SMALL FARM VERSUS LARGE FARM DEVELOPMENT IN IRAN

A common strategy for agricultural development in less developed countries is that, for rapid agricultural development, efforts must be concentrated on large commercial farms which participate in the market, and those which operate as small subsistence family units must be left aside. In some countries, however, the majority of farmers operate as small subsistence family units. Economic development of farming in these countries does not call for a rapid increase in the scale of farms and a substantial reduction in the number of existing cultivators.* According to Owen (6), to prevent a continuing expansion in the world’s population of landless rural households or an excessive rate of rural-urban migration and the associated additional strains they would place on urban welfare services and political stability, small farm oriented development programming deserves greater priority than it has been accounted heretofore. He also suggests that the population supporting potential would increase if all the farm land in the world were used in the same manner as most small farms. However, the fundamental reality of poverty and income gap between rural and urban population will still remain. Others maintain that both types of farming can, and should be, developed side by side, in accordance with the appropriate relative priorities that each deserves, given the particular circumstances and stage of development that prevails in any given country (2).

Iran’s agriculture is characterized by a large number of small size family farms and a relatively small number of large-scale commercial farms. While the country is experiencing a relatively high growth in its national income, agriculture has been a lagging sector. Per capita income in the rural areas is substantially below the national average resulting in a large exodus of rural population and high social costs in the urban areas.

A major agricultural development problem in Iran is the optimal organizational form to be adopted in agriculture. Should Iran proceed through small-scale family farm (peasant farming) or through large-scale ‘corporate’ farm? The type of organization adopted should result in closing the income gap between agriculture and other sectors and in reducing the excessive rate of rural-urban migration.

The purpose of this paper is: (1) to compare the relative efficiency of small versus large-scale farms in a developing agricultural region of Iran and (2) to determine the minimum average ownership needed to achieve a rural per capita income close to that of the urban population. Toward this end, a brief description of the region and study procedure is outlined first. Then, the results and the implications of the study will be discussed in the context of existing and future man-land ratio in the agricultural sector.

Study Procedure

In addition to small family farms and large privately owned farms which were not subject to land reform, three new types of farms have been adopted

* The figure in brackets refers to the literature cited at the end.
in Iran. These are agribusiness, farm corporation and production co-operatives. With the exception of production co-operatives in which the structure and ownership of farm remains intact, other types are large-scale mechanized units formed by consolidation of small holdings. A detailed description of these units is beyond the scope of this paper and can be found elsewhere (3).

Production co-operatives are very new in Iran and could not be included in this study due to lack of sufficient data. To study the relative performance of large mechanized and small family farms, a somewhat typical developing agricultural region was selected. The region is in the South-central Iran, comprising 48 villages within the Darius Irrigation Project. No significant differences are reported with respect to soil, drainage and water supply conditions. The agricultural situation in the region is characterized by a large number of small size farms and a few large mechanized farms, with the former group using hired machinery from the large farms mainly for seed-bed preparation. This is a common characteristic of many other regions of Iran. The organizational characteristics of small farms were similar for different size of farms. Most farmers in the region still use traditional farming techniques, prevalent crops in the region are wheat, rice, barley, sugar beets, cotton, sunflower, and alfalfa. In some farms wheat and barley are harvested by combines. The smaller farms, however, harvest their crops by hand and, thresh by tractors. Sugar beets and other crops are mainly non-mechanized operations. The use of chemical fertilizer and pesticides is gradually increasing in the region.

The size of farms ranged from 2.8 to 29.7 hectares in the small family farms and from 35.7 to 2,035 hectares in the large mechanized farms. The latter group consists of private and corporate farms. Management and labour in the small farms are supplied by the operators and their families. Large mechanized farms are managed by their owners (private) or the managers recruited by Government (corporate farms). Labour in these farms is hired (private farms) or supplied by the shareholders (corporate farms).

In this study budgeting and the regression analysis procedure was followed in estimating the cost per unit of output and long-run average cost function. For this purpose a stratified random sample of 95 small family farms and 10 large mechanized farms was selected in the region. The data on costs, returns, and performance by size were obtained by interviewing the operators. Total revenues were used as an output measure and both the total cost per unit of total revenue and per unit of land were utilized as measures of cost (efficiency).

Cash costs per hectare are all actual calendar year outlays made by the operators. Fixed cost includes the operator’s fixed labour, buildings, machinery and equipment costs. Unpaid labour cost is derived from the reported

---

1. Prior to the land reform law of 1962, a high concentration of land ownership existed in the country. Under the three phases of the land reform programme approved by the Parliament about 50 per cent of the cultivated land was transferred to some 70 per cent of Iran’s rural population. The remaining land is under some form of large and medium size farms.
days of available operator and family labour valued at a hired man's daily wage rate of 250 Rials. An interest charge of 6 per cent was made on all capital inputs using depreciated cost of buildings and machinery.

To determine the long-run cost function and the optimum size of family farm, three simple regression models—polynomial, hyperbolic, and linear forms—were employed using the cost per hectare and per unit of money output as dependent variables and acreage and total revenue as independent variables. To determine the influence of size on the rate of adoption of new technology, the degree of association between size and the use of chemical fertilizer and pesticides was tested using both total revenue and acreage as measures of size and the quantity of fertilizer and pesticides used per hectare in each farm as a measure of adoption. Finally, the minimum average ownership needed to achieve a rural per capita income close to that of the urban population was determined by dividing the national average income by the average net income per hectare in the region.

The Results

Table I shows the yield per hectare in the small family farms and large mechanized farms. As shown, in most crops, the yield per hectare is greater in the small family farms than in the large corporate and private mechanized farms. Table II shows the distribution of land by the size of holdings, cost and income per hectare in both types of farms. As indicated, total farm income per hectare is greater for most small farms than that in the large mechanized farms, reflecting higher yield obtained in the former farm group. Total cost per hectare, however, is higher in the smaller size groups. This is largely due to the higher fixed labour cost in the small farms and the spreading of machinery and other fixed costs over larger size in the large mechanized farms.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Yield (kg.) per hectare*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Small farms</td>
</tr>
<tr>
<td>Wheat</td>
<td>2,440</td>
</tr>
<tr>
<td>Barley</td>
<td>2,420</td>
</tr>
<tr>
<td>Rice</td>
<td>3,040</td>
</tr>
<tr>
<td>Sugar beets</td>
<td>23,800</td>
</tr>
<tr>
<td>Cotton</td>
<td>1,890</td>
</tr>
<tr>
<td>Sunflower</td>
<td>1,290</td>
</tr>
<tr>
<td>Peas</td>
<td>1,060</td>
</tr>
<tr>
<td>Sesame</td>
<td>900</td>
</tr>
</tbody>
</table>

* Yield differences in the case of wheat, sugar beets and sunflower are not significant, other differences are significant at 0.01 or 0.10 probability level.

2. 70.5 Rials equal one U.S. Dollar. It should be noted that only the the portion of operator's labour allocated to crop enterprises was considered. Since there was no unemployment in the towns, it was valued at the going wage rate.

3. The basis for regression analysis is the theory underlying economies of scale.
RESEARCH NOTES

TABLE II—DISTRIBUTION OF LAND BY SIZE OF HOLDING, COST AND INCOME PER HECTARE IN SMALL AND LARGE FARMS

(Rials)

<table>
<thead>
<tr>
<th>Cultivated land (hectare)</th>
<th>Per cent of farms</th>
<th>Variable cost per hectare</th>
<th>Fixed cost per hectare</th>
<th>Total cost per hectare</th>
<th>Income per hectare</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1-5</td>
<td>44.2</td>
<td>10,020</td>
<td>26,720</td>
<td>36,740</td>
</tr>
<tr>
<td></td>
<td>5.5-9.5</td>
<td>48.4</td>
<td>9,920</td>
<td>15,830</td>
<td>25,750</td>
</tr>
<tr>
<td></td>
<td>10-14</td>
<td>4.2</td>
<td>7,520</td>
<td>8,600</td>
<td>16,120</td>
</tr>
<tr>
<td></td>
<td>14 and over</td>
<td>5.2</td>
<td>7,950</td>
<td>7,980</td>
<td>15,930</td>
</tr>
</tbody>
</table>

(Rials)

<table>
<thead>
<tr>
<th>Cultivated land (hectare)</th>
<th>Per cent of farms</th>
<th>Variable cost per hectare</th>
<th>Fixed cost per hectare</th>
<th>Total cost per hectare</th>
<th>Income per hectare</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1-300</td>
<td>50</td>
<td>6,190</td>
<td>8,210</td>
<td>14,400</td>
</tr>
<tr>
<td></td>
<td>301-600</td>
<td>10</td>
<td>6,640</td>
<td>8,810</td>
<td>15,450</td>
</tr>
<tr>
<td></td>
<td>601-900</td>
<td>40</td>
<td>4,350</td>
<td>5,770</td>
<td>10,120</td>
</tr>
<tr>
<td></td>
<td>901-1,200</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Net income per hectare is higher for the large farms than for the small farms. In terms of cost as a percentage of total revenue, however, some small farms appear to produce as efficiently as the large farms. For example, as indicated in Table III, in the small farms with size ranging from 5 to 16 hectares (40 per cent of the small farms), total cost varied from 30 to 60 per cent of the total revenue which is within the cost range of mechanized farms. It must be indicated, however, that most small farms are at the higher end of this range and none at the lower end; while most mechanized farms operate at the lower end of this range.

TABLE III—DISTRIBUTION OF SMALL AND LARGE FARMS BY COST AS A PERCENTAGE OF TOTAL REVENUE

Per cent of farms

<table>
<thead>
<tr>
<th>Cost as a percentage of total revenue</th>
<th>Small farms</th>
<th>Large farms</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-30</td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td>31-40</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>41-50</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>51-60</td>
<td>24</td>
<td>10</td>
</tr>
<tr>
<td>61 and over</td>
<td>60</td>
<td>0</td>
</tr>
</tbody>
</table>

The relation between size and unit cost of production in the large mechanized farms is shown in Table IV. As indicated, the average total cost does not follow the usual pattern of economic theory. Although, farm number 4 has the lowest average total cost, the cost figures obtained from the corporate records appear unusually low. Because of this, and the limited observations, the optimum size in the case of large mechanized farms could not be determined.
Table IV—Unit Cost of Production in Relation to Total Revenue and Size in Large Mechanized Farms

<table>
<thead>
<tr>
<th>Farm number</th>
<th>Cultivated land (hectare)</th>
<th>Total revenue (thousand Rials)</th>
<th>Cost per unit of total revenue (Rials)</th>
<th>Cost per hectare (Rials)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1,140</td>
<td>48,419</td>
<td>0.373</td>
<td>15,834</td>
</tr>
<tr>
<td>2</td>
<td>1,014</td>
<td>38,525</td>
<td>0.385</td>
<td>14,615</td>
</tr>
<tr>
<td>3</td>
<td>1,002</td>
<td>32,787</td>
<td>0.373</td>
<td>14,615</td>
</tr>
<tr>
<td>4</td>
<td>990</td>
<td>36,623</td>
<td>0.120</td>
<td>4,420</td>
</tr>
<tr>
<td>5</td>
<td>657</td>
<td>26,956</td>
<td>0.376</td>
<td>15,450</td>
</tr>
<tr>
<td>6</td>
<td>300</td>
<td>7,292</td>
<td>0.580</td>
<td>13,980</td>
</tr>
<tr>
<td>7</td>
<td>145</td>
<td>4,500</td>
<td>0.264</td>
<td>8,190</td>
</tr>
<tr>
<td>8</td>
<td>100</td>
<td>5,514</td>
<td>0.311</td>
<td>17,150</td>
</tr>
<tr>
<td>9</td>
<td>22</td>
<td>915</td>
<td>0.385</td>
<td>16,000</td>
</tr>
<tr>
<td>10</td>
<td>20</td>
<td>810</td>
<td>0.412</td>
<td>16,690</td>
</tr>
</tbody>
</table>

Unit cost of production in relation to size in the small farms to some extent follows the usual pattern mentioned above. Of the three regression models used to estimate this relationship and the optimum size of small farms, the hyperbolic form resulted in a better fit. The estimating equation is:

\[ \hat{y} = 0.2828 + 8.3188 \left( \frac{1}{x} \right) \]

\((0.0193) \quad (0.29822)\)

(Figures in parentheses are standard errors of estimates \(b_1\) and \(b_2\))

where \(\hat{y}\) = total cost per unit of total revenue. The coefficient of determination, \(R^2 = 0.8932\), indicating that about 90 per cent of the variation in the unit cost is explained by the variation in the size of farm when measured in terms of total revenue. The estimated equation indicates that as total revenue is increased, per unit cost tends to decline largely because fixed cost is distributed over larger volume of output. Since the available sample data do not extend to farms with total output over 545,000 Rials, no observation of either continued decreasing or increasing unit cost is available to support or reject the usual theoretical concept of increasing cost for larger farms.

However, when cost per hectare is related to size measured in hectares, the polynomial regression model resulted in a better fit than the other models mentioned. The estimating equation is:

\[ \hat{z} = 61.9096 - 8.1439x + 0.343x^2 \]

\((2.452) \quad (0.7007) \quad (0.04203)\)

(Figures in parentheses are standard errors of estimates.)

where \(\hat{z}\) = cost per hectare and \(x\) = hectares of land. \(R^2 = 0.72\), indicating that in addition to size, other factors such as productivity affect the average cost per hectare \((8)\). Minimizing the estimated cost function, the optimum size would be \(11.86\) hectares with a total cost of 13,500 Rials per hectare (minimum average cost). This shows that the unit cost trends downward until the farm size reaches \(11.86\) hectares. But for farms over \(11.86\) hectares
the unit cost seems to turn upward. The conclusion to be drawn from this estimate is that under existing technology, scale or cost economies in the case of the small farms do not extend beyond about 12 hectares. In addition, the minimum cost per hectare in the small farms is about the average cost per hectare in the large mechanized farms (Table IV).

**Size and the Rate of Adoption of New Technology**

One of the questions concerning the small farmer/large farmer comparison is the relative propensity of the two types of farms to innovate. Does the small farmer have less propensity to innovate? To answer this question the degree of association between size and the use of chemical fertilizer and pesticides was tested using both total revenue and acreage as measures of size and the quantity of fertilizer and pesticides used per hectare in each farm as a measure of adoption.

The analysis indicated that there is a significant association between size measured in terms of total revenue and the use of fertilizer and pesticides with correlation coefficients being 0.46 and 0.224 respectively. However, test of association between size measured in hectares, and the use of fertilizer and pesticides revealed no influence of size on the use of these inputs.

A rather interesting result of the analysis is the correlation between size and productivity. As measured by the association between acreage and income per hectare, the correlation coefficient was—0.287. Therefore, a negative correlation exists between increasing size and land productivity, indicating that small farms have performed better than both large mechanized and non-mechanized farms in terms of land productivity.

**Minimum Ownership**

The average cultivated land per farm in the region is 5.58 hectares. Given the average family size of five, this provides an income of about 21,000 Rials per head. Per capita income in the country as a whole is about 84,000 Rials. Thus the earnings of farm operators in the selected region are substantially below the national average income. Since the cost of living in the urban areas is almost twice that of the rural areas, the net income gap or the real standard of living gap between the rural and urban areas (including the cost of living) would be less than indicated. With the level of management of family farming in the selected region, a minimum average ownership of about 18 hectares would be needed in order to achieve a rural per capita income close to that of the urban population. This implies, in view of land and water

---

4. Both the coefficients are significant at 0.10 probability level.
5. The correlation coefficients between size and the use of fertilizer and pesticides were —0.1148 and 0.06426, respectively.
6. The cost of living for an average urban family in 1975 was about 145,000 Rials and for a rural family about 76,800 Rials. These amount to $414 and $220 per head, respectively (5).
7. Considering the difference between per capita cost of living between the urban and rural areas, a per capita income of about 70,000 Rials in the rural areas is equivalent to 84,000 Rials in the urban areas. To earn this income, 18 hectares of land is needed as 5.58 hectares provide 21,000 Rials per head.
constraint, a 65 per cent reduction in the number of existing owner cultivators in the region. Assuming that 40 per cent of the income of the rural population is earned from livestock production and off-farm activities, the required reduction in the number of farmers would be 40 per cent.\textsuperscript{8} For the country as a whole, the average farmer is living on about 2.8 hectares of land which cannot provide him with a decent living even with the higher level of technology and management.

Therefore, to close the income gap between agriculture and other sectors of the economy, the most feasible solution appears to be diversification of sources of income in the agricultural sector and supply of productive technology to the small farmers.\textsuperscript{9} The long-run solution has to deal with the gradual reduction in the number of existing farmers and their transfer to other jobs. This would require the creation of new orientation and training courses and placement activities for rural population on a large scale.

Should the transfer of rural population result in high unemployment in the towns, costs of unemployment would enter the equation. Then, an alternative solution might be the break up of the larger farms into small holdings. Farm corporation and other models of land consolidation, being compelled by the administration of technologically intensive activities to over-mechanize and displace labour, are likely to aggravate the problem. Individual family production systems with medium technology may prove to be the most feasible solution to agricultural development in Iran, given the present and future conditions regarding land, water, capital, and human resources.

Individual family production system is particularly feasible in the areas where the land-labour ratio is small. The greater pressure of population in these areas serves as a major factor in stimulating more intensive production efforts on these holdings. In other words, low size of holdings in relation to manpower may lead to greater use of manpower both directly on agricultural operation and on the development of such inputs as irrigation water, local manures, and land improvement resulting in higher output.\textsuperscript{10}

**Summary and Conclusions**

The objective of this study was to (1) compare the relative efficiency of small versus large scale farms in a developing region of Iran, and (2) determine the minimum ownership needed to achieve a rural per capita income close to that of the urban population. The analysis indicated that in terms of cost per unit of output and net income per hectare, large farms have performed better than most small farms. In terms of production per unit of land however, small farms have been able to demonstrate a higher level of performance than large mechanized farms. The conclusion to be drawn is that a considerable gain

\textsuperscript{8} In 1972, about 40 per cent of family income in the region was earned from livestock production, carpet weaving and off-farm employment (7).

\textsuperscript{9} Some possible sources of income include creation of supplementary opportunities in rural industries, food processing factories, irrigation works or in proximate urban-industrial enterprises.

\textsuperscript{10} According to a study by Daval and Eliot (1), yield per hectare, the rate of double cropping, the area devoted to high valued crops, number of livestock and poultry per hectare in many regions of Iran were higher in small holdings than in larger ones.
in productivity can be attained in the region without major changes in the man-
land ratio. The belief that small holdings inhibit the adoption of modern
technology in less developed countries appears to be contrary to the findings
of this study as no significant association between size and the use of fertilizer
and pesticides was revealed. One of the advantages of large mechanized
farms is the cost economies achieved by distributing fixed machinery cost over
the larger size of farm. When the man-land ratio cannot be improved to
provide full use of machinery for lack of non-farm alternative opportunities
or other reasons, custom hiring or co-operative arrangement may provide
an alternative solution. Custom harvesting and seed-bed preparation is
common in the region studied. The higher unit cost of production for the
small farms is in part due to the high rental charge for custom hiring.

The study showed that given the existing population and labour force
in the region, the optimum size of farm in the case of small holdings should
be around 11.86 hectares. In the case of large holdings however, the average
total cost did not follow the usual pattern of economic theory and no optimum
size could be determined due to the limited observations. The average total
cost per hectare in the latter group was about the minimum total cost per
hectare in the small farms.

Per capita income in the region is substantially below the national average
income. With the level of technology of family farming in the selected region,
a minimum ownership of 18 hectares would be needed in order to achieve a
rural per capita income close to that of the urban population. The average
cultivated land per farm in the region is 5.58 hectares. Thus, in view of land
and water constraints, a 65 per cent reduction in the number of existing culti-
vators in the region and a greater reduction in the agricultural sector is neces-
sary to reach this goal. Therefore, to reduce the income gap between agri-
culture and other sectors of the economy, the immediate solution appears to
be diversification of sources of income in the agricultural sector. The long-
run solution has to deal with the gradual reduction in the number of existing
farmers and their transfer to other jobs.

Finally, in this analysis, the cost per unit of output and production per
unit of land was used as measures of performance of various farm units. Other
relevant efficiency measures such as production per unit of fertilizer, per unit
of labour, or total output-input ratio can also be employed. In addition, differ-
ences in access to credit, water, technical information and other collective
goods should be taken into account. However, these measures and factors
could not easily be computed or quantified.

G. R. SOLTANI∗

Associate Professor, Department of Agricultural Economics, Pahlavi University, Shiraz, Iran.
REFERENCES


