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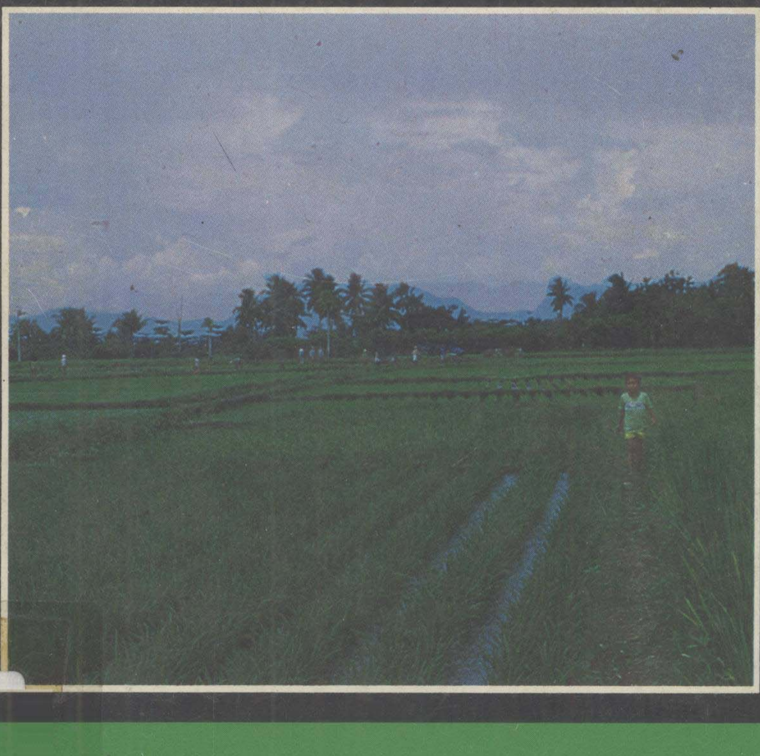
- ☐ Economies of Size in Rice Production in Selected Provinces in the Philippines, 1974-1975
- ☐ A Survey on Capital Formation on Philippine Farms, Cropyears 1974 and 1975
- ☐ Research and Development for Statistics in Food and Agriculture: The BAEcon Experience



BUREAU OF AGRICULTURAL ECONOMICS

# FOREWORD

This issue of the *Philippine Agricultural Economics Review* discusses two studies that are of significance to the nation's efforts in uplifting agricultural productivity – the first relates to economies of size in rice production; and the second, to capital formation in agriculture in Philippine farms. Both articles reflect the substance of BAEcon's efforts in economics research in the seventies: in the first case the continuing studies on growth trends in the agricultural sector and in the second instance, concentrating on a number of micro areas so as to come up with a viable picture of Philippine farms. Both macro and micro studies in farm, resource and policy economics will continue to be pursued as BAEcon expands its research role for countryside development and rural uplift.

This issue also includes a presentation of the BAEcon program in research and development for statistics in agriculture, which essentially discusses the current sampling design and statistical research techniques followed by the bureau as it continues its primal role as the official compiler and repository of agricultural statistics in the country.

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IN THIS ISSUE

# ECONOMIES OF SIZE IN RICE PRODUCTION IN SELECTED PROVINCES OF THE PHILIPPINES, 1974-1975

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## Objectives

Little work has been done on determining the costs of paddy production or the profitability of using high levels of inputs to attain high yields from improved rice varieties (IRV). Further, little is known about how the costs of paddy production relate to farm size or the degree to which increases in farm size could increase the profitability of harvesting high yields, i.e., the extent to which economies of size exist in rice growing.

Given these deficiencies in the research to date, this study has the following objectives:

1. to identify and measure the physical and financial inputs required for paddy production;
2. to determine the rate at which the costs of these inputs decline as farm size and the quantity of output increase;
3. to estimate the size of farm which produces paddy at the lowest cost using these inputs;
4. to draw conclusions based on the findings and to suggest possible measures that could be undertaken to achieve any changes which are considered necessary on the basis of such conclusions.

To gain insight into the cost-size relationship, paddy farms located in two selected irrigated areas in Central Luzon and Southern Tagalog were chosen for the cropyear 1974-1975 to obtain the necessary information.

## THE THEORY AND STUDY OF ECONOMIES OF SIZE

### Economies of Size

Economies of size exist when increases in the quantity of resources used in the production process result in reductions in total cost per unit of output. A special case is that of economies of scale. Here all inputs are varied in the same proportion, and result in a more than proportionate increase in output. However, in most production situations, one or more of the inputs will be available only in limited quantities. Continued proportional changes in the use of all resources are therefore not possible and declining unit costs are more appropriately explained by economies of size. The concept of economies of size can be made more clear by examining the average cost curves associated with the production process.

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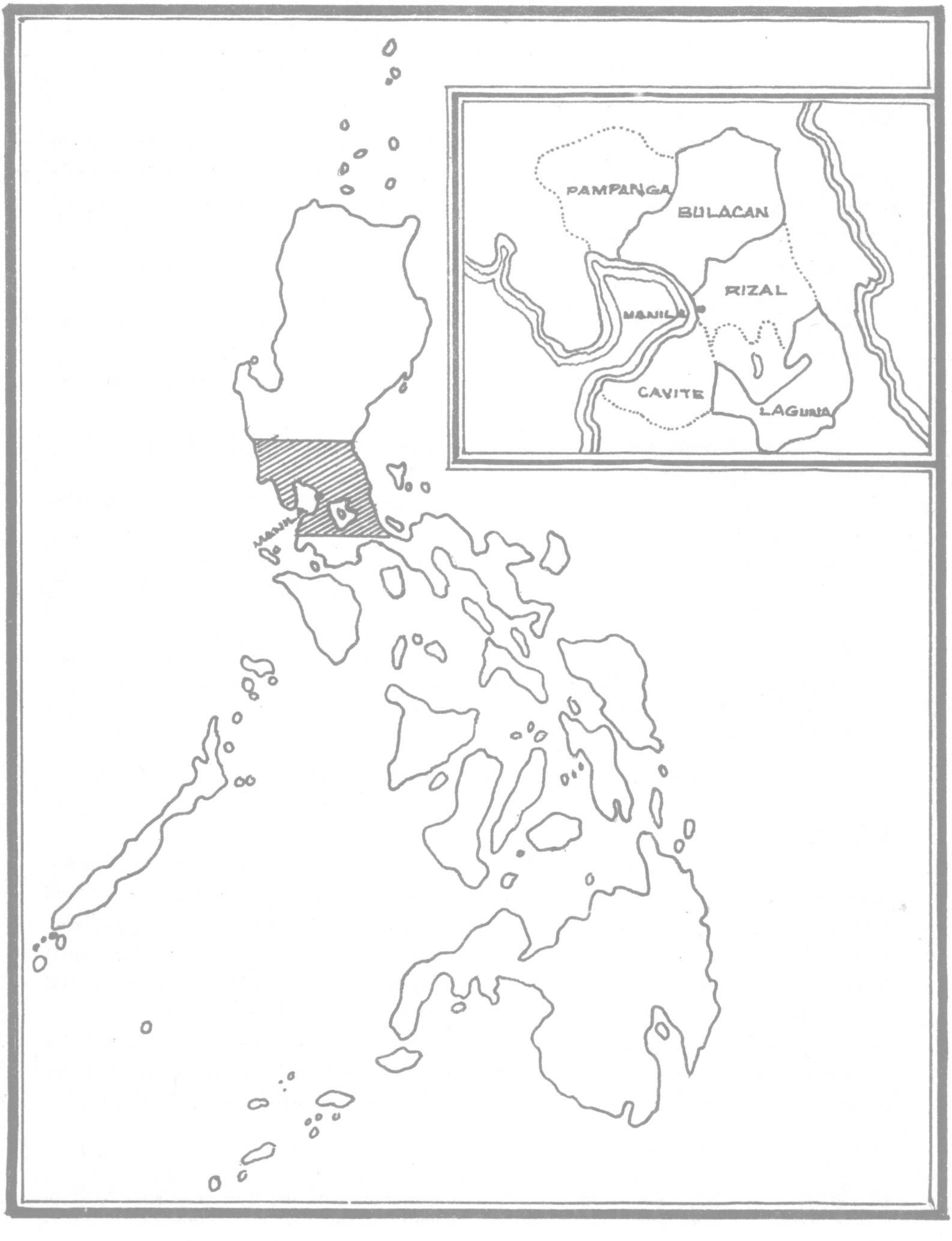
[1]The author is Agricultural Economics Assistant at the Bureau of Agricultural Economics. This article was largely taken from her dissertation submitted to the Australian National University where she completed her Master of Agricultural Development Economics in 1977.

FIGURE 1. MAP OF THE PHILIPPINES SHOWING MAJOR REGIONS AND INSET SHOWING BULACAN AND LAGUNA AREAS



## Short Run and Long Run Average Costs

The short run is defined as the period during which one or more of the inputs is available in a fixed quantity. Output is altered by changing the application of the variable inputs. For example, on a farm of given size, output can be increased by increasing the use of seeds, fertilizer, insecticides, labour, etc. The cost curve which would apply in such a situation is represented by $SAC_1$ in Figure 2.

Over time, it may be possible to vary the level of the previously fixed input, say by purchasing or renting additional land. The land input will then be fixed at this new level, but again output will depend on the quantity of other inputs used. The relevant cost curve is represented as $SAC_2$. For output levels above $Y_1$ it would be better to produce using input combinations represented by $SAC_2$, since they produce the output at a lower cost than input combinations represented by $SAC_1$.

Similarly, when the fixed input can again be varied, so that the relevant cost curve becomes $SAC_3$, output levels above $Y_2$ should be produced using this changed level of the fixed input. All of the above assume that returns in any period are sufficient to cover variable costs; if returns are surplus to variable costs then the surplus can be used to meet fixed costs.

The solid curve shown in Figure 2 represents the costs which apply as successive changes in the "fixed" inputs are made and is referred to as the long run average cost curve (LAC) or envelope curve. The long run is therefore defined as that period in which all inputs can be varied.

Only three short-run average cost curves are considered in the diagram. If a large number of changes in the fixed inputs were made over time, then the transition between successive short run cost curves would appear smoother. In fact, if an infinite number of short run curves were considered, the long run curve obtained from them would be tangential to the minimum points of each of the short run curves. The long run cost curve can be considered a planning curve; farmers can pass through successive short run periods, perhaps by borrowing capital or by purchasing or renting land, etc., to reach the level of output which can be produced at minimum cost.

Both the short run and long run average cost curves decline over a range of output to reach a minimum and then rise again. This characteristic shape can be attributed to economies and diseconomies of size. The decreases in unit costs which occur with increases in output are the result of both technical and pecuniary economies.

**Technical economies**. These arise when there is some indivisibility in the production process and excess quantitites of some inputs are being used. Farm machinery and equipment, for example, cannot be purchased in fractional amounts; instead the whole unit must be bought. Further increases in output can be obtained by utilizing idle machinery, i.e., the increase in output does not require a proportionate increase in the input and hence unit costs with respect to machinery inputs decrease. Lumpiness and excess capacity can apply to human capital as well as to the physical inputs. The management capabilities of a farmer may not be fully utilized at a certain level of farm operations, and hence further output increase might not require additional management inputs.

FIGURE 2. SHORT RUN (SAC) AND LONG RUN (LAC) AVERAGE COST CURVES

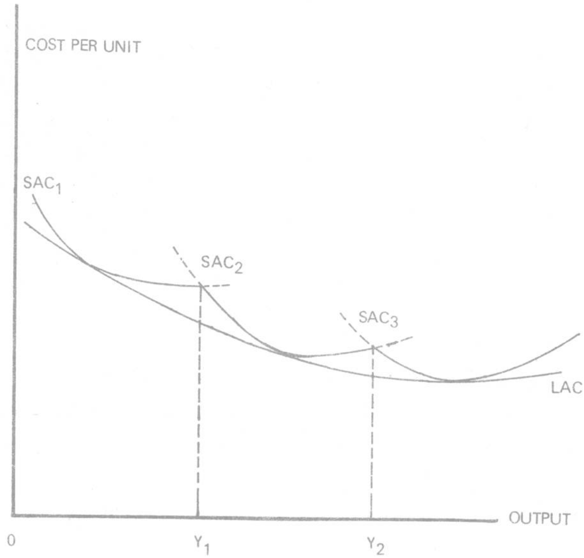
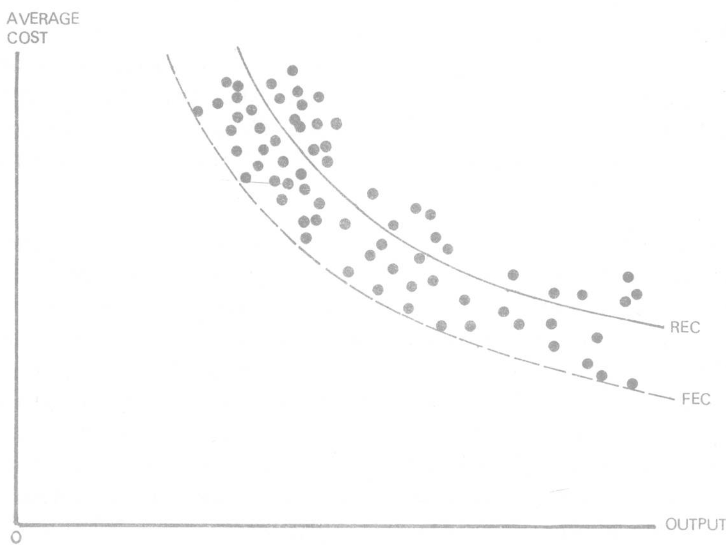



FIGURE 3. COST-OUTPUT RELATIONSHIP



**Pecuniary economies.** Those farms which operate at a relatively large size and level of output will generally require greater quantities of inputs than farms of smaller size and output. Often, in purchasing the larger quantities of various inputs the farmer will be given a price discount that is not available to those farmers purchasing smaller quantities. Hence, the average cost of such inputs will be less for the larger farms.

In the short run when some costs are fixed, the average fixed cost can be decreased by spreading the fixed costs over a greater quantity of output. For the long run, however, the same does not apply since all costs are variable.

Pecuniary and technical economies will also exist over the range of input usage for which the marginal productivities of the inputs are increasing. Continued increases in the use of the inputs will result in proportionately greater increases in output. This is equivalent to saying that a given change in output will therefore be produced at a lower average cost. Again, this will apply to management inputs as well as to physical inputs.

Economies of size will exist only over a certain range of output. Beyond some output level diseconomies of size will cause unit costs to increase as further output increases take place. For example, a point is reached where the marginal productivity of some inputs begins to decline. Hence successive changes in the use of these inputs will result in smaller and smaller increases in output and the output will therefore be produced at a higher average cost.

## Measurement of Farm Size

In the preceding discussion, the size of an enterprise was defined by the level of input usage. Since this study is concerned with economies of size in rice growing it would therefore seem appropriate to measure the size of a farm by the quantity of inputs it uses. However, problems arise in measuring total farm input usage. The difficulty is in aggregating the quantitites used of various inputs measured in different units. For example, fertilizer application will be measured by units of weight whereas the use of labour will be expressed in mandays. To convert all input usages to a common base requires some decision as to what some quantity of one input is equivalent to in terms of another input.

One means of overcoming this problem is to use a variable closely related to input usage, and which is easily quantified, as the measure of farm size. Two such variables are farm area and farm output. The choice of farm area assumes that larger farms would use more inputs than smaller farms. While this is true generally there is a problem; for a farm of given size it may be possible to use many different quantities of the other inputs. The use of output to represent farm size rests on the assumption that a greater output will be the result of a greater use of inputs. However, factors such as natural endowment (soils, topography), climate and managerial ability, etc., will also affect output. Despite these limitations, output and area will be used as measures of farm size for this study.

## Analytical Methods for Estimating Cost Curves

**The synthetic method.** As the name implies, this method involves the synthesis of cost functions. A number of farm studies using this method have been

FIGURE 4. AVERAGE COST CURVES FOR BULACAN AND LAGUNA, CROPYEAR 1974-1975

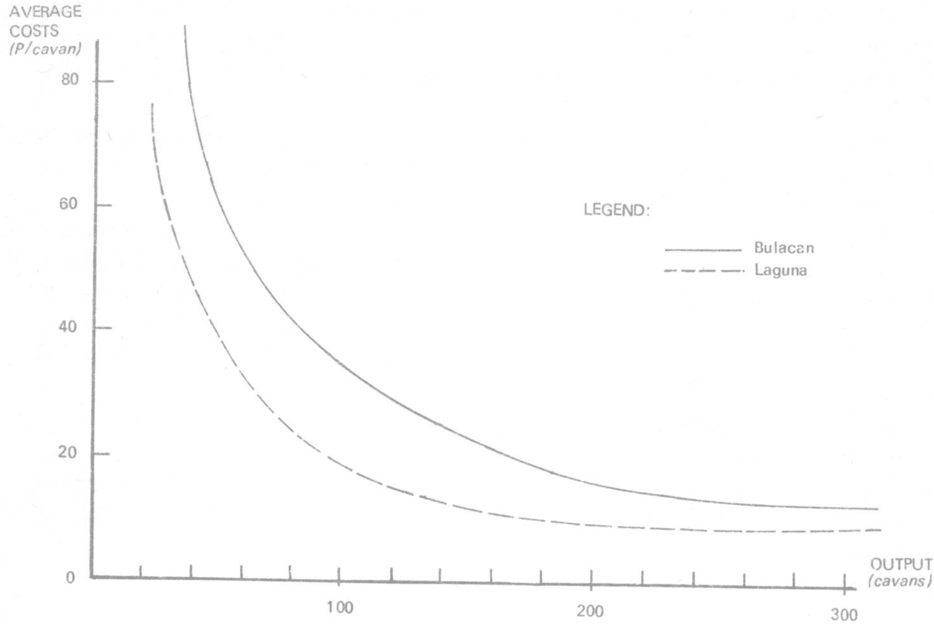
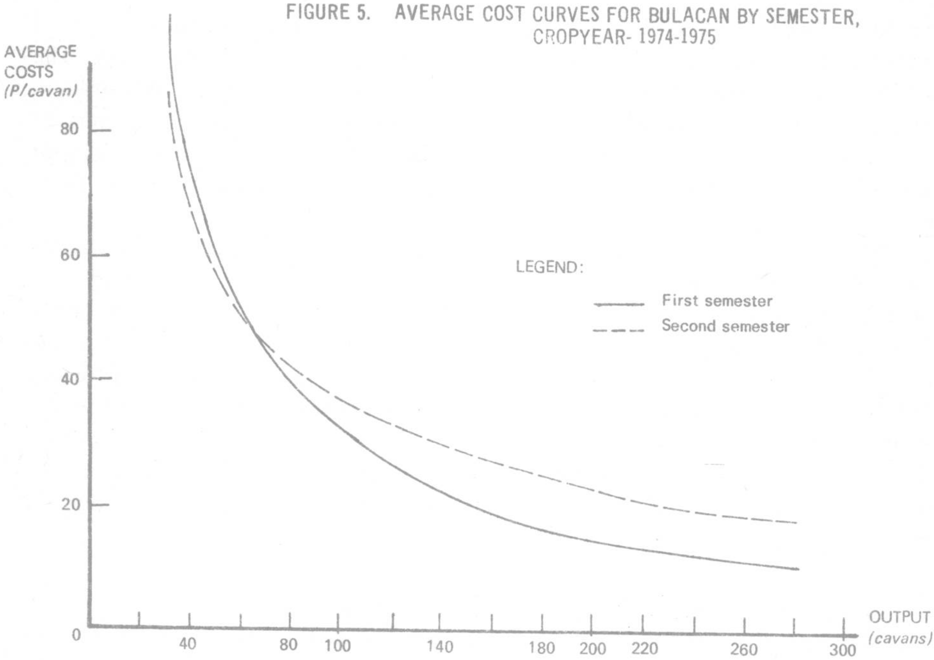



FIGURE 5. AVERAGE COST CURVES FOR BULACAN BY SEMESTER, CROPYEAR- 1974-1975



summarized by Madden (1967). Estimation of the cost function is done through the following steps:

1. Selecting various planned rates of operation.
2. Breaking the production process into various stages.
3. Determining the lowest cost input combination for each stage.
4. Synthesizing those optimally designed stages into complete plans.
5. Estimating the cost for the plant of producing each planned rate of operation.

Product and factor prices are assumed constant and the technical coefficients (relating inputs and outputs) are determined from sources such as experimental farms. The method enables costs to be determined over a range of output sizes, provided that these factors are assumed constant. However, in using this method the problems of coordinating large sized farms are often ignored, although occasionally an implicit assumption is made regarding the increasing managerial burden as size increases. The main disadvantage of the method is that it requires much time and cost if reliable estimates are to be made (Madden *et al.* 1972, p. 95).

**Statistical estimation of cost functions.** The relationship between average cost and farm size can be estimated using regression analysis. With this method size cost observations are plotted and the line of best fit is found by ordinary least squares. Several studies have used this method, including those of Ford *et al.* (1969), and Longworth *et al.* (1972).

The data used may be in the form of a time series (the costs of one farm are measured over several points of time) or may be cross-sectional (the costs of more than one farm are measured at one point in time) or a combination of both. Most studies have used cross-sectional data because observations of one or more farms over a period of time are generally unavailable.

The estimated cost equation will be of the form:

$$AC_i = f(Q_i, E_i)$$

where,

$AC_i$ = average cost per unit of output for farm i
$Q_i$ = size of farm i
$E_i$ = random disturbance term

When the cost size observations are plotted it may be that farms of an equal size produce at different average costs. There are several possible explanations for the cost variation:

1. **Different natural endowments of farms** – differences in the topography, soil, climate, etc., between farms can give rise to differences in yields even though the use of farm inputs is the same for all farms. Higher or lower yields from the given quantity of inputs will respectively decrease and increase the unit costs of the output.
2. **Variations in managerial ability** – the knowledge and ability of farmers will also influence the yield obtained from a set quantity of physical inputs, and hence the unit costs of the output.

3. **Different input costs** – if the prices which farmers pay for their inputs vary between farms of equal size then the average costs of production will naturally vary. This is a different matter to the pecuniary economies associated with input purchases, for farms of different size.

It may be that the above influences are in fact quantifiable and can therefore be incorporated as additional explanatory variables in the regression equation. However, when they cannot be quantified they will instead be summarily represented in the disturbance term.

To estimate an equation using regression analysis the following assumptions are made:

(i) the disturbance term is a random variable with zero expectation;
(ii) the disturbances are uncorrelated with each other and with the independent variables;
(iii) the disturbances have a common variance;
(iv) no exact relationship exists between any of the independent variables;
(v) the number of observations exceeds the number of parameters to be estimated.

Estimation of the regression curve is relatively easy compared to other methods, and although the curve obtained will be an average curve it still provides a satisfactory basis for managerial decision-making and policy formulation. Problems may arise however in equation specification and the reliability of the results will depend on data limitations. Often the problems encountered in using this method derive from breakdowns in assumptions with respect to the disturbance term; particularly when the error terms for each farm are correlated with each other or with the independent variable ($Q_i$).

When a scatter diagram of cost-size observations is plotted, it is also possible to draw a cost curve by hand. Generally when this free-hand curve is drawn it passes through the minimum points in the scatter (FEC). The rationale for this is that such farms will indicate the minimum cost which can be achieved for each output level and hence the true degree of cost efficiency which can be obtained. Such a curve is therefore regarded as more appropriate than the regression curve (REC). However, it may in fact be that the minimum points are more attributable to random factors (as outlined earlier) rather than to efficiency in attaining economies of size.

**Partial budgeting**. Budgeting involves the estimation of possible changes in costs (and returns) arising from variations in the farm operations. Separate budgets can be constructed and compared for different levels of farm operations and output. The method focuses only on those inputs, and prices which are expected to change during a specified period.

Although budgeting is simple in its approach it is time consuming because it is basically a trial and error method. The most frequent error made in partial budgeting is the failure to include all of the added costs. In addition, different degrees of risk and time horizon must be taken into account before a realistic comparison can be made.

**The survivorship technique**. This method explores the shape of cost curves by comparing the competitive success of farms of different size (Stigler 1958; Saving 1961). Farms are classified into size classes and then it is determined which size classes are increasing or decreasing their share in total output. It is assumed that in the long run only the most efficient farm sizes can compete; entry and exit of farms over time will cease when all farms are operating at output levels which give normal profits.

### The Approach Used

The choice as to which of the estimation methods is best will vary according to each study and the objective which it seeks to achieve; no one method can be said to be best for all occasions. For this study the average cost curve was estimated using regression analysis. The ease of equation estimation and the cross-sectional nature of the survey data both contribute to the choice of this estimation method. As indicated earlier, the curve obtained is an average curve but still provides sufficient information on the general relationship between costs and farm size.

## DESCRIPTION OF THE STUDY AREA AND SURVEY PROCEDURES

### Choice and Description of the Study Areas

The regions of Central Luzon and Southern Tagalog are the largest and second largest rice producing regions in the Philippines, respectively. It was therefore felt that they would provide information most relevant to studying the relationship between farm costs and farm size for rice production. Within these regions study areas were selected where double cropping was practised and both improved and local rice varieties were grown. This would enable comparison of average cost curves not only between regions but also between seasons and different varieties.

The province of Bulacan representing Central Luzon and the province of Laguna representing Southern Tagalog were judged to be the most suitable locations for the study. Bulacan was one of the first priority provinces in the initial proclamation of Land Reform in 1962. Further, farmers in the province adopted the improved rice varieties on a province-wide scale. Laguna on the other hand was the first province that planted improved rice varieties from the International Rice Research Institute and the University of the Philippines, College of Agriculture. Both of these institutions are situated in the province and are involved in the breeding and distribution of improved rice varieties.

### Description of the Study Areas

**Geographical characteristics.** The province of Bulacan has a total cultivated land area of 116,970 hectares and that of Laguna, 175,973 hectares. Bulacan consists of 26 municipalities (towns) and lies diagonally across the Central Plain of Luzon. It is sandwiched by the provinces of Rizal on the south, Quezon on the east, Nueva Ecija on the north and Pampanga on the northeast. The shores of Manila Bay form the southern boundary of the province. There are 29 municipalities making up the province of Laguna which is bounded to the north by the Laguna de Bay, to the south by Batangas, to the west by Cavite and by Quezon province to the east.

The terrain of Bulacan is generally low flat plains while Laguna consists mainly of low flat plains with some elevation towards the northeastern portion of the province.

Soils in both provinces are varied with fine sandy loam soil on swampy areas and silt loams to heavy clay loams on lowlands. Foothills adjacent to lowlands are alluvial in the lower levels and mostly conglomerate at higher altitudes. Paddy grows best in areas of clay loam and medium clay soils, with average annual rainfall of 1,500 to 2,000 millimeters (falling evenly during the growing period of the crop) and with open land allowing plenty of daylight.

The northern section of Bulacan province has two pronounced seasons: dry from November to April, and wet for the other months of the year. For the remainder of the province, rainfall is distributed evenly throughout the year. Topography is the major factor contributing to the seasonality of rainfall in the north. Mountain ranges shield the area except from the southeast monsoons and cyclonic storms, both of which periodically flood the fertile stretch of lowland. Laguna province can also be divided into areas with and without even distribution of rainfall. Both study areas have been subject to drought, and although extensive irrigation systems exist in the areas, their efficiency is dependent upon ample rain during the wet season. In 1972, for example, the dry season in some locations lasted as long as ten months and the irrigation networks turned dry.

The combined facilities of national irrigation systems (such as the Maasim and Angat Irrigation Systems), and communal and pump irrigation serve a total irrigable area of 43,072 hectares in Bulacan. The agricultural census of 1960 reveals that the irrigation facilities available in the province serve some 43.6 percent of the total arable land.

For the province of Laguna, national irrigation systems (such as Balanac, Lumban, Mabacan Malaunod, Mayor, Sta. Cruz and Sta. Maria Irrigation Systems), together with communal and pump irrigation serve a total of 12,261 hectares or about 32.5 percent of the total arable rice land.

**Farm characteristics.** Cultivated paddy land in Bulacan is widespread, occupying 90,705 hectares or some 94 percent of the total food crop area. This compares with 37,765 hectares in Laguna which represents about 81 percent of the total area used for food crops. Most farmers in the study areas observed two cropping seasons. The first semester (wet season) crop in Bulacan is normally transplanted during the months of July to December, while in Laguna the first semester crop is transplanted from May to August. The second semester crop (dry) is transplanted from October to December in both provinces.

The differences in planting periods are due to variations in the arrival, duration, distribution and intensity of rain and solar radiation available during the growing period.

Farmers growing rice within each of the province can be classified according to their tenure status as follows:

1. Full-owners are those who own all the land they operate.
2. Part-owners are farm operators who own a part of the land they operate while the remaining portion is held as tenant.

3. Share-tenants are farm operators who rent from others (landlord) all the land they operate and pay the owner of the land with a share of the harvest as per agreement.
4. Leaseholders are farm operators who also rent from others all the land they operate but pay the owner a fixed amount of cash or produce for the use of the land. In the event of crop failure or damage due to typhoons, floods, pests and diseases, the leaseholder is obliged to pay the amount agreed upon in the contract or as per agreement with the landowner.

Table 1. Land utilization of paddy in relation to total food crop area and total crop area, Bulacan and Laguna, Philippines

| Item | Bulacan[1] | Laguna[2] |
|---|---|---|
| Total paddy area (hectares) | 90,705 | 37,765 |
| Total area, food crops (hectares) | 96,500 | 46,351 |
| Total crop area (hectares) | 116,720 | 175,973 |
| Proportion of paddy area to total food crop area (percent) | 93.90 | 81.48 |
| Proportion of paddy area to total crop area (percent) | 77.50 | 21.46 |

Sources: 1. *Socio-Economic Profile, Province of Bulacan, Philippines (1974).*
2. *Socio Economic Development Program, Laguna, Philippines (1975).*

Table 2. Planting and harvesting calendar for irrigated paddy, Bulacan and Laguna, Philippines

| PROVINCE | FIRST CROP | | SECOND CROP | |
|---|---|---|---|---|
| | Planting | Harvesting | Planting | Harvesting |
| Bulacan | Jul-Dec | Nov-Apr | Oct-Dec | Mar-May |
| Laguna | May-Aug | Sep-Dec | Oct-Dec | Feb-Apr |

Credit assistance for rice farmers is provided by the Agricultural Credit Administration (ACA), Philippine National Bank (PNB) and Central Bank (CB) through the privately owned Rural Bank (RB). These institutions extend credit through the coordination and the cooperation of the Farm Management Technicians (FMT's) of the Bureau of Agricultural Extension (BAEx). Moneylenders were the most common and available source of credit some twenty years ago, but can no longer manage to operate due to government control of the credit program and the difficulty in competing with the massive financial assistance given by the private sectors to small farmers.

All of these credit services have been used as tools for encouraging farmers in the adoption of new technology in rice farming. A production loan, which is a short-term loan, was extended to farmer-members without collateral at an interest rate of not more than 12 percent per annum. The loans were channeled through the Barrio Association (Samahang Nayon)[2] in order to familiarize and spur farmers to greater involvement in the associations. As currently designed, the associations are essentially an arm of the government to assure loan repayments; payments for amortizing farmers and elicit savings to help pay for the land reform.

## Sampling Technique and Survey Procedures

**Sample design.** The province is the largest unit of administration in a region. A region is made up of a few or more provinces which, in turn, are comprised of a few municipalities, and a municipality is made up of many villages (barrios).

A stratified two-stage sampling design was employed with the barrios taken as the primary sampling unit (psu) and farmers as the ultimate sampling unit (usu). Only those barrios in which rice is the major crop were considered. Such barrios were stratified according to the type of farms (i.e., irrigated lowland, lowland rainfed and upland) and estimated average farm size.[3] This research study deals only with irrigated lowland farms.

A sampling fraction of about 1/10 was used in the survey. The sample barrios were drawn by simple random sampling without replacement. Within a sample barrio, one out of every ten paddy farmers were drawn systematically with a random start. Sample farmers were drawn from the Integrated Agricultural Survey (IAS) lists of farmers producing rice as their major crop. Fifty-seven farms for each study province (Bulacan and Laguna) or a total of 114 farmers were drawn from the 13 sample barrios, the number of farmers chosen in each barrio being proportionate to the number of farmers in the barrio.

Data used in this study were taken from the *Costs and Returns Study* undertaken by BAEcon covering both semesters of cropyear 1975. This survey was conducted due to the continuing need for current information on production costs, particularly in the light of global efforts at increasing production; and also in view of the recognition of the importance of substantial application of inputs in affecting an uptrend in productivity of paddy. Although the *Costs and Returns Study* was not primarily designed to study economies of size, its sampling technique and nature of the data suit the purpose of this study.

**Survey procedure.** The survey schedules were translated into Tagalog (local dialect in the study areas) and pre-tested by enumerating a few sample farmers in the study areas. Questions were simplified according to the degree to which farmers understood the questions and were able to provide the information sought.

Interviewers were trained data collectors from the Bureau of Agricultural Economics with at least two years of college work in agriculture, commerce or engineering. They were recruited within or around the sample barrios and were

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[2]Samahang Nayon are farmers' cooperatives established in conjunction with the present land reform program.

[3]It has been employed and pointed out (Bhati, 1976, p. 3; Foreman, 1968; West, 1956, p. 121) that stratified random sample containing adequate numbers of varying sizes of sample farms is more appropriate than purely random sample for economies of size.

briefed on the survey technique as well as the interpretation of each question before the actual survey was started. The interviewers were closely supervised by the Provincial Statistician and by the Central Office Supervisor.

Before the actual interview of sample farmers, the interviewer met with the Captain of the sample barrio, informed him the purpose of the survey and requested assistance relative to the survey. Thereafter, the interviewers met with the sample farmers personally to obtain the information desired.

All of the sample farmers were interviewed personally on their farms or in their houses. They were interviewed on rice production, and related information such as physical and financial inputs of man, animal and machine labour by field operation, fertilizers and farm chemicals. Market value of land, land rent, land tax, interest on crop loan, inventory of capital investment on work and/or draft animals, tool and farm implements, farm machinery and farm buildings were also recorded in the survey schedule.

Cross-checks were employed on the information supplied by asking further indirect questions. Wherever possible, the information was supplemented by personal observation (e.g., farmers were asked to show the empty fertilizer bags and/or bottles of chemicals to record the kind and weight of fertilizer; type and usage of farm chemicals, etc.). Farmers were asked the dates when certain farm activities were done (plowing, harrowing, transplanting, etc.), the estimated number of days for hired operator and family and/or exchanged labour for each farm operation.

The survey was conducted soon after the completion of the harvesting operation in the second cropping season to minimize the difficulty in recalling information desired. Nevertheless, as most of the data were from memory (Filipino farmers rarely keep farm records), some deficiencies in the data are inevitable.

## CHARACTERISTICS OF THE SURVEY FARMS

### Geographical Characteristics

The topography of the survey area is generally level. Almost 70 percent of the farms surveyed in each province were located on level land, the remaining 30 percent being moderately sloping.

The average area of level farms is greater than that for farms situated on moderately sloping land for both provinces. This is because the proportion of farms on level land is greater in the class range of larger farms.

Land which is moderately sloping also tends to be irregular in contrast to the more uniform level land. In turn, the irregular topography may form a natural division which limits the size of farms. This would help explain why the farms on such land are smaller than those on level land.

Generally level land is easier to farm and would enable a given output to be produced at lower cost, other things being constant, than land of uneven topography. In addition, level land permits a more uniform distribution of water to the growing rice crop and again, other things being equal, should enable higher yields to be achieved (*Rice Production Manual,* 1970, p. 74).

Table 3. Topography of sample farms by farm size, 1974-1975

| PROVINCE/FARM SIZE (hectares) | TOPOGRAPHY | | ALL FARMS |
|---|---|---|---|
| | Level | Moderately Sloping | |
| Bulacan | Number of farms | | |
| < 1.00 | 3 | 1 | 4 |
| | (75)[a] | (25)[a] | (100)[a] |
| 1.10–1.90 | 9 | 9 | 18 |
| | (50) | (50) | (100) |
| >2.00 | 27 | 8 | 35 |
| | (77) | (23) | (100) |
| All Sizes | 39 | 18 | 57 |
| | (68) | (32) | (100) |
| Average Area | 2.20 | 1.75 | 2.06 |
| Laguna | | | |
| < 1.00 | 19 | 13 | 32 |
| | (60) | (40) | (100) |
| 1.10–1.90 | 9 | 2 | 11 |
| | (82) | (18) | (100) |
| > 2.00 | 12 | 2 | 14 |
| | (86) | (14) | (100) |
| All Sizes | 40 | 17 | 57 |
| | (70) | (30) | (100) |
| Average Area | 1.51 | 0.97 | 1.37 |

[a]Figures in parentheses are percentages of all farms.

Soils throughout the survey area varied from medium clay to clay loam. Within Bulacan the majority of the farms (65 percent) had medium clay soils while for Laguna, clay loam soils tended to be more dominant (63 percent).

It is also observed that relatively more large farms have clay loam soils in each province. As a result, the average area of farms with clay loam soils is greater than that for farms with medium clay soils.

To a large degree, this will be linked with the topography of the sample farms in that clay loam soils are generally situated on level land. Clay loam soils are more fertile than medium clay soil, requiring less phosphorous fertilizer, and would therefore be expected to give higher yields. In addition, the medium clay soils are more permeable than clay loam and hence drainage from the paddy yields is more rapid so that the fields dry out more quickly (Villegas, 1970, p. 69).

All farms in the survey areas were irrigated but varied in the type of irrigation used. The distribution of survey farms by type of irrigation is shown in Table 5. About 79 percent of the sample farms in Bulacan were irrigated by gravity and the remaining 21 percent were irrigated by pump. Sample farms in Laguna were all irrigated completely by gravity. With gravity, irrigation water is supplied through a system of canals and the irrigation fee is the same irrespective of the volume of