations do not seem to have much value when applied to agriculture. According to him, these models provide: "... a basis for setting up ideal goals for agricultural investment rather than as an explanation of, or guide to, entrepreneurial action ...". Based on these reasons, he proposed an alternative model referred to as the residual funds model in the literature.

The importance of internal liquidity in farm capital formation has been emphasised by Campbell (1959) in the following words: "The most plausible formulation would treat investment outlay as a residual, defined as the net income realised from current operations less tax commitments and some conventional allowance for farm family living expenses". In this context, he sees the particular relevance of Friedman's (1957) theory of consumption to the farming situation. In farming situations, "transitory" income changes are likely to arise from weather conditions and product demand shifts.

The residual funds hypothesis has gained widespread acceptance because of its simplicity and intuitive appeal. It is therefore proposed to briefly review three studies - two from Australia and one from India - which have the residual funds hypothesis underlying their
analyses.

For a sample of 300 Australian wheat and sheep farmers, Pearse (1955) attempted to relate through correlation analysis the net farm investment to six factors, namely (1) net income, (2) age of farmer, (3) years spent farming present property on account, (4) size of debt, (5) amount of debt repaid and (6) amount spent on replacements. Results of the statistical analysis showed that of the six factors, net income alone had a significant relation with the level of investment spending. This to some extent provides important evidence in support of the residual funds hypothesis of Campbell.

Shah and Singh (1969) have implicitly applied a residual funds based investment function in their study of capital formation in one of the agricultural districts of India. The sample farmers were classified into two groups as "progressive" farmers (owners of irrigation facilities and at least one agricultural machine, adopters of new farm practices) and "less progressive" farmers (do not own irrigation facilities, etc.). Using cross-sectional data, for each of the two groups of farmers they examined the relationship between capital investment and disposable income:

\[ C = a + bY \]

where, \( C = \text{capital investment} \), and \( Y = \text{disposable income} \). In the simple regression analysis, a significant and positive relationship was found to exist between capital investment and disposable income for the progressive group of farmers but not for the less progressive group.

Herr (1964), however, recommends certain refinements and modifications in the residual funds model in order to gain a more satisfactory explanation of both the short and long run investment
behaviour. Since in theory,

\[ I = Y_d - C \]

where, \( I \) = investment, \( Y_d \) = disposable income, and \( C \) = consumption, Herr argues that the short run version of the residual funds hypothesis needs to consider additional variables such as liquid assets (\( A_L \)) and outstanding debts (\( D \)). Thus,

\[ I = f(Y_d, C, A_L, D) \]

In the long run, on the other hand, the more appropriate relationship would be,

\[ I = f(Y_d', C), \text{ or} \]
\[ I = f(Y_n) \]

where, \( Y_n \) = net cash income.

The above relationships were empirically tested by Herr. He found that there are significant differences in the investment behaviour of farms which are not explained by the residual funds hypothesis even with the modifications. Hence, Herr concludes that if the explanatory power of the residual funds hypothesis is to increase, there is a need to re-introduce the profit maximisation and the risk and uncertainty principles into investment functions.

3.1.5 A Combined Accelerator - Residual Funds Model

The above discussion and the studies reviewed above show that there are certain limitations when either the accelerator model or the residual funds model alone is used in explaining the investment behaviour of farm firms. To overcome these limitations, a number of recent studies, e.g. Glau (1971), Girao (1974) and Waugh (1977), have combined the accelerator and the residual funds models into one model.
In his study of agricultural investment in Australia, Glau (1971) developed an investment model based on the Jorgenson model of gross investment, i.e. flexible accelerator model of net investment and replacement investment, as discussed earlier.

\[ I_t = b(K^*_t - K_{t-1}) + \delta K_{t-1} \]

where, \( I_t \) = gross investment, \( b \) = rate of adjustment of capital towards its desired level, \( K^*_t, K_t \) = desired and actual stock of capital, respectively, and \( \delta \) = rate of replacement. Alternatively, gross investment is expressed as \([K^*_t - (1 - \delta) K_{t-1}]\). In Glau's model, \( b \) is a variable rate of adjustment and a linear function of internal liquidity. Hence,

\[ I_t = b_t [K^*_t - (1 - \delta) K_{t-1}] \]

and,

\[ b_t = f(L_{t-1}) \]

where, \( b_t \) = rate of adjustment in year \( t \), and \( L_t \) = internal liquidity in period \( t \). According to Glau, the above equation suggests that the rate of adjustment is a linear function of internal liquidity relative to the desired investment, i.e.

\[ b_t = b_1 + b_2 \left( \frac{L_{t-1}}{K^*_t - (1 - \delta) K_{t-1}} \right) \]

where, \( b_1 \) and \( b_2 \) are constants. By substituting the above expression for equation (2), Glau obtained the following investment function:

\[ I_t = b_1 [K^*_t - (1 - \delta) K_{t-1}] + b_2 L_{t-1} \]

Assuming that the replacement rate and depreciation are identical, the actual stock of capital in a given year is the sum of the undepreciated values of all investment expenditures in previous years, \( K_t = \sum_{i=0}^{\infty} (1-\delta)^i I_{t-i} \).
Substituting the latter expression for the actual capital stock and by adding and subtracting \((1 - \delta) I_{t-1}\) and \((1 - \delta) L_{t-2}\) from the right side of equation (3), the investment function with a variable rate of adjustment is stated below:

\[
I_t = b_1 [K^*_t - (1 - \delta) K^*_{t-1}] + b_2 [L_{t-1} - (1 - \delta) L_{t-2}]
+ (1 - b_1) (1 - \delta) I_{t-1}
\]

The empirical application of the above equation becomes possible by expressing the desired capital stock as a function of its determinants which Glau enumerates as:

- \(Q_t\), the level of expected output;
- \(c_t/w_t\), the relative price ratio of user cost to the wage rate; and \(c_t/p_t\), the relative price ratio of user cost to the price of output. Thus,

\[
K^*_t = a_0 + a_1 Q_t + a_2 (c_t/w_t) + a_3 (c_t/p_t)
\]

Substituting the above equation in equation (4) results in Glau's transformed investment model with variable rate of adjustment:

\[
I_t = b_1 a_o + b_1 a_1 A Q_t + b_1 a_2 A (c_t/w_t) + b_1 a_3 A (c_t/p_t)
+ b_2 A L_{t-1} + (1 - b_1)(1 - \delta) I_{t-1}
\]

where,

- \(A Q_t = [Q_t - (1 - \delta) Q_{t-1}]\);
- \(A (c_t/w_t) = [(c_t/w_t) - (1 - \delta)(c_{t-1}/w_{t-1})]\);
- \(A (c_t/p_t) = [(c_t/p_t) - (1 - \delta)(c_{t-1}/p_{t-1})]\); and
- \(A L_{t-1} = [L_{t-1} - (1 - \delta) L_{t-2}]\).

Results of the least squares regression indicated that the coefficient of the variable \(A (c_t/p_t)\) was insignificant, resulting in its exclusion in the re-estimated model. Results obtained from the second regression, however, showed that the rate of adjustment of
desired to actual capital stock was not particularly sensitive to internal liquidity variations. Glau attributed this lack of sensitivity to the inability of defining consumption withdrawals. Nevertheless, Glau's model has provided an improvement to the standard constant rate stock adjustment model by allowing for a variable rate of adjustment.

The combined accelerator-residual funds model was indirectly used by Girao (1974) in his study of the effect of income stability on the investment behaviour of American farmers. He postulated an accelerator type investment function in which the observed level of capital stock is given by:

\[ K = g(K^*, TS^*, F^*) \]

where, \( K \) = actual level of capital stock, \( K^* \) = desired level of capital stock, \( TS^* \) = expected level of total sales, each expectation is a weighted sum of geometrically declining weights, and \( F^* \) = expected level of financial variables.

Defining net investment (IN) as, \( IN = K_t - K_{t-1} \), and assuming replacement investment (IR\(_t\)) to be proportional to the existing capital stock (IR\(_t\) = \( \delta \) \( K_t \)), the gross investment (I = IR + IN) function was stated by Girao as follows:

\[ I_t = a_0 (1 - \lambda) + a_1 TS_t + a_2 TS_{t-1} - (1 - \lambda + a_3 - \delta) K_t + a_4 F_{t-1} \]

where, \((1-\lambda)\) = rate of adjustment of capital towards its desired level, and \( \delta \) = rate of replacement.

Several financial variables were considered including the level of debt at the beginning of each year, the debt-asset ratio, and internal funds. Alternative internal funds variables considered were lagged savings, \( S_{t-1} \), and transitory component of income (\( \Delta Y_{t-1} - \Delta \bar{Y} \)), where, \( \Delta Y_{t-1} = Y_{t-1} - Y_{t-2} \), and \( \Delta \bar{Y} \) as the average change in income for the
observed period. The transitory income component was utilised as a test to Campbell's residual funds hypothesis.

Based on their incomes, the sample farmers were classified by Girao into "stable" and "unstable" income groups. Regression results confirmed the residual funds hypothesis, with the transitory income component serving as a better explanatory variable than lagged savings for investment decisions of farmers with unstable income. The lagged savings variable, on the other hand, was important for the stable income group. Aside from these, the results of Girao's study also confirmed the mechanism of the capital stock adjustment as discussed earlier in the flexible accelerator model. Thus, confirming the appropriateness of the combined accelerator-residual funds model.

Waugh (1977) also applied a revised accelerator or stock adjustment-residual funds model to intertemporal cross-sectional data of the wheat-sheep farms of Australia. The initial cross-sectional-time series model was stated as follows:

\[
I_{\text{net}} = a_1 + \sum_{j=2}^{n} a_j DV_j + \beta_1 (K_{it}^* - K_{it-1}) + \beta_2 Y_{it-1} + \beta_3 \Delta D_t + U_{it}
\]

where, \( I_{\text{net}} = K_t^* - K_{t-1} \) net investment, \( DV_j \) = dummy variables of the 0,1 categories used to determine individual between-farm effects, \( a_1 \) = intercept in the regression for farm 1, \( a_i + a_i \) = intercept for farm \( i, i=2...n \), \( Y_{t-1} \) = internal funds variable, \( \Delta D_t \) = external funds variable, and \( U_{it} \) = error term.

Owing to the difficulty of directly measuring the desired capital stock, \( K_{it}^* \), Waugh represented this variable by:

\[
K_{it}^* = \gamma_0 + \gamma_1 O_{it} + \gamma_2 O_{it-1} + \gamma_3 O_{it-2} + \gamma_4 O_{it-3} + \gamma_5 P_{it} + \gamma_6 P_{it-1} + \gamma_7 P_{it-2} + \gamma_8 P_{it-3} + U_{it}
\]
where, \( O_{it} \) = real farm output, defined as deflated gross farm receipts (sales), and \( P_{it} \) = real price of capital \( P_K \) or alternatively, the ratio of money wages to the money price of capital, \( W/P_K \).

Substituting equation (1) into equation (2), Waugh derived the following investment model which he estimated by ordinary least squares:

\[
I_{netit} = (a_0 + \beta_1Y_0) + a_1D_{it} + \beta_1Y_{1it} + \beta_2Y_{2it-1}
+ \beta_3Y_{3it-2} + \beta_4Y_{4it-3} + \beta_5Y_{5it} + \beta_6Y_{6it-1}
+ \beta_7Y_{7it-2} + \beta_8Y_{8it-3} - \beta_9K_{it-1} + \beta_2Y_{9t-1}
+ \beta_3AD_{it} + U_{it}
\]

Following Girao (1974), Waugh represented the internal funds variable \( Y_{it-1} \) by transitory income \((\Delta Y_t - \bar{\Delta Y})\), where, \( \Delta Y_t = Y_t - Y_{t-1} \), the change in real net cash income, and \( \bar{\Delta Y} \) as the average change in real net cash income on the sample period. The external funds variable \( AD_{it} \), was in terms of change in real debt. In the preliminary regression results, however, Waugh detected high multicollinearity between the transitory income \((\Delta Y_t - \bar{\Delta Y})\) and the change in debt \((AD_{it})\) variables. The problem was resolved by adding the two variables and thus forming a new variable, \( Y^*_{it} = (\Delta Y_t + \bar{\Delta Y}) + AD_{it} \), in the second regression equation. The main results obtained from Waugh's regression analyses are described below.

The negative coefficient of the lagged real net cash income variable in the first regression equation suggested a "timing" role rather than a "determining" role of internal funds in investment behaviour. According to Waugh, this means that the internal funds of farmers exert an influence on the timing of their investment under-
takings instead of determining their actual level of investment. This result, together with the positive coefficient of the combined transitory income-debt variable in the second regression equation and the negative value of the overall adjustment coefficient, support the "backlogging" pattern in investment behaviour of farmers. In times of adverse market conditions, farmers may tend to postpone investment. The positive coefficient of the real output variable in the two regression equations indicated that farmers' expectations as to their level of output was the main factor determining the desired capital stock. However, it was also concluded that the adjustment of the actual stock to this desired level was subject to financial limitations.

3.2 A Review of Other Investment Studies

The preceding Section 3.1 has presented the accelerator-residual funds model of capital formation in agriculture, and the results of empirical studies based on such models. These studies have provided insight as to the determinants of private investment on farms. However, several non-econometric and other studies have also been undertaken which throw additional light on the determinants of private investment on farms.

Other investment studies in agriculture in both developed and less developed countries show that internal funds of farmers themselves (e.g. income and savings) and external funds (e.g. credit) are the prime determinants of capital formation in agriculture. A study made by Tostlebe (1957) on U.S. agriculture indicated that the availability of savings and credit lead to higher investment on farms.

Spitze (1961) has also noted the importance of both savings and a proper use of credit in farm capital formation. He argues that savings must precede capital formation and if farmers' knowledge and use
of credit is deficient, farm capital formation can be thwarted. He also commented on the role of inheritance in the capital formation process in these words:

"...whatever levels of capital accumulation are achieved by (savings and credit) tend to be perpetuated by the inheritance process. No generation begins at the same point; in fact, inheritance looms large as the dominant source of farm capital."

Similar studies in developing countries by Inman and Southern (1960), and Firth (1964) report that low income influences capital investment in farms. Shukla (1965) in India, and De Guzman (1964) in the Philippines have confirmed the interrelationship between income, savings and investment in the agricultural sector. Further, Soeharjo (1964) from Indonesia has also postulated the relationship between income, savings and capital formation on farms. He has outlined his concept in a chart which is presented below as Figure 3.1.

**FIGURE 3.1**

THE INTERRELATIONSHIP BETWEEN INCOME, SAVINGS AND FARM CAPITAL FORMATION
Several farm management studies in the Philippines have indicated that farm size and farm income have a marked influence on the amount of farm investments (Bratton and Robertson 1954 and Sardido 1969). Ray (1970) also suggested that bigger farms tend to have higher rates of investments also in India.

Household size as a factor of investment is contained in Desai's (1969) study of the level and pattern of investment in one of the agricultural districts of India. Desai considered the size of the farmer's household, which he termed as family size, as a proxy for the labour supply and also as a gauge for the family living expenditure of a farmer.

It has also been suggested that farmers' education plays an important role in the process of farm capital formation (Woodsworth and Fanning 1961). In the case of the Philippines, Trinidad (1964) suggested that the low literacy of the majority of farmers contributed to the low output per unit of investment in Philippine agriculture. Since agriculture is becoming increasingly technically oriented, it demands greater competence of its labour force. Within such an environment, the education of farmers becomes increasingly important and has relevance to capital formation.

Other investment studies point to the importance of tenure in capital accumulation in farms. Raup (1961) hypothesised that the optimum conditions for capital formation in agriculture are established when tenure systems create the security of expectations which will in turn permit a reduction in current withdrawal of income for consumption purposes in favour of greater long term total gains. He contends that aside from farm ownership, certain kinds of leasing arrangements can create security expectations specific to the farmer, and for a period
of time sufficient to encourage long term investment. In the context of the Philippines, Sandoval (1964) has demonstrated the substantial limitations imposed by share tenancy, relative to other tenure categories, on the farmers' ability to save or to acquire capital.

3.3 Summary

Various studies surveyed in sections 3.1 and 3.2 are now summarised below in Table 3.1. The table aims to bring into focus the factors which have been suggested or found to be associated with investment on farms. Since these factors have already been discussed fully earlier in the chapter, the table is assumed to be self-explanatory.

**TABLE 3.1**

**FACTORS ASSOCIATED WITH PRIVATE INVESTMENT OF FARMS - A SUMMARY**

<table>
<thead>
<tr>
<th>Author, Date</th>
<th>Factors</th>
<th>Output</th>
<th>Internal Finance</th>
<th>External Finance</th>
<th>Implicit Farm Size</th>
<th>Family Size</th>
<th>Tenure Education</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bratton &amp; Robertson</td>
<td>+ a</td>
<td>+ a</td>
<td>a</td>
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<td>1954</td>
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<tr>
<td>Pearse 1955</td>
<td>+ a</td>
<td>+ a</td>
<td>+ e</td>
<td>- g</td>
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<tr>
<td>Tostlebe 1957</td>
<td>+ a</td>
<td>+ e</td>
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<td>- g</td>
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<tr>
<td>Campbell 1959</td>
<td>a</td>
<td></td>
<td>+ e</td>
<td>+ g</td>
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<tr>
<td>Inman &amp; Southern 1960</td>
<td>- b</td>
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<td>-</td>
<td>+ g</td>
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<td>Raup 1961</td>
<td>+ e</td>
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<td>Spitze 1961</td>
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<td>+ e</td>
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<td>Woodsworth 1961</td>
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<td>Herr 1964</td>
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<tr>
<td>De Guzman 1964</td>
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<td>Sandoval 1964</td>
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<tr>
<td>Soeharjo 1964</td>
<td>+ a</td>
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<td>Trinidad 1964</td>
<td>+ a</td>
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<td>Desai 1969</td>
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<td>+ a</td>
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<td>Sardido 1969</td>
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<td>Shah &amp; Singh 1969</td>
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<td>Ray 1970</td>
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<td>+ a</td>
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<tr>
<td>Glau 1971</td>
<td>+ i</td>
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<td>- d</td>
<td>- g</td>
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<tr>
<td>Girao 1974</td>
<td>+ j</td>
<td></td>
<td>+ d + e</td>
<td>- g</td>
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<tr>
<td>Fisher 1974</td>
<td>+ j</td>
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<td>- d + f</td>
<td>+ h</td>
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<td></td>
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<tr>
<td>Waugh 1977</td>
<td>+ j</td>
<td>- d</td>
<td>+ f</td>
<td>+ h</td>
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</table>
TABLE 3.1 (Cont'd)

Notes: A positive (negative) sign means that the factor has a positive (negative) effect on the investment.

a, net income, income; b, low income; c, disposable income;
d, transitory component of income; e, savings;
f, real income plus change in aggregate debt;
g, debt or credit;
h, change in aggregate debt;
i, price ratio of user cost to output price;
j, total farm sales, expected sales; k, ownership;
l, low literacy.

A survey of selected literature on agricultural investment has been presented in this chapter. These studies have identified a number of key factors which are associated with private investment in farm firms. The findings of these studies will form the basis for the formulation of an analytical model in the next chapter.
A review of models and studies on investment in agriculture was presented in the preceding chapter with a view to providing a framework for the formulation of a farm investment function for this study. Within the limitations of data available for this study, the present chapter attempts to formulate a model to test empirically selected factors which may be associated with farm investment in the Central Luzon region. The chapter is divided in two related parts, Part 4.1 deals with the model specification for the investment function and the estimation technique, and Part 4.2 discusses the results.

4.1 Model Specification

On the bases of the theoretical as well as empirical evidence discussed in Chapter 3, it is clear that investment, viewed as the net change on the level of capital stock \( I_{\text{net},t} \) at a given period \( t \), depends on two factors. First, on the relationship between desired \( K^* \) and actual capital stock \( K \) and second, on the speed of long-term adjustment response \( \beta \) of actual to desired capital stock. Thus,

\[
I_{\text{net},t} = K_t - K_{t-1} = \beta(K^*_t - K^*_{t-1}), \quad 0 < \beta \leq 1
\]

This flexible accelerator model, which postulates a geometric distributed lag adjustment response, provides a good explanation for the change in the capital stock. The empirical application of the above model requires the specification of the determinants of desired capital stock \( K^* \) and hence results in a complete model of investment. A number of variables exist which can be considered as determinants of the desired level of capital stock. But as mentioned in the preceding
chapter, they are generally classified into three categories, namely, capacity utilisation or expected level of output, internal finance variables and external finance variables. Thus, the desired level of capital stock may be stated as a function of the three categories of determinants:

\[ K^* = f (\text{output, internal finance, external finance}) \]

4.1.1 The Model

As stated in Chapter 1, only cross-sectional data are available for this study. The unavailability of time series data therefore prevents the application of the flexible accelerator types of model with appropriate lag distribution. Hence, in this study attention is concentrated on the investments made by the sample farmers at one point of time, i.e. the crop year 1973-74. In the choice of the factors associated with the investment, however, the internal and external finances will be incorporated as explanatory variables in the investment function because data are fortunately available to measure these variables.

Furthermore, it is the a priori belief that farm investment in the region would be a function not only of the internal and external finances of farmers but also of some factors characteristic of the farms and agriculture in the region itself. These factors are described below. The choice of factors selected for consideration here is based on the data available on the sample farms.

The size of holding has been found to be a determinant of farm investment in studies by Ray (1970) and by Bal, Bal and Singh (1974). Since the size of holding varies among the sample farms, this may be expected to have an influence on the capital investment undertaken by farmers.
Where the farm firm is a family-based production unit, the size of the farmer's household may also have an effect on investment. A larger household may mean more labour to work on the farm, but on the other hand, it may mean a larger expenditure on household and consumption items. Household size as one of the factors affecting farm investment has been the subject of Desai's Study in 1969.

Moreover, the level of technology of agriculture in the region may be an important factor of farm investment. The agricultural technology in the region has improved relatively over the past years, as a result of development efforts by the government. Technology in the form of improved farm practices, e.g. planting of high-yielding varieties of rice, irrigation use, investment in agricultural machinery, etc. are generally more capital-intensive. Hence, their adoption by farmers may influence their level of investments to some extent.

The studies of Von Oppenfeld et al. (1957), Raup (1961) and Sandoval (1964) have pointed to the relationship between farmer's tenure and farm investment. The region, as earlier described in Chapter 1, is characterised by the predominance of the landlord-tenant system. Thus, the kind of tenure that a farmer holds would affect to some extent his decision to invest.

It is hypothesised that the factors of internal and external finances, size of holding and adoption of new farm practices would have positive effects on farm investment. The nature of the effect of household size and certain types of farm tenure on investment may either be positive or negative.

With these considerations, a short-term investment function is developed in this study. The causal relation between the dependent variable (Y) and the independent variables \( X_1, X_2, \ldots X_n \) has the
implicit functional form:
\[ Y = f (X_1, X_2, \ldots, X_n) \]

Most of the econometric investment studies in Chapter 3 have employed linear regression models. Their results have to some extent justified the assumption of a linear relationship between investment and the factors associated with it. Hence, in this study also, it is assumed that the investment and the factors associated with it have a linear relationship. Further, it is also assumed that the farm investment function is a single independent relationship. As will be seen later, some variables in the investment function are in the dummy categories; this function also assumes that the slopes in respect to the variables represented by dummies are identical. Thus, the explicit investment model for the 324 cross-sectional sample farms may be stated as follows:

\[ Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_{3t-1} \]
\[ + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 \]
\[ + \beta_8 X_8 + \beta_9 X_9 + e_j \]

The model implies that for a given farm, the net investment (\(Y\)) is a linear function of its:
- size of holding \((X_1)\)
- income \((X_2)\)
- savings \((X_{3t-1})\)
- credit \((X_4)\)
- household size \((X_5)\)
- adoption of new farm practices \((X_6)\), and its tenure, i.e.
- part-owner tenure \((X_7)\)
- lessee tenure \((X_8)\) or
- share-tenant tenure \((X_9)\) as the case may be.
\( \beta_0 \) is the constant parameter in the equation. In the mathematical sense of the word, the constant term is interpreted as the intercept, the value that the dependent variable (Y) takes on when all independent variables \( (X_i) \) are set to zero. The other \( \beta \)'s are the investment coefficients. Each \( \beta \) coefficient represents the marginal propensity to invest, i.e. the marginal change in investment associated with a unit change in the given \( X_i \) \( (i = 1, \ldots, 9) \). The \( e_j \) is the random error term.

4.1.2 Measurement of the Conceptual Variables

To reiterate, the choice and measurement of the variables in the above model is confined within the limits of the data made available for this study. The measurement of the variables is described below.

**Dependent Variable**

\[ Y = \text{value in pesos, P, in 1973 prices, of net capital formation or net investment per farm during the crop year under July 1973 - June 1974.} \]

It was derived by subtracting depreciation and other capital consumption allowances from the value of gross investment as earlier defined in Chapter 2. Its value is either positive or negative. It is positive when gross investment exceeds capital consumption allowances and negative when the reverse is true. The value of \( Y \) varied between P-1,349 and P15,399 with a mean of P1,956 for the sample.

**Independent Variables**

\[ X_1 = \text{Size of holding. The existing physical} \]
farm area measured in terms of hectares devoted to production of crops. The size of holding ranged between 0.35 and 7.00 hectares with a mean of 2.48 hectares for the sample.

\[ X_2 = \text{Income (P), in 1973 prices. One of the internal finance variables considered. It is measured in terms of the farmer's total household income derived from farm and non-farm sources during the crop year. Farm income is derived from the value of crops and livestock sold and consumed, rental from agricultural properties, etc. It also includes gross off-farm income, the value of payment received for farm services rendered by a farmer and his household outside the farm, e.g. harvesting crops for others. Non-farm income is derived from subsidiary activities that the farmer and his household may have engaged in, e.g. carpentry, fishing, etc.} \]

Because of the nature of agriculture in the region itself, where farms are mostly family based production units, expenses for the farm as well as for the household are defrayed from the same sources of

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1 See the appendix relating to the survey questionnaire for the composition of farm and non-farm incomes.
income. Farm income is in net figures, i.e. gross farm income less farm operating costs. It is believed that farmers would give priority to meeting the operating costs before they consider investing in fixed assets. Non-farm income is in gross figures. Consumption expenditure was not deducted from total income owing to the difficulty of obtaining reliable data on consumption expenditure of the farmers. The value of $X_2$ varied between P374 and P16,589 with a mean of P3,731 for the sample.

\[ X_3 = \text{Savings (P), in 1973 prices, during the previous year.} \]

Like farm income, this is also an internal finance variable. In the survey questionnaire, the farmers were asked the amount of cash savings that they may have had at the beginning of the period under study, which in a sense, were their savings during the previous year. Few farmers, i.e. only 50 out of 324 (or 15 percent), reported to have savings. The savings were in relatively small amounts varying between P17 and P3,000 with a mean of P46 for the sample.

As mentioned earlier in Chapter 3, savings as a source of finance must always precede capital formation. Therefore, savings is a lagged variable. This conforms with Girao
(1974) who used a lagged savings variable, $S_{t-1}$, in his model of farm investment.

$$X_4 = \text{Credit (P), in 1973 prices.}$$

The external finance variable is represented by the value of total agricultural loan obtained from all sources during the year in cash and in kind. The value of credit obtained by the sample farmers varied between P50 and P10,000 with a mean of P1,066. Not all of the sample farmers had obtained agricultural loans, however. A number of 80 farmers or 25 percent of the total sample farmers did not avail themselves of external financing.

$$X_5 = \text{Household size. Measured by the number of persons living in the farmer's household.}$$

It consists of the farmer's immediate family and other persons, not necessarily related by kinship ties, living together in the same dwelling unit and sharing a commonly pooled income. For the sample farms, the smallest household unit consisted of 2 persons while the largest household unit consisted of 15 persons. The average household size is 7 persons.

$$X_6 = \text{Adoption of new farm practices. The new farm practices refer to the adoption of high-yielding varieties of rice, irrigation,}$$
application of fertilizer and chemicals and double cropping. Of the 324 sample farmers, 285 or 88 percent were adopters and 39 or 12 percent were non-adopters of the new farm practices. The nature of the data made available to the study compelled the specification of this variable into discrete categories by assigning a "dummy" for each category. A farmer is assigned a value of "0" if he is a non-adopter of new farm practices and a value of "1" if he is an adopter.

$X_7, X_8, X_9 =$ Tenure. This refers to the proprietary relationship between the farm operator and the land he actually tilled during the crop year. A farmer was regarded in this study as: a full-owner if he and his family owned all the land they worked on; a part-owner if he and his family owned a portion of the total land tilled by them and rented in or leased the remaining part of the land; a lessee if the land tilled was not owned by him and in exchange he payed rent at a fixed rate to the land owner for a specified period of time; and a share-tenant if he did not own the farm he cultivated but was being paid for the job on a sharing system either in kind
and/or in cash. Of the total sample farmers, 75 or 23 percent were full-owners, 21 or 7 percent were part-owners, 166 or 51 percent were lessees, and 62 or 19 percent were share-tenants.

In the computer run, one category of tenure, namely, full-owner, was dropped to avoid a linear dependency in the data matrix (Johnston 1972), and this is illustrated in Table 4.1. Thus, only the remaining set of three tenure dummy variables were included in the regression:

\[ X_7 = \text{part-owner tenure}, \]
\[ X_8 = \text{lessee tenure}, \]
\[ X_9 = \text{share-tenant tenure}. \]

**TABLE 4.1**

<table>
<thead>
<tr>
<th>Tenure Categories</th>
<th>Variables</th>
<th>No. of Farms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[X_7]</td>
<td>[X_8]</td>
</tr>
<tr>
<td>1. Full-owner</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2. Part-owner</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3. Lessee</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>4. Share-tenant</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

4.1.3 Estimation Technique

The technique of ordinary least squares (OLS) was employed for estimation of the investment function. From a statistical viewpoint, OLS provides the best linear unbiased estimates (BLUE) of the regression
coefficients when the usual assumptions underlying the OLS formulation are fulfilled (Heady and Dillon 1961, p111; Wonnacott and Wonnacott 1970, pp.15-17; and Kementa 1971, Chapters 7 and 8). Assuming that the basic assumptions were adequately fulfilled, the investment function was estimated by OLS. The estimated function is given in Table 4.2.

4.2 Results and Discussion

This section presents and discusses the empirical results obtained from the fitted regression equation. First, the discussion deals with the summary statistics which provide an assessment of the usefulness of the fitted regression equation. This is followed by an interpretation of the estimated coefficients for factors associated with investment. Where possible, results of this study are compared with the results of previous investment studies.

4.2.1 The Summary Statistics

F-ratio: The F-statistic provides a test of the null hypothesis that $\beta_1 = \beta_2 = \ldots = \beta_n = 0$ against the alternative hypothesis that $\beta_1 \neq 0$. Table 4.2 shows that the calculated F-statistic for the estimated function was 15.303 at 9 and 314 degrees of freedom, implying that for the fitted regression model there are only 5 chances in 100 in which $\beta_1 \neq 0$.

Coefficient of Multiple Determination: The coefficient of multiple determination adjusted for the number of independent variables and the observations ($R^2$) shows the proportion of variation in the dependent variable explained by the independent variables included in the regression. Its value ranges from zero to unity. The value of zero implies that the independent variables have not explained the variations in the dependent variable, whereas the value of unity means that the independent variables have been able to explain the whole of
### TABLE 4.2
ESTIMATED COEFFICIENTS OF THE INVESTMENT FUNCTION

<table>
<thead>
<tr>
<th>Factors</th>
<th>Parameters</th>
<th>Regression Coefficients ($B_i$)</th>
<th>t-value (Absolute)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size of holding</td>
<td>$\beta_1$</td>
<td>737.680 ****</td>
<td>7.911</td>
</tr>
<tr>
<td>Income</td>
<td>$\beta_2$</td>
<td>0.070 ***</td>
<td>1.808</td>
</tr>
<tr>
<td>Savings</td>
<td>$\beta_3$</td>
<td>0.201 (n.s.)</td>
<td>0.414</td>
</tr>
<tr>
<td>Credit</td>
<td>$\beta_4$</td>
<td>0.274****</td>
<td>2.490</td>
</tr>
<tr>
<td>Household Size</td>
<td>$\beta_5$</td>
<td>-56.618 *</td>
<td>1.241</td>
</tr>
<tr>
<td>Adoption of New Farm Practices</td>
<td>$\beta_6$</td>
<td>890.587 ****</td>
<td>2.494</td>
</tr>
<tr>
<td>Part-Owner Tenure</td>
<td>$\beta_7$</td>
<td>-1267.457 ****</td>
<td>2.511</td>
</tr>
<tr>
<td>Lessee Tenure</td>
<td>$\beta_8$</td>
<td>-364.263 **</td>
<td>1.281</td>
</tr>
<tr>
<td>Share-Tenant Tenure</td>
<td>$\beta_9$</td>
<td>-412.195</td>
<td>1.189</td>
</tr>
</tbody>
</table>

Summary Statistics:

- Constant, $B_0$ = -458.007
- $R^2$ = 0.305
- $R^2$ = 0.285
- F-ratio = 15.303
- Degrees of Freedom = 9, 314
- Number of Observations = 324
- Durbin-Watson Statistic = 1.995

n.s. not significant
* significant at the 20 percent level
** significant at the 10 percent level
*** significant at the 5 percent level
**** significant at the 1 percent level
the variation in the dependent variable. Table 4.2 shows that the value of $R^2$ for the function was 0.285. Hence, about 29 percent of the total variation in farm investment is explained by the explanatory variables in the equation.  

A low $R^2$ is not unique to this study. Even Girao's (1974) linear regression model for farm investment using both cross-sectional and time-series American data resulted in a low $R^2$. Fitting the same investment model to two groups of farms which he classified as unstable and stable income groups, yielded low $R^2$ values of 0.30 and 0.32, respectively. Girao attributes the relatively poor fits, especially the equation for the unstable income group, to the inherent random behaviour of the data. This is particularly true, because according to him, the cross-section dimension of the data is larger than the time series data.

Similarly, a low $R^2$ value was obtained by Shah and Singh (1972) for their linear regression model of capital formation in one of the agricultural areas of India. But the low value of $R^2$ of 0.36 was due  

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1 Efforts made at fitting a semi-logarithmic investment function and a quadratic investment function did not increase the $R^2$. Theoretically, by definition the closer the $R^2$ is to unity, the better is the fit. Rao and Miller (1971) observe that in some econometric studies, $R^2$ has been misused and they trace this misuse to the definition of $R^2$ itself. In some cases, a nonsensical definition of a variable may result in a very high $R^2$, but this does not imply that it is the appropriate one to use. They contend further that the acceptance of a maximum $R^2$ is justified when (a) the model has been fully specified, and (b) the variables are well-defined. Unless these conditions are met, Rao and Miller suggest that a high $R^2$ should not always be interpreted as a determinant of "goodness of fit". Nevertheless, according to them "... A high $R^2$ may imply the appropriateness of a regression equation, but a low $R^2$ does not necessarily imply that the regression equation is inappropriate ... a relatively low $R^2$ does not necessarily mean a poor fit...". See also Whittingham (1978) for the proper treatment of a low $R^2$.
to the fact that there was only one explanatory variable, namely the disposable income, in their model.

The estimation of the true regression model can only be made with the availability of data on all variables and their exact measurement. One probable reason for the relatively low value of $R^2$ in this study is the cross-sectional nature of the data itself. The inability to include certain important variables in the regression may also be another reason for the low $R^2$. This is a situation of "left-out" variables (Rao and Miller 1971 and Whittingham 1978) and it has arisen here as a result of the unavailability of data. It is highly likely that the farmers' decision to invest during a given year is affected by the investments they had already made in previous years, their debt position during previous years, their price expectations, risks and uncertainty. Another important factor would be the extent of the government's investment in the region. If data were available, these variables would certainly have been included in the regression model, which could have given a higher $R^2$. But data limitations, as mentioned earlier in this study, have constrained the specification of such variables in the farm investment function. It is suggested that future studies should seriously consider inclusion of these variables in the survey questionnaires designed for data collection.

**Multicollinearity**: In regression analysis, the presence of any fixed relationship between independent variables presents a problem called *multicollinearity*. Hence, it may not be possible to find the individual regression coefficients with sufficient accuracy (Tintner 1963). According to Heady and Dillon (1961), the problem may arise if the correlation coefficient between a pair of independent variables is

---

1 Nerlove (1958) classified the sources of error in measuring economic variables into: (a) sources of error of a conceptual nature; (b) sources of voluntary misrepresentation; (c) sources of inadvertent misrepresentation; and (d) incompleteness of data gathered.
greater than $|0.8|$. On the other hand, Huang rules out that multicollinearity is "tolerable" if the simple correlation coefficient between two exogenous variables is less than the square root of the computed coefficient of multiple determination. With this background, the issue of multicollinearity may be looked into through the correlation matrix given in Table 4.3. The highest correlation coefficient in Table 4.3 is -0.50, between the tenure dummy variables lessee and tenant. Following Heady and Dillon, and Huang, 0.50 is less than 0.80 and less than $R = 0.55$ ($R^2 = 0.30$), therefore, multicollinearity is not a problem in this study.

Auto Correlation. The auto (serial) correlation refers to the correlation between the current residual error ($e_t$) and the residual errors of previous periods ($e_{t-1}$, $e_{t-2}$, etc.). If such correlation is high, which may be expected in time series data, the estimates of the regression coefficients are likely to be biased. Since the data used in this analysis is cross-sectional, the autocorrelation bias is not likely to be present in the estimates presented in Table 4.2.

4.2.2 Estimated Coefficients for Factors Associated with Investment

As Table 4.2 shows, the estimated marginal investment coefficients ($\beta_i$s) for the variables included in the equation are of the expected signs. Most of them are also significantly different from zero. Size of holding, income, savings, credit and adoption of new farm practices variables all have positive coefficients. The variables for household size and tenure dummy variables, on the other hand, have negative coefficients. These coefficients are interpreted and discussed below under the ceteris paribus assumption.

The estimated coefficient for size of holding ($X_1$) was 737.679
<table>
<thead>
<tr>
<th></th>
<th>Y</th>
<th>X₁</th>
<th>X₂</th>
<th>X₃ₜ₋₁</th>
<th>X₄</th>
<th>X₅</th>
<th>X₆</th>
<th>X₇</th>
<th>X₈</th>
<th>X₉</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>1.00000</td>
<td>0.04942</td>
<td>0.23608</td>
<td>0.00588</td>
<td>0.33479</td>
<td>0.06548</td>
<td>0.20022</td>
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<td>0.08701</td>
<td>-0.07767</td>
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<tr>
<td>X₁</td>
<td>1.00000</td>
<td>0.25301</td>
<td>-0.03920</td>
<td>0.43803</td>
<td>0.18211</td>
<td>0.09469</td>
<td>0.07866</td>
<td>0.11058</td>
<td>-0.03824</td>
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</tr>
<tr>
<td>X₂</td>
<td>1.00000</td>
<td>0.04202</td>
<td>0.15353</td>
<td>0.23166</td>
<td>0.15013</td>
<td>-0.06864</td>
<td>0.06845</td>
<td>-0.09356</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X₃ₜ₋₁</td>
<td>1.00000</td>
<td>0.01816</td>
<td>-0.05797</td>
<td>-0.06961</td>
<td>0.00176</td>
<td>0.03102</td>
<td>-0.06236</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X₄</td>
<td>1.00000</td>
<td>0.16840</td>
<td>0.21598</td>
<td>0.08745</td>
<td>0.19966</td>
<td>-0.10627</td>
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</tr>
<tr>
<td>X₅</td>
<td>1.00000</td>
<td>-0.00599</td>
<td>-0.09014</td>
<td>0.00725</td>
<td>0.06587</td>
<td></td>
<td></td>
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<tr>
<td>X₆</td>
<td>1.00000</td>
<td>0.05886</td>
<td>0.11121</td>
<td>-0.15762</td>
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<tr>
<td>X₇</td>
<td>1.00000</td>
<td>-0.26818</td>
<td>-0.12807</td>
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<td></td>
<td></td>
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<tr>
<td>X₈</td>
<td>1.00000</td>
<td>-0.49555</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>X₉</td>
<td>1.00000</td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Y = Net Investment  
X₁ = Size of Holding  
X₂ = Income  
X₃ₜ₋₁ = Savings  
X₄ = Credit  
X₅ = Household Size  
X₆ = Adoption of New Farm Practices  
X₇ = Part-Owner Tenure  
X₈ = Lessee Tenure  
X₉ = Share - Tenant Tenure
and found to be significantly different from zero at the one percent level. This implies that, on the sample farms, a marginal net investment of P738 occurred with an increase of one hectare in the size of holding. The squared value of the size of holding ($\text{size of holding}^2$) was tried in the regression to test whether the net investment marginally increased or decreased with a unit increase in size of holding. The regression coefficient of this variable turned out to be positive but statistically non-significant. It therefore appears that the relationship between investment and the size of holding was predominantly linear and therefore the marginal investment remained fairly constant. The relationship between investment and size of holding is depicted in Figure 4.1.

The importance of farm size in investment decisions has been confirmed by Bal, Bal and Singh (1974). In their study of farmers' decision for investment in agricultural machinery in India, they considered farm size among other factors. Results of their discriminant analysis indicated that farm size alone contributed about 46 percent of the difference between farmers with a large investment and those with a small investment. Other studies, e.g. Ray (1970) have obtained identical results on farm size as an important determinant of farm investment.

As an internal finance variable, income ($X_2$) had a positive coefficient of 0.070 which was significantly different from zero at the 5 percent level. The value of the coefficient implies that an increase in income by one peso resulted in a marginal increase in investment of about seven cents. The relationship between investment and income can be gleaned from Figure 4.2.

In Pearse's (1955) study of investment on Australian sheep farms, results of the correlation analysis showed that of the six explanatory variables considered (see Chapter 3), net income alone had a significant
FIGURE 4.1

THE RELATIONSHIP BETWEEN NET FARM INVESTMENT AND SIZE OF HOLDING, FULL-OWNER/NON-ADOPTER, WITH OTHER VARIABLES HELD AT THEIR MEAN LEVELS

\[ Y = -458.007 + 737.680X_1 \]
FIGURE 4.2

THE RELATIONSHIP BETWEEN NET FARM INVESTMENT AND INCOME, FULL-OWNER/NON-ADOPTER, WITH OTHER VARIABLES HELD AT THEIR MEAN LEVELS

NET INVESTMENT, $Y$ (₱'000)

$Y = -458.007 + 0.070X_2$

INCOME, $X_2$ (₱)
positive relation with the level of investment spending. A positive relationship between income and investment was also found by Bratton and Robertson (1954) and Sardido (1969) in the Philippines.

The previous savings of farmers ($X_{3t-1}$) as expected had a positive coefficient of 0.201. But it was statistically non-significant. Hence, savings had little or no influence on the investment level. This may be due to the fact that most of the farmers did not have any savings, and that those few who did have any had very small savings. It could be, as stated earlier in Chapter 2, that some farmer respondents did not correctly report their savings to the interviewers.

Results obtained by Girao (1974) from his regression analysis indicated that the investment for the unstable income group was less responsive to savings than to income. The reverse was true with farmers under the stable income groups. In their investment decisions, the latter were more responsive to savings than to income. On the other hand, Tostlebe (1957) found out that the availability of savings by farmers is one important factor of higher investment in agriculture in the United States.

The estimated coefficient for the external finance variable, credit ($X_4$), was 0.274, which was significantly different from zero at the one percent level. Thus, an increase by one peso in agricultural loans resulted in a marginal increase of only twenty-seven cents in investment. One explanation which may be given is that the agricultural loans obtained by farmers were used primarily as farm working capital and not for capital asset investment. Another reason is the possible misapplication of loans. Most of the sample farmers might have had a tendency to use a larger portion of the amount borrowed for non-farm
purposes, such as farm living and household expenses or education expenses. The relationship between investment and credit is depicted in Figure 4.3.

It is interesting to note that although all of the three finance variables, i.e. income, savings and credit, are positively related with net investment, farmers tended to rely more on income and credit as their main sources of financing. Between income and credit, on the other hand, the higher estimated coefficient for credit (0.274) relative to that of income (0.070) may imply that the level of farmers' investment undertakings were more influenced by external finance sources than by internal finance sources. The combined income and savings of farmers may not be sufficient to meet both consumption and farm investment demands, so that credit served as an augmenting factor. The availability of agricultural loans in the region itself (see Chapter 1) is one reason why farmers tended to rely more on credit than any other source of financing. The studies of Tostlebe (1957), De Guzman (1964) and Spitze (1971) have also confirmed the importance of credit in farm investment.

The negative coefficient (-0.618) for the variable household size \(x_5\) implies that the addition of one member to the farmer's household resulted in a marginal decrease in farm investment by about P57. One possible implication for the negative coefficient derived for this variable is that the portion or amount of income, saving or credit which could have been used for farm investment was diverted to consumption as well as the other requirements of a larger household. The significance of the estimated coefficient at the 20 percent level implies that, in 20 out of 100 chances, a one unit increase in household size may not result in a decrease in investment. The relationship between investment and household size is reflected in Figure 4.4.
FIGURE 4.3
THE RELATIONSHIP BETWEEN NET FARM INVESTMENT AND CREDIT,
FULL-OWNER/NON-ADOPTER, WITH OTHER VARIABLES HELD AT THEIR MEAN LEVELS

\[ Y = -458.007 + 0.274X_3 \]
FIGURE 4.4

THE RELATIONSHIP BETWEEN NET FARM INVESTMENT AND HOUSEHOLD SIZE,
FULL-OWNER/NON-ADOPTER, WITH OTHER VARIABLES HELD AT THEIR MEAN LEVELS

\[ Y = -458.007 - 56.618X_5 \]
The negative relationship between farm investment and household size has been confirmed by Desai (1972). Using a simple correlation analysis he found a negative but insignificant correlation between farm investment and household size, which he termed as family size, both for the progressive and backward agricultural areas in Central Gujarat, India. He interpreted the negative correlation to the change in consumption expenditure on account of change in family size. He attributed the insignificant nature of the influence, on the other hand, to the availability of loan which may have been used to defray the change in consumption expenditure.

The adoption of the new farm practices variable had a positive and statistically significant coefficient at the one percent level. Hence, farmers who adopted new farm practices had higher investment levels as compared to those who did not adopt new farm practices (see Table 4.4). The positive influence of adopting new farm practices on farm investment has been found in the study by De Guzman (1964). It was suggested that agricultural technology through improved farm practices results in an increase in productivity, which in turn positively affects income and therefore induces higher capital accumulation.

As explained earlier, the exclusion of one tenant dummy variable, viz. full-owner, was necessary in order to prevent linear dependency in the data matrix. The exclusion of one tenure category, however, does not actually result in a loss of information. The excluded category, referred to as a reference category (Nie, et al. 1975), becomes a point of reference by which the effects of the tenure categories included in the regression are interpreted. But since there are two sets of dummy variables included in the regression equation, i.e. adoption of new farm practices and tenure dummy variables, it must be
pointed out that the category **Non-Adopter-Full-Owner** (see Table 4.4) becomes a *joint reference* category (Nie et al. 1975) for the interpretation of the effects of adoption, part-owner, lessee and share-tenant dummy variables. The differences among the coefficients for $\beta_7$, $\beta_8$ and $\beta_9$ represent the linear effects of part-owner, lessee and share-tenant tenures having adjusted for the effect of the adoption of the new farm practices variable. On the other hand, $\beta_6$ represents the linear effect of adoption of new farm practices, or the expected difference between non-adoption and adoption, having adjusted for the difference in tenure.

**TABLE 4.4**

**ESTIMATED MEAN VALUES OF FARM INVESTMENT BY CATEGORIES OF TENURE AND BY ADOPTION/NON-ADOPTION OF NEW FARM PRACTICES**

<table>
<thead>
<tr>
<th>Tenure Categories</th>
<th>Non-Adopter (0)</th>
<th>Adopter (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full-owner</td>
<td>$\beta_0$ = -458.01</td>
<td>$\beta_0 + \beta_6$ = 432.58</td>
</tr>
<tr>
<td>Part-owner</td>
<td>$\beta_o + \beta_7$ = -1,725.47</td>
<td>$\beta_o + \beta_7 + \beta_6$ = -834.88</td>
</tr>
<tr>
<td>Lessee</td>
<td>$\beta_o + \beta_8$ = -822.27</td>
<td>$\beta_o + \beta_8 + \beta_6$ = 68.32</td>
</tr>
<tr>
<td>Share-tenant</td>
<td>$\beta_o + \beta_9$ = -870.20</td>
<td>$\beta_o + \beta_9 + \beta_6$ = 20.39</td>
</tr>
</tbody>
</table>

The estimated coefficients for part-owner, lessee and share tenant variables though significant at the 1, 10 and 20 percent levels, respectively, are all negative. This implies that the relative effects of being a part-owner, lessee or share-tenant on farm investment are
worse compared to that of being a full-owner. It can be gleaned from Table 4.4 that the mean effect on investment is worst for the part-owner relative to the other tenure categories. There is little difference between lessee and share-tenant; however, the mean effect on investment of being a lessee is slightly favourable as compared to a share-tenant.

Results of a farm management study in the Philippines by Von Oppenfeld et al. (1957), has indicated the differences in the increase of investment among farmers under various tenure groups. During the particular period studied, crop year 1954-55, the increase in investment for owners was P14; part-owners, P4; and share-tenant, P1.

4.3 Summary

Within the constraints of the available data an attempt has been made in this chapter to develop a short-term farm investment function for the Central Luzon region. Based on economic theory, results of previous studies and the availability of data, a set of major factors which were deemed to be associated with investment in agriculture in the region were incorporated in the investment function. The function was estimated by OLS. The results obtained in general were theoretically consistent and statistically dependable. This showed the relevance of the model and of the included variables in explaining farm investment in the region. The conclusions which can be drawn from the findings and their policy implications are contained in the following chapter.
CHAPTER 5
SUMMARY AND CONCLUSIONS

Capital formation or investment is one of the important sources of agricultural development. It represents the accumulation of additional stock of capital resources to the already existing stock of capital. As discussed in Chapter 1, capital formation in agriculture may be generated both by the public and private corporate sectors and private non-corporate sectors. This study, however, is concerned with only non-corporate or private capital formation in agriculture, that is, the investments made by farmers. Farm investment serves as a source of productivity growth and as a vehicle for technological change both of which are necessary for agricultural development to occur. Thus, effective agricultural development policy formulation should be geared, among others, towards the judicious and discerning encouragement of farm investment. This could be possible through a comprehensive understanding of the process and mechanism of farm investment. But due to limited research on the subject, the present understanding has been rather inadequate especially in the developing countries such as the Philippines.

This study was therefore undertaken with the view of making a contribution towards an understanding of farm capital formation or investment in the Central Luzon region of the Philippines. The study has attempted to estimate the amount of net capital formed on a sample of farms located in the region. In particular, this study has empirically investigated some factors affecting capital formation.

Exhaustive time series data on private investment in agriculture
in the Philippines are not available. Data used in this study were provided by the Philippines Bureau of Agricultural Economics. The data were confined to one crop year (1973-74) and to a sample size of 324 farms. The data had certain limitations for the purposes of this study. As mentioned in Chapter 2, these limitations pertained particularly to the respondents' memory bias inherent in the questionnaire interview method of data collection, the items of information contained in the questionnaire and to the special problems involved in estimating capital formation in a predominantly subsistence agriculture.

In the context of agriculture, the concept of capital relates to real capital assets. In this study capital was subdivided into three categories, namely, (a) farmland; (b) fixed assets e.g. construction and works on the farm, farm buildings, implements, tools and machinery, and perennial crops; and (c) inventories e.g. livestock, poultry and stored crops. In the measurement of farm capital formation, the expenditure approach was utilised for farmland and fixed assets, and the inventory approach was employed for livestock, poultry and stored crops.

The estimates of capital formed for the sample farms were presented in Chapter 2. They revealed that a large part of the net investment was in the form of livestock, poultry and stored crops. Increase in these inventories accounted for 87 percent of total net farm investment, and out of these, stored crops in the form of increases in palay (rough rice) stocks accounted for 82 percent. The change in palay stocks was the result of increased production. Livestock and poultry were mostly on a small scale. Next to inventories, the other important investment was in the form of fixed assets which accounted for 12 percent of the total net investment. Implements, tools and
machinery contributed about 60 percent to total net investment for fixed assets. Investment in farmland accounted for only one percent of total net investment which was mainly in the form of purchase and lease of additional land for cultivation. While the composition or nature of investment is likely to vary among different sizes and types of farms, it was not possible to investigate this within the research resources available for this study. Since this aspect of capital formation is important for policy purposes, it is suggested as a topic for future research.

Net capital formation as a whole is influenced by a large number of economic, social and institutional factors. This was clearly discernible from a review of selected studies and models on investment presented in Chapter 3. The review was undertaken with the aim of providing a theoretical framework for the formulation of a farm investment model for this study and to canvassing conceptual variables for it. From the evidence presented in Chapter 3, it was gleaned that the flexible accelerator model provides a good explanation of the change in capital stock within a given time period. The flexible accelerator model postulates a geometric distributed lag investment adjustment response. Besides the time series data, the empirical application of this model requires the specification of the determinants of investment generally classified into three categories, namely, capacity utilisation, internal finance and external finance.

The cross-sectional nature of the data available for this study, however, constrained the use of the flexible accelerator model. But the availability of data on the internal and external finances of the sample farms enabled their inclusion as explanatory variables in the short-term investment model presented in Chapter 4. Other explanatory
variables included in the model were size of holding, household size, adoption of new farm practices, and tenurial status. The choice and measurement of the variables in the model were determined by two factors. First, the results of the previous studies concerned, among others, with farm capital formation especially in the developing countries, and second, the limits of the data available for this study.

A linear regression equation was fitted for the sample farms to examine the effects of the above mentioned factors on farm investment. Before summarising the findings and their implications, it may be reiterated that due to the dated nature of the data and their limitations mentioned earlier, it would be prudent to regard this study as exploratory in nature. The results therefore are tentative and valid only for the given technological and other settings of the Central Luzon region. Also, the results of the analysis are valid only within the range observed in the sample in respect of each of the variables. Nevertheless, the results of the analysis are of sufficient interest to warrant the attention of other researchers and policy makers in the Central Luzon region in particular and the Philippines in general. As a case study, they may also be of some interest and relevance to other developing countries. With these caveats, major conclusions and some policy implications emerging from this study are stated below.

On the factors associated with farm investment as a whole

The effects of the economic and other factors on farm investment were indicated by the algebraic sign, size, and statistical significance of their estimated regression coefficients. The estimated coefficients were of the expected signs and most of them had statistical significance at the chosen level of probability. The size of each of these coefficients represents the marginal propensity to invest, that is, the
marginal change in investment associated with a unit change in each of the factors.

The estimated coefficient for the size of holding was positive and significant at the one percent level. The marginal increase in the investment was about P738 for an increase in the size of holding of one hectare. The attempts to test whether the rate of investment decreases or increases with the change in the size of holding were inconclusive.

As indicated by the estimated coefficients of the income and farm credit variables, farmers tended to rely more on income and credit than on savings for financing their investment. The coefficient for savings, although positive, was not statistically significant. This implies that savings had no measurable influence on investment. Between income and credit, it was credit that had a larger coefficient (0.274) than the coefficient of income (0.070). Hence, the marginal increase in net investment is higher for one Peso of credit than for one Peso in the form of income. This implies that the farmers tended to rely more on the external sources of financing instead of on their own funds in their decision to invest. The amount of credit (loan) obtained by a farmer served to augment the income and savings as sources of financing the investment. It must be noted from the estimated coefficient for credit that an increase in agricultural loan by P1.00 resulted in an increase in investment of only P0.27. There are two plausible reasons for this. First, the agricultural loans obtained by farmers were mainly granted by the lending sources as farm working capital instead of for investment as capital assets. Second, the farmers in some cases may have applied a part of the amount of farm credit in non-farm purposes such as family living expenses, education and the like. It is, however, not possible to be certain on the significance of these
reasons because of an absence of data on separate amounts actually spent for agricultural purposes and for other purposes out of the agricultural loans obtained. What possible policy implications can we then infer from the results on income, savings and credit? First, the low capacity to save is all too familiar a situation in Philippine farming as well as the rest of the less developed economies. This can be traced largely to the relatively low levels of income. For this study alone the income of farmers (net of farm operating expenses) ranged from ₱374 to ₱16,589. It is certain that small increments in income of farmers are spent in the form of consumption. Thus, the creation of surplus income through increased productivity provides the pool for saving and hence for investment. Second, if our contention of the misapplication of credit is true, then the efforts of the lending agencies should be geared towards ensuring the proper use of credit. Moreover, the findings of studies on agricultural credit in the Philippines by De Guzman (1958) and Tablante (1964) for example, indicated that late releases of loan and lack of supervision are major factors causing misapplication. Hence, to ensure proper use of farm credit, the lending institutions should also expedite loan processing to meet the demands of farmers on time.

The regression coefficient for household size was negative and significant. This indicated the negative effect of a large household on farm investment. The rationale usually given for this is that a larger household may entail increased expenditure on consumption and other family living expenses, so that instead of using the financial resources for farm investment the demands of family living expenditures are usually met first. The low income and savings in the farm may not be able to meet both consumption and investment demands. Under these
conditions, rural-based labour-intensive industries which would create employment for the unemployed and underemployed members of the farm households should be given priority by the policy-makers. On the other hand, a larger farm household to some extent may imply more labour supply for the labour-intensive forms of investment on farms. While the pattern of investment was not dealt with in this study, it is an important aspect of capital formation. Hence, future research in this field should investigate the types of investment in farms - whether they are capital-intensive or labour-intensive and how they vary among different sizes and types of farms. Such research it is hoped, will throw more light on the implications of a large household and other factors influencing farm investment.

The adoption of new farm practices, defined as planting of high-yielding varieties, use of irrigation, fertilizer and chemical application, etc. as against the non-adoption was found to have an important positive impact on farm investment. This result supports a general view that the adoption of new farm technology and larger capital investment tend to go hand in hand. Adoption of the improved technology on farms enhances productivity, which in turn results in higher farm incomes. This then may lead to larger savings and greater credit worthiness, and hence, finally to a possible increase in the level of farm investment.

Four land tenure groups, namely, full-owner, part-owner, lessee and share-tenant were investigated through the model. Results indicated that, in comparison to being a full-owner, a part-owner, a lessee or a share-tenant had an adverse effect on investment. Ownership of land by a farmer gives him a sense of long-term interest in his farm which a mere lessee or tenant may scarcely feel. This may be an important factor influencing the decisions of full-owner farmers to invest more
relative to other tenure groups. Tenurial reform may be the partial answer to the kind of security of tenure which would enhance farm investment. In the Philippines, a land reform programme has already been in force since 1963. In spite of the difficulties encountered in its implementation, it has to some extent been successful in converting share-tenants into reform leaseholders. Nevertheless, it still has to overcome some institutional and administrative barriers before it can be fully implemented.

It is often said that econometric studies generally raise more questions than they answer and this study, it seems, is no exception. To the extent that this study was limited by the available data and other research resources, it is suggested that further work in this subject area may focus on the following aspects:

(1) Data base: The data base needs to be expanded by supplementing the questionnaire-interview method with farm record keeping where possible. Such surveys may be conducted periodically to generate adequate time series data which would allow the estimation of more realistic and dynamic models of investment.

(2) Determinants of investment: The other determinants of investment such as risk and uncertainty, price expectations, the effects of agricultural taxation also need to be investigated.

(3) Estimation of farm capital formation: The estimation of farm capital formation by using
alternative definitions, methods of estimation or measurement of farm capital investment by other researchers. These may result in different estimates for purposes of comparison which may eventually lead to an improved estimation of capital formation of farms.

(4) Nature and pattern of farm investment: The nature and pattern of farm investment as mentioned earlier should be explored. Also, further analysis is required on the individual components of net investment, i.e. distinction should be made between investment in rice stocks and productive investment in fixed assets.
APPENDICES
APPENDIX A

COMPONENTS OF FARM CAPITAL IN AGRICULTURE, PHILIPPINES

I. FIXED ASSETS

1. FARMLAND

2. CONSTRUCTIONS ON THE FARMLAND

<table>
<thead>
<tr>
<th>Bridge</th>
<th>Dam</th>
<th>Fence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canal</td>
<td>Dike</td>
<td>Irrigation</td>
</tr>
<tr>
<td>Culvert</td>
<td>Drainage</td>
<td>Well</td>
</tr>
</tbody>
</table>

3. FARM BUILDINGS

<table>
<thead>
<tr>
<th>Farm dwelling</th>
<th>Poultry house</th>
<th>Tobacco flue curing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hoghouse and pen</td>
<td>and pen</td>
<td>Barn</td>
</tr>
<tr>
<td>Livestock barn</td>
<td>Pump house</td>
<td>Warehouse</td>
</tr>
<tr>
<td>Machinery, equipment and tool shed</td>
<td>Rice granary</td>
<td>Others</td>
</tr>
</tbody>
</table>

4. MACHINERY, EQUIPMENT AND TOOLS

<table>
<thead>
<tr>
<th>Disc harrow</th>
<th>Stationary engine</th>
<th>Cart</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disc plow</td>
<td>Tractor</td>
<td>Claw hammer</td>
</tr>
<tr>
<td>Hand tractor</td>
<td>Axe</td>
<td>Hand saw</td>
</tr>
<tr>
<td>Harrow</td>
<td>Rake</td>
<td>Spading fork</td>
</tr>
<tr>
<td>Hoe</td>
<td>Scythe</td>
<td>Sprayer</td>
</tr>
<tr>
<td>Mattock bar</td>
<td>Shovel</td>
<td>Sprinkler</td>
</tr>
<tr>
<td>Plow</td>
<td>Sled</td>
<td>Trowel</td>
</tr>
<tr>
<td>Post hole digger</td>
<td>Spade</td>
<td>Wheel barrow</td>
</tr>
<tr>
<td>Pump</td>
<td>Yoke</td>
<td>Others</td>
</tr>
<tr>
<td>Rotary tiller</td>
<td>'Bolo'</td>
<td></td>
</tr>
</tbody>
</table>

5. PERENNIAL CROP PLANTATION

<table>
<thead>
<tr>
<th>Abaca</th>
<th>Coffee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banana</td>
<td>Orchard (fruit trees, citrus)</td>
</tr>
<tr>
<td>Cacao</td>
<td>Rubber</td>
</tr>
<tr>
<td>Coconut</td>
<td>Vineyards</td>
</tr>
</tbody>
</table>

II. INVENTORIES

1. Livestock 'Carabao', cattle, goat, hog, etc.
2. Poultry chicken, duck, goose, etc.
3. Stored Crops grains, legumes, etc.
APPENDIX B

GROSS INVESTMENT, CAPITAL CONSUMPTION ALLOWANCES, AND NET INVESTMENT

I. FARMLAND

Gross Investment

1. Value of additional area farmed through:
   a. purchase
   b. inheritance
   c. lease
   d. tenancy
   e. management (managed farms)

2. Value of improvements through:
   a. clearing
   b. reclamation
      (Includes material costs, man and animal labour costs, both paid and unpaid.)

Capital Consumption Allowances

1. Value of decrease in area farmed through:
   a. sale
   b. parted as inheritance
   c. surrender of farms to owner of leased, tenanted and managed farms
   d. soil erosion

Net Investment = Gross investment - Capital consumption allowances.

Value of Ending Inventory = Beginning inventory + net investment, or in the absence of information on the value of beginning inventory, equals net investment.
II. FIXED ASSETS

1. Constructions on the Farmland

Gross Investment, value of

a. Major repairs of old and new constructions (includes labour and material costs, both paid and unpaid, and other costs incurred).

b. New constructions, contractual and on account (includes labour and material costs, both paid and unpaid, and other costs incurred).

Capital Consumption Allowances, value of

a. Damage.

b. Depreciation.

Net Investment = Gross investment - Capital consumption allowances.

Value of Ending Inventory = Beginning inventory + Net investment, or in the absence of information on the value of beginning inventory, equals net investment.

2. Farm Buildings

Gross Investment, value of

a. Major repairs and alterations of old and new buildings.

b. Extensions.

c. New constructions, contractual and on account.

(Includes labour and material costs, both paid and unpaid, and other costs incurred).

Capital Consumption Allowances, value of

a. Damage.

b. Insurance indemnity, if any.

c. Sales.

d. Depreciation.
3. Implements, tools and machinery

Gross Investment, value of

a. Major repairs and alteration of old and new items.
b. New acquisitions.

(Includes labour and material costs, both paid and unpaid, and other costs incurred.)

Capital Consumption Allowances, value of

a. Damage.
b. Insurance indemnity, if any.
c. Depreciation.

4. Perennial Crop Plantation

Gross Investment, value of

a. Replanting and new planting (includes labour costs both paid and unpaid, seedlings both paid and unpaid and other costs incurred).
b. Plantation care and improvement = vegetative propagation, pest and disease control, cultivation and fertilisation.

Capital Consumption Allowances, value of

a. Damage.
b. Sale (of plantation, if any).

Net Investment (as before)

Value of Ending Inventory (as before)
III. INVENTORIES

1. Livestock

**Gross Investment**

a. Value of increase in stock through birth, purchase, gifts.
b. Appreciation in value due to natural growth.

**Capital Consumption Allowances** or the value of decrease in stock through:

a. Slaughter.
b. Sale.
c. Death (died of diseases, etc.).
d. Given away as gifts, etc.

**Net Investment** = Gross Investment - value of decrease in stock

**Value of Ending Inventory** = Beginning inventory + net investment, or in the absence of information on the beginning inventory, equals net investment

2. Poultry

**Gross Investment**

a. Value of increase in stock through purchase, gifts, hatch.
b. Appreciation in value due to natural growth.

**Capital Consumption Allowances** or the value of decrease in stock through:

a. Sale.
b. Dressed (consumption).
c. Death (died of diseases, etc.).
d. Given away as gifts, etc.

**Net Investment** = As in livestock

**Value of Ending Inventory** = As in livestock

3. Stored Crops
Gross Investment or the value of increase in stock through:

a. Purchase.
b. Share of landlord.
c. Share of harvester, etc.
d. Payment of loan received.
e. Gifts, etc.
f. Production

Capital Consumption Allowances or the value of decrease in stock through:

a. Sale.
b. Share of harvester.
c. Share of landlord.
d. Loan payment.
e. Gifts, etc.
f. Food consumption.
g. Feeds, seeds.
h. Damage.

Net Investment = Gross investment - decrease in stock

Value of Ending Inventory = Beginning inventory + net investment, or
in the absence of information on the
beginning inventory, equals net investment
APPENDIX C

Republic of the Philippines
Department of Agriculture
BUREAU OF AGRICULTURAL ECONOMICS
Quezon City

SURVEY ON CAPITAL FORMATION IN AGRICULTURE
Reference Period:
July 1, 1973 to June 30, 1974

PART - I
GENERAL INFORMATION

1) NAME OF SAMPLE FARMER:

2) NO. OF YEARS RESIDING IN PRESENT ADDRESS

3) AGE (Encircle code)
1 - Less than 20 4 - 40 - 49
2 - 20 - 29 5 - 50 - 59
3 - 30 - 39 6 - 60 - 69
7 - 70 and above

4) EDUCATIONAL ATTAINMENT (Encircle code)
1 - None 5 - H.S. grad.
2 - Grades 1 to 5 6 - Vocational
3 - Elem. grad. graduate 7 - 1st to 3rd yr
4 - 1st to 3rd Yr. College
High School 8 - College grad.

5) OCCUPATION:
a) Primary:

b) Secondary:

6) YEARS OF FARMING EXPERIENCE
(Encircle code)
1 - / than 5 yrs. 5 - 20 - 24
2 - 5 - 9 6 - 25 - 29
3 - 10 - 14 7 - 30 - 39
4 - 15 - 19 8 - 40 - 49
9 - 50 and above

7) NUMBER OF HOUSEHOLD MEMBERS
(including head)

8) HOW MANY HAVE REACHED:
a) Elementary:

b) High School:

c) Vocational:

d) College:

9) NUMBER OF HOUSEHOLD MEMBERS HELPING
IN THE FARM (including head):
a) Part Time:

b) Full Time:

10) TENURIAL STATUS (Encircle code)
1 - Full Owner
2 - Part Owner
3 - Lessee
4 - Share-Tenant

11) PARTICIPATION IN GOVERNMENT
PROGRAMS (July 1, 1973 to
June 30, 1974, Encircle code(s))
1 - Masagana 99
2 - Masaganang Maisan
3 - Feed Grains
4 - Livestock & Poultry

* For the sake of brevity, this appendix gives only the general information and capital formation parts of the questionnaire used in the survey. Remaining parts of the questionnaire, dealing with topics other than capital formation, are not reproduced here.
FARMLAND

A. INVENTORY, JULY 1, 1973

A1. Total farm area _______ hectares
A2. Assessed value P ________

B. CAPITAL FORMATION, JULY 1, 1973 to JUNE 30, 1974

B1. Improvements - clearings of forested land, if any. How many hectares were cleared within the reference period?
   1.1 Area _______ hectares
   1.2 Assessed value of the portion cleared P _______
   1.3 Total cost incurred in clearing P ________ (Include cash cost for labour, materials and others, as well as value for free labour and materials)

B2. Additional area farmed: ARENA : VALUE: 
   w/in reference period : (has.) : (P) :
   2.1 PURCHASE 2.4 TENANTED
   2.2 INHERITANCE 2.5 MANAGED
   2.3 LEASED 2.6 RECLAMATION

B3. Decrease in area farmed: AREA : VALUE:
   w/in reference period : (has.) : (P) :
   3.1 SALE 3.4 SOIL EROSION
   (run-off)
   3.2 PARTED AS INHERITANCE
   a. decrease in area, if any
   3.3 Surrender of farm to owner
   a. LEASED
   b. TENANTED
   c. MANAGED
   3.5 Others
   (roads, paths, etc.)

NOTE: Value for purchased area (item B2.1) and area sold (item B3.1) call for the actual cost. All other items call for the assessed value of the farm area.
C. LAND UTILISATION. Within reference period: TENURE

OWNED:LEASED: TENANTED: MANAGED

C1. Cultivated Area
   1.1 Planted to permanent crops only
   1.2 Planted to temporary crops only
   1.3 Intercropped area (a parcel of land planted to permanent and temporary crops at the same time)
   1.4 Temporary pasture/idle land
      Sub-Total (1.1 to 1.4)

C2. Uncultivated Area
   2.1 Forested land
   2.2 Swamps
   2.3 Others (Including homelot IF within farm area)
      Sub-Total (2.1 to 2.3)

D. INVENTORY, JUNE 30, 1974

D1. Total farm area _______ hectares
D2. Assessed value $ _______

CONSTRUCTIONS ON THE FARMLAND

Items to be reported are:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>bridge</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>canal</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>culvert</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>fence</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>well</td>
<td></td>
</tr>
</tbody>
</table>

SPECIFY ITEMS

| a | b | c |

A. INVENTORY, July 1, 1973

A1. Date constructed
A2. Total construction cost
A3. Present value (Central Office Use Only)
B. CAPITAL FORMATION, July 1, 1973 to JUNE 30, 1974

B1. Major Repairs/Alterations
   1.1 Parts repaired/altered
   1.2 Labour cost
      i. hired
      ii. family, exchange
   1.3 Material cost
      i. bought
      ii. free supply
   1.4 Other costs incurred
   1.5 Total cost

B2. New Construction (specify if on Account or Contractual)
   2.1 Date constructed
   2.2 Labour cost
      i. hired
      ii. family, exchange
   2.3 Material cost
      i. bought
      ii. free supply
   2.4 Other costs incurred
   2.5 Total Cost

B3. Capital Consumption Allowances, etc.
   3.1 Value of material damage
   Do not fill up items B3.2 to Cl.2 (for Central Office personnel use only)
   3.2 Depreciation
      i. old existing units
      ii. new construction

C. INVENTORY, JUNE 30, 1974

Cl. Book Value
   1.1 Old existing unit
   1.2 New construction

FARM BUILDINGS

Items to be reported are:

1 - farm dwelling
2 - hoghouse and pen
3 - livestock barn
4 - machinery, equipment
    and tool shed
5 - poultry house and pen
6 - pump house
7 - rice granary
8 - silo
9 - tobacco flue-curing barn
10 - warehouse
A. INVENTORY, July 1, 1973
   A1. Number of useful existing units
   A2. Date constructed
   A3. Total construction cost
   A4. Present value (Central Office use only)

B. CAPITAL FORMATION, JULY 1, 1973 to JUNE 30, 1974
   B1. Major Repairs/Alterations
      1.1 Parts repaired/altered
      1.2 Labour cost  i. hired
         ii. family, exchange
      1.3 Material cost  i. bought
         ii. free supply
      1.4 Other costs incurred
      1.5 Total cost

   B2. New Constructions (Specify if on Account or Contractual. Include purchase of farm bldgs. within reference period and indicate if so.)
      2.1 Number of units
      2.2 Labour cost  i. hired
         ii. family, exchange
      2.3 Material cost  i. bought
         ii. free supply
      2.4 Other costs incurred
      2.5 Total cost

   B3. Capital Consumption Allowances, etc.
      3.1 Value of material damage
      3.2 Decrease in number of units due to sales obsolescence, etc.

Do not fill up items B3.3 to Cl.2 (for Central Office personnel use only).

   3.3 Depreciation  i. old existing unit
                  ii. new construction
C. INVENTORY, JUNE 30, 1974

Cl. Book Value
   1.1 Old existing unit
   1.2 New construction

IMPLEMENTS, TOOLS AND MACHINERY

Items to be reported are:

1 - disc harrow 11 - claw hammer 21 - shovel
2 - disc plow 12 - hand saw 22 - sled
3 - jeep 13 - harrow 23 - spade
4 - hand tractor 14 - hoe 24 - spading fork
5 - rotary tiller 15 - mattock bar 25 - sprayer
6 - stationary engine 16 - plow 26 - sprinkle
7 - tractor 17 - post hole digger 27 - trowel
8 - axe 18 - pump 28 - wheelbarrow
9 - bolo 19 - rake 29 - yoke
10 - cart 20 - scythe 30 - others

A. INVENTORY, JULY 1, 1973

A1. Number of useful existing units
A2. Date acquired/made
A3. Type
A4. Total acquisition cost
A5. Present value (Central Office use only)

B. CAPITAL FORMATION, JULY 1, 1973 to JUNE 30, 1974

Bl. Major Repairs/Alterations
   1.1 Parts repaired/altered
   1.2 Labour cost i. hired
      ii. family, exchange
   1.3 Material cost i. bought
      ii. free supply
   1.4 Other costs incurred
   1.5 Total cost
B2. New Acquisitions (within the reference period)

2.1 Number of units
2.2 Type
2.3 Acquisition cost
2.4 Other costs (transportation, taxes, fees, etc.)
2.5 Total cost

B3. Decrease in Units Due to:

3.1 Sales
   i. number of units
   ii. value
3.2 Obsolescence
3.3 Loss, given away, etc.

B4. Capital Consumption Allowances, etc.

4.1 Value of material damage
4.2 Amount of insurance indemnity

Do not fill up items B4.3 to Cl.2 (for Central Office personnel use only).

4.3 Depreciation
   i. old existing unit
   ii. new acquisition

C. INVENTORY, JUNE 30, 1974

Cl. Book Value

1.1 Old existing unit
1.2 New acquisition

PERENNIAL CROP PLANTATION

Crops to be reported are: (Report only those planted into at least 1000 sq. metres or 0.1 hectares)

1 - abaca
2 - banana
3 - cacao
4 - coconut
5 - coffee
6 - orchard
   (fruit trees, citrus)
7 - rubber
8 - vineyards
SPECIFY PERENNIAL CROPS

A. INVENTORY, JULY 1, 1973

A1. Area planted (hectares)
A2. Total no. of trees/hills planted
   2.1 Bearing
   2.2 Non-bearing
A3. Estimated value of plantation (including land)

B. CAPITAL FORMATION, JULY 1, 1973 to JUNE 30, 1974

B1. Replanting costs:
   1.1 Labour i. hired
      ii. family, exchange
   1.2 Seedlings i. bought
      ii. free supply
   1.3 Other costs incurred
B2. Additional Area Planted:
   2.1 Area (hectares)
   2.2 Total no. of tree/hills planted
      i. Bearing
      ii. Non-bearing
   2.3 Estimated value of additional
tree/hills planted
   2.4 Labour cost i. hired
      ii. family, exchange
   2.5 Seedlings i. bought
      ii. free supply
   2.6 Other costs incurred
B3. Cost of Plantation Care: (Include labour and material cost.)
   3.1 Vegetative propagation
   3.2 Pest and disease control
   3.3 Cultivation
   3.4 Fertilisation
B4. Damages:
   4.1 No. of trees/hills affected
   4.2 Extent of damage
   4.3 Value of damage
   4.4 Cause of damage
B5. Sold:
5.1 Area (hectares)
5.2 Value of area sold
5.3 No. of trees/hills sold
5.4 Value of trees/hills sold

C. STATUS AS OF JUNE 30, 1974:
C1. Area planted (hectares)
C2. Total no. of trees/hills
   a. Bearing
   b. Non-bearing
C3. Estimated value of plantation
   (including land)

LIVESTOCK AND LIVESTOCK PRODUCTS

<table>
<thead>
<tr>
<th>CARABAO</th>
<th>CATTLE</th>
<th>GOAT</th>
<th>HOG</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. Value:</td>
<td>No. Value:</td>
<td>No. Value:</td>
<td>No. Value:</td>
</tr>
</tbody>
</table>

A. INVENTORY, JULY 1, 1973
A1. TOTAL NO. & VALUE OF HEADS OF ALL AGES
   a. Farmer's share
   b. Landlord's share
   Breakdown:
   1.1 Work animals
   1.2 Breeding
   1.3 Fattening
   1.4 Milking

B. INCREASE IN STOCKS. During the period from July 1, 1973 to June 30, 1974, how many units were:
   B1. Born alive on this farm?
   B2. Purchased?
   B3. Received from others
   B4. TOTAL NO. & VALUE OF HEADS ADDED

C. DECREASE IN STOCKS. During the period from July 1, 1973 to June 30, 1974, how many units:
   C1. Were slaughtered on this farm?
   C2. Were sold alive?
### D. INVENTORY, JUNE 30, 1974

#### D1. TOTAL NO. & VALUE OF HEADS OF ALL AGES

<table>
<thead>
<tr>
<th>Breakdown</th>
<th>Young</th>
<th>Below 3 years</th>
<th>Below 2 years</th>
<th>Below 6 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work animals</td>
<td>CHICKEN</td>
<td>Others, specify</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### POULTRY AND POULTRY PRODUCTS

<table>
<thead>
<tr>
<th>AGE CLASSIFICATION</th>
<th>Young</th>
<th>Below 3 years</th>
<th>Below 2 years</th>
<th>Below 6 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult 3 years</td>
<td>CHICKEN</td>
<td>Others, specify</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&amp; over</td>
<td>: No. Value : No. Value</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### A. INVENTORY, JULY 1, 1973

#### A1. TOTAL NO. & VALUE OF HEADS OF ALL AGES

<table>
<thead>
<tr>
<th>Breakdown</th>
<th>Young</th>
<th>Below 3 years</th>
<th>Below 2 years</th>
<th>Below 6 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broilers</td>
<td>CHICKEN</td>
<td>Others, specify</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### POULTRY AND POULTRY PRODUCTS

<table>
<thead>
<tr>
<th>AGE CLASSIFICATION</th>
<th>Young</th>
<th>Below 3 years</th>
<th>Below 2 years</th>
<th>Below 6 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult 3 years</td>
<td>CHICKEN</td>
<td>Others, specify</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&amp; over</td>
<td>: No. Value : No. Value</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
B. INCREASES. During the period from July 1, 1973 to June 30, 1974, how many units were:
   B1. Hatched on this farm?
   B2. Purchased?
   B3. Received from others?
   B4. TOTAL NO. & VALUE OF HEADS ADDED

C. DECREASES. During the period from July 1, 1973 to June 30, 1974, how many units:
   C1. Were dressed on this farm?
   C2. Were sold alive?
   C3. Died of diseases
   C4. Given away, stolen, lost etc.
   C5. TOTAL NO. & VALUE OF HEADS DECREASED

D. INVENTORY, JUNE 30, 1974
   D1. TOTAL NO. & VALUE OF HEADS OF ALL AGES
       a. Farmer's share
       b. Landlord's share

Breakdown:
   1.1 Broilers
   1.2 Layers
   1.3 Breeding

<table>
<thead>
<tr>
<th>AGE CLASSIFICATION</th>
<th>YOUNG</th>
<th>ADULT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Below 6 months</td>
<td>6 months and over</td>
</tr>
</tbody>
</table>
**DIFFERENT CROPS & STANDARD UNITS OF MEASUREMENT TO BE USED**

<table>
<thead>
<tr>
<th>Grains, Legumes &amp; Other Crops</th>
<th>Unit to be Reported</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grains:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Palay sack</td>
<td>sack</td>
<td>50 kg per cavan</td>
</tr>
<tr>
<td>Shelled corn sack</td>
<td>sack</td>
<td>57 kg per sack (if unshelled estimate the equivalent to sack of shelled corn at 57 kg per sack)</td>
</tr>
<tr>
<td><strong>Legumes:</strong></td>
<td>ganta</td>
<td></td>
</tr>
<tr>
<td>Mongo (dry seeds)</td>
<td>ganta</td>
<td></td>
</tr>
<tr>
<td>Beans (dry seeds)</td>
<td>ganta</td>
<td></td>
</tr>
<tr>
<td>Cowpeas (dry seeds)</td>
<td>ganta</td>
<td></td>
</tr>
<tr>
<td>Peanut (shelled) sack</td>
<td>sack</td>
<td>46 kg per cavan or 23 ganta per cavan (if unshelled estimate the equivalent to sack of shelled peanut at 46 kg per sack)</td>
</tr>
<tr>
<td><strong>Other Crops:</strong></td>
<td>quintal</td>
<td></td>
</tr>
<tr>
<td>Tobacco</td>
<td>quintal</td>
<td></td>
</tr>
<tr>
<td>Coconut</td>
<td>nuts</td>
<td>Actual no. of nuts produced</td>
</tr>
<tr>
<td>Cacao</td>
<td>ganta</td>
<td></td>
</tr>
<tr>
<td>Coffee</td>
<td>ganta</td>
<td></td>
</tr>
<tr>
<td><strong>Other Crops Planted:</strong></td>
<td>picul</td>
<td></td>
</tr>
<tr>
<td>Sugarcane</td>
<td>picul</td>
<td>63.25 kg per picul</td>
</tr>
<tr>
<td>Abaca</td>
<td>picul</td>
<td>63.25 kg per picul</td>
</tr>
</tbody>
</table>

1. For fruit vegetables, leafy vegetables, fruits, tubers, roots and bulbs planted to area of 1000 sq metres or 0.1 hectares and above, use kilograms as the standard unit of measurement; convert to kilograms if reported in local units.

**SPECIFY CROPS PRODUCED**

CROP PRODUCTION. Only crops planted into areas of at least 1000 sq metres or 0.1 hectares should be reported. Use back page if space provided is not enough.

1. Absolute area planted (hectares)
2. Variety(ies) planted
3. Area irrigated (hectares)
4. Type of irrigation (enter code)
   1 - gravity; 2 - deep well;
   3 - shallow well; 4 - pumped from stream

<table>
<thead>
<tr>
<th>1st Semester : 2nd Semester</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>July 1, 1973 - Jan. 1, 1974-</td>
<td></td>
</tr>
<tr>
<td>Dec. 31, 1973 : June 30, 1974</td>
<td></td>
</tr>
<tr>
<td><strong>5. Source of irrigation (enter code)</strong></td>
<td></td>
</tr>
<tr>
<td>----------------------------------------</td>
<td></td>
</tr>
<tr>
<td>1 - NIA; 2 - Communal; 3 - Private;</td>
<td></td>
</tr>
<tr>
<td>4 - Combination</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>6. Area fertilised (hectares)</strong></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>7. Kind of fertiliser applied (enter code)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - urea</td>
</tr>
<tr>
<td>2 - ammosul</td>
</tr>
<tr>
<td>3 - ammonium</td>
</tr>
<tr>
<td>4 - complete</td>
</tr>
<tr>
<td>5 - combination</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>8. Area treated with farm chemicals (hectares)</strong></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>9. Type of farm chemicals applied (enter code)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - pesticide</td>
</tr>
<tr>
<td>2 - insecticide</td>
</tr>
<tr>
<td>3 - weedicide</td>
</tr>
<tr>
<td>4 - fungicide</td>
</tr>
<tr>
<td>5 - combination</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>10. Area damaged (hectares)</strong></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>11. Cause of damage (enter code)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - weather effects</td>
</tr>
<tr>
<td>2 - pest &amp; disease</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>12. Area Harvested (hectares)</strong></th>
</tr>
</thead>
</table>

**A. INVENTORY, JULY 1, 1973 (or JAN. 1, 1974 as the case may be).**
Item A1. is for GRAINS, LEGUMES & OTHER CROPS only.

A1. Total no. & value on hand

**B. INCREASE IN STOCKS.** All crops planted into areas of at least 1000 sq metres or 0.1 hectares should be reported.

B1. From July 1, 1973 to Dec. 31, 1973 (or from Jan. 1, 1974 (as the case may be), how many units (& value) did this household bring in as:
1.1 Purchases
1.2 Share as landlord for rent of land
1.3 Share as harvester, thresher & other services
1.4 Payment of loan as lender
1.5 Gifts & loans received

B2. Production
2.1 Production from irrigated area
2.2 Production from non-irrigated area

B3. Total Supply, for Grains, Legumes and Other Crops Only
[Add items B1. (1.1 to 1.5) to B2. (2.1 to 2.2)]

C. DECREASE IN STOCKS. For all crops produced within reference period.
C1. From July 1, 1973 to Dec. 31, 1973 (or Jan. 1, 1974 to June 30, 1974), how many units (and its value) did this household dispose of as:

1.1 Sales
1.2 Share of harvesters, shellers and other services
1.3 Landlord share/land rental
1.4 Payment of loans as borrower
1.5 Fertiliser, irrigation fees and other farm costs paid in kind
1.6 Gifts & loans granted to others

C2. How many units (and value) did this household use for:
2.1 Home consumption
2.2 Animal feeds
2.3 Seeds

C3. About how many units (and value) were damaged by rats, weevils, etc.?

C4. Total Disposition. For Grains, Legumes & Other Crops Only. [Add items C1. (1.1 to 1.6) + C2. (2.1 to 2.3) + C3.]

D. INVENTORY, DEC. 31, 1973 (or JUNE 30, 1974 as the case may be) for Grains, Legumes & Other Crops Only.
D1. Total No. on hand and value
### INCOME FROM ALL SOURCES, July 1, 1973 to June 30, 1974

(Do not fill column CASH for items A1.1 to A1.3. Also items A2.1 to A2.3, A3 and NOT IN CASH for item A4. For Central Office use only)

<table>
<thead>
<tr>
<th></th>
<th>CASH</th>
<th>NOT IN CASH</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FARM INCOME</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1. Sale of</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1 Crops</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2 Livestock &amp; livestock products</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.3 Poultry &amp; poultry products</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.4 Others, specify:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2. Farm Privileges</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1 Crops consumed, used as seeds, feeds, etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.2 Livestock &amp; livestock products consumed, etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3 Poultry &amp; poultry products consumed, etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A3. Value of farmer's and other household members' labor used in the farm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A4. Farmer's and other household members' wages from off-farm services</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A5 Rental from agricultural lands; farm animals, buildings, machineries, and other farm properties</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A6 Interest on loans to others</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A7 Government relief &amp; subsidy</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NON-FARM INCOME</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B1. Farmer's and other household members' wages from non-farm activities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HH members</td>
<td>Kind of Work</td>
<td></td>
</tr>
<tr>
<td>B2. Rental from non-agricultural lands, rooms or spaces and other properties</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B3. Rental value of owner-occupied houses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B4. Interest and dividends, including insurance dividends</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B5. Profits from sale of stock &amp; bonds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B6. Pension and retirements</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B7. Receipts and gifts from absentee relatives</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B8. Net winnings in gamblings</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### FAMILY EXPENDITURES, July 1, 1973 to June 30, 1974

(Paid for in cash: Exchange, etc)

| **FOOD, BEVERAGES and TOBACCO** |   |             |
| **HOUSING**                     | 2.1 Rent |             |
|                                  | 2.2 Minor house repair |             |
| **FUEL, LIGHT and WATER**       |   |             |
| **HOUSEHOLD FURNISHING EQUIPMENT** |   |             |
| **HOUSEHOLD OPERATIONS**        |   |             |
| **CLOTHING and OTHER WEAR**     |   |             |
| **MEDICAL CARE**                |   |             |
| **TRANSPORTATION and COMMUNICATION** |   |             |
| **RECREATION**                  |   |             |
SAVINGS

Amount of savings if any, July 1, 1973, P ____________________

Did you have any savings to finance your (check)

a. farm operations? ( ) YES ( ) NO
b. farm expenditures? ( ) YES ( ) NO

CREDIT

Fill up the following items if you have incurred debt within the reference period (July 1, 1973 to June 30, 1974).

<table>
<thead>
<tr>
<th>PURPOSE FOR WHICH AN WAS APPLIED FOR</th>
<th>AMOUNT</th>
<th>INTEREST</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cash</td>
<td>%</td>
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<tr>
<td>CROP PRODUCTION</td>
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<td>FARM IMPROVEMENT</td>
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<td>COMMODITY</td>
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<td>EDUCATION</td>
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<td>CONSUMPTION</td>
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<tr>
<td>OTHERS</td>
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</tbody>
</table>

Loan Sources:

1 - ACA  4 - Rural banks  7 - Landlord
2 - DBP  5 - Commercial banks  8 - Private money lenders
3 - PNB  6 - Credit Unions  9 - Relatives/friends

Was the loan(s) adequate to finance your (check)

a. farming needs? ( ) YES ( ) NO  b. other needs? ( ) YES ( ) NO

Do you consider the interest too high? (check) ( ) YES ( ) NO

If repayments were already made, did you have any difficulty in repaying your loan(s)? (check) ( ) YES ( ) NO

If YES, why (Encircle code)

1 - Low crop production  3 - Misapplication of loan received
2 - High cost of inputs  4 - Others, specify:

What difficulties did you encounter in availing of a loan? (Encircle code)

1 - No experience applying for a loan  3 - No collateral to offer; thus refused
2 - Too many paper requirements  4 - Others, specify:
REFERENCES


Firth, R. and Yamey, B.S. 1964. Capital, Saving and Credit in Peasant Societies, Studies from Asia, Oceania, The Caribbean and Middle America, George Allen and Unwin Ltd.


Sandoval, P.R. et.al. (no date). Agricultural Land Reform in the Philippines: Economic Aspects, Department of Agricultural Economics, University of the Philippines at Los Banos, p.475 in ILO, 1974.


