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SOME DYNAMICS OF THE AGRICULTURAL LABOR MARKET

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Journal Paper No. ____, Purdue Agricultural Experiment Station. The structural model on which this paper is based was developed at the University of Chicago under a grant from the Ford Foundation. Additional research took place at Purdue University under Project 1107. Helpful comments on an earlier draft of this paper were received from Vern Ruttan, Zvi Griliches, Paul Farris, and Charles French.

In the period since 1929 economic forces both in agriculture and in the nonfarm sector have led to a sizeable transfer of labor resources from the farm to the nonfarm sector. Considerable attention has been devoted to the analysis of this transfer process, primarily because of its relevance in obtaining incomes for farm people comparable to those in the nonfarm sector.

The failure of incomes in the farm sector to rise as rapidly as those in the nonfarm sector has been taken as *prima facia* evidence that the labor transfer process has not been rapid enough. A major portion of the research has in turn been devoted to examining the impediments to the desirable farm to nonfarm adjustment, with the hope that this would aid in developing more desirable public policies.

Attention has been centered on three points of the transfer process. One group, among them Schultz,[1/] Gale Johnson,[2/] and my discussant,[3/] have concentrated on the migrant, and argued that the failure to obtain a more rapid rate of adjustment was due to the lack of mobility of the labor resource. This approach leads to a policy recommendation of subsidizing mobility *per se*, either directly through cash payments, or indirectly through improved labor market information and increased capital formation in the human agent.

1/ Schultz, T. W., "An Alternative Diagnosis of the Farm Problem," Journal of Farm Economics, Dec., 1956, pp. 1137-1152. See also Homesteads in Reverse.

2/ See Johnson, D. Gale, "Functioning of the Labor Market," Journal of Farm Economics, Feb. 1951, pp. 75-87; and "Labor Mobility and Agricultural Adjustment," Agricultural Adjustment Problems in a Growing Economy, The Iowa State College Press, Ames, Iowa, pp. 163-172.

3/ Martin, Lee, "The Role of Investment in Human and Community Capital," Journal of Farm Economics, December 1960, pp. 1210-1221.

A second group, among them Hendrix,[4] have stressed conditions in the nonfarm sector as an impediment to labor mobility. Here attention is focused on the imperfections in markets in the nonfarm sector. A prominent role is given to lack of competition in both product and factor markets in the nonfarm sector in preventing additional labor from being utilized at prevailing wage rates.

Glenn Johnson has been almost alone in stressing still a third impediment to mobility. His theory of fixed assets suggests that labor may be "trapped" in agriculture due to the commitment of nonlabor resources in highly specialized forms. The farm operator can then best utilize his total bundle of resources by remaining in agriculture, despite the fact that he could obtain a higher return on his labor resource elsewhere. Johnson's analysis places the impediment directly in the agricultural industry.

In this paper I want to focus attention directly on the transfer process. Specifically, I want to do three things: (1) examine historically the degree to which the agricultural industry has been out of long-run equilibrium adjustment, and the nature of the adjustment process; (2) identify and quantify the adjustments imposed on the agricultural labor force by exogenous forces, and (3) identify and measure the degree to which the incentive for movement has come from demand conditions within agriculture and the degree to which they have been labor supply conditions. The analysis will be based on a structural model of the agricultural hired labor market that identifies both long-run and short-run relationships by the use of a Nerlove-type distributed lag model.

4/ Hendrix, William E., "Income Improvement Prospects in Low-Income Areas," Journal of Farm Economics, Dec. 1959, pp. 1065-1075.

5/ Johnson's position with respect to labor is perhaps best summarized in "The Labor Utilization Problem in European and American Agriculture," Journal of Agricultural Economics, June 1960.

A Model of the Market for Agricultural Hired Labor[6/]

The structural model consists of a long-run demand relation and a long-run supply relation, both of which are stochastic, and two non-stochastic adjustment equations,[7/] one for the supply relation and one for the demand relation. For estimation purposes, these are reduced, in the manner developed by Nerlove,[8/] into two equations in two endogenous variables. Agricultural wages and hired employment are assumed to be endogenously determined subject to the following exogenous variables: income to be earned in nonfarm employment, unemployment,[9/] the civilian labor force, "real" farm prices, and an index of technology.

In implementing the distributed lag analysis, reduction of the four-equation system leads to the introduction of hired employment lagged as an additional independent variable in each estimating equation. In addition, a trend variable is introduced into the supply equation to remove part of the specification bias that may arise as a result of omitted variables.[10/]

Models estimated using Nerlove-type distributed lags give rise to two sets of structural equations--long-run equations and short-run equations.

6/ A more complete description of the model can be found in the author's doctoral dissertation, "An Econometric Investigation of the Market for Hired Labor in Agriculture," University of Chicago, 1961, and in an article by the same title in the Journal of Farm Economics, forthcoming. The structural and reduced form equations on which this analysis is based appear in the appendix.

7/ See the appendix.

8/ Nerlove, Marc, Distributed Lags and Demand Analysis, Agriculture Handbook No. 141, Agricultural Marketing Service, USDA.

9/ Nonfarm earnings and unemployment are combined into one variable, hereafter referred to as corrected nonfarm income, by multiplying average compensation of employees in the nonfarm sector by the percent of the labor force employed.

10/ There are strong reasons for suspecting that the coefficients of adjustment are subject to a greater extent than other parameters to specification bias, or the omission of relevant variables.

This in turn implies that two sets of reduced form equations can be derived. A major portion of the analysis in this paper is based on predicted values from the long-run demand and supply relations, and from the four reduced forms that can be derived.

Coefficients of Adjustment

Models estimated in this framework lead to coefficients of adjustment,[11] which indicate what proportion of the discrepancy between current values and equilibrium values are eliminated in a given time period. Three coefficients of adjustment may be obtained from a two-equation supply-demand model: one for the demanders of hired labor--the farm operators, one for the suppliers of hired labor--members of the labor force, and one for the employment reduced form[12]--which indicates the adjustment of hired employment as suppliers and demanders interact with each other.

The coefficient of adjustment implied by the supply equation is .32,[13] indicating that 32 per cent of the discrepancy between equilibrium and actual employment is removed in a given time period. Eight years are required to eliminate 95 per cent of a given disequilibrium, assuming other factors remain unchanged.[14] This coefficient of adjustment implies long-run elasticities that are approximately three times as large as the short-run elasticities, where the short-run refers to the response within one year.

11/ The estimated coefficients of adjustment are important dynamic properties of the model and permit an analysis of the time path of adjustment. In this sense they can be used to determine the length of time needed to reach long-run equilibrium adjustments on the assumption that a change in economic conditions is permitted to work itself out completely.

12/ The employment reduced form derived from the short run structural equations is a distributed lag model. Hired employment is the dependent variable and hired employment lagged one period appears as an independent variable.

13/ The adjustment refers to the year-to-year changes in average employment over the entire year, and not to seasonal variation within the year. The same applies to the other coefficients of adjustment.

14/ The adjustment path is asymptotic to the equilibrium level.

The coefficient of adjustment implied by the demand equation is .30, indicating that 30 per cent of the discrepancy between equilibrium and actual employment is eliminated in a given period of time by the demanders of labor. This is slightly lower than the coefficient of adjustment on the supply side, and would require between eight and nine years to eliminate 95 per cent of a given disequilibrium, assuming other factors remain unchanged. This coefficient of adjustment also implies long-run elasticities that are slightly more than three times as large as the short-run elasticities.

The coefficient of adjustment for the employment reduced form, which indicates how the forces of supply and demand actually work themselves out in changes in the level of employment, is .31. The close similarities in the coefficients of adjustment for supply and demand result in actual levels of adjustment being quite similar to those for the demanders and suppliers. Thirty-one per cent of the discrepancy between actual employment and long-run equilibrium employment is removed in one year, with slightly over eight years being required to eliminate 95 per cent of the difference, if conditions are unchanging so that the original "shock" can completely work itself out.

Intuitively, eight years appears to be a long time for reaching a new equilibrium level. Three comments can be made on this. First, the institutional characteristics of the farm labor market are very important. Changing types of work is seldom a spur-of-the-moment decision, but taking alternative employment for members of the farm labor force typically involves moving long distances, with the concomitant separation from family and friends and the uncertainty of new social environments. This is compounded by the fact that an important part of the hired labor force is composed of younger people from local communities. This component of the agricultural labor force finds

alternative employment only as the underlying population base from which it is drawn shifts geographically, or as local industrialization takes place. Both of these are admittedly slow processes.

Second, the importance of the eight-year adjustment period is tempered by recognizing that over 75 per cent of the adjustment to a new equilibrium level is accomplished within three years. The time path of adjustment implied by the employment reduced forms shows quite clearly that a major portion of the adjustment takes place in the early years. (Figure 1)

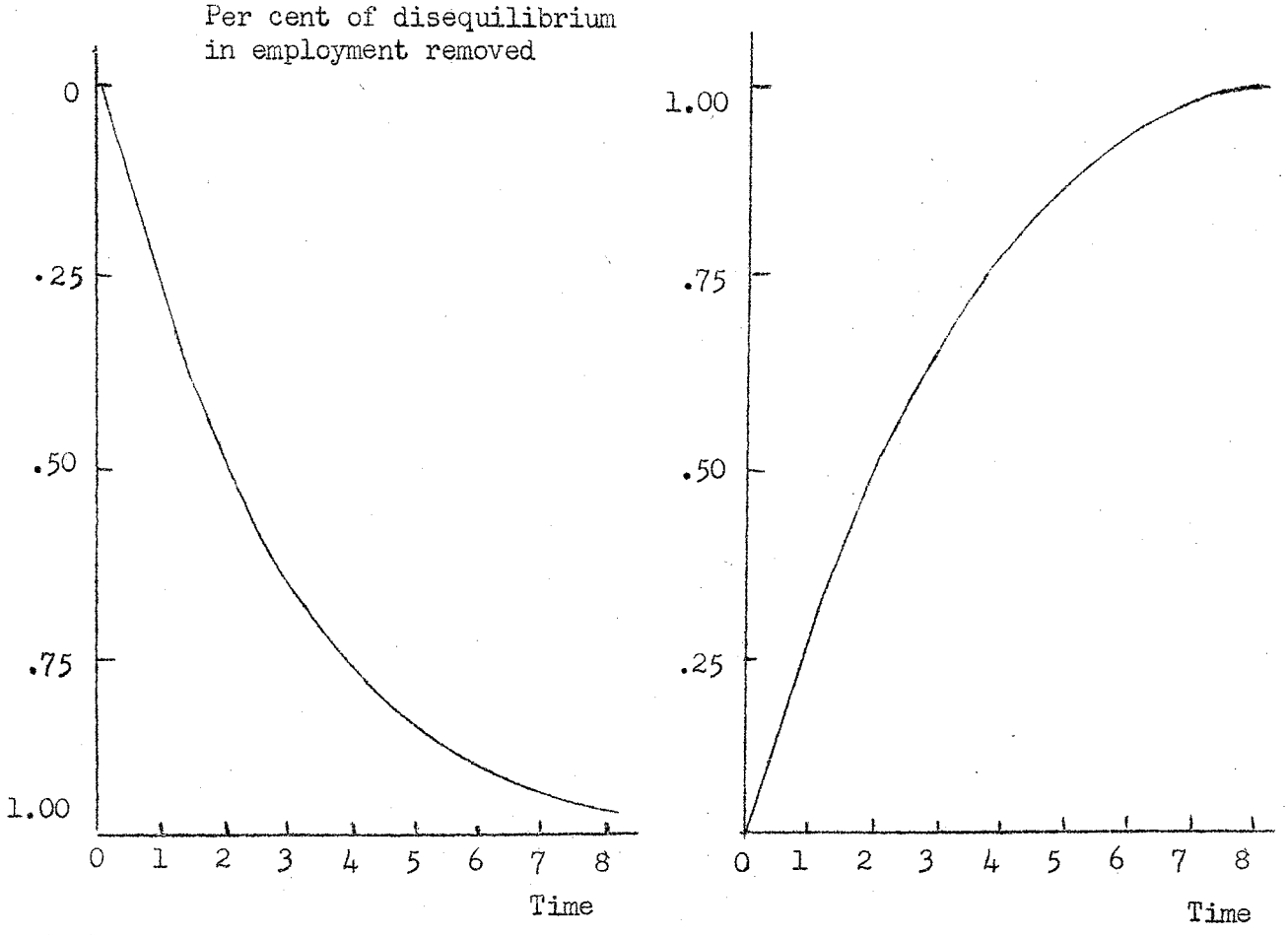
And finally, conditions seldom exist in the real world in which a given economic force is permitted to work itself out completely. Economic conditions continue to change, and in the agricultural labor market, the consequence of these changing conditions has been fresh stimuli almost each year to further reduce the size of the labor force.

Comparison of Long-Run Equilibrium Levels of Employment With Actual Levels of Employment[15/]

The distributed lag models used in this study identify the long-run relations of firms and members of the labor force. Consequently, it is possible to compute historically the long-run equilibrium levels of employment and make a comparison with the actual level of employment. The comparison illuminates directly the dynamics of the agricultural labor market, especially in the context of a market receiving continuous impetus to change from exogenous forces.

Care must be exercised in not reading an excessive amount of normative content into this equilibrium concept. The long-run equilibrium concepts indicate the quantity of labor supplied and demanded if agricultural firms

15/ A more detailed exposition of the analysis in this section is presented in a paper read before the American Farm Economic Association: "The Long-Run Equilibrium in the Hired Farm Labor Force: History and Implications."



(a) Decreasing employment (b) Increasing employment

Fig. 1.--Time Path of Adjustment.

and members of the labor force took current information seriously and adjusted completely to it. In some cases this may not be the action they "should" take.16/ In the same respect, the equilibrium level should not be assumed optimum from an efficiency standpoint. Information concerning the marginal costs and returns of changing the level of resource use would be needed to permit efficiency statements.

The underlying equations on which the analysis is based are behavioral equations. As such they provide insights into the behavior of suppliers and demanders of hired labor, independent of normative and/or economic efficiency propositions.

Figure 2 provides a comparison of the long-run equilibrium level of employment--as implied by the employment reduced form--with the actual levels of employment in the period from 1929 to 1959. It is clear from this comparison that through most of the period the actual level of hired farm employment has been greater than the long-run or equilibrium level of employment. The two exceptions are 1934 and the years 1946 through 1949.

Both demand and supply forces were at work in each of these periods to raise the equilibrium level above the actual level. In 1934, real farm prices were roughly 10 per cent higher than they had been in 1933. In addition, labor earnings in the nonfarm sector declined in 1934, shifting the labor supply schedule to agriculture to the right.

In the immediate post-war period, 1946 and 1947 were years of the highest relative prices for farm products since 1929 (index values of 124 and 123

16/ A basic, implicit assumption of using distributed lags is that long-run equilibrium values continually change, and in fact, fluctuate rather widely. For reasons of strategy, or rigidities of various sorts, economic man is assumed not to adjust completely to these changing equilibrium levels in a given period of time. In the farm labor market, where historic conditions have been such as to require essentially a continuous transfer of labor resources to nonfarm employment, there is relatively more normative content present.

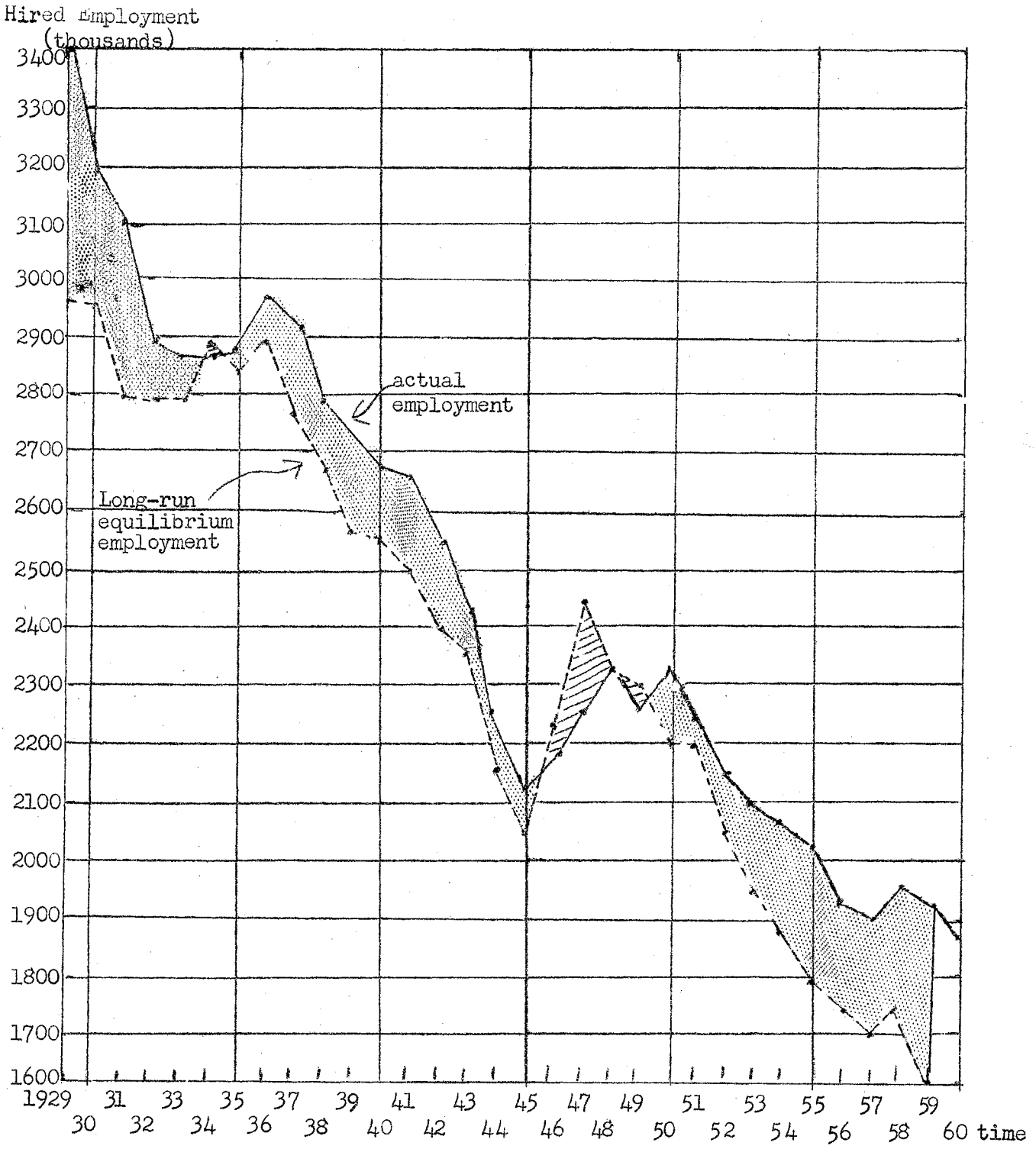


Figure 2

Actual Employment Compared to Long-run Equilibrium Employment In Agriculture 1929-1959.

respectively). In addition, the sizeable increase in the size of the civilian labor force as a result of disarmament shifted the labor supply schedule to the right. Real farm prices dropped off to an index of 115 in 1948 and 105 in 1949, still relatively high for the total period covered, but the 1948-49 recession, with its high level of unemployment, was probably the dominant factor making the equilibrium level of employment in 1949 higher than the actual level.

The average disequilibrium for the entire period was 6.2 per cent. (Disequilibrium is measured as the percentage discrepancy between the equilibrium level of employment and the actual level of employment at a point of time, with equilibrium employment as the base.) The average disequilibrium for only the years when actual employment was in excess of the equilibrium level was 6.7 per cent. If attention is focused on shorter periods of time, there are roughly three periods when the agricultural hired labor force was seriously in excess of its equilibrium level: 1929-31, 1937-42, and 1952-59. (Table 1.)

Table 1. Average Long-run Disequilibrium in Employment, Selected Periods.

	1929-31	1932-36	1937-42	1943-45	1946-49	1952-59
Reduced form	11.0%	2.1%	5.7%	3.4%	2.9%*	10.6%

*Predominantly negative values.

Since economic conditions do continue to change rather than remain stationary so the consequences of previous change can work themselves out, it is useful to examine historically how soon a given equilibrium level of employment has been attained. This can be done by referring again to Figure 2 and examining the horizontal distance between actual and equilibrium levels of employment, recognizing that the estimates are annual averages with straight

line interpolation. This means that only yearly estimates are meaningful, and not the movement within the year.

In the major portion of the cases, equilibrium levels of employment are attained in from one to two years. Exceptions are the equilibrium levels of employment for the years 1929, 1931, 1938, 1939, 1940, and 1952 to the present. And only in the period from 1954 to the present has the actual level of employment lagged the equilibrium level by more than three years. Considered in a broad historical context, the period required to reach the equilibrium levels of employment has been comparatively short--until recent years.

Summarizing this comparison of the equilibrium levels of employment with the actual levels of employment, three points can be stressed: (1) The persistence of the "farm problem," which is characterized by low labor returns in agriculture, reflects the continuing need to transfer labor resources, rather than the failure of the adjustment to take place. The problem is one of continually adjusting toward a dynamic equilibrium, and historically a given equilibrium level of employment has been attained in a relatively short period of time, (2) there have been three periods of serious disequilibrium in the period since 1929, and (3) in the period since 1953 we find a persistent widening in the gap between actual employment and the long-run equilibrium level of employment.

The Impact of Exogenous Forces on the Agricultural Labor Market

The Impact of Economic Growth

Changes in the farm and nonfarm sector of the economy impose adjustments on the agricultural labor market. These changes are channeled into the model through variables treated as exogenous. The more systematic of

these changes are those associated with the growth of the economy, as reflected through increases in the civilian labor force, increases in nonfarm earnings, and increases in the level of technology in the farm sector. These are forces that operate on both the demand and supply of agricultural labor, and an understanding of their impact gives some insight into the nature of the labor adjustment problem faced by agriculture.

The impact of these exogenous forces can be analyzed through the use of the reduced form equations. Percentage changes in the exogenous variables can be imposed, with a recent year chosen as a base, and the impact on the endogenous variables, agricultural wage and hired employment, examined.17/

In the period covered by the model, 1929-1957, the economy has been subject to varying rates of growth, ranging from the decline in economic activity of the 1930's to the rapid expansion of the war and postwar years. In order to analyze to a limited extent the effects of these varying rates of change, two conditions of economic growth are examined.

Under the first condition, the average rate of growth over the entire 1929-57 period is used in an attempt to arrive at an "average" rate of growth that could be considered typical. During this period economic growth has been characterized by average annual increases of 1% for the civilian labor force, 2% for nonfarm average annual earnings,18/ and 1½% in the level of technology.

17/ For this purpose, values of the exogenous variables were chosen at their 1958 level, with the exception that unemployment was adjusted to 4 per cent. This permits an evaluation in the context of recent magnitudes for the variables, without extrapolating excessively beyond the limits of the model, and in addition develops the analysis in the context of a fully employed economy. The predicted values for the endogenous variables are obtained on the basis of the conditions existing in 1958. Then the various changes in the exogenous variables are imposed with 1958 as a base and the resulting changes in the endogenous variables are evaluated from their 1958 predicted values.

18/ The 2 per cent refers to the increase in pecuniary earnings, not to the corrected nonfarm income concept. In computing the corrected nonfarm income for the prediction, pecuniary earnings were increased 2 per cent from their 1958 level, the civilian labor force was increased 1 per cent from its 1958 level, and unemployment was taken as 4 per cent of this projected labor force.

Under the second condtion, growth of the economy as represented by the period from 1947 to 1957 was used. This was a ten year period of rather rapid growth in which nonfarm annual earnings were increasing at a more rapid rate of 2.8% per year, the civilian labor force increased at a more rapid rate of 1.2% per year, and technology in agriculture was increasing at a more rapid rate of 2.5% per year.19/

Impacts of these changes on the agricultural labor market are examined under two conditions: first on the assumption that the government is able to maintain real farm prices at a stable level, and second, on the assumption that real farm prices decline at the rate of 3 per cent per year, as they did in the period from 1951-1957. (Table 2) In both cases it is assumed that the level of unemployment remains at 4 per cent of the labor force.

The impact of the typical conditions of economic growth are shown in the top part of the table. In Situation 1, where real farm prices are held constant, agricultural wages lag slightly behind the increase in nonfarm earnings in the short run, and a slightly less than one per cent reduction in the labor force is indicated. Given sufficient time to adjust completely to the growth of the economy, the wage rate would return almost to its original level, with approximately a three per cent transfer of labor resources out of agriculture.

19/ Ruttan's index of technology, as used in estimating the model, was constructed before the latest revision of the manhours worked in agriculture series. On that basis it shows a 1.3% increase per year in the level of technology from 1947-57. The revision, based on the period from 1949 to the present, will result in Ruttan's index showing a considerably more rapid rate of technological advance in recent years. Since the revision in the index of technology is not available at the present time, a crude estimate of 2.5% per year as the rate of change has been assumed. This is consistent with Barton's index of productivity. (Changes in Farm Production And Efficiency, Statistical Bulletin No. 233, U. S. Department of Agriculture, July, 1960.) Introducing this more rapid rate of technical change into the model estimated with a data series showing a slower rate of change probably overstates slightly the impact of technical change.

Table 2. Percentage Changes in Agricultural Wages and Hired Employment in Response to Selected Annual Changes in Exogenous Variables.

Typical Conditions of Economic Growth:[a]

	Situation 1[c]		Situation 2[d]	
	Agricultural Wage	Employment	Agricultural Wage	Employment
	percentage change			
Short run[e]	+1.9	- .8	+1.2	-1.2
Long run[f]	+ .2	-2.9	- .1	-4.5

Recent, More Rapid, Rate of Economic Growth:[b]

	Situation 1		Situation 2	
	Agricultural Wage	Employment	Agricultural Wage	Employment
	percentage change			
Short run	+2.1	- .9	+1.2	-1.4
Long run	+2.3	-3.5	+1.3	-5.0

Notes:

a. Represents average changes in exogenous variables in 1929-57 period: Civilian labor force increases 1%, real average annual nonfarm earnings at 2%, and technology at 1½%; unemployment is held at 4% of labor force and trend variable increased 1 unit.

b. Represents average changes in exogenous variables in 1947-57 period: Civilian labor force increases 1.2%, real average annual nonfarm earnings at 2.8%, and technology at 2.5%; unemployment is held at 4% of labor force and trend variable increased 1 unit.

c. Real farm prices held constant (1958 level).

d. Real farm prices assumed to decline by 3%.

e. The short run indicates the change in the current year implied by the given changes in exogenous variables.

f. The long run indicates by how much the endogenous variables would change eventually if the given changes in exogenous variables persisted indefinitely. The computed coefficient of adjustment implies that 95% of this change would be accomplished in slightly over 8 years.

In Situation 2, where real farm prices are assumed to decline three per cent per year in the presence of the normal growth of the economy, the agricultural wage rate lags further behind the increase in nonfarm earnings in the short run, and results in a somewhat larger transfer of labor out of the industry. In the equilibrium position, a slight decline in agricultural wages is indicated and a larger decrease in the quantity of labor employed.

The impact of the more rapid conditions of economic growth is shown in the lower half of the table. In Situation 1, with real farm prices held constant, agricultural wages lag relatively more behind the increase in nonfarm earnings in the short run, and slightly less than a one per cent reduction in the labor force is indicated. Given sufficiemt time to adjust to these changed conditions, the wage rate increases slightly more and employment declines by $3\frac{1}{2}$ per cent. The short-run impact of these changes is reflected in the wage rates, while the longer run effect is reflected primarily in changes in the level of employment.

In the second situation, where farm prices are declining, the rise in the wage rate is much less, and the impact on the level of employment is much larger, particularly on the equilibrium level of employment.

Differences in the impact of the two rates of growth are reflected primarily in their effect on agricultural wage rates. Under the slower conditions of growth, equilibrium wage rates in agriculture lag seriously behind those in the nonfarm sector. Under the more rapid conditions of growth, the equilibrium agricultural wage rate more nearly approaches the change in the nonfarm sector, though the short run adjustment in the wage rate lags relatively more the change in the nonfarm sector. A somewhat larger reduction in the agricultural labor force is induced with the more rapid rate of growth.

In both cases however, it is important to recognize that these are not once-for-all shocks to the agricultural labor market, but continuing annual adjustments imposed from the growth of the economy, assuming no change in structure. The structural relationships as estimated indicate that even if real farm prices are stabilized, agricultural wages will continue to lag behind nonfarm earnings, and the long-run equilibrium level of employment will decline. If real farm prices decline as they have in recent years, agricultural wages lag even further and the equilibrium level of employment decreases more rapidly. The growth of the economy results in a continual need to transfer labor out of agriculture, and the transfer process itself results in agricultural wages lagging behind the increase in nonfarm earnings.

Is Labor "Pulled" or "Pushed" Out of Agriculture?

A quite different question can be asked using the same kind of analysis. For some purposes it is useful to know to what extent labor has been "pushed" out of agriculture by declining labor conditions on the farm and to what extent it has been "pulled" out by conditions in the nonfarm sector. One way of answering this is to take the reduced form for employment, divide the exogenous variables into those appearing only in the demand equation and those appearing only in the supply equation, and ask which group accounted for a larger fraction of the total change in employment and during what periods.

By using the long-run reduced form,[20] changes in the equilibrium level of employment can be examined. For the entire period, 1929-1959, 29% of the decline in equilibrium employment is explained by variables appearing in the farm demand for labor equation and 71% by those appearing in the farm labor

20/ The relative orders of magnitude are the same with the short-run reduced form, though the analysis is compounded due to the presence of the lagged variable.

supply equation. Hence, for the period in general, the major portion of the decline in the long-run equiliorium level of employment is explained by forces in the nonfarm sector. In general the labor has been "pulled" off the farm.

Shorter periods of time can be analyzed in a similar fashion. (These periods will be selected to roughly parallel the periods of serious long-run disequilibrium.) In the first period, 1929-32, the demand and supply forces were offsetting. The net reduction in the equilibrium level of employment in this period was 184,000. This represents the resolution of a 106,000 increase in the agricultural labor force called for from the supply variables and a 290,000 reduction called for from the demand variables. Stated differently, the supply of labor relation to agriculture was shifting to the right, while the farm demand for labor relation was shifting to the left. The reduction in the labor force resulted from the declining demand for labor on the farm.

The period of 1936-45 was the next period of sizeable reduction in the labor force. In this period 97% of the decline in the equilibrium level of employment is explained by variables in the farm labor supply equation, and only 3% by the variables in the demand equation. The supply of labor relation to agriculture was shifting rapidly to the left over a farm demand for labor relation that was shifting only slightly to the left. Hence in this period the labor force was being "pulled" out of agriculture.

In the more recent period, 1950-59, 66% of the decline in the equilibrium level of employment is explained by variables in the farm labor supply equation and 34% by variables in the farm demand for labor equation. Both farm demand conditions and nonfarm supply conditions were at work reducing the labor force, though the exogenous labor supply variables were still the major factors.

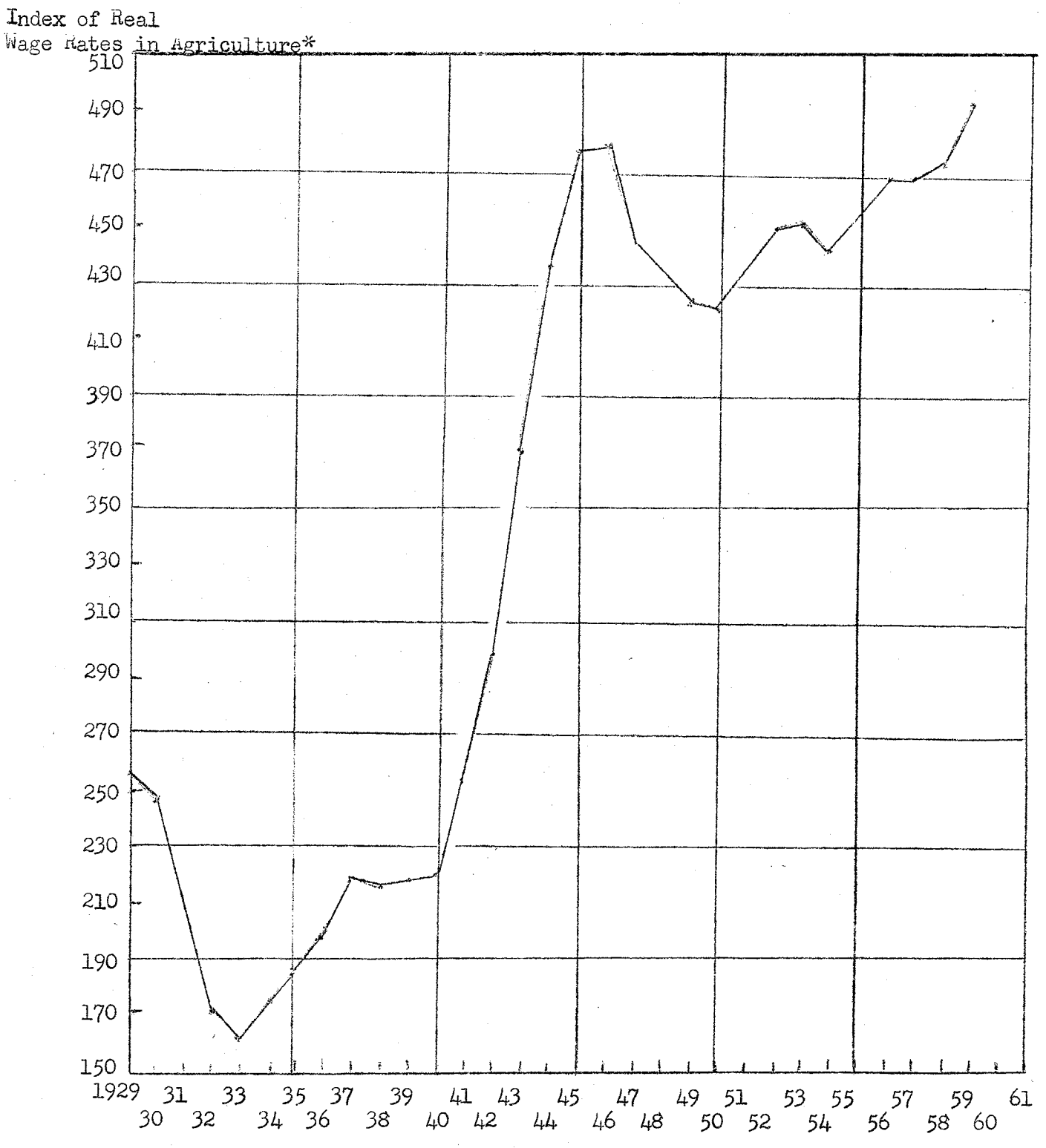
Concluding Comments

Transferring labor from the farm to the nonfarm sector is a continuing part of our overall national resource utilization problem. The above analysis suggest that the magnitude of this transfer problem is sizeable and continuous, and that while it is taking place farm incomes will lag behind those in the nonfarm sector.

Integrating the analysis of the agricultural labor market with both the agricultural sector and the nonfarm sector points up the fact that the incentive to migrate from agriculture can come from a labor demand schedule in agriculture shifting to the left due to declining farm prices and increasing levels of technology or to a labor supply schedule to agriculture shifting to the left because of increasing nonfarm opportunities. The "painfulness" of the adjustment process will differ, depending on which of these is taking place. (Figure 3)

The 1929-32 period was one in which the labor supply schedule to agriculture was shifting to the right, while the farm demand for labor was shifting rapidly to the left. The adjustment of labor resources out of agriculture under these conditions is accompanied by declining real wage rates in agriculture.

In the 1936-45 period a rapid reduction in the agricultural labor force was accomplished with a rapidly rising agricultural wage. This is because the farm demand for labor schedule shifted only slightly to the left, while the supply of labor schedule to agriculture shifted rapidly to the left. Improving nonfarm employment opportunities induced the migration with an absolute increase in agriculural wages, though they may have been declining relatively in part of this period.



*USDA Composite Index of Wage Rates deflated by Consumer Price Index

Figure 3. Agricultural Wage Rates, 1929-59

In the more recent 1950-59 period both the farm demand for labor schedule and the supply of labor to agriculture were shifting to the left, though the supply schedule was shifting relatively more than the demand. The consequence is relatively stable to slightly rising agricultural wage rates.

The first and last periods, when declining farm demand for labor was instrumental in "pushing" labor out of agriculture, were periods of increasing public attention to the farm problem. The adjustment in the middle period, 1936-45, was made with fewer appeals for public aid.

These findings stress the importance of obtaining a rapid rate of growth in the nonfarm sector of the economy as a means of alleviating the income problem in agriculture. The increase in nonfarm demand for labor that accompanies growth in the nonfarm sector permits the transfer of labor from the farm to the nonfarm sector with rising wages in agriculture rather than declining wages. This does not alter the importance of eliminating structural unemployment in general through education and retraining programs.

Appendix

The model can be illustrated by considering the demand equation for hired labor. A long-run labor demand function is postulated which may be written:

$$\bar{X}_{8t} = aX_{7t} + bX_{2t} + cX_{6t} + d$$

where $\bar{X}_{8t}$ = the long-run or equilibrium quantity demanded, X_{7t} = the agricultural wage rate, X_{2t} = the "real" price of farm products, and X_{6t} = an index of technology.

The long-run or equilibrium quantity demanded cannot be observed because the other variables are continually changing. Therefore, this equation cannot be estimated directly.

Let X_{8t} be the current quantity demanded. In the absence of changes in the independent variables upon which demand depends, it is assumed that the current quantity demanded would change in proportion to the difference between the long-run equilibrium quantity and the current quantity. This assumption may be expressed by the following difference equation:

$$X_{8t} - X_{8t-1} = \gamma\left[\bar{X}_{8t} - X_{8t-1}\right] \qquad 0<\gamma<1$$

where the variables are identified as earlier and γ is a coefficient of adjustment, showing what proportion of the disequilibria is removed in one time period.

Substitution of this adjustment equation into the long-run or equilibrium demand equation leads to the following estimating equation:

$$X_{8t} = a\gamma X_{7t} + b\gamma X_{2t} + c\gamma X_{6t} + (1-\gamma)\, X_{8t-1} + d\gamma$$

estimated in the form:

$$X_{8t} = \pi_1 X_{7t} + \pi_2 X_{2t} + \pi_3 X_{6t} + \pi_4 X_{8t-1} + \pi_5$$

This equation is not any sort of a demand function but merely a relationship among observable variables. It is useful because it is possible to derive estimates of the parameters in the long-run equation from its parameter estimates.

The coefficient of adjustment, γ, can be obtained by subtracting π_4 from one. Dividing the other parameter estimates of the estimating equation in turn by γ leads to estimates of the parameters of the long-run or equilibrium equation. These can then be used to compute the long-run elasticities. Short-run elasticities are obtained from the coefficients of the estimating equation. The coefficient of adjustment determines the relation among the short-run elasticities and the long-run elasticities. Similar considerations apply when dealing with the supply equation.

This model assumes, rather arbitrarily, that prices adjust immediately to changed conditions, while the quantity variable is adjusted with a lag. The reasonableness of this assumption must be evaluated in the individual instance. In the case of agricultural labor, the historical record indicates that the assumption is not unrealistic.

The structural demand and supply relations on which the analysis in this paper is based are:

$$\underset{(.5668)}{1.8818Y_2} - \underset{(.1237)}{.3547X_{10}} + \underset{(.1254)}{.6792X_4} + \underset{(.1080)}{.5311X_5} - \underset{(12.76)}{45.023X_9}$$

S: $Y_1 = -1330.22 +$

$R^2 = .9844$ Durbin-Watson Statistic = 2.23

$$\underset{(.4599)}{.9002Y_2} + \underset{(1.6547)}{4.0071X_2} + \underset{(.1083)}{.7009X_4} - \underset{(2.2732)}{2.5578X_6}$$

D: $Y_1 = 969.91 -$

$R^2 = .9698$ Durbin-Watson Statistic = 1.82

where:

Y_1 = hired employment in agriculture, USDA estimate

Y_2 = index of composite wage rate in agriculture, USDA, deflated by consumer price index

X_2 = index of prices received by farmers, all products, deflated by index of prices paid by farmers for items used in production, excluding labor

X_4 = Y_1 lagged one year

X_5 = civilian labor force

X_6 = Kuttan's index of technology

X_9 = linear time trend

X_{10}= "corrected" nonfarm income, measured by average annual compensation to nonfarm employees, weighted by percent of the labor force employed.

The reduced forms that can be derived from this structure are as follows:

Agricultural wage, Y_2:

Short run:

$$Y_2 = 826.79 + 1.4404X_2 + 1.275X_{10} + .0078X_4 - .1909X_5 - .9194X_6 + 16.1838X_9$$

Long run:

$$Y_2 = 832.53 + 1.5094X_2 + .1246X_{10} - .1865X_5 - .9635X_6 + 15.8124X_9$$

Hired employment in agriculture, Y_1:

Short run:

$$Y_1 = 225.64 + 2.7105X_2 - .1148X_{10} + .6939X_4 + .1718X_5 - 1.7302X_6 - 14.5686X_9$$

Long run:

$$Y_1 = 737.08 + 8.8543X_2 - .3749X_{10} + .5614X_5 - 5.6518X_6 - 47.5907X_9$$