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In the name of Allah

LABOR PRODUCTIVITY ON SMALL FARMS IN RELATION TO RURAL MIGRATION: THE CASE OF IRAN[1]

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ABSTRACT

The productivity of hired and family labor on small farms in relation to rural migration in Iran was studied. Two hypotheses were tested relating to the marginal and average value products of labor (MVP_L and AVP_L) with respect to the wage rate. The results of budgeting and production function analyses indicated that the MVP of hired labor is above the real wage rate and that of family labor is well below it. Despite a low marginal productivity of labor, families on small holdings stayed and produced so long as the AVP of their labor equaled or exceeded their opportunity cost of remaining on the farm.

Rural out-migration before the revolution resulted in an increase in the share of off-farm income, a shortage of labor for crop production, and a reduction in crop output in the region. Thus, while higher urban wages pulling labor from rural areas benefited the migrants and industrial sector, it is not clear whether such movement

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بنام خدا

بازده کار در واحدهای کوچک کشاورزی در ارتباط با مهاجرت روستائی در ایران

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خلاصه

در یک بررسی بازده نیروی کار روزمزد و خانوادگی در کشاورزی و ارتباط آن با مهاجرت از ارعین مطالعه گردید. دو فرضیه در مورد بازده نهائی و بازده متوسط کار و رابطه آن با نرخ دستمزد مورد آزمون قرار گرفت. نتایجی که از تجزیه و تحلیل بودجه مزرعه و تابع تولید بدست آمد نشان داد که بازده نهائی نیروی کار روزمزد بیشتر از دستمزد واقعی بوده حال آنکه نیروی کار خانوادگی کمتر از آن میباشد. با وجود این تا زمانی که متوسط بازده نیروی کار خانوادگی برابر یا بیشتر از نرخ دستمزد در خارج از مزرعه باشد، زارعین کوچک (خرده پا) به تولید خود ادامه داده و از مهاجرت به شهرها خودداری میکنند.

مهاجرت روستائی در ایران قبل از انقلاب سبب افزایش سهم درآمد نیروی کار کشاورزی از کار در خارج مزرعه، کمبود نیروی کار در کشاورزی و کاهش تولیدات کشاورزی در منطقه گردید. گرچه بالا بودن دستمزد در بخش صنعت انگیزه مهاجرت قسمتی از نیروی کار کشاورزی بوده و به بخش صنعت کمک نموده، معذالک با در نظر گرفتن هزینه اجتماعی نگهداری مهاجرین در شهرها و اثر منفی این مهاجرت بر روی تولیدات کشاورزی، نمیتوان سود بخشی مهاجرت روستائی را برای کشور مشخص نمود. سیاستهائی برای کشورهای رو برشد بمنظور افزایش بازده نیروی کار کشاورزی و جلوگیری از مهاجرت روستائیان پیشنهاد گردیده است.

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was beneficial to the country as a whole, given the social cost of maintaining migrants and the negative impact of migration on crop output. Policies to raise labor productivity and reduce rates of rural-urban migration for developing nations are proposed.

INTRODUCTION

The migration of rural population to urban areas is a recognized concomitant of economic development (5). Past models generally conclude that net rural-urban migration is explained by urban employment opportunities, distance between sectors, housing availability, and other "quality of life" indicators. As applied to developing countries, past models have stressed rural-urban wage differentials and empirical studies have tended to confirm their significant impact on migration (11).

While higher urban wage is widely recognized as an important variable pulling wage labor from rual areas, the evidence is less clear on the migration of unpaid family labor from the farm holdings. Theory suggests that the low marginal productivity of labor will provoke migration from the rural sector, but in many areas small farmers and their families do not migrate even in the face of very low marginal productivities of their labor.

Considerable literature in economic development has been devoted to issues concerning labor productivity in the small farms in developing countries (6). In spite of many empirical studies (7, 9), testing and rejecting the hypothesis of zero marginal value product of agricultural labor in developing nations, the issue of the MVP of family labor on small holdings is far from being resolved. The main reason is that the concept of "surplus labor" is not carefully defined and a clear distinction is not made between peak and slack labor demand periods of small farm agriculture in developing countries.

This study examines the productivity of hired and family labor in relation to migration on small farm agriculture

with the objectives of a) estimating the marginal and average value products of family and hired labor on small crop and livestock farms in Iran, b) examining the relationships among labor productivity, the opportunity costs of labor, and small farmers' decisions to continue or discontinue agricultural production, and c) determining the impact of migration on farm activities in a developing agricultural region of Iran. Two hypotheses are tested. First, that the MVP of family and hired labor employed on small farms equals or exceeds the average urban wage rate and second, that production, as a family venture, continues as long as the AVP of family labor exceeds the opportunity cost of such labor. Towards this end, a brief description of background, data sources and methodology is presented first. The results and the implications of the study are then discussed.

BACKGROUND AND DATA SOURCES

Iran is a relatively large country with a population of 40 million people. Close to half is considered rural and of this group, nearly 74% are living on some 2.5 million farms. Nearly 83% of the latter live on small farms of less than 10 hectares. These small units occupy about 38% of total land area in farms and produce 41% of total agricultural output (4). The rest of the rural population are landless inhabitants (*khoshneshins*).

Most data utilized in the analyses were collected through a 1977 survey of some 60 small farms with an area of 20 hectares or less, chosen on a stratified random basis. Unit of sampling for population, labor force, and migration data was village rather farm.

The study site was a region in the south central Iran and was comprised of 48 villages mostly within the Dorudzan Irrigation project near Shiraz, capital city of the Fars province. Total irrigated land in the region is about

40000 hectares, of which approximately 53% is cultivated each year and the rest is left fallow. Many farms in the region use some improved farming techniques. Hired tractors do the plowing. Prevalent crops in the region are wheat, barley, rice, sugarbeets, and alfalfa. In most farms, wheat and barley are harvested by combine. For sugarbeets and other crops, mainly non-mechanized operations are employed. The use of chemical fertilizers and pesticides is gradually increasing in the region.

While much of the labor on these farms is provided by family members, given the low level of mechanization, it is common for hired labor to be employed during peak labor demand periods, especially the planting and harvesting seasons. The contribution of the landless villagers to the farm labor is about 20%.

The region has a population of approximately 85000 people with a work force of 29000. In 1977 some 47% of labor force were engaged in farming (crop and livestock production), 21% in rural industry (carpet weaving) and the rest on off-farm activities (construction and related employment in the nearby towns and Shiraz).

METHODOLOGY

The traditional budgeting technique was followed in estimating AVP of labor. The MVPs of hired and family labor were estimated from a polynomial production function fitted to the data. It should be noted that polynomial function generally results in a better fit than other functional forms such as Cobb-Douglas and transcendental. It allows both positive and negative marginal productivities, whereas with Cobb-Douglas, the MVP is forced to be constant. Input-output data were obtained by interviewing the farm operators. All production activities, including farm and non-farm activities were included.

To determine the relation between the average income of

family labor and the decision to migrate, three periods were considered: 1974, when migration from rural areas was not significant (8); 1977, when a large exodus of labor (mostly young) from villages to urban areas was observed; and 1981, after the revolution (10). The average value product of labor in these periods was determined and compared with the opportunity cost of remaining on the farm. Since the cost of living in urban areas is higher than rural areas, the opportunity cost of labor on farm was discounted by the difference between the per capita cost of living in the two areas. The difference has been reported to be nearly 15000 Rials (3). The opportunity cost of the operator and family labor remaining on the farm was derived from reported days of available family labor valued at going wage rate for unskilled labor in cities whereto the farm labor migrated.

Cash costs per hectare were all actual calendar year outlays made by the operators. Fixed costs included the operators fixed labor, building, machinery, and equipment cost. Man-year equivalents were computed by applying weights of 1.0 and 0.53 based on the going wage rates for men and women, respectively.

RESULTS

Of the three functional forms (Cobb-Douglas, transcendental and polynomial) fitted to the data, the polynomial production function resulted in a better fit. The estimating function was:

$$Y = 3154.9 - 43.018\ X_1 + 0.0483\ X_1^2 + 955.42\ X_2 - 21.24\ X_2^2 - 181.299\ X_3 + 10.28\ X_3^2$$

Where Y = crop income per hectare, X_1 = operating cost, X_2 = family labor in man-days, and X_3 = hired labor in man-days. The standard errors of the estimates of the coefficients were 11.27, 0.01, 289.42, 6.44, 137.49, and 5.0, respectively.

The adjusted multiple coefficient of determination, $R^2 = 0.54$, indicates that 54% of the variation in income per hectare is explained by factors included in the analysis. The estimated marginal productivities taken at the mean of the input factors are as follows: $X_1 = 84.3$ Rials (approximately 80 Rials equal one U.S. Dollar), $X_2 = 85.5$ Rials, and $X_3 = 751.5$ Rials.

The estimated marginal value products (MVP) indicate diminishing marginal returns to family labor and increasing marginal returns to operating costs and hired labor. This conclusion is economically important; it indicates that the first condition for the optimum use of resources is only met in the case of family labor. In the case of current operating inputs and hired labor, however, the limitation of fund and the shortage of hired labor in 1977 has forced the farm operators to use these inputs short of their optimum. Therefore, a greater availability of hired labor (reduction of migration) in the labor demanding periods of production and more funds for operating inputs would increase agricultural output in the region.

The significance of family and hired labor coefficients implies that participation of both types of labor in the production process has a significant effect on total production. However, the marginal product of hired labor is much higher than that of family labor in the region (Table 1).

The average wage rate in off-farm employment in 1977 was about 550 Rials per day. Discounting for the higher cost of living in the urban areas, the real wage rate (opportunity cost of labor on the farm) would be around 500 Rials per day. Therefore, the marginal productivity of hired labor is above the real wage rate and that of family labor is well below it. Thus, the hypothesis that the MVP of family labor equals the wage rate is rejected. The high marginal productivity of hired labor implies that the

Table 1. Mean value per hectare, MVP, and AVP of hired and family labor.

Type of labor	Mean value per hectare (man-days)	MVP (Rials)	AVP (Rials)	
	1977		1977	1981
Hired labor	12.47	751	2720	----
Family labor in crop production	34.8	85.5	975	----
Family labor spent on farm activities	100	----	510	1880
Total family labor	130	----	390	940

planting, weeding, and harvesting periods require hired hand even on these small holdings. Since the MVP of hired labor is higher than the going wage rate in the region, hiring more labor is beneficial to the small farmers. During these periods, marginal productivity of family labor is also likely to be high. Between these peaks, however, little hired labor is utilized and family labor becomes excessive, yielding a low marginal productivity for the entire production period. (It would be more appropriate to take account of seasonal variations in family labor employed and hence its marginal product. This was not possible in the present study due to lack of sufficient data).

These findings suggest that the concept of "surplus labor on small farm agriculture" should be carefully defined. Although surplus family labor exists during some seasons of the production period, this labor could not be withdrawn from the small holdings without reduction in crop output. A comparison of marginal value product of family labor and the average wage rate indicates that

farmers and their families on small holdings continue production in the face of much lower marginal productivity for their labor. To find a rationale for such behavior, one can look at the average value product of family labor. As shown in Table 1, the AVP of family labor in farm activities is 510 Rials, which is about the average wage rate in off-farm employment. However, when total available family labor force is considered as a fixed factor, its AVP is less than the real wage rate. This explains why family labor seeks partial off-farm employment. Nearly 32% of labor force in 1977 engaged in off-farm activities, about 34% of which had permanent employment in the city (out-migration from small holdings).

As indicated, the AVP of family labor allocated to farm activities (crop, livestock, and rural industry), was close to the going wage rate. This explains why those remaining on the farm continue production. These findings seem to provide sufficient evidence to support the second hypothesis mentioned above. Thus, it could be expected that a low marginal productivity of one or more family members would not provoke migration from the farm holding. Rather, families on small holdings seem to migrate as a unit. This is consistent with Harberger's argument that families stay and produce together so long as the AVP of their labor equals or exceeds their opportunity cost of remaining on the farm (2). The fact that about one third of family workers had non-farm jobs in 1977 suggests that non-farm income plus farm income may be higher than the amount that could be earned in a non-farm job only.

Returns per man-year of family labor (AVP) in relation to its opportunity cost in 1974 and 1981 (when out-migration in the region was insignificant), provide further evidence to support the second hypothesis. Annual family income (income from crop, livestock, and carpet weaving) in 1974 amounted to 197000 Rials (8). Given the average

family size of 6.04 and working members of 2.1, return per man-year of labor would amount to approximately 93000 Rials. About 6% of family income was earned by temporary off-farm employment. The opportunity cost of family labor remaining on the farm was about 60000 Rials. Therefor, in 1974, the AVP of family labor exceeded the real wage rate in the city, while in 1977, it lagged behind the real wage rate.

After the Islamic Revolution

Realizing the social cost of rural out-migration and its negative impact on agricultural output, the aim of the government has been tc achieve substantial reduction in the demographic shift toward the urban areas. To this end, agriculture is to be given a high priority in the national development plan. Accordingly, policies to provide production incentives, and infrastructive services will be adopted. In addition, farm prices will be raised to improve agriculture's terms of trade. At present, no accurate population data are available to show the exact direction and magnitude of migration after the revolution.

It should be indicated, however, that emphasizing agricultural development alone is not likely to provide sufficient employment opportunities and achieve the above objective as the farming employment base is not large enough to result in a net reduction in rural out-migration. A reduction of rural out-migration demands development of industrial as well as farming activities in the rural areas. Despite the difficulties of such a task, there has been some evidence of back-to-the-farm movement in the region as well as some other regions of the country after the revolution. Non-economic considerations related to gradual change in attitudes and values as well as economic factors can be mentioned as motivating factors in this trend. Reduction of the urban-rural income and wage gaps accompanied by certain nature-oriented antimaterialistic

elements of the Islamic Revolution, the high cost of urban housing and the reduction of many former rural-urban gaps in material conveniences of living are among the major causes of such a movement. The high cost of urban housing is mainly due to the shortage of capital and the high demand created by rural-urban migration.

Considering the economic factors, the study indicates that the share of crop production in income and employment in 1981 has increased and the share of livestock has decreased relative to 1977 (Table 2). The AVP of family labor

Table 2. Sources of farm income and their relative shares.

Sources of income	Relative shares (%)		
	1974	1977	1981
Crop income	84.4	43.6	88
Livestock	4.0	8.7	6
Handicraft	5.3	23.0	6
Off-farm	6.3	24.7	-

spent on farm activities and total farm family labor in 1981 were estimated at 1880 and 940 Rials, respectively. Hence, the AVP of family labor spent on farm activities in 1981 was higher and that of total family labor was almost equal to the real wage rate in off-farm employment. Thus, despite a high unemployment rate in the region, there is no economic incentive for family workers to move out of the farming. To keep up with increasing cost of living, off-farm wages have increased since the revolution. However, since inflation has affected urban more than rural population, the increased real wage has not been sufficient to pull rural unemployed labor from the

land. This negative force coupled with non-economic forces mentioned above is likely to discourage rural out-migration. This situation is likely to continue unless some economic push factors again counter the forces acting in favor of rural living.

The Impact of Migration on the Farm Activities

The share of crop income in total income of small farmers has declined from about 84% in 1974 to 43% in 1977, while the shares of livestock, handicraft, and off-farm incomes in 1977 have increased (Table 2). This is largely due to the re-allocation of family labor from crop production to livestock and off-farm employment. Carpet weaving is almost exclusively a woman's job in the region and the increase in its share is mainly due to the rapid rise in the carpet price. In 1977, more male labor was spent on off-farm employment as compared to 1974. This was due to higher urban wages pulling labor from small holdings in the region. The movement of labor resulted in an increase in the share of off-farm income, a shortage of labor for crop production, and a reduction in crop output in the region. The magnitude of such reduction could not be determined due to lack of sufficient data. Thus, while higher urban wages pulling labor from rural areas has benefited the migrants and industrial sector, it is not clear whether such movement is beneficial to the country as a whole, given the social cost of maintaining migrants and negative impact of migration on crop output. Whether the migrants' social cost outweighs their benefits, is a question requiring further study.

Another cause of migration was a changing crop combination; from a diversified to a more specialized cropping system. For example, in 1974 nearly 10 types of crops were grown. Of the total land actually cultivated, about 87% consisted of small grains (wheat, barley, and rice) and

the rest was in summer crops (cotton, sugarbeets, sunflower, sesame, and peas) and alfalfa. While, in 1977, only wheat, barely, rice, and sugarbeets were produced. The acreages of other crops were too small to be considered. Cash crops such as cotton, sunflower, sesame, and peas were not grown in 1977 due to price uncertainty and their high demand for labor. Sugarbeet acreage (produced on contract basis) increased from 2% in 1974 to approximately 20% of cultivated land in 1977. This was mainly due to an increase in its price. Other crops omitted from the cropping system were mainly non-mechanized and labor-intensive crops. The observed variation in crop combination could not be attributed to reduced rural out-migration in 1981 since part of this change was due to the pricing policy in favor of food grains resulting in a considerable increase in wheat and rice acreages.

Considering the existing cropping pattern in the region, the peak labor demanding seasons occur at two periods; May through August and the two months of September and October. Since these periods coincide with the active period of construction business in the city, agriculture is facing a shortage of labor in the area. Hence, mechanization of farm operations is suggested as a solution to the problem of labor supply shortage during the indicated peak labor demand periods.

CONCLUSIONS AND POLICY IMPLICATIONS

In many developing countries, there is a "push" effect exerted upon rural inhabitants to migrate where they might be more productive. The volume of rural-urban migration before the revolution in Iran, however, was larger than in many less developed countries. Despite a rapid rate of rual out-migration, the findings of this and other studies indicate that peak season labor demand on small farms is indeed a constraint to increased production since farm

families are working at capacity during this period.

Due to the negative impact of migration on agricultural output and the high social cost of maintaining migrants, policies to reduce rates of rural-urban migration in Iran deserve attention. Maintaining the AVP of farm family labor equal to or greater than the real or perceived opportunity wage, is, at minimum, a necessary condition to accomplish such an objective. By no means, however, can it be contended that this is a sufficient condition; the basis for migration decisions is indeed complex and beyond the scope of this paper. Yet, the analysis does point out some areas for policy attention. First, non-traditional (modern) inputs offer the potential for enhancing labor productivity. Policies to stimulate the adoption of labor-saving technology for peak season operations and to raise labor productivity are tempting. Labor bottlenecks at planting and harvesting time, as is common in the region (and some other regions of Iran), encourage the mechanization of planting and harvesting operations. In addition, mechanization could increase total productivity by allowing more timely planting and harvesting operations.

As expressed by most farmers interviewed, the emigration of farm labor which, at least in the beginnings, is intended to be temporary, is induced by the seasonality of farm activities. However, better opportunities in the city, as existed before the revolution is likely to make such temporary movement eventually permanent. Since the aim of the government is to slow out-migration of farmers, peak labor demand periods for small farms should be of less concern than the periods of slack labor demand. Thus, landsaving technologies and non-traditional production and farm organization patterns over time may be more appropriate for enhancing labor productivity on small farms. This implies stimulation of intercropping, multiple cropping and diversification of agricultural production

activities on these farms. Andrews (1) has evaluated the potential for increasing agricultural output. By no means these policy suggestions, however, are considered exhaustive. To keep up with the general increase in the rising wage rate in the city, these should be coupled with provision of production incentives and improvement of marketing systems. These measures are likely to offer the potential for enhancing total output and income on small farms.

Regarding the application of mechanical technology where a low land-labor ratio can not provide full use of farm machinery, some institutional changes such as cooperative arrangement or custom hiring may provide a solution. Measures to establish new farm cooperatives and strengthen existing cooperatives has been adopted after the revolution. For example, under the Islamic land reform law, agricultural land is transferred to a group rather than individual farmers.

The agricultural situation in the region is characterized by a large number of small and few medium-sized farms. This is a common characteristic of many other regions of Iran and developing countries. Thus, applicability of the findings can be extended to other areas with similar conditions.

Finally, given the small size of holdings and the high rate of population growth, farming households are bound to end up with surplus members who can not be absorbed in the rural sector alone. Therefore, increasing rural employment opportunities should be accompanied by the expansion of the urban labor market.

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