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FARM LABOR DEMAND

by

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Cooperating

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Agricultural income problems stem from forces operating in the national economy which affect both the supply of and demand for farm products. Since consumer demand for farm products is relatively unresponsive to changes in income, a rise in national and per capita income does not result in a similar increase in returns to the agricultural sector. The per capita demand for agricultural products decreases relative to other goods and services. Industries producing products the demand for which is relatively responsive to income changes bid up the prices of inputs used in agriculture. Hence, farmers' costs rise relative to product prices, creating the "cost-price" squeeze.

On the supply side, technological advancement increases the amount by which one added unit of a production factor, such as labor, increases the total product. The supply of productive factors is relatively inelastic or fixed in the short run period. This lack of mobility of agricultural factors along with technical change which permits increased production with the same amount of input has caused food output to increase more rapidly than can be absorbed by population growth and a rising national income. Substantial surpluses of agricultural products have risen accordingly.

One of the principal means often suggested for solving the farm income problem is in adjustments in the size of the farm labor force. Hence, greater knowledge of the factors which affect the demand and supply of farm labor is important in analysis of factors related to the supply of farm products and income
of the industry. The demand for and supply of this particular resource, farm labor, is analyzed in this study. Labor, of course, is not an inanimate resource that can be shunted abruptly out of agriculture in immediate response to relative price changes. Rather, labor represents a human resource with a consuming unit attached to it. It has many sociological attributes which relate to its mobility. This study, however, emphasizes the economic aspects of labor as a resource and examines responses by it in respect to farm income, wage-rates, and other relevant variables.

While a study of the total labor force in agriculture would be preferred, emphasis in this study is primarily on the demand for hired labor. The primary reasons for studying hired labor separately (and, to some extent, family workers) are: (1) The farm operator's decision on changes in employment of human resources is concerned with hired and family labor. (2) Hired labor is a more mobile resource and may provide an indication of adjustment to price and other changes at the margin. (3) The "price" of hired labor is the farm wage-rate while the "price" of family workers and operators is not readily available. The demand for farm labor (or of hired farm labor) is much less independent of the supply of labor. While most of the demand factors in this study are estimated singly, some factors governing demand and supply are, however, estimated simultaneously.

1/ Project 1406 of the Iowa Agricultural and Home Economics Experiment Station, Center for Agricultural and Economic Adjustment cooperating.
While information concerning the demand for and supply of farm labor is extremely important in output and price of farm products, relatively little quantitative research effort has been directed toward basic relationships surrounding the resource. Improved knowledge of quantitative demand and supply functions for farm labor is of importance to economists and national farm program administrators. The objective of this study is to predict these relations for different strata of farm labor, for different periods, and under different systems of estimation. It is expected that these predictions will lead to useful knowledge for such questions as:

(1) How much time must elapse, for specified differentials between farm and nonfarm incomes, before a specified amount of labor leaves agriculture?

(2) What is the effect of varying rates of unemployment in the national economy on the rate of migration from agriculture?

(3) What is the elasticity of supply response for farm labor in respect to farm and nonfarm wage-rates?

(4) What are the lagged relationships of farm labor in respect to price stimuli?

(5) What are the important variables which affect the demand for farm labor and the amount of labor held on farms in the various geographic regions of the United States?

(6) Is the supply of farm labor highly responsive to changes in the farm wage?

The results of this study provide some initial answers to questions such as these, and to questions which are related in judging adjustment rates and po-
The more specific objectives of the study are: (1) to estimate and analyze factors governing demand functions for both hired and family labor on a national and regional basis; (2) to estimate and analyze factors governing the supply of hired and family labor for the United States; (3) to summarize and appraise the quantitative estimates of the farm labor force; and (4) to offer some predictions on the size of the farm labor force for 1965 and 1975.

TRENDS IN FARM LABOR AND RELATED INPUTS

The farm labor market has undergone considerable change in recent decades, the general trend in agricultural employment since 1910 being downward. The total number of farm workers declined 45 percent between 1910 and 1959. (See fig. 1.) Estimated requirements for man-hours in agriculture declined 50 percent during the same period (fig. 2). However, the rate of decrease was far from constant over the 50-year period. Farm employment dropped by only 8 percent from 1910 to 1930. Due to depression and lack of off-farm opportunities, farm employment increased 2 percent between 1930 and 1935, however the rate of net migration from farms increased. Farm employment declined by 19 percent between 1935 and 1946, and by 26 percent between 1946 and 1957.

Of the 7.6 million farm workers in 1957, roughly one-fourth were hired
workers. The hired labor force has constituted about 25 percent of the national farm labor force since 1910. Hence, changes in the numbers of hired and family workers over time have been similar to changes in the total farm labor force. However, this relative stability of the ratio of hired to total farm employment does not hold true on a regional basis. Changes in farm labor over time for nine geographic regions (fig. 3) are presented in table 1. Two general conclusions can be drawn from these data: (1) The percentage changes in total farm labor from 1910 to 1957 and from 1929 to 1957 are similar for nearly all regions. Farm employment decreased slowly from 1910 to 1929, but decreased rapidly from 1929 to 1957 in all but one region, the Pacific region. (2) Differential changes in employment of hired and family labor were greater for specific regions than for the United States. No consistent pattern of relative change in hired and family workers existed among all regions.

The seasonal pattern of farm employment also has changed somewhat, but more for family than for hired labor. As fig. 4 indicates, the amount of fluctuation in employment has diminished greatly for family labor, but only slightly for hired labor. The seasonal pattern of hired labor for four regions is compared between the years 1931 and 1957 in fig. 5. Total demand for seasonal hired labor increased in the Pacific region, but declined in the other three. Changes in mechanization and the cropping patterns brought a quite different peak in hired-labor requirements in the South Atlantic region, however. Of a total of 3.6 million farm workers who did any farm work for wages during
1956, 1.5 million or 40 percent of the total worked 25 days or less (fig. 6). Only 750,000 farm workers reported working 150 days or over.  

The demand for farm labor is affected by resources which serve as substitutes for labor. Relative prices of these several resources and the technology used determine the rate at which labor is replaced from farms. Inputs other than farm labor have changed greatly over the years. Farmers have made large adjustments in the resource mix, (combination of inputs) shifting from resources which were more expensive to those which were less expensive. Relative changes in prices and use of major factors between 1940 and 1957 are shown in table 2. These data indicate that as the price of a factor rose relative to product prices and relative to the price of other factors, use of the specific factor decreased. For example, the price of farm labor increased relative to prices of farm products and other resources, and the number of man-hours worked decreased by 34 percent over the period 1940-57.

SOURCES AND NATURE OF DATA

The data used in this study are time series observations of employment, prices and other relevant variables. They were taken from USDA sources for the nation, except as otherwise indicated on a regional basis.

Table 1. Relative change in prices and use of major resource categories, United States, 1957 as compared with 1940.

<table>
<thead>
<tr>
<th>Resource category and percentage change in price, 1940-57, as a percentage of 1940</th>
<th>Resource category and percentage change in use, 1940-57, as a percentage of 1940</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wage rates&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Man-hours&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Real estate&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Cropland&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Farm machinery&lt;sup&gt;e&lt;/sup&gt;</td>
<td>Tractors&lt;sup&gt;f&lt;/sup&gt;</td>
</tr>
<tr>
<td>Fertilizer&lt;sup&gt;e&lt;/sup&gt;</td>
<td>Fertilizer&lt;sup&gt;g&lt;/sup&gt;</td>
</tr>
<tr>
<td>Farm products&lt;sup&gt;h&lt;/sup&gt;</td>
<td>Farm output&lt;sup&gt;i&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

427 | -34 |
302 | -2 |
228 | +203 |
154 | +258 |
235 | +41 |

<sup>d</sup> USDA, Agricultural Research Service. Changes in farm production and efficiency, op. cit., p. 10.  
<sup>f</sup> USDA, Agricultural Research Service. Changes in farm production and efficiency, op. cit., p. 29.  
<sup>g</sup> Ibid., p. 16.  
<sup>i</sup> USDA, Agricultural Research Service. Changes in farm production and efficiency, op. cit., p. 6.
Numerous statistical or empirical methods were used in this study. Statistical analysis, other than tabular descriptive presentations, is difficult because some of the forces which affect the employment of farm labor change at the same time and their separate effects are, therefore, hard to isolate. Several important "forces" affecting farm labor are: (a) growth in the national economy, which has increased non-farm wage rates, (b) a declining price of machinery relative to farm products and farm wage rates over much of the past three decades, (c) a decline in farm income relative to non-farm income over the last two decades, (d) a rapid increase in farm mechanization, (e) and improved farm technology, greater knowledge and increased mobility of people growing out of better education and communication. When two or more of these "forces" change together, and at about the same rate, statistical analysis is complicated and the estimated effect of one of the "forces" may cover up that which actually exists for the other.

Because of the above difficulties, several different statistical approaches were used in this study. The most widely used statistical method assumes a simple relationship between one quantity, such as the quantity of farm labor, and another quantity, such as the level of farm wages or the level of non-farm wages.

However, many of these quantities are affected by joint relationships. Thus where one quantity being predicted also has impact on a second quantity being used to predict the first, methods were used which account for these conditions. Some recent developments in these methods were also employed, although they did not always or greatly improve the estimates and predictions. The several methods
used give major support to the hypotheses tested. However, additional research is needed, not only because of the importance of the farm labor problem but also to improve estimates of the kind included in this study.

WHAT THIS STUDY MEANS

Problems of depressed prices and incomes in agriculture are directly the result of a large supply of farm products in relation to demand. In turn, this large supply is directly related to the quantity of resources used in agriculture, such as land labor, capital machinery and fertilizer. Hence we need to know more about the demand for and the supply of such resources in order to attack price and income problems of agriculture.

The major objective of this study has been to examine the variable factors affecting the demand for one of those resources: labor.

The results provide support for the major hypotheses tested: that the demand for hired labor appears to be responsive to changes (a) in farm wage rates and (b) in farm prices.

Furthermore, the demand for hired labor was more responsive to a sustained price change in the war-postwar period than in the depression period. Thus it appears that farm labor demand is affected by the period of the business cycle and the existence of non-farm job opportunities.

The study showed that the demand for hired labor adjusts to a sustained price change in a relatively short time.

It also showed rather dramatically that the demand for hired labor is responsive to the level of prices received by farmers. A decrease of 10 percent in prices received was accompanied by a decline in the demand for hired workers of 3 to 6 percent over the period 1910-1957, of 17 percent from 1920 to 1939, of 8 percent from 1929 to 1957, and of 20 percent from 1940 to 1957.

The demand for farm labor adjusts more rapidly to a sustained price or other
variable change now than in earlier years. This trend appears to stem from a growing mobility of the agricultural labor force.

The regional pattern was similar to that of the nation as a whole. In four of the nine regions—New England, South Atlantic, Mountain and Pacific—the level of farm wage rates was not statistically correlated to the demand for farm labor. However, special farm labor problems exist in these regions which account for these results, and in all nine regions of the U. S. the results indicated that as wage rates increase the demand for farm labor declines.

The level of the parity ratio, a measure of farm product purchasing power, was significantly related to changes in farm wage rates in the four central regions.

Mathematical formulae were used to estimate demand for labor by taking into consideration the related factors. These included the quantity of labor employed annually on U. S. farms, the quantity of labor supplied by households, the farm wage rate index, the index of prices received by farmers, the index of farm machinery prices, the index of farm machinery on hand Jan. 1, time and non-farm wage rates (a composite of the annual index of hourly factory wages altered to reflect the percentage of jobless in the total work force.)

Farm labor demand was predicted for the years 1958, 1959 and 1965. Estimates for 1965 (using previous definitions of farms and the farm labor force) ranged from 6,400,000 to 6,760,000 farm workers depending on the estimating equations used.\(^3\)

Indexes of the number of hired farm workers in the United States for 1910-1957 and 1940-1957 as predicted by means of the formulae and as actually shown by U. S. Department of Agriculture figures are compared in Fig. 6 and Fig. 7, pages 20 and 21.

\(^3\) These figures would be reduced somewhat by more recent census definitions.
An extremely important finding of this study, one substantiated by other studies, is that farm labor employment and mobility are importantly related to expansion of the non-farm economy. Movement of labor from agriculture has typically been high since there began to be a net migration of labor from farms about 1920, when farm incomes also were high. Farm incomes often have been high during periods of full employment, when there were ample non-farm opportunities. But there must be non-farm jobs and laborers must know about such jobs in order to migrate. This factor appears to be more important than the level of farm income. While economic opportunity may be unfavorable on the farm when farm prices and returns are low, labor is not so likely to move from farms when many people are out of work in the cities and there are few job opportunities. This study was able to predict on the basis of data from past decades, that when unemployment in the non-farm economy reaches 10 percent net migration from farms drops to zero. These predictions need to be refined, however, as they relate to more recent conditions of the economy.

We were not able to separate the individual effects of improved knowledge, substituting machines for people, and related forces. However, improved farming technology and knowledge have been important over a period of time in causing labor to migrate from farms. While the data are not presented in our study, we have made some estimates indicating the rate at which improved technology substitutes for labor, freeing labor to migrate to other industries. It is obvious that machines substitute for labor. One man using equipment can handle more acres and animals, and accordingly fewer persons are required. New crop varieties and proper use of fertilizers help to achieve higher yields per acre as do practices which increase the production per animal. A new crop variety which increases yield per acre frequently
requires a trivial increase in labor per acre; however, fewer acres and less labor are then needed to produce the nation's food requirements. The effects of these substitutions are indirect and have lagged effect, but they are taking place with great impact on American agriculture.

Numerous forces which affect the employment of labor in agriculture continue with unabated momentum. Under further economic growth, it is likely that wage rates will increase faster than the cost of capital items such as farm machinery. If so, a further substitution of capital for labor in agriculture will take place. If the nations' growth goals give rise to high employment rates and increased wage rates in the non-farm sector, migration will be further encouraged. It also seems likely that technical improvement of agriculture will continue as a result of public educational programs, innovation by farmers and knowledge and new materials supplied by private industry. As the productivity of land and labor increases from these sources a further decline in the farm labor force will be possible. The potential of this reduction in farm employment is evident from recent USDA figures. They show that 20.6 percent of farms had sales of $10,000 and over produced 71.8 percent of the nation's farm sales and 38.2 percent of farms had sales of $5,000 and over produced 87.3 percent.

While the percentage reduction in the farm labor may continue at about the same rate in the next decade and a half as in the last dozen years, the absolute decline eventually is expected to "level off." As the labor force becomes smaller, migration becomes more and more difficult. For one thing, the average age of farm operators tends to become greater and a greater proportion of those remaining on the

4/ Supplied by Farm Economics Division, Economic Research Service, USDA.
farm cannot fit into non-farm jobs. Also, special problems appear in farm com­munities as there are fewer families to be serviced by retail establishments, public fa­cilities, etc.

The ease with which future migration will take place depends on the circum­stances surrounding agriculture. One set of circumstances which encourages labor to migrate was mentioned previously. However, public education, vocational guidance facilities and employment services also affect migration. Organized in one direction, these facilities fail to prepare a sufficient number of persons for non-farm employment and therefore hold them in agriculture. Organized in other directions, they can facilitate the acquisition of skills, knowledge and aids which help labor transfer from agriculture. Since so many of the facilities for these purposes are in the hands of public organizations, people have an opportunity to help determine the future rate of migration and the size of the farm labor force. Thus they have an op­portunity either to help improve or to hold down the economic position of many persons in farm communities. These factors are not, however, likely to dominate national economic growth. Economic growth provides employment opportunities and helps determine the relative price of labor and capital and the rate at which capital and technology are substituted for human effort.
Table 2. Size of the farm labor force, by regions, for 1957, and the percentage change in the labor force, by regions, 1910-57 and 1929-57, as a percentage of 1910. A/

<table>
<thead>
<tr>
<th>Region</th>
<th>Size of farm labor force, 1957</th>
<th>Percentage change, 1910-57</th>
<th>Percentage change, 1929-57</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Thousands)</td>
<td>(Percent)</td>
<td>Total farm employment</td>
</tr>
<tr>
<td>New England.....</td>
<td>172</td>
<td>-53</td>
<td>-36</td>
</tr>
<tr>
<td>Mid. Atlantic...</td>
<td>444</td>
<td>-53</td>
<td>-36</td>
</tr>
<tr>
<td>East North Central.</td>
<td>1,307</td>
<td>-36</td>
<td>-22</td>
</tr>
<tr>
<td>West North Central.</td>
<td>1,398</td>
<td>-36</td>
<td>-35</td>
</tr>
<tr>
<td>South Atlantic...</td>
<td>1,345</td>
<td>-49</td>
<td>-42</td>
</tr>
<tr>
<td>East South Central.</td>
<td>969</td>
<td>-58</td>
<td>-56</td>
</tr>
<tr>
<td>West South Central.</td>
<td>1,000</td>
<td>-54</td>
<td>-57</td>
</tr>
<tr>
<td>Mountain.........</td>
<td>354</td>
<td>-18</td>
<td>-35</td>
</tr>
<tr>
<td>Pacific..........</td>
<td>588</td>
<td>+14</td>
<td>+1</td>
</tr>
<tr>
<td>United States...</td>
<td>7,577</td>
<td>-44</td>
<td>-40</td>
</tr>
</tbody>
</table>

Fig. 6. Actual number of hired farm workers in the United States, 1910-57 and corresponding number predicted by this study.
Fig. 7. Actual number of hired farm workers in the United States, 1940-57, and corresponding number predicted by this study.
Fig. 8. Actual number of family farm workers in the United States, 1910-57, and corresponding number as predicted by this study. Solid line represents actual numbers.
Fig. 9. Actual number of family farm workers in the United States, 1940-57 and corresponding number predicted by this study. (The solid line represents the actual numbers.)
Fig. 10. A prediction of agricultural man-hour requirements and an extension of linear trend, 1957-75.
Sources of data used in the study are:


