FUNCTIONING OF LABOR MARKET AND FARM PROBLEM IN THE UNITED STATES

By

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I. Introduction

This study is undertaken to explore the structural relations of out-migration of labor force from agriculture. The out-migration of labor force is the core of adjustment problem of agriculture in an growing economy. The underemployment problem in agriculture is its name.

It will be illuminating for understanding of the problem to show how much the underemployment in agriculture is ascribed to inefficiency in functioning of the labor market for migrant labor force. Alleged diseqilibrium of the labor market will be tested in this paper. I will try to establish that non-farm supply of labor from agriculture is very responsive to *income difference* and the non-farm labor market for farm workers is functioning very well. In this respect, I am going to make the statement which is contrary to the prevailing opinion. The prevailing opinion says that out-migration of farm labor is primarily a function of job opportunity but not of income differential. There is found no alleged

* I am greatly indebted to Professors Theodore W. Schultz, Albert E. Rees, and Finis R. Welch, and the members of TEA association of Japan, especially to Dr. K. Ohkawa for their valuable comments on this paper. All remaining errors are, of course, my sole responsibility.

disequilibrium in the labor market in this paper.

The central problem is that the slacks in aggregate demand for labor disturb the equilibrium level of out-migration and of wage earnings of farm labor. Another key factor to the farm problem is the low educational attainment of farm workers relative to that of urban workers. These points are indicated by the structural parameters of the non-farm labor market for farm workers. The structural parameters tell us considerably high elasticities of equilibrium level of migration and of wage earnings of farm workers with respect to national unemployment and educational attainment of farm workers.

II. Conceptual Model

1. *Non-farm Supply of Labor from Agriculture*

It is assumed that the quantity of farm labor force available to non-agricultural sector depends upon the difference in expected real earnings between agriculture and non-agriculture on one hand and the cost of migration on the other.

Conceptually occupational migration of farm labor into non-farm occupations may be analysed in the light of cost and returns to investment in migration. Labor earnings is expected to be risen with occupational migration. The increment of labor earnings is the returns to migration. At the same time, cost is incurred in the occupational migration. Included in the cost of migration are transportation cost, cost of job information, retraining cost, and income foregone during migration and retraining. Cost of selling out farm is also included in the cost of migration. Under certain circumstances of traditional family system, extra cost of migration could be incurred to overcome several immobility factors which stem from institutional pecuriality of the system.[1] The cost of migration as such will be paid off only in long period by incremental income stream after migration. Hence the migration may be regarded as an investment which buys the incremental income stream for the cost of migration.

1) I attempted elsewhere to analyse cost of migration for farm people with particular reference to the immobility factors steming from the traditional family farm of Japan. Yukio Masui, "Supply Price of Labor of Farm Family", in Kazushi Ohkawa ed., *Economic Crowth in Agriculture of Japan* (Japanese edition), Tokyo, Taimeido, 1964, pp. 41-57. (English edition is forthcoming).

In terms of the cost and returns to occupational migration, equilibrium of the migration would be represented as follows,

$$\sum_{t=0}^{r-s-1} \frac{W_{2,t}-W_{1,t}}{(1+i)^{t+1}} = \sum_{t=0}^{r-s-1} \frac{C_t}{(1+i)^{t+1}} \qquad (1)$$

where W_2 stands for expected real labor earnings in non-farm occupation, W_1 for expected real labor earnings in farming, C for cost of migration. Suffix t refers to period t since migration. i stands for discount rate measured by opportunity rate of interest in farming, r for the age of retirement in non-farm occupation and s for the age of migrant. The left-hand side of equation (1) represents the present value of incremental income stream $W_{2,t}-W_{1,t}$, and the right-hand side represents the present value of cost of migration. Equation (1) holds at the margin. From equation (1) the equilibrium age of migrant s is determined given $W_{2,t}-W_{1,t}$, C_t, i and r. Number of farm workers under the age s is the amount of intended migration.

As wage difference between $W_{2,t}$ and $W_{1,t}$ is increased either by an increase in $W_{2,t}$ relative to $W_{1,t}$ or by a fall in $W_{1,t}$ relative to $W_{2,t}$, the equilibrium age of migrant is risen and the amount of intended migration will be increased through the age distribution of total labor force in agriculture. As cost of migration C_t is increased the equilibrium age of migrant is fallen and the amount of intended migration will be decreased through the age distribution of total labor force in agriculture. Then it is easily seen that non-farm supply of labor from agriculture depends upon the difference in expected real earnings between agriculture and non-agriculture, and the cost of migration.[1)]

Distinct feature of non-agricultural employment is insecurity of employment for employees while self-employment is predominant in agriculture. Any meaningful comparison of labor earnings between agriculture and non-agriculture has to take into account higher probability of unempoymentl in non-agriculture.[2)] In this sense, the earnings difference

1) For more elaborate discussion of the aspect of investment in human migration, see Larry A. Sjaastad, "Cost and Return of Human Migration", J.P.E., Vol. LXX, No. 5, Part 2, Supplement edition, Oct., 1962, pp. 80–94.

2) For wage laborers unemployment rate is very low in agriculture. It is about one quater of total national unemployment rate for the selected period of 1921–1941. Source: *Farm Labor*, Bureau of Agricultural Economics, USDA.

between agriculture and other occupations which farm labor are qualified to enter should be real allowing for the probable unemployment in the non-farm occupations (as well as difference in cost of living between rural farm areas and urban areas).

In this paper the supply equation, therefore, expresses availability of farm labor to non-agricultural work as a function of: (1) difference between expected earnings in agriculture and expected earnings offered to farm labor force in non-agriculture, (2) probable unemployment in the other non-farm occupations for which farm migrants are qualified and (3) cost of migration.

Thus the intended supply of farm labor force to other industries may be represented in the following form.

$$M^s = f_1(W_1, W_2, u, C)$$

where M^s stands for intended migration of farm labor, W_1 and W_2 for expected average earnings in agriculture and in the other occupations respectively, u for unemployment rate in the non-farm occupations which are accessible to farm workers, and C for cost of migration.

Expected average earnings in agriculture W_1, and unemployment rate u are synthesized into one variable V in the following fashion.

$$V = \frac{W_1}{1.00 - u}$$

The synthesized variable V is named "corrected" earnings in agriculture.[1] When a migrant compares the expected earnings between agriculture and other occupation he must give a premium to each dollar of agricultural earnings according to the relative profitability of agricultural employment due to the security of employment. Premium $\frac{1}{1.00-u}$ varies with unemployment rate. The premium increases as unemployment rate increases but less than proportionally.[2]

Expected signs for the coefficients of these variables are positive for

1) This concept is developed and used in the study of agricultural labor market by G. Edward Schuh. G. Edward Schuh, "An Econometric Investigation of The Market for Hired Labor in Agriculture", *J.F.E.*, Vol. XLIV, No. 2, May, 1962, p. 311.

2) u has to be the effective and relevant unemployment rate in the labor market for labor from farms. It is well known fact that incidence of unemployment is different for different skill level, industries and occupations.

W_2, and negative for V and C. Wage earnings difference between agriculture and the other occupations is not taken literally in this paper. Instead we bring W_1 and W_2 seperatedly in the supply function to allow for measurement errors in these variables and let the data determine the coefficients freed from undue restriction of literal earnings difference, i. e., the coefficient of V should be equal to that of W_2 in the obsolute value and be opposite in the sign.

2. *Non-Farm demand for farm labor force*

It is assumed that the non-farm demand for farm labor is the excess demand for labor in the non-farm occupations.[1] Suppose total demand for labor and total supply of labor in the other occupations be represented as,

$$X_2^d = h_2(W_2, K_2, S, T_2, Y, G) \qquad \text{(Demand function)}$$
$$X_2^s = g_2(W_2, U) \qquad \text{(Supply function)}$$

where X stands for quantity of labor, W_2 for wage rate, K_2 for physical capital stock, S for quality of labor, T_2 for quality of capital, Y for per capita national income, G for change in aggregate demand, and U for national unemployment.

The excess demand for labor may be expressed as,

$$X_2^d - X_2^s = f_2(W_2, K_2, S, T_2, Y, G, U)$$

Then the demand for farm labor in non-farm M^d is expressed as

$$\begin{aligned} M^d &= X_2^d - X_2^s \\ &= f_2(W_2, K_2, S, T_2, Y, G, U) \end{aligned}$$

The demand for farm labor, M^d, is a function of (1) wage rate W_2, (2) physical capital stock in non-agriculture K_2, (3) quality of farm worker

1) This assumption is employed purely for an analytical device. No particular assumption but competitive labor market is made about priority of employment which could be applied by employers in non-agriculture either for labor force of farm origin or that of urban origin. One might argue for the *de facto* racial discrimination in employment in the case of occupational migration from agriculture. This subject is out of the scope of this paper. Only a way in which the problem could be reflected in the analysis of this paper is that the industries and the level of wages offered to the farm migrants are carefully selected before available data are used for estimation of the demand function for the migrant labor.

S_1, (4) quality of capital T_2, (5) per capita national income Y, (6) change in general level of aggregate demand G, and (7) general conditions in the non-agricultural labor market, national unemployment U.

The excess demand curve has a negative slope with respect to wage rate, i. e., $\partial M^d/\partial W_2<0$. S_1, T_2, K_2, Y, G, and U are the shift variables of the excess demand. Among them S_1, T_2, are the major factors of so-called technology. Physical capital, K_2, is closely connected with S_1 and T_2 since K_2 also embodies some of technological factors in the form of capital goods. All of these three will affect marginal productivity of labor and then the demand for labor. We are not able to predict the direction of shift of the demand curve for farm labor in non-farm occupations with changes in each of these variables *a priori*. This is entirely an empirical question.

It depends upon, first of all, (1) nature of demand for product of each industry, (2) closely related to (1), the industrial complex of non-agricultural occupations which changes in the process of economic growth through the law of demand for the product of each industry and with technological progress there. These two conditions are dependent of per capita national income, Y.[1)]

Fluctuations in aggregate demand lead to fluctuations in the demand for labor. Then it is clear that the excess demand for labor is shifted in the same direction to the aggregate demand, other things being equal. It is assumed that the excess demand for labor responses to rate of change of aggregate demand more sensitively than to the level of aggregate demand in this paper.

On the other hand, fluctuations in total national unemployment cause shifts of the total supply of labor in the other occupations. Unemployment both encourages and discourages the supply of labor. Which is true in the particular labor market is again an empirical question. It is assumed that some of the unemployed or their families member flow into the labor maket for farm labor force to increase the total supply of labor. Thus fluctuations in total unemployment will lead to fluctuations in the excess demand for labor in the unfavorable direction for farm workers.

1) In this context, the empirical study of the industrial demand for labor in agriculture by Micha Gisser gives us an insight into the subject. Micha Gisser, "Schooling and the Farm Problem", *Econometrica*, Vol. 33, No. 3 July, 1965, pp. 582-592.

As a result, $\partial M^d/\partial G>0$, $\partial M^d/\partial U<0$.[1] Here U refers to the number of total unemployment rather than unemployment rate since it is assumed that the former affects the excess demand more directly than the latter.

III. Econometric Model

Now we have obtained the conceptual model as expressed in the following structural equations system.[2]

$$M^s = f_1(W_2, V, C)$$
$$M^d = f_2(W_2, K_2, S_1, T_2, Y, G, U)$$

We can easily see that migration of labor from agriculture, M, and wage rate in the other occupations, W_2, are interdependently determined given the parameters; $V, C, K_2, S_1, T_2, Y, G, U$.[3] In this study, we are going to analyse net out-migration during the selected period of 1921 to 1940. There has occured migration of labor force out of and into agriculture during the period. The behavior differs between the out-migration and the in-migration. It is, therefore, questionable that the net out-migration is a pertinent measure of migration from agriculture. Gross migration from agriculture could be more pertinent measure of actual human behavior of rural farm people. But when you want to analyse the earnings

1) One could argue that changes in unemployment rate *per se* reflects fluctuations in aggregate demand. In fact, total unemployment rate is high when aggregate demand is falling. But total unemployment rate is not necessarily low when aggregate demand is rising. Conceptually unemployment is related to the supply and demand conditions in the labor market. Aggregate demand is related to the product markets. Therefore we cannot represent the one by the other.

2) The equations system is asymmetrical in that the concept of excess demand for labor is applied to the demand for migrant labor force while the similar concept is not applied to the supply of migrant labor force. One might question if the concept of excess supply could be applied to the supply of migrant labor force. Where migration of labor force incurs costs, costs and returns of migration are more fundamental factors in the supply of labor force and the supply of migrant labor force is substantially differed from the excess supply by its very nature of cost consideration of migration.

3) Since net out-migration from agriculture accounts for more than 65 percent of new employment in occupations which majority of migrants from farms find them qualified to enter each year during the selected period of 1921–1940, it is assumed that W_2 is affected by M. Bureau of The Census, *Historical Statistics of The United States,* D 123–572.

level of farm labor at the equilibrium the gross out-migration does not help much. Therefore I use the net out-migration in the analysis of equilibrium of the labor market.

In the case of the intersectoral migration of labor force between agriculture and other industries, critically important is the specification of occupations and earnings offered where the labor force from farms are qualified to enter. The level of educational attainment of labor from farms and peculiarity of farm skill will limit the industries and occupations where they can compete supply of labor. They may obtain the technical knowledge and the skill usefull in other occupations through more schooling and retraining. The scope of better job opportunities in other occupations through this process, however, is considerably limited for them since the process involves considerable cost to be paid off only for long period. As a matter of fact the competing group for farm people is confined to the groups of lower earnings occupations such as foremen, operatives and laborers.[1] A rise in earnings in these occupations will induce them to move into these occupations. But a rise in salaries of college professors will never affect the supply of labor force from agriculture except in very indirect ways.

In this respect, the non-agriculture is too broad concept to be relevant to the migrant labor force from agriculture. The non-agriculture or other occupations in our model should be read as those groups of occupations where farm labor are qualified to enter. It seems that economic analysis of migration has, so far, failed to realize the critical importance of this specification problem.

It is clear that transfer of labor force between occupations depends upon the over-all work conditions including level, pattern and stability of earnings, hours of work, security of employment, time pattern of work, fringe benefit, location, and all other personal and sociological conditions as well. On the other hand, farm earnings are subject to risk and uncertainty stemming from the particular nature of agricultural industry. In this paper, however, it is assumed that the intended migration of

1) Over 70 percent of out-migration from rural farm areas is accounted for by such occupations as operatives, laborers, and craftmen and foremen in 1950. Larry A. Sjaastad, "Occupational Structure and Migration Patterns" in *Labor Mobility and Population in Agriculture*. Iowa State University, Center for Agricultural and Economic Adjustment, 1961, p. 20.

labor force from agriculture depends upon the difference of expected real earnings which are a product of expected wage rate and probable work hours in each occupation. Other conditions are neglected because of less importance to our problem at hand.

On the nature of simultaneous determination of level of migration and earnings in non-farm occupations the structual parameters of the demand and the supply relations are estimated in a framework of simultaneous equations system, employing the 3 stage least squares method proposed by Zellner and Theil.[1)]

Both the demand and the supply functions of farm labor force are approximated by a linear function in terms of actual magnitude of explanatory variables.

Unfortunately, any measures of cost of migration, C, is not applied to transportation cost, cost of job information, income foregone, and retraining cost and so on for the reason of difficulties with availability of data.

As noted earlier, there are many evidences which indicate that most of farm labor have been entering into the occupations in the category of unskilled laborers. Thus we adopt the level of earnings in these occupations as the measure of W_2. The available data is the average weekly earnings of unskilled male production workers in manufacturing industries. The series is adopted neither because all migrant labor enter into manufacturing industries nor they are all male labor force but because changes in the earnings offered to the labor from farms are probably better represented by this series than others.[2)]

Earnings in agriculture W_1 is measured by average annual earnings per hired workers in agriculture. On the assumption that agricultural labor market is competitive, returns to farm labor is better measured by agricultural wage earnings of hired labor than imputed labor returns to unpaid farm labor based on controversial residual methods. And there

1) Arnold Zellner and H. Theil, "Three Stage Least Squares: Simultaneous Estimation of Simultaneous Equations", *Econometrica*, Vol. 30, 1962. pp. 54–78,

2) For example, average annual earnings of production workers in manufacturing industries or average annual compansation per full-time employees in non-agricultural sector could be the alternative measures. But these are too much aggregated to represent the level of and changes in the incentive earnings relevant to migrant labor force from farms.

are more theoretical difficulties in assuming that labor supply is responsive to total farm income per labor force.

Due to many difficulties in availability of the adequate measure of capital stock in non-farm industries where farm labor can find occupations, variable K_2 is dropped out of our econometric model. Index of quality of capital T_2 is also dropped out of the model due to lack of available data.

More important shift variable in the demand function, i.e., per capita national income Y is omitted in our econometric model. There is very close correlation between Y and V, i. e., $\rho(Y, V)=.6864$ for the selected period. It is clear that this high correlation between predetermined variables Y and V causes the multicolinearity difficulty in the estimation of structural parameters, thus one of them, Y, is omitted.

The quality of labor from farms is approximated by average of median years of school completed for farm population 25 years old and over. The probability of unemployment in the non-farm occupations is approximated by total unemployment rate in the non-agriculture because of lack of available time series data of unemployment rate in the labor market concerned for the selected period.

As a result, our econometric model is represented as follows.

Supply equation:

$$M = a_0 + a_1 W_2 + a_2 V + e_1$$
$$V = W_1/(1.00 - u)$$

Demand equation:

$$M = b_0 + b_1 W_2 + b_2 S_1 + b_3 G + b_4 U + e_2$$

M ··· Net annual out-migration of labor force from agriculture measured by the net out-migration ratio of farm population (USDA series) applied to farm employment (USDA series).

W_2 ··· Average annual earnings of unskilled male production workers in manufacturing industries (real term).

W_1 ··· Average annual earnings per hired worker in agriculture (real term).

u ··· Unemployment rate as fraction of total civilian labor force in non-agriculture.

S_1 ··· Quality of farm labor measured by average of median years of school completed by age group for rural farm population (Extrapolation of Census of Population data in 1940).

G ··· Rate of economic growth in real term.
U ··· Unemployment in non-agriculture.
V ··· Corrected earnings of hired worker in agriculture.
a_0 and b_0 ··· Constant terms.
e_1 and b_2 ··· Disturbance terms.

In our model, M and W_2 are the dependent variables and V, S_1, G, and U are the predetermined variables. Both the supply and the demand equations are identified on the criteria of rank condition of identification; the demand function is over identified, the supply function is exact identified.

IV. Some Data Problem

(1) *Net out-migration of farm labor force*

There is no ready made date available to us. I estimate it as the net out-migration rate of farm population applied to farm employment figure both of which are provided by USDA.

As to the net out-migration of population, the USDA data have several undesirable qualities. First they are largely for change in residence—a change from a farm to non-farm residence (and vice versa) in any given year. Such a move does not necessarily imply a shift from a farm to a non-farm job. As widely recognized, a substantial number of farm non-farm movers do in fact retain agricultural job.[1] At the same time, a substantial number of farm labor force engages in non-agricultural jobs without changing residence as multiple job holders.

As to farm employment data, the USDA data counts the number of different individuals who do some minimum amount of farm work at given farms. That is, the data is an establishment basis data. And there is no limit on age. Establishment basis data tends to count the same person twice. The USDA data counts unpaid family labor under 14 years old which is not normally counted in any other employment statistics.[2]

1) For example, 20.3 percent of farm to non-farm migrants engaged in farm occupations such as farmer, farm manager, farm laborer, and foreman after migration in 1950. Larry A. Sjaastad, Ibid., p. 20.

2) Farm employment in 1929 is 12,763,000 by USDA data and 10,450,000 by BLS data. BLS series count the number of individuals 14 years old and over whose major work activitsies are farm works. Thus there is considerable difference in farm employment figure between these two series.

No attempt was made to adjust these data for our use on the assumption that changes in these figures almost reflect real changes in the net out-migration of farm labor force. Attentions was paid to keep comparability of the data over time.

(2) *Average of median years of school completed for farm population 25 years old and over*

This is the weakest series among the data used in this paper. This is essentially extrapolation of the 1940 Census data. Average of median years of school completed by age for 45 years old and over in 1940 weighted by age distribution of population 25 years old and over in 1920 is applied to the estimate for 1920. With the same method, the estimate for 1930 is obtained. Using these estimates along with 1940 Census figure as benchmarks, (The estimates are 6.88 years for 1920, 7.09 for 1930, and 7.36 for 1940.) a series is interpolated by a series of school attendance rate for the intervening years. The series may underestimate the rate of change in the average years of school completed since the benchmarks at 1920 and 1930 overestimate the average years of school completed. The series shows larger rate of change for 30's than for 1920's.

(3) *Average annual earnings in agriculture*

The earnings in agriculture is average annual compensation for hired farm workers in agriculture. This is estimated by dividing farmer's expenditure for hired labor by number of hired farm workers which are provided by USDA.

All persons working one hour or more during the survey week for pay at farm work or chores are classified as hired farm workers. Members of the operator's family receiving wages for work on their farms are counted as hired workers. A person employed as both a family worker and a hired worker during the survey week on the same farm is counted as a hired worker. It is clear that this definition leads to overestimate of hired workers in agriculture.

Farmer's expenditure for hired labor, on the other hand, counts actual expenditure on wages and perquisite for hired labor but does not count the imputed labor cost of unpaid family labor which is classified as hired worker on the above definition. As a result the series of average annual compensation for hired workers in agriculture underestimate

annual earnings in agriculture.

When this series is compared with the average annual earnings per full-time employees by US Bureau of the Census, *Historical Statistics of the United States*,[1] it turns out that there is no significant difference in the behavior between them but there is essential difference in the levels of the series. Our series is lower than that of Bureau of the Census by about 40 percent. The level of estimates is adjusted to the Bureau of the Census data for our series in this paper.

V. Statistical Results

Employing 3 stage least squares method in estimation of structural coefficients in our model the following results are obtained for the selected period 1921–1940.

The supply equation:

$$M = -93.76 + .7624\,W_2{}^{**} - .936\,V^{**}$$

$$\begin{array}{cc} (.18578) & (.2526) \\ 4.104 & -3.706 \end{array}$$

The demand equation:

$$M = -4438 - .1662\,W_2 + .6564\,S_1{}^{*} + 4.944\,G^{**} - .03427\,U^{*}$$

$$\begin{array}{cccc} (.1166) & (.3433) & (1.576) & (.01233) \\ -1.426 & 1.912 & 3.137 & 2.779 \end{array}$$

* and ** indicate that the coefficient is significantly different from zero at the 5 percent and 1 percent one tail level, respectively.

Figure in parenthesis below the coefficient refers to the standard error of the coefficient. Figure below the standard error refers to t-ratio.

For the supply equation we obtained estimates of structural coefficients which are significantly different from zero at the 1 percent one tail level for both W_2 and V. The signs of the coefficients coincide with the expected ones in theory for both W_2 and V.

For the demand equation we obtained significant coefficients for S_1, G, and U. The signs of the estimates are what we expect in theory. We failed to obtain significant estimate of coefficient for W_2. Since the standard error, 0.1166 is within magnitude of the estimate of coefficient

1) U. S. Bureau of the Census, *Historical Statistics of the United States: From Colonial Time to 1957*, 1958, D 686, D 698, D 710. (USDA Data).

of W_2, 0.1662, the sign of the coefficient is likely negative. This is in accordance with what we expect in theory.[1] We also obtained a significant coefficient for S_1, the average years of school completed for farm migrants. The sign of the coefficient of S_1 is positive which implies that the demand for farm labor increases with the years of school completed. But, it must be recalled that the measure of quality of migrant labor force, i. e., the average of median years of school by age class of farm population 25 years old and over is inaccurate. We cannot give much credidence on the estimated coefficient of S_1.

An attempt was made to estimate the dynamic structure of the supply function by employing Nerlovian distributed lag model in the framework of simultaneous equations system, but failed to obtain meaningfull result.[2]

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1) I find some evidences that the sign of the coefficient of W_2 is negative in the preliminary experiments in specification of variables in which a little different econometric models were employed. The estimated demand equation were as follows.

$$M = -3379 - 1.704\,W_2{}^* + .7516\,S_1{}^* - 2.166\,G - .09065\,U^*$$
$$\begin{array}{lllll} (2029) & (.7176) & (.3663) & (2.271) & (.04020) \\ -1.665 & -2.374 & 2.052 & -.9535 & -2.255 \end{array}$$

Period: 1921–1941

$$M = -12210^{**} - 1.902\,W_2{}^{**} + 1.955\,S_1{}^{**} - 5.864\,G^* - 0.3047\,U^{**}$$
$$\begin{array}{lllll} (2249) & (.5111) & (.3737) & (3.115) & (.005392) \\ -5.429 & -3.721 & 5.233 & -1.882 & -2.255 \end{array}$$

Period: 1929–1940

* Significantly different from zere at the 5% one tail level.

** Significantly different from zero at the 1% one tail level. Number in parenthesis indicates standard error. In these cases, W_2 is measured by the average annual earnings of full-time employees in the service industry. The fact that a more significant coefficient of S_1 is obtained for the shorter period of 1929–1940 may reflect a character of the series of the years of school completed. The series is essentially an extrapolation of the data of the Census of Population in 1940. The Closer the selected period is to 1940, the better is the estimated series.

2) The statistical results were as follows.

(a) Adjustment lag model

$$M^s(t) = -94.65 + .3776\,W_2{}^{**}(t) - 1.482\,V^{**}(t) - .03086\,M(t-1)$$
$$\begin{array}{llll} (135.3) & (0.9545) & (.4136) & (.09108) \\ -.6993 & 3.954 & -3.583 & -.3389 \end{array}$$

$$M^d(t) = -4586^* - .1721\,W_2(t) + .6764\,S_1{}^*(t) + 5.053\,G^{**}(t) - .3396\,U^{**}(t)$$
$$\begin{array}{lllll} (2566) & (.1262) & (.3686) & (1.829) & (.1273) \\ -1.787 & -1.364 & 1.835 & 2.763 & -2.669 \end{array}$$

(Continued on p. 197)

The goodness of fit of structural equation may be tested by number of variables which have significant coefficients, and by the value of R^2. More specifically, the goodness of fit is tested by the value of R^2 which is accounted for by the explanatory variables which have significant coefficients. In the case of 3 stage least squares method, however, ordinary criteria on the value of R^2 is not applicable. We will tentatively apply the ordinary criteria on the value of R^2 to the second stage of the 3 stages least squares estimation. The value of R^2 is .42 for the supply equation. All explanatory variables, W_2 and V have significant coefficients. W_2 and V are powerfull explanatory variables and that there could be found other powerfull variables among excluded variables, e. g., the cost of migration. There can be also some rooms for correction for error in the measures of W_2 and V.

For the demand equation, the value of R^2 is .53, the number of explanatory variables which have significant coefficients is three out of four, i. e., S_1, G, and U. S_1, G, and U are powerfull explanatory variables in the demand equation.

The error in the measurement of W_2 is conspicious in the demand equation. There is a doubt about omitted variables in our model. As a matter of fact, one of important variables Y is omitted because of the multicolinearity with V.

Very interesting statistical results are obtained in our model especialy for the supply equation of farm labor force to other industries. It seems that we have obtained for the first time the expected signs for the coefficients of wage variables in the supply equation of farm labor force.[3)]

(b) Expectation model

$$M^s(t) = \underset{(188.6)}{15.04} + \underset{(.1456)}{.3031}\, W_2{}^*(t) - \underset{(.5744)}{1.268}\, V^*(t-1) - \underset{(.2018)}{.01537}\, M(t-1)$$

$$.07973 \quad 2.082 \quad -2.208 \quad -.7614$$

$$M^D(t) = \underset{(3302)}{-4601} - \underset{(.1658)}{.1911}\, W_2(t) + \underset{(.4769)}{.6901}\, S_1(t) - \underset{(3.567)}{3.996}\, G(t) - \underset{(.1724)}{.3702}\, U^*(t)$$

$$-1.393 \quad -1.152 \quad 1.447 \quad -1.092 \quad -2.148$$

* Significantly different from zero at the 5% one tail level.

** Significantly different from zero at the 1% one tail level.

3) To my knowledge, no other estimate is found for the structural coefficients in the supply function of farm labor force. Professor C. E. Bishop and Professor Larry A. Sjaastad have attempted to regress the net outmigration rate of farm labor force on the relative income between farm and

(Continued on p. 198)

The elasticities are computed from the estimated structural equations in this section. The elasticities are computed at three points of time. The elasticities evalvated at the middle point on the function is more reliable in a statistical sence. But they are less meaningfull in an economic sence since economic change pushes the economy to other positions on the structural relations. This is especially true for the selected period 1921–1940 which involves ever great short-run swings in the levels of employment and wage earnings. Then an alternative position might argue that a representative elasticity would be found at the point of time under normal conditions of the economy. But the concept of normal condition involves ambiguity.

In the national labor market the unemployment at the rate of over 15 percent was normal during 30's, and the recovery from the ever high unemployment rate was not accomplished before 1941. For the 20's, on the other hand, unemployment at the rate of 5% was normal. As for as the general condition of labor market is concerned the 10 years of 30's is quite different from those of 20's.[4] Then one year from each of these two period will better selected as the representatives of each period. They are 1929 and 1937. Real national income was about the same, i. e., $48.4 billions in 1929 and $49.6 billions in 1937, both in 1947–1949 dollar. Real gross farm income was also at the same level in 1929 and 1937, i. e., $3.8 billions in 1929, and $3.9 billions in 1937, in 1947–1949 dollar. Net out-migration was 195,300 in 1929 and 198,500 in 1937. Both of them are close to the average for the selected period of 1921–1940, i. e., 207,010.

We may be interested in the particular behavior of migration in the

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non-farm sectors and unemployment rate of the economy. But these kinds of regression analysis may not be comparable to my analysis. The regression equation by them cannot be called the supply equation in any sence. In fact the regression equation merely represents the locus of intersections of the supply of and the demand for the farm labor force. C. E. Bishop, "Economic Aspects of Changes in Farm Labor Force", in Center for Agricultural and Economic Adjustment, Iowa State University, ibid., pp. 36–50. Larry A. Sjaastad, 'Structure and Migration Patterns', ibid., pp. 8–28.

4) The general condition refers to the quantitative aspect of labor market such as employment and wage rate. I distinguish structural relations governing the labor market from the condition of labor market. It is assumed that the structural relation was not changed through the two period of 20's and 30's in this paper.

years of The Great Depression. It is desirable, therefore, to find the elasticities in the depression. The year of 1934 is selected for this special purpose in addition to the years selected above.

Untill the linearity is proved to be real, the extreme years should be avoided. Thus the year of 1934 is preferable to 1932 when the net out-migration from agriculture was at the very trough of −127,800 persons. Economic activities were turning around toward the recovery in 1934.

Our structural model is of nature of the static. The elasticities presented in this paper is a combination of long-run and short-run adjustments. The absolute magnitude of the elasticity is rather the short-run nature.

1. *Supply elasticities*

The supply elasticities are summerized in Table 1[1]. The elasticity with respect to wage earnings in other occupations is 6.697 at the 1929 level. The corrected earnings in agriculture has an elasticity of −4.332.

Table 1. Supply Elasticities Implied By Simultaneous Equations Model

	Elasticities with respect to		
	Wage Earnings in Non-farm Occupations	Corrected Earnings in Agriculture	Total Unemployment*
At 1929 Level	6.697	−4.332	−.143
At 1937 Level	7.008	−5.295	−.879
At 1934 Level	6.254	−5.160	−1.430

* The elasticity of total unemployment is computed as elasticity of corrected earnings in agriculture times $U/(L-U)$, U being total unemployment and L being non-agricultural civilian labor force.

1) The elasticity of supply with respect to unemployment is derived as follows.

$$\frac{\partial M^S}{\partial U} = \frac{\partial M^S}{\partial V}\frac{\partial V}{\partial u}\frac{du}{dU} = \frac{\partial M^S}{\partial V}\frac{W_1}{(1.00-u)^2}\frac{1}{L}$$

$$\frac{\partial M^S}{\partial U}\frac{U}{M^s} = \frac{U}{(L-U)}\frac{\partial M^S}{\partial V}\frac{V}{M^s}$$

The supply elasticity with respect to corrected earnings in agriculture is identical to the elasticity with respect to earnings in agriculture. Since

$$V = \frac{W_1}{1.00-u}$$

$$\frac{\partial M^S}{\partial W_1} = \frac{\partial M^S}{\partial V}\frac{\partial V}{\partial W_1} = \frac{\partial M^S}{\partial V}\frac{1}{1.00-u}$$

then

$$\frac{\partial M^S}{\partial W_1}\frac{W_1}{M^s} = \frac{\partial M^S}{\partial V}\frac{1}{1.00-u}\frac{(1.00-u)V}{M^s} = \frac{\partial M^S}{\partial V}\frac{V}{M^s}$$

These are surprisingly high and the former is somewhat higher than the latter. This is the case too in 1937. The elasticity of earnings in non-farm occupations is 7.008 and that of corrected earnings in agriculture is −5.295. The supply of farm labor force is very responsive to the incentive incomes.[1] There is a tendency that the supply elasticity with respect to non-farm earnings is greater than that with respect to farm earnings,[2] although the difference in the elasticities is not statistically significant.

The supply elasticity with respect to national unemployment is −.143 at the 1929 level. Essentially, this is not low, however, as it appears at the first glance. It indicates that an increase in unemployment rate from 5 percent to 6 percent, for example, will lead to a decline in the intended level of migration by 2.86 percent. If the elasticity value of −.879 at the 1937 level is applied, the decline in the supply of farm labor force will be so much as 17.58 percent with a rise in unemployment rate from 5 percent to 6 percent.

Comparing the elasticities at the two levels of the 1929 and 1937 level, the order of magnitudes of three elasticities is the same. The supply elasticity with respect to earnings of non-farm occupations would not be significantly different between the two years. The supply elasti-

Table 2. Demand Elasticites Implied By Simultaneous Equations Model

	Elasticities with respect to			
	Wage Earnings in Non-farm Occupations**	Rate of Economic Growth	Total Unemployment	Education
At 1929 Level	−2.817	.1435	−.272	27.200
At 1937 Level	−3.004	.1435	−1.334	27.174
At 1934 Level	−2.727	.2830	−2.366	27.272

** Computed from the coefficient estimate which is not significantly different from zero at the 5 percent one-tail level.

1) Derived from a study by Micha Gisser, we may find the supply elasticity with respect to agricultural wage rate in the agricultural labor market as a reference although it is not comparable to ours. The supply elasticity is 3.26. Micha Gisser, ibid., Table 4.

2) G. Edward Schuh found the similar kind of supply behavior among hired farm laborers. The elasticity of supply of labor with respect to incentive income of non-farm is higher than that of agricultural wage in the estimated supply function of hired labor in agriculture. G. Edward Schuh, ibid., p. 317.

city with respect to unemployment tends to increase acceleratedly as total unemployment increases. It is the highest as 1.43 in 1934.

2. *Demand elasticities*

The demand elasticities are summerized in Table 2. The elasticity with respect to wage earnings in non-farm occupations is −2.817 evaluated at the 1929 level,[1] considerably lower than the supply elasticity although the demand elasticity is computed from non-significant coefficient. Unemployment has an elasticity of −.272 in 1929.

The elasticity of unemployment again tends to increase acceleratedly with the level of unemployment. It is −1.334 in 1937 and −2.366 in 1934. They are higher than those in the supply relation.

The elasticity of education is high enough to imply the very important role of education in the labor market. It is 27.200 in 1929 and essentially the same throughout the selected period. There is, however, a room for the doubt about the statistical significance of the elasticity. As indicated in the previous discussion the measure of education level of farm labor force is better described as an ordinary trend variable. It reflects every unspecified variables connected with time. Untill the education variable is separated from these unspecified variable, e. g., per capita real national income, physical capital stock, technological factors, we cannot accept the value of elasticity at the face value. Any time-series analysis will be subject to the same difficulties with education variable. We could better count on cross-section analysis to obtain meaningfull coefficient for the education variable.

3. *Properties of Model*

It is very interesting to examine the properties of the model implied by the elasticities in the supply and the demand relations.

How fluctuations in total unemployment affects equilibrium position of the non-farm labor market for farm labor force is the most interesting question. This is discussed first in this section. Elasticities of equilibrium level of endogenous variables with respect to the exogenous variable, total unemployment, will be computed to indicate the impact of fluctuations in total unemployment on out-migration and earnings levels.

1) The corresponding demand elasticity in agricultural labor market is −2.46 derived from Gisser's study.

Table 3. Impact of Total Unemployment on Equilibrium Levels of Migration and Wage Earnings†

Impact on		Elasticity		
		At 1929 Level	At 1937 Level	At 1934 Level
A. Supply of Labor				
Partial	(1)	−.143	−.879	−1.43
Total	(2)	.006	.157	.384
B. Demand for Labor	(3)	−.272	−1.334	−2.366
C. Migration				
Partial	(4)	−.183	−1.24	−1.21
Total	(5)	−.137	−.994	−.749
D. Wage Earnings in Non-farm Occupations**				
Partial	(6)	−.0107	.0266	.0362
Total	(7)	−.0265	−.0548	−.1120
E. Relative Earnings in Non-farm Occupations				
Partial	(8)	−.0107	.0266	.0362
Total***	(9)	.0084	.1042	.1492
F. Wage Earnings in Agriculture	(10)	−.0349	−.1590	−.2612

† Based on the supply and the demand relations in the estimated model, the impacts of fluctuations in total unemployment on the equilbirium levels of migration and wage earnings would be easily derived mathematically.

Suppose that the model is represented as,

$$M = a_0 + a_1 W_2 + a_2 V \qquad \text{(Supply)} \qquad (1)$$

$$M = b_0 + b_1 W_2 + b_2 S_1 + b_3 G + b_4 U \qquad \text{(Demand)} \qquad (2)$$

$$V = \frac{W_1}{1.00 - u} \qquad (3)$$

where M stands for net out-migration; W_2 for wage earnings in non-farm occupations; W_1 for earnings in agriculture; S_1 for educational attainment of farm labor force; G for rate of economic growth; U for total unemployment, and u for total unemployment rate. This model implies equilibrium levels of M and W_2 are a function of others, i.e., V, S_1, G, U, and u. Let's denote the equilibrium levels of M and W_2 by asterisks.

$$M^* = g(V, S_1, G, U, u)$$

$$W_2^* = h(V, S_1, G, U, u)$$

Then the impact of changes in any of these parameters V, S_1, G, U, and u on M^* and W_2^* may be indicated by partial derivatives of M^* and W_2^* with respect to the parameter. We are concerning about the impact of unemployment U and u on M^* and W_2^*.

In the equations system (1)-(3), W_1 is given to the system. But actually W_1 is also affected by U and u through concurrent changes in out-migration of labor from agriculture. Then we may show the impact each case on the explicit assumption about the impact of U and u on W_1. All of impacts will be shown in elasticity expression for convenience.

A) Partial Elasticities

$$\left(\frac{\partial M^*}{\partial U}\frac{U}{M^*}\right)_0 = \frac{1}{a_1-b_1}\left[a_1\left(\frac{\partial M^D}{\partial U}\frac{U}{M}\right)-b_1\left(\frac{\partial M^S}{\partial U}\frac{U}{M}\right)\right] \quad (4)$$

$$\left(\frac{\partial W_2^*}{\partial U}\frac{U}{W_2^*}\right)_0 = \frac{1}{\left(\frac{\partial M^S}{\partial W_2}\frac{W_2}{M}\right)-\left(\frac{\partial M^D}{\partial W_2}\frac{W_2}{M}\right)} \times\left[\left(\frac{\partial M^D}{\partial U}\frac{U}{M}\right)-\frac{1}{a_1-b_1}\left(\frac{\partial M^S}{\partial U}\frac{U}{M}\right)\right] \quad (5)$$

B) Total Elasticities

$$\left(\frac{\partial M^*}{\partial U}\frac{U}{M^*}\right)_1 = \left(\frac{\partial M^*}{\partial U}\frac{U}{M^*}\right)_0+\left(\frac{\partial M^*}{\partial V}\frac{V}{M^*}\right)\left(\frac{dW_1}{dU}\frac{U}{W_1}\right) \quad (6)$$

where
$$\left(\frac{\partial M^*}{\partial V}\frac{V}{M^*}\right) = -\frac{\left(\frac{\partial M^S}{\partial V}\frac{V}{M}\right)\left(\frac{\partial M^D}{\partial W_2}\frac{W_2}{M}\right)}{\left(\frac{\partial M^S}{\partial W_2}\frac{W_2}{M}\right)-\left(\frac{\partial M^D}{\partial W_2}\frac{W_2}{M}\right)} \quad (7)$$

$$\left(\frac{\partial W_2^*}{\partial U}\frac{U}{W_2^*}\right)_1 = \left(\frac{\partial W_2^*}{\partial U}\frac{U}{W_2^*}\right)_0+\left(\frac{\partial W_2^*}{\partial V}\frac{V}{W_2^*}\right)\left(\frac{dW_1}{dU}\frac{U}{W_1}\right) \quad (8)$$

where
$$\left(\frac{\partial W_2^*}{\partial V}\frac{V}{W_2^*}\right) = -\frac{\left(\frac{\partial M^S}{\partial V}\frac{V}{M}\right)}{\left(\frac{\partial M^S}{\partial W_2}\frac{W_2}{M}\right)-\left(\frac{\partial M^D}{\partial W_2}\frac{W_2}{M}\right)} \quad (9)$$

All the values of the involved elasticities except $\frac{\partial W_1}{\partial U}\frac{U}{W_1}$ are ought to be directly computed by the estimates of coefficients in our model. The elasticity of W_1 with respect to U is computed on the independent regression equation of W_1 on u. The regression equation is

$$W_1 = -.0073-6.5067\,u+.5217\,Y-.02585\,P-1.180\,S_1-.02521\,N$$
$$(.00182)\ (2.4312)\quad (.2435)\quad (.02199)\quad (.2434)\quad (.01244)$$
$$R^2 = .943 \qquad \text{Period: } 1921\text{–}1941$$

W_1 … Average annual wage earnings in agriculture.
u … Unemployment rate (%).
Y … Per capita real income.
P … Real agricultural price level.

S_1 ··· Index of average years of school completed for farm population 25 years old and over.

N ··· Farm population 14 years old and over.

** Computed from the coefficient estimate which is not significantly different from zero at the 5 percent level.

*** The total elasticity of relative earnings of non-farm occupations with respect to unemployment is computed as the total elasticity of earnings of non-farm occupations with respect to unemployment minus the elasticity of agricultural earnings with respect to unemployment.

$$\frac{\partial}{\partial U}\left(\frac{W_2^*}{W_1}\right)=\frac{1}{W_1}\frac{\partial W_2^*}{\partial U}-\frac{W_2^*}{(W_1)^2}\frac{dW_1}{dU}$$

$$=\frac{1}{U}\frac{W_2^*}{W_1}\left[\left(\frac{\partial W_2^*}{\partial U}\frac{U}{W_2^*}\right)_1-\left(\frac{dW_1}{dU}\frac{U}{W_1}\right)\right]$$

$$\therefore\quad \frac{\partial\left(\frac{W_2^*}{W_1}\right)}{\partial U}\frac{U}{W_2^*/W_1}=\left(\frac{\partial W_2^*}{\partial U}\frac{U}{W_2^*}\right)_1-\left(\frac{dW_1}{dU}\frac{U}{W_1}\right)$$

The elasticities are summerized in Table 3.

The supply elasticity with respect to total unemployment in Table 1 is a partial elasticity in the sense that it neglects the feedback effect from farm sector to the labor market concerned. A rise in total unemployment leads to a rise in corrected earnings in agriculture to decrease the supply of farm labor force, other things being equal. A fall in migration due to a fall in the supply and in the demand concurrent with the rise in total unemployment, however, results in a fall in earnings in agriculture through the decline in migration to increase total supply of labor in agriculture. The fall in earnings in agriculture, in turn, leads to a increase in the non-farm supply of farm labor force. Total effect of unemployment on the supply is caught here.[1)]

1) The total effect of unemployment on the supply will be indicated by first partial derivative of the supply function with respect to u taking into account the effect of u on W_1.

$$\frac{\partial M^S}{\partial u}=\frac{\partial M^S}{\partial V}\left(\frac{\partial V}{\partial u}+\frac{\partial V}{\partial W_1}\frac{dW_1}{du}\right)$$

In elasticity expression,

$$\left(\frac{\partial M^S}{\partial u}\frac{u}{M}\right)=\left(\frac{u}{1-u}\right)\left(\frac{\partial M^S}{\partial V}\frac{V}{M}\right)+\left(\frac{\partial M^S}{\partial V}\frac{V}{M}\right)\left(\frac{dW_1}{du}\frac{u}{W_1}\right)$$

The first term on the right-hand side of equation represents the partial effect of unemployment on the supply of labor at the first stage of adjustment. The second term represents the partial effect of unemployment on the supply of labor at the second stage of adjustment. Total effect of unemployment is the sum of them.

There are two ways to know the effect of total unemployment on agricultural earninings. The one is to use an extraneous information about the elasticity of agricultural earnings with respect to total unemployment, the other is to estimate it directly by incorporating the agricultural labor market into our model. The former method is applied in this paper.[1] The estimates are indicated on the row 10 of Table 3.

The total elasticity of supply with respect to total unemployment is shown on the row 2 of Table 3. It is .006 at 1929 level, .157 at the 1937 level. The row 1 indicates the partial elasticity. It is −.143 at the 1929 level, −.879 at the 1937 level. The total effect is offsetting the partial effect. The sign of partial elasticity is reversed and the absolute value is decreased. In other words, an increase in total unemployment leads to a rightward shift of the supply curve.

The impact of total unemployment on equilibrium level of migration which takes into account the feedback process is indicated on the row 5. It is −.137 in 1929 and −.994 in 1937.[2]

It will be easily seen that the elasticity of migration with respect to unemployment is smaller than that of the demand curve since the supply curve shifts in the opposite direction to that of the demand curve. In other words, migration does fluctuate with total unemployment but not so much as the demand for labor

Another consequence of different shift rates between the supply and the demand curves concurrent with changes in total unemployment is the changes in wage earnings in the labor market. There are also two kinds of elasticity depending upon whether the feedback effect is taken into account or not. The row 6 indicates the elasticity which neglects the feedback effect. (The sign of the partial elasticity changes with the level of unemployment. But taking into account that the elasticity is computed with the non-significant coefficient estimate, we may not take the changes in the sign seriously.) The row 7 indicates the total elasticity. As expected, the total elasticity is negative and larger than the partial elasticity in its absolute value. As total unemployment increases,

1) See the footnote of Table 3.

2) C. E. Bishop obtained the estimate of the elasticity of net out-migration with respect to total unemployment rate. It was 0.58 for the period of 1920–1957 exclusive of 1942–47. This estimate is comparable to ours taking into account the difference in the selected periods. C. E. Bishop, ibid., p. 46.

the wage earnings in non-farm occupations tends to fall. Compared to the impact of total unemployment on the wage earnings in non-farm occupation, the impact of total unemployment on agricultural wage earnings is substantially strong. This is especially true in the Great Depression (see the row (10) and (7)). Elasticity of wage earnings in agriculture is over two times of the elasticity of non-farm earnings at 1934 level. This tells us how much agricultural earnings is affected by total unemployment.

Next, the elasticity of relative earnings in non-farm occupations with respect to total unemployment is computed. The elasticity indicates percentage changes in the relative earnings in non-farm occupations with percentage changes in total unemployment. It is shown on the row 8 of Table 3. It has a positive sign as expected based on the elasticities of earnings in non-farm occupation and in agriculture with respect to total unemployment. That is essentially the difference of the former minus the latter. The relative earnings in non-farm occupation increases with total unemployment.

Now turn to other interesting properties of the model. The education level of labor force helps very much to enter non-farm job and it also improves wage earnings in the non-farm job considerably. This is indicated by the elasticities of migration and wage earnings with respect to education level. The elasticity of migration with respect to education is 19.18 evaluated at the 1929 level. This is surprisingly high.[1] No other factor can be powerfull as much as education in the labor market.[2]

1) Micha Gisser's model implies that the elasticity of net out-migration with respect to education level is 15.8. The estimate of the elasticity of farm employment with respect to education level is −.60. (Average net out-migration rate is 3.8 percent for the period of 1950–1957.) Then it follows that one percent increase in education level leads to .60 percent decrease in farm employment. This amount of farm employment accounts for 15.8 percent of the net out-migration, i.e., (.600/3.8)=.158.

2) It is a commonly accepted tendency that unemployment rate is lower for higher skilled workers. We can safely say higher skill is closely connected with higher education level of the workers. Then the effect of education is far-reaching in the labor market for farm labor. How education affects unemployment rate to increase migration, how education affects the relative earnings between agriculture and other occupation are interesting questions. But we cannot treat them in this paper. Walter Y. Oi, "Labor as a Quasi-fixed Factor", *J.P.E.*, Vol. LXX, No. 6, Dec., 1962.

Table 4. Effects of Education and Rate of Economic Growth on Equilibrium Levels of Migration and Wage Earnings* in Non-farm

Elasticity with respect to	At 1929 Level	At 1937 Level
A. Education		
in migration	19.18	19.04
in wage earnings	2.863	2.852
B. Economic Growth		
in migration	.1015	.0992
in wage earnings	.0161	.0161

* The effects will be easily computed in the following way. Notation is the same to the footnote to Table 3.

$$\left(\frac{\partial M^*}{\partial S_1}\frac{S_1}{M^*}\right)=\frac{\left(\frac{\partial M^S}{\partial W_2}\frac{W_2}{M}\right)\left(\frac{\partial M^D}{\partial S_1}\frac{S_1}{M}\right)}{\left(\frac{\partial M^S}{\partial W_2}\frac{W_2}{M}\right)-\left(\frac{\partial M^D}{\partial W_2}\frac{W_2}{M}\right)}$$

$$\left(\frac{\partial M^*}{\partial G}\frac{G}{M^*}\right)=\frac{\left(\frac{\partial M^S}{\partial W_2}\frac{W_2}{M}\right)\left(\frac{\partial M^D}{\partial G}\frac{G}{M}\right)}{\left(\frac{\partial M^S}{\partial W_2}\frac{W_2}{M}\right)-\left(\frac{\partial M^D}{\partial W_2}\frac{W_2}{M}\right)}$$

$$\left(\frac{\partial W_2^*}{\partial S_1}\frac{S_1}{W_2^*}\right)=\frac{\left(\frac{\partial M^D}{\partial S_1}\frac{S_1}{M}\right)}{\left(\frac{\partial M^S}{\partial W_2}\frac{W_2}{M}\right)-\left(\frac{\partial M^D}{\partial W_2}\frac{W_2}{M}\right)}$$

$$\left(\frac{\partial W_2^*}{\partial G}\frac{G}{W_2^*}\right)=\frac{\left(\frac{\partial M^D}{\partial G}\frac{G}{M}\right)}{\left(\frac{\partial M^S}{\partial W_2}\frac{W_2}{M}\right)-\left(\frac{\partial M^D}{\partial W_2}\frac{W_2}{M}\right)}$$

The elasticity of wage earnings of farm migrants in non-farm occupation is 2.863 evaluated at the 1929 level. The wage earnings in non-farm occupation are very responsive to education level of farm migrants

The elasticity of migration with respect to rate of economic growth is .1015 evaluated at the 1929 level. The elasticity of wage earnings with respect to rate of economic growth is .0161. Economic growth *per se* does not change the labor market significantly. This is contrasted to the role of education.

VI. Economic Implications

Although the statistical results are still prelimenary in this paper, they contain many interesting points in economic sense. They are going to be discussed in this section. It is desirable to keep in mind the tentative nature of this analysis. It is hoped to find the way of further development of this study in the future.

1. Fluctuations in total unemployment lead to shifts of the non-farm demand curve for labor from farms in the opposite direction. It also causes shifts of the supply curve of labor from farm in the opposite direction. Thus fluctuations in total unemployment are accompanied by fluctuations in the net out-migration in the opposite direction without affecting much the wage earnings.[1] This is the first stage of adjustment to the fluctuations in total unemployment. (See the rows (1), (3), (4), (6), and (8) of Table 3).

A fall in the net out-migration concurrent with a rise in total unemployment leads to an increase in total labor supply in agriculture and thus a fall in agricultural wages. (See the row (10) of Table 3). The fall in agricultural wages, in turn, results in an increase in the non-farm supply of farm labor force to offset the decline in the supply at the first stage of adjustment. With this offsetting shift of the supply curve at the second stage of adjustment, the supply curve eventually can go back to the pre-fluctuation position or even outrun the previous position in a severe depression. (See the row (2) of Table 3). Thus the decreased demand curve is combined with the unchanged or increased supply curve. As a result, the net out-migration declines along the intersections of the decreased demand curve and the slightly increased supply curve when total unemployment increases. (See the row (5) of Table 3.) Concurrently, wage earnings in the market may fall. (See the row (7) of Table 3). Normally, fluctuations in total unemployment are accompanied by fluctuations in the net out-migration and in wage earnings in the adverse direction. This is the picture of the labor market for migrant labor

1) This statement is based on the fact that the partial elasticities with respect to unemployment are nearly the same for the demand and the supply. For example, the elasticity is −1.334 in the demand relation and −.879 in the supply relation for 1937. Allowing for the standard errors in the relevant coefficients the difference in the elasticity between the demand and the supply relations would not be significant.

force implied by our model for the period of 1921–1940.

2. Our model indicates that both the supply and the demand relations of migrant labor force are very responsive to the wage parameter. The fact that the supply is very responsive to the wage difference between farm and non-farm occupations or the signs of coefficient are positive for earnings outside agriculture and negative for agricultural earnings may be understood in the light of cost and returns of human migration.[1)]

3. If the non-farm labor market for farm labor force were out of equilibrium and thus there were a pile of alleged underemployment in agriculture, we would find farm labor force that stands ready to migrate to other occupations at the prevailing wages. Then it follows that the supply elasticity with respect to the wage parameter would be extraordinarily high and the supply of labor would be irresponsive to unemployment. Our result does not support this position (Keynsian position).

One might argue that the unexpectedly high supply elasticities with respect to wage earnings of non-farm occupations in this paper imply a nearly horizontal supply curve reflecting underemployment in agriculture. The extraordinary high elasticity of wage parameter, however, is merely the necessary condition to it. Whenever supply curve passes through wage axis above the origin of the coordinate the supply elasticity with respect to wage is always greater than unity whether slope of the curve is large or small. And the elasticity will increase infinitely as a point of observation gets close to the wage axis. The sufficient condition is undoubtedly an infinite slope coefficient of wage rate. It is noteworthy that the supply elasticity with respect to wage earnings in non-farm occupations is not affected by the general unemployment level; that is, the elasticity does not increase under high unemployment conditions.

Furthermore, the negative signed and high elasticity of the supply with respect to earnings in agriculture involves a convincing evidence against the alleged underemployment proposition. If many farm workers were involuntarily engaging in farming, earnings in agriculture would not

1) Gary S. Becker, "Investment in Human Capital: A Theoretical Analysis", *J.P.E.*, Vol. LXX, No. 5, Part 2, Supplement, October, 1962, pp. 39–40. He establishes that wage difference is more appropriate measure in supply study and wage ratio is more appropriate in demand study.

affect the non-farm supply of labor from farms.

4. How is the business cycle felt in the behavior of the labor market concerned? The total behavior of the labor market for labor force from farm, the net out-migration, is very sensitive to fluctuations in the general employment condition. The non-farm labor market for farm labor force is highly dependent upon the general employment condition. But responsiveness of the supply and the demand to wage parameters is not impaired by the level of total unemployment. In other words, economic rationality of individual economic unit itself is not affected by business cycles.[1)]

The fact that elasticity of corrected earnings in agriculture in the supply relation changes with the general level of unemployment reflects that farm migrants indeed concern very much about the insecurity of employment in other occupations. As total unemployment increases the corrected earnings in agriculture increases to deter migration. The detention effect increases with the level of unemployment. There is found no peculiarity or irrationality in these economic behavior of individual farm worker. It is indicated that real earnings in terms of security of employment is the pertinent parameter of occupational migration for farm workers.

In short, the labor market for migrant labor force is subject to bare impact of total unemployment, but the efficiency of the labor market is not damaged throughout business cycle. The most clear evidence is that the earnings difference between agriculture and other occupations does not increase under high unemployment economy. The difference between the corrected earnings in agriculture and non-farm earnings is $882 for 1929, $923 for 1937, and $655 for 1934.[2)]

5. Our model suggests a moving equilibrium positions of the labor market of farm migrants instead of alleged disequilibrium. It is meaningless in analytical sense to infer inefficiency of functioning of the labor market from a simple minded calculation of relative income between

1) There is no doubt that resource flows in agriculture are responsive to prices at all stages in the business cycle and economic behavior of farmer is rational. Dale E. Hathaway, "Agribulture and Business Cycle" in A Policy for Commercial Agriculture. U. S. Congress, Joint Economic Commitee, November 22, 1957.

2) The wage difference tends to fall in the Depression. This is consistent with a tendency of declining migration of labor force from farms.

agriculture and other industries. First of all, we have to specify the relevant income and identify the relevant labor market accessible to the farm migrants.[1] Conception of competing group is very relevant here. It seems that within the competing group of farm migrants there is no significant disequilibrium in the labor market..

6. The annual earnings of unskilled workers in manufacturing industries was $1,670, and corrected earnings per annum in agriculture was $854 on the average for the selected period. The ratio of the former to the latter is 1.96. The ratio tends to decline somehow during high unemployment period. Is the hypothesis that the labor market is very efficient still valid in the face of this large earnings difference? Yes, the labor market is extraordinarily efficient in that the direction and the magnitude of response of migration to labor earnings difference is exactly what is expected in theory. But this does not imply that effectiveness of the migration in equalizing earnings between agriculture and non-farm occupations is also strong enough. Labor market by itself cannot affect much occupational earnings difference.[2] In the light of theory of investment in migration, we cannot expect equality of earnings for comparable labor if labor market is efficient and competitive.[3] Underemployment problem in agriculture may not be described as a disequilibrium of labor market, instead it is a problem of economic obsolescence of farm workers for whom migration out of farming is not profitable because of their age and particular skill level. This problem emerges in the process of rapid

1) Professor D. Gale Johnson has attempted to eveluate the extend to which labor of comparable quality has earned equal returns at the margin in alternative employments on a regional basis. There was found no significant inefficiency in the labor market. D. Gale Johnson, "Functioning of Labor Market", *J.F.E.*, XXXIII (1956), pp. 75-86: "Comparability of Labor Capacities of Farm and Nonfarm Labor", *A.E.R.*, XLIII (1953): "Labor Mobility and Agricultural Adjustment" in Heady ed., *Agricultural Adjustment Problem in Growing Economy*, Iowa State Univ. Press 1958, pp. 163-172.

2) Professor Dale E. Hathaway has found the uniform occupation-wage differentials in urban-industrial areas. It appears that the main result of urban industrial development is not so much to change the relative income differentials more favorable to farmers but to change occupation complex in favor of high paid occupations. Dale E. Hathaway, "Urban-Industrial Development and Income Differentials between Occupations", *J.F.E.*, Vol. 46, No. 1, Feb., 1964, p. 65.

3) Larry A. Sjaastad, "The Cost and Returns of Human Migration", ibid., p. 88.

industrialization as found in many highly industrialized countries.[1)]

7. In the supply relation the elasticity of corrected earnings in agriculture is lower relative to that of earnings in other occupations. The similar tendency is found in the agricultural labor market.[2)] In relative sense employment is stable and wages are fluctuating in agriculture wheras employment is fluctuating and wages are stable in other industries. These two facts stems from the common root. That is, they reflect the fact that there are many immobile farm labor force in economic sense that migration is not profitable for them within actual range of change in incentive earnings because of more expensive cost of migration due to their particular level of skill and ages relative to earning difference expected in their working years left after migration. Then the supply of labor is inelastic in agriculture. Agricultural wages cannot be stable. Then it is easily seen that when a common variable M is regressed on two conceptually similar variables W_1 and W_2 but the one W_1 is more fluctuating than the other W_2, the elasticity with respect to the former is smaller that the other with respect to the latter.

8. It is already implied in the foregoing discussions that the phenomena is common but the economic reasoning is quite different between the prevailing opinion and our model as to out-migration of labor force from agriculture. The prevailing opinion says that occupational migration out of agriculture is primarily a function of employment opportunities rather than wage parameters. If the supply function of migrant labor were meant by their regression equation, and so is it often, the opinion is entirely errorneous.

First of all, the regression analysis utilized in the prevailing opinion is neither the supply function nor the demand function of migrant labor force.[3)] It represents the locus of moving intersection of the two curves.

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1) See T. W. Schultz, "Reflections on Poverty within Agriculture", *J.P.E.*, No. 58, Feb., 1950, and "Policy to Redistribute the Losses from Economic Progress", Iowa State University, Center for Agricultural and Economic Adjustment, ibid., p. 162.

2) See Table 2 in G. Edward Schuh, ibid., p. 316. The elasticity of supply of hired labor in agriculture with respect to agricultural wage rate is lower than that with respect to non-farm income.

3) For example, C. E. Bishop, ibid., pp. 44-47. Larry A. Sjaastad, ibid., p. 16. Dale E. Hathaway, "Migration from Agriculture. The Historical Record and its Meanings", *A.E.R.*, No. 50, pp. 379-391.

The ill-fed confusion in this dimension yields to far-reaching misconception about economic behavior of out-migration of farm labor force. The confusion should be made clear at this moment. The locus of moving interesection could be insensitive to wage difference or wage differential (ratio) while the supply is very sensitive to wage difference. Firstly, the supply curve could shift concurrent with the demand curve for farm workers. Secondly the supply is not function of misspecified over-all wage differential between agriculture and induustry as such. It is one thing to advocate that observed out-migration of farm workers is not a function of wage difference (or wage differential) on the regression analysis of locus of intersection of the supply and the demand curve. It is another to advocate that intended out-migration is a function of wage difference.

The difference in economic reasoning on the subject is very important since the policy implications essentially differ between them.

9. The importance of education of farm people and the stability of employment in other industries can hardly be overemphasized to solve the farm problem. Improvement of educational attainment of farm people is followed by increases in out-migration and wage earnings of migrants outside agriculture as well. No other policy than the education policy can be more effective and efficient in coping with the underemployment problem in agriculture.[1)]

VII. Unfinished Analysis

It will be helpfull for further development of this study of farm migration to list up the unfinished works.

1. The earnings of unskilled workers in manufacturing industries was $1.760 and the corrected earnings per annum in agriculture was $854 on the average for the selected period. How can we explain this large earnings difference? This is the central question in the subject. I suspect that the earnings difference could be explained by the disequilibrium in the labor market. The function of the labor market is considerably efficient. Equilibrium of migration should be analysed in terms of cost and returns to the migration. But I have not estimated any cost

1) Strictly speaking, this prospective role of the education should be tested against its cost.

of migration. Inequality in earnings between farming and non-farm occupations may be much larger than needed to cover the costs.[1] For this analysis, cost data, data on wage earnings by occupation, and data on migration by age, by occupation entered are badly needed.

2. Education variable which is employed to measure quality of labor of farm migrants is the weakest variable amoung others in this paper. It is essentially extrapolation of the 1940 Census data and is better described as an ordinary trend variable although school attendance rate is utilized in the extrapolation. It reflects every unspecified variables which are connected with time. Untill the measure of educational attainment of farm workers is isolated from these unspecified variable, e. g., per capita national income, physical capital stock, technological factors we may not accept the coefficient of education variable at the face value.

More basic difficulty with the education variable is how the years of school completed can measure the quality of industrial labor adequately. For example, one might raise a question that a given years of school completed ten years ago is quivalent in terms of its usefullness in industrial work to the same years of school completed this year.[2]

3. There were migration of labor force out of and into agriculture during the selected period the behavior differs between these two. It is, therefore, questionable that the net out-migration is a pertinent measure of the migration from agriculture. This paper is untenable to this question. Gross migration could be more pertinent measure of actual behavior of out-migration of farm worker. At the same time, the analysis of in-migration of workers to agriculture is another subject of independent importance. The in-migration could be the key factor of underemployment problem in agriculture.[3]

1) I owe this point to Professor Albert E. Rees.
2) I owe this point to Professor Theodore W. Schultz.
3) I owe this point to Professor Theodore W. Schultz.

Table 5. Data

	(S_1) Index of Years of School Completed (1960=100.0)	(G) Rate of Economic Growth (%/Year)	(U) Unemployed Persons in the Economy (in 1,000)	(V) Corrected Earnings in Agriculture ($/Year)	(W_2) Earnings of Unskilled Workers in Manuf. Ind. ($/Year)	(M) Net Out-Migration (in 1,000)
1921	79.2	−8.0	5,010	719.7	1,325	234.2
1922	79.5	15.9	3,220	662.1	1,420	475.2
1923	79.7	12.0	1,380	724.0	1,530	337.3
1924	79.9	−0.1	2,440	778.3	1,535	203.5
1925	80.2	8.6	1,800	775.6	1,530	294.1
1926	80.4	5.6	800	749.4	1,535	375.6
1927	80.6	−0.2	1,890	777.1	1,585	189.9
1928	80.9	0.8	2,080	787.1	1,630	176.1
1929	81.1	5.8	1,550	782.9	1,665	195.3
1930	81.3	−9.5	4,340	833.3	1,535	126.4
1931	81.7	−7.0	8,020	799.1	1,475	32.3
1932	82.0	−15.0	12,060	795.8	1,240	−127.8
1933	82.3	−2.7	12,830	796.6	1,350	188.4
1934	82.6	9.4	11,340	784.6	1,440	164.3
1935	82.9	10.4	10,610	853.7	1,560	249.4
1936	83.2	13.3	9,030	872.2	1,685	264.3
1937	83.6	5.9	7,700	901.7	1,825	198.5
1938	83.9	−4.1	10,390	1,057.6	1,715	154.4
1939	84.2	8.1	9,480	1,095.8	1,920	252.7
1940	84.5	8.7	8,120	1,116.5	1,995	223.1

Sources of Data

(S_1)—Index of average years of school completed of farm population. Bureau of the census, *U. S. Census of Population 1920, 1930, 1940.*

(G)—Annual rate of economic growth. E. F. Denison, *The Source of Economic Growth in the United States and the Alternatives Before Us,* Supplementary Paper No. 13 Committee of Economic Development, 1962, p. 17.

(U)—Unemployment in the economy (HS-D 46). For 1920–1928, S. Levergott, "Annual Estimates of Unemployment in the United States, 1900–1954", in *The Measurement and Behavior of Unemployment,* NBER, 1956. For 1929–1939, "Labor Force, Employment and Unemployment, 1929–1939: Estimating Methods" *Monthly Labor Review,* July, 1948, p. 50. For 1940, Bureau of the Census,

Current Population Reports, Series p. 50, No. 2.

(V)—Corrected earnings in agriculture. Average annual earnings per hired workers in agriculture is obtained by dividing the aggregate expenditure on hired labor by number of hired workers. Total expenditure on hired labor and number of hired workers come from *Major Statistical Series of the U. S. Department of Agriculture*, Vols. 3 and 7, Agricultural Handbook No. 118. Unemployment rate comes from Bureau of the census, *Historical Statistics of the United States*, Series D 47, p. 73. Deflator is C.P.I. (1947-1949=100) of Bureau of Labor Statistics in Bureau of the Census, ibid., Series E 113, p. 126.

(W_2)—Average annual earnings of unskilled male production workers in manufacturing industries (HS-D 665). National Industrial Conference Board, *The Economic Almarnac for 1950*, New York, 1950, pp. 336-344. Originally, average weekly earnings was obtained by dividing the aggregate payroll for reporting companies by the aggregate man-weeks. The distinction in classification between unskilled male and other male workers was not precisely stated by NICB, and the classification was made by the reporting firms. Deflator is the same to V.

(M)—Net out-migration of farm labor force. The series is estimated by applying the net out-migration ratio of farm population to farm employment figure. The net out-migration ratio of farm population comes from Agricultural Marketing Services, USDA, *Farm Population, Migration To and From Farms, 1920-150*, AMS-10, 1954; *Farm Population Estimated For 1955-1957*, AMS-80, 1957. The data for 1930-1939 is adjusted for the change in farm population through classification of residence so that comparability of figures is retained throughout the period 1920-1940. From 1930 to 1939 the figures exclude entrance into or withdrawal from farm population without migration. The data for farm employment comes from, Agricultural Marketing Services, USDA, *Major Statistical Series of the U. S. Department of Agriculture*. Vol. 7, Agricultural Handbook No. 118.

FUNCTIONING OF LABOR MARKET AND FARM PROBLEM IN THE UNITED STATES

By

Yukio Masui

This study of farm-nonfarm migration in the United States from 1921 to 1940 was made within the framework of costs of and returns to the activity of migration from agriculture. The supply function of labor from farms to nonfarm sector was estimated simultaneously with the nonfarm demand function for the labor. Special effort was made to identify the competing group of farm workers in terms of comparable quality of labor in the nonfarm labor market and to specify the relevant wage variables in the supply and the demand functions.

The results indicate a strong response of migration to earning difference, years of schooling of farm population and national unemployment. The nonfarm labor market for farm workers was functioning quite efficiently. The gross wage difference between farm and nonfarm sectors is regarded as an equalising wage difference instead of disequilibrium of the market. Farm problem is described as the problem of instability of nonfarm employment, education of farm people and the obsolescence of farm skill in the process of economic growth rather than the problem of inadequate functioning of nonfarm labor market for farm workers.