Economics Research Report

1979 SERIES • Number 4 •

A Study of Private Farm Capital Formation in Central Luzon

MINDA MANGABAT

BUREAU OF AGRICULTURAL ECONOMICS

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Mangabat, M. C. 1979. A study of private farm capital formation in Central Luzon. Economics Research Report No. 4 (1979 s.). Bureau of Agricultural Economics, Quezon City, April 1979.

Published by the
Information Section
BAECON, Delos Santos Bldg.
Quezon Avenue, Quezon City, Philippines

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A STUDY OF PRIVATE FARM CAPITAL FORMATION IN CENTRAL LUZON

by

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INTRODUCTION

Capital formation or investment 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 non-corporate sectors. Government outlays on irrigation projects, rural roads, credit, research and extension services would constitute public corporate investment in the agricultural sector. Private corporate investment would pertain to the agricultural loans extended by the private financial institutions, and the supply of agricultural inputs, such as fertilizers, 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 the individual farmers on their farms. Such private capital formation may be in the form of planting tree crops, opening up of 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.

This study was undertaken with the view of making a contribution towards an understanding of private farm capital formation or investment in the Central Luzon region. Since research resources were limited and capital formation is a complex topic, the objectives of this study are kept modest. The study has attempted to estimate the amount of private farm capital formed

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from a sample of farms located in the region. In particular, this study has empirically investigated some factors affecting private farm capital formation.

The Data and Scope of the Study

Exhaustive time series data on private investment in agriculture in the Philippines are not available.

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 Bureau of Agricultural Economics in 1974. The survey involved a multi-stage sampling technique. 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 rice farms were relatively small holdings ranging from 0.35 hectare to seven hectares.

Data limitations in this study pertain particularly to the respondents' memory bias inherent in the questionnaire/interview method of data collection and the items of information contained in the questionnaire. The special problems associated with the estimation of capital formation in a predominantly subsistence agriculture may also have some influence on the data. Labor and traditional materials used in most private farm construction such as farm buildings were owned and produced by the farmers themselves. Since no active market existed 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, recognized 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.

Concepts of Farm Capital

Capital is a concept which has received a great deal of theoretical exploration. In the context of agriculture, the concept of capital relates to *real* capital assets. *Real capital* refers to physical durable assets and inventories. For the purposes of this study,

however, three major types of physical assets have been defined. They are as follows:[1]

a. Farmland
b. Fixed assets: construction and works on the farmland; farm buildings; and perennial crops
c. Inventories: livestock, poultry & stored crops

The above categories do not include farmers' inventories of other forms of farm capital such as farm supplies of chemicals and fertilizers. These were not taken into account in the survey because it was believed that their amounts were relatively small and would result in insufficient estimates for the period under study.

Currency and demand deposits held by farmers were potential sources of capital for use in farming. Although information on savings was incorporated in the survey questionnaire, few farmers reported cash savings.

Questions have been raised about the inclusion of farmland because of the nature of its origin, and farm dwellings because of the difficulty in dividing the investment on the basis of use in production and consumption. There are two reasons for including land in the inventory of farm capital. First, although the supply of land is fixed, its *productive* capacity can be increased by fertilization, irrigation, prevention of erosion or depletion, and the like. Secondly, farm financial operations especially in securing loans are influenced by the value of farm buildings and equipment. On the other hand, the farm dwelling provides an abode convenient to the fields of the farmer and his family and it frequently serves as a store for farm products, supplies and a place to feed hired labor.

Measurement of Capital

Valuation – In the measurement of capital, a problem 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 diver-

[1]There are differences of opinion as regards the composition of capital for purposes of estimates. Although Tostlebe (1957) 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.

gent capital goods on the basis of a common unit of measurement. There are two alternative ways in the valuation of capital. One way is to deflate the current value figures with an appropriate cost index or alternatively, valuation can be based on the market prices of the capital items. In this study, a price deflator was utilized, i.e. the general wholesale price index computed by the Central Bank adjusted for 1973 as the base year. The prices of the capital items relevant to this study were incorporated in the computation of said index.

Estimation – In practice, there are two basic approaches to the estimation of capital formation, namely, the "inventory or commodity flow approach," and the "expenditure approach." The application of the two approaches in agriculture depends on the type of agriculture in the country concerned. Hooley (1964) contends that in view of the low degree of monetization in agriculture of the LDCs, the expenditure approach may not be applicable. He 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. Soharjo (1964), on the other hand, favours the adoption of the combination of both approaches rather than an exclusive use of either. A combination of both approaches was employed in this study.

Depreciation – Correct estimation of depreciation, or the reduction in the ability of capital goods to contribute to production in the future is important for the precise measurement of net capital formation. For this study, the simple method of straight line depreciation was utilized.

Gross capital formation – In investment theory, gross capital formation (or gross investment) is normally observed. Gross farm capital formation as adopted in this study, represents the following:

Farmland:

a. Value of gross additions to area farmed through purchase, inheritance, etc.
b. Gross expenditures incurred for permanent improve ments such as clearing of land for cultivation, reclamation, etc.

Fixed Assets:

a. Gross value of new acquisitions through purchase, and value of additional construction.
b. Gross expenditures on major repairs and alterations,

renovations, etc.

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

Inventories:

a. Gross 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.

Net 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.

ESTIMATES OF FARM CAPITAL FORMATION IN THE REGION

The estimates of capital formed for the sample farms are presented in Table 1. The last column of the table shows the percentage composition of total net investment. The figures reveal 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 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.

FACTORS ASSOCIATED WITH PRIVATE FARM INVESTMENT – A REVIEW

Farm capital formation as a whole is influenced by a large number of economic, social and institutional factors. This section surveys selected major investment models and empirical studies in agriculture. The survey is undertaken with the 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, while the second part deals with a review of the studies which have commented on the relevance of institutional settings (e.g. land tenure) and other factors of private investment on farms.

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 briefly below.

The Flexible Accelerator Model. This model is associated with the names of Chenery (1952) and Koyck (1954). 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, B. In the adjustment response, it is assumed that the increase in capital undertaken during year t is some fixed proportion (B) of the difference between the desired and actual capital stocks. If B 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 B is less than unity, only a fraction of the adjustment will be completed during the year.

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,

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

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

duced some modifications to Clark's model to make it more realistic. Their flexible accelerator model centers on the time structure of the investment process. Hence, the investment adjustment coefficient B 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-B, of that of the preceding year t-1. This can be represented as:

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

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 utilization, 2) internal finance variables, and 3) external finance variables.

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. Fisher specified gross investment as a function of output and the change in the implicit rental price of capital services.[2] 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.

The Residual Funds Model. Campbell (1956) 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 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. He proposed an alternative model referred to as the residual funds model in the literature.

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[2] The implicit rental price postulates that a firm equates the purchase price of an asset with the present value 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 (1971).

The residual funds model would treat investment outlay as a function of net income realized from current farm operations less tax commitments and some conventional allowance for farm family living expenses. In this context, Campbell 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.

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,

$$I = Yd - C$$

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

Thus, $$I = f\ (Yd,\ C,\ A_L,\ D)$$

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

$$I = f\ (Yd,\ C) \text{ or}$$

$$I = f\ (Y_n)$$

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 reintroduce the profit maximization and the risk and uncertainty principles into investment functions.

A Combined Accelerator – Residual Funds Model. A number of recent studies, e.g. Glau (1971), Girao (1974) and Waugh (1977), have combined the accelerator and the residual funds models.

In Glau's model, the variable adjustment mechanism of capital towards its desired level is a linear function of internal liquidity. Results obtained from the least squares regression, how-

ever, showed that the rate of adjustment of desired to actual capital stock was not particularly sensitive to external 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 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 gross investment is a function of several financial variables like 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 and transitory component of income. The transitory income component was utilized 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 variable, on the other hand, was important for the stable income group. Aside from these, the result of Girao's study also confirmed the mechanism of the capital stock adjustment as discussed earlier in the flexible accelerator 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. He derived an investment model in which net investment is a linear function of real farm output, internal funds variable and external funds variable. Following Girao (1974), Waugh represented the internal funds variable by transitory income. The external funds variable was in terms of the change in real debt. In the preliminary regression results, however, Waugh detected high multicollinearity between the transitory income and the change in real debt variables. The problem was resolved by combining the two variables and thus forming a new variable in the second regression equation. Results obtained indicated a positive coefficient for the combined transitory income-debt variable. This, together with the negative value of the overall investment adjustment coefficient, support a "backlogging" pattern in investment behaviour of farmers. In times of adverse market conditions, farmers may tend to postpone

investment. The real output variable had a positive coefficient which 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.

Other Investment Studies

The preceding section 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 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.

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, Soharjo (1964) from Indonesia has also postulated the positive relationship between income, savings and capital formation on farms.

Several farm management studies in the Philippines have indicated that farm size and farm income have a marked influence on the amount of farm investment (Bratton and Robertson 1954 and Sardido 1969).

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 as a proxy for the labor supply and also as a gauge for the family living expenditure of a farmer.

It has also been suggested that farmer's 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 labor force. Within such environment the education of farmers becomes increasingly important and has relevance to capital formation.

The importance of tenure in capital accumulation in farms has been pointed out in some investment studies. Ray (1961) hypothesized 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 favor of 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 farmer's ability to save or to acquire capital.

EMPIRICAL FARM INVESTMENT FUNCTION

On the bases of the theoretical and empirical evidence provided in the review of investment studies in the preceding sections, it can be gleaned that investment is a dynamic process and that the flexible accelerator model provides a good explanation for the change in the capital stock. Occasionally, however, as Evans (1960) has noted, there are still investment studies that deal with the static sense. Nevertheless, these have become rarer.

Only cross-sectional data are available for this study, hence, investment will be viewed in its static sense. Attention is concentrated on the investments made by the sample farmers at one point of time, i.e. the crop year 1973-74.

The model. Farm investment in the region would be a function of the internal and external finances of farmers as well as other factors characteristic of the farms and agriculture in the region itself. The choice of factors selected for consideration here is based on economic theory and on the availability of data. 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, . . . X_n) has the implicit functional form:

$$Y = F\ (X_1,\ X_2,\ \ldots\ X_n)$$

Most of the econometric investment studies reviewed previously 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 assumed that the slopes in respect to the variables represented by dummies are identical.[3] Thus, the explicit investment model for the 324 cross-sectional sample farms may be stated as follows:

$$Y = B_0 + B_1 X_1 + B_2 X_2 + B_3 X_{3_{t-1}} + B_4 X_4 + B_5 X_5 + B_6 X_6 + B_7 X_7 + B_8 X_8 + B_9 X_9 + e_j$$

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	($X_{3_{t-1}}$)
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.

[3]This is the assumption usually taken in multiple regression with a dummy variable, instead of fitting independent regression for each dummy category which may yield unrealiable estimates of slopes. See for example, Wonnacot and Wonnacot (1970) for a detailed explanation.