FURTHER CONSIDERATIONS ON THE TURNING POINT IN THE JAPANESE ECONOMY (II)

By RYOSHIN MINAMI*

V. *Marginal Productivity of Labor in the Subsistence Sector (Test Depending on Criterion 5)*

(1) *Estimation of the Agricultural Production Function: Pre-World War II*

The marginal productivity of agricultural labor is obtained by multiplying the average productivity of labor in agriculture by the output elasticity of labor in agriculture. The average productivity is easily calculated by dividing the value added by the amount of labor input. The output elasticity of labor is obtained by means of estimating the production function. Therefore to estimate this function is the first step in our study. Estimation will be made separately for the pre and the post-World War II periods. For the prewar period an attempt at estimating a macroscopic production functions will be made. On the other hand for the postwar period, production functions will be estimated separately over a range of various scales of farm households (the word scale in this context is taken to mean the size of the land area operated by a household). This contrast in the mean of estimation between the pre and the postwar periods arises from differences between the two periods in the structure of their agricultural production and from differences in the availability of data. For the prewar period there is a generally accepted theory that agricultural production was almost homogeneous among the various scales of farm households. Furthermore, scale-type statistics are not readily available. For the postwar period, however, productivity differentials have existed to a great extent among the various scales of farm households and the *Nōka Keizai Chōsa* (*Survey of Farm Household Economy*) by the *Nōrin-shō* (*Ministry of Agriculture and Forestry*) provides good scale-type statistics.

In the relation below a macro time-series production function for the prewar period, a linear homogeneous Cobb-Douglas function with neutral technological progress, is estimated.

$$Y=Ae^{\lambda t}N^{\alpha}K^{\beta} \qquad (\alpha+\beta=1).$$

or

$$\frac{Y}{N}=Ae^{\lambda t}\left(\frac{K}{N}\right)^{\beta}.$$

Here Y, K, N, and λ, denote real gross value added, real *total* fixed assets, the number of employees, the rate of neutral technological progress respectively. α and β are the output elasticities of labor and of total fixed assets respectively. Rewriting the relation above in logarithmic terms and adding a random variable u_t to it, we have

$$ln\, y_t=a+\lambda t+\beta\, ln\, kt+u_t,$$

* Assistant Professor (*Jokyōju*), The Institute of Economic Research.

where

$y_t \equiv Y_t/N_t$, $k_t \equiv K_t/N_t$, $a \equiv ln\, A$

$E(u_t)=0$ for $t=1, 2, \cdots 59$.

The estimates for data used for these variables are arrived at in the following way. For Y, the estimates by M. Umemura and others (in 1934～36 prices) [Umemura & others 1966, pp. 226～27] are used. K is the total amount of land assets together with the total amount of fixed capital (both in 1934～36 prices). (K is described as *total* fixed assets in the sense that it includes land assets.) The total amount of land assets is derived by adding the weighted total of arable land area (in terms of *tan*)[35] of paddy field to the weighted total of arable land of upland field [Umemura & others 1966, pp. 216～17]. Weights for the former and for the latter are the prices of arable land per *tan* of paddy field and of upland field respectively (378 and 159 yen respectively) [Umemura & others 1966, p. 221]. Both prices are average prices for 1934～36. For the amount of fixed capital, the gross capital stock estimated by Umemura and others [Umemura & others 1966, pp. 226～27] is used. The number of employees is calculated by deducting the number of employees in forestry from the Umemura estimates for the number of employees in agriculture and forestry.[36] All of these statistics can be obtained for the whole period 1877～1940. In estimating the production function, seven year moving averages are used, which thus takes into consideration short-term cycles in agricultural production and any possible discontinuity in these statistics. Consequently the actual period of estimation extends for 59 years, 1880～1938. The results of the estimation in Table 10 show that for the prewar period 1) the annual rate of technological progress was about 1 per cent, and 2) that the output elasticity of labor was .343.

TABLE 10. ESTIMATES OF THE PRODUCTION FUNCTION IN PREWAR AGRICULTURE

a	△2.62*	(210)
λ	.0125*	(7.33)
β	.657*	(3.42)
$\bar{R}^2$	.981	

Remarks: △ signifies negative value. Figures in parentheses are t-statistics.

* means that any parameter marked with such an asterisk is significant at the 95 per cent significance level.

Let us compare these conclusion with those from studies which have been made by other writers. An agricultural production function which included technological progress was estimated by H. Ueno and S. Kinoshita. The estimation period was for 1920～61 excluding 1937～51. The rate of technological progress was estimated separately for the prewar and for the postwar periods. It was .4 per cent for the prewar period [Ueno & Kinoshita 1965, p. 44]. This is less than half of our estimate. The output elasticity of labor was estimated by them to be .408. This is somewhat larger than our estimate. However a strict comparison between the two sets of estimation (those by us and those by Ueno and Kinoshita) is impossible, because the estimation period is different. As far as estimation of the output

[35] *tan*=.1 *chō*=.099 hectare=.245 acre.

[36] See Table 12 for details.

elasticity of labor is concerned, a much more comprehensive study of the agricultural production function by K. Ohkawa is available. He used cross-sectional data from the *Seisan-hi Chōsa* (*Production Cost Survey*) by the *Teikoku Nōkai* (Imperial Agricultural Association) and estimated Cobb-Douglas functions. According to his estimation, the output elasticity of labor for rice production is as follows [Ohkawa 1945, p. 155].

1937	.237
1938	.280
1939	.185

A simple average for these figures is .234. For *mugi* (wheat, barley and naked barley) production, the output elasticity of labor is as follows [Ohkawa 1945, p. 174].

1940		1941	
wheat	.286	wheat	.372
wheat	.324	wheat	.437
naked barley	.274	naked barley	.394
		naked barley	.334
		barley	.201

An average for these figures is calculated to be .328. The average figures, .234 and .328 for rice production and *mugi* production respectively, are somewhat smaller than our estimate, .343. In the writer's opinion, however, the difference between our estimates and those of Ohkawa may not be so serious, considering the fact that there were some differences in the estimation period, in the data used, and in the shape of production function.[37]

To close this section we should point out some problems involved in our estimation of production function.

1) Our production function is a special one in the sense that the output elasticity of labor is assumed to be constant for the entire period. This assumption comes from the assumptions of unit elasticity of substitution and of neutral technological progress.[38]

2) As a variable of non-labor input, we used the (weighted) total of land area and capital stock. This signifies of course that the assumption has been made that the marginal productivity of land and that of capital stock are equal.[39] This assumption was made to counterbalance the multi-collinearity problem which can be expected to occur when three inputs

[37] It is not our aim here to give a comprehensive survey on agricultural production function estimates. This is given in the following publications [Tsujimura & Watanabe 1966] [Tsuchiya 1967].

[38] For the prewar period, in the writer's opinion, it does not make sense to estimate the CES production function under the assumption of equality between wages and marginal productivity of labor. The reason for this is that such an assumption does not seem to be valid for this particular period because according to a conclusion in this article, the turning point was not passed in the prewar period.

[39] Denoting capital stock and land by K_1 and K_2 respectively,

$$K=K_1+K_2,$$

our production function is rewritten as

$$Y=Ae^{\lambda t}(K_1+K_2)^{\beta}N^{\alpha}.$$

From this we have

$$\frac{\partial Y}{\partial K_1}=\beta\frac{Y}{K_1+K_2}$$

$$\frac{\partial Y}{\partial K_2}=\beta\frac{Y}{K_1+K_2}.$$

That is to say, marginal productivities of both capital and land are equal to each other.

It may make sense also to use the product (not the sum) of capital stock and land as input K. In this case equality in output elasticity between capital and land should be assumed. This is a much more general assumption than that of equality in marginal productivity. Furthermore in this case there is no need to express land area in value terms.

(labor force, capital stock and land area) are separately included in a production function.[40]
3) Although inputs in the production function should be measured in terms of flow units, stock figures were used as the indexes for labor and non-labor inputs. That is to say that N in our production function is the number of employees (not the working hours) and K is the amount of assets (not the service flow of assets).
4) No consideration was made on any possible quality changes in inputs. For instance the effects of quality changes in the labor force were neglected. (Quality changes in the labor force may come from two sources; i.e , firstly the changes in sex and age composition of the labor force, and secondly quality changes by sexes and age groups of groups within the labor force.

Because of these problems, our estimation of the production function must be acknowledged to be a tentative one. Considering the availability of data for this period, however, it would appear to be difficult to improve our study to any great extent. Therefore the writer has been forced to assume that our estimate for the input elasticity of labor is at least moderately reliable, and will proceed to use it, on the basis of that assumption, in Section (3).

(2) *Estimation of the Agricultural Production Function: Post-World War II*

For the postwar years the *Survey of Farm Household Economy* provides detailed statistics of agricultural production. They are compiled in terms of the scales of farm households (in terms of land area) and by agricultural regions. Some attempts have been made by other writers to estimate production functions using these data. Estimates by Y. Yuize [Yuize 1964] and Y. Torii [Torii 1966] are representative of these attempts. However these estimates are cross-sectional ones for some particular years. That is to say that a macro production function was estimated for particular years by pooling the scales of farm household statistic with these same statistics by agricultural regions as well. In such an estimation the assumption was made that there was a unique production function was good for all scales of farm households and for all regions. The assumption of a unique production function among various regions may be realistic in Japan, such a narrow country, which has homogeneous wheather conditions among its various regions. For the scales of farm households, however, the production function cannot be considered to be unique. This is because there are big differences between the large and the small scale farm households in their conditions of agricultural production. These differences have not tended to disappear but may in fact be increasing. Therefore, in the writer's opinion, the agricultural production function has to be estimated by the scales of farm households. An attempt has been made in this direction by S. Ishiwata and the writer [Minami & Ishiwata 1969]. In the present paper their study is summarized.

The *Survey of Farm Household Economy* is made up of five classes:

Class	Land Area Operated
I	less than .5 *chō*[41]
II	.5~1.0
III	1.0~1.5
IV	1.5~2.0
V	2.0 *chō* and more.

[40] The writer attempted to estimate the production function which included the three factors. However he was unable to get any satisfactory results.
[41] See footnote 35.

For 1957～61 Class I is divided into two sub-classes; less than .3 *chō* and .3～.5 *chō*, while after 1962 the two sub-classes became .1～.3 *chō* and .3～.5 *chō*. However, joining these two sub-classes together to obtain figures for Class I which would enable us to have continuous figures for the postwar period is extremely difficult, and so we have omitted Class I from our study. The statistics are compiled by the following regions:

$r=1$	Tōhoku
2	Hokuriku
3	Sanin
4	Northern Kantō
5	Southern Kantō
6	Tōkai
7	Kinki
8	Setouchi
9	Northern Kyūshū
10	Nankai
11	Hokkaidō.

From these eleven agricultural regions, Hokkaidō ($r=11$) is excluded from our study. The reasons why this is done are as follows. 1) Hokkaidō has different weather conditions to other districts, 2) it has suffered sometimes from bad harvests caused by cold-weather and 3) it has a different organization in its agricultural production (for instance big scale operations are dominant). The period of estimation extends for 13 years from 1953 through 1965. In our estimation cross-sectional and time-series statistics are combined and used. Therefore the sample size is $10\times13=130$.

Our production function is a Cobb-Douglas one with assumption of linear homogeneity and the neutral technological progress. It contains three inputs: labor force N, capital stock K, and land L, all in per household terms. The production function is given by

$$Y=Ae^{\lambda t}N^{\alpha}K^{\beta}L^{\gamma}, \qquad (\alpha+\beta+\gamma=1)$$

where α, β and γ are the output elasticities of labor, capital and land respectively. It can be transformed into land productivity function

$$x=Ae^{\lambda t}n^{\alpha}m^{\beta},$$

where

$$x\equiv Y/L,\ n\equiv N/L,\ m\equiv K/L.$$

Now let us presume that shape of the production function (that is to say, the values of output elasticities of labor α and capital β and the rate of technological progress λ are equivalent among ten agricultural regions. The function is also assumed to be different among regions only in its initial level (the constant term A). These differences can be expressed in terms of regional dummy variables. It should also be noted here that the *Survey of Farm Household Economy* changed its division of agricultural regions in 1962. We tried to rearrange the statistics after 1962 and to make them continuous with those prior to 1961. However a complete rearrangement could not be made. Consequently it should be acknowledged that there may remain some discontinuities in various variables between the two periods (before 1961 and after 1962). These possible discontinuities are expressed in terms of time dummy variables. Then we combine the time dummy variables with the regional dummy variables. In other words we are inserting the regional dummy variables for 1953～61 D_r (10) and those for

1962～65 E_r[42] $(\overline{10}-1)$ into the production function. Now the function is expressed as follows:

$$ln\, x_{rt}=a+\lambda t+\alpha\, ln\, n_{rt}+\beta\, ln\, m_{rt}+\sum_{r=1}^{10}\delta_r D_r+\sum_{r=1}^{9}\varepsilon_r E_r+u_{rt},$$

where δ_r and ε_r are the parameters of dummy variables D_r and E_r respectively and u_{rt} is a random variable.

$E(u_{rt})=0$ for $r=1, 2, \cdots 10$, $t=1, 2, \cdots 13$

Statistics for the variables are obtained as follows:

Y=real gross value added (in 1960 prices):—This is calculated as the difference between the real value of agricultural production and the real value of current inputs. The real value of agricultural production is the total of the various items of agricultural commodities deflated by their individual price deflators. Commodities are 1) rice, 2) *mugi* (wheat, barley, naked barley and so forth), 3) miscellaneous cereals and pulses, 4) potatoes, 5) vegetables, 6) fruits and nuts, 7) industrial crops and other crops, 8) cocoons, 9) livestock and poultry products, and 10) others. Price deflators are from the *Nōson Bukka Chingin Chōsa* (*Survey on Prices and Wages in Rural Villages*) by the *Nōrin-shō* (Ministry of Agriculture and Forestry). The real value of current inputs is obtained by dividing the total value of current inputs by its deflator. This deflator is taken also from the same source.

N=number of labor hours, male worker equivalent:—This is the weighted total of working hours of male workers added to the weighted total of working hours of female workers. The weights are unity for the former and the female/male wage ratio for the latter. (The basic idea for this is that quality differentials are reflected in wage differentials.) Wage statistics are from our estimates based on the *Survey on Prices and Wages in Rural Villages* (Appendix Table 1). The same weights are applied to all classes and to all regions for each year.

K=real gross capital stock (in 1960 prices):—This is the total of three items of capital stock: 1) agricultural equipment, 2) livestock, and 3) trees and shrubs.[43] The estimation for each item of capital stock is made separately for two periods, 1953～61 and 1962～65, in view of the discontinuity of statistics between 1961 and 1962. The capital stock for the 1953～61 period and for the 1962～65 period is estimated by adding the real value of annual gross investments to the capital stock in 1953 and 1962 respectively. The capital stock in each class and in each region in the two bench-mark years obtained by multiplying the nation wide figures for capital stock estimated by M. Umemura and S. Yamada by the proportions of capital stock found in each class and each region in those years. Because of the unavailability of data regarding the real value of capital stock, the proportions used here are given in nominal terms which can be found in the *Survey of Farm Household Economy*. The annual investments in constant prices are the annual investments divided by the investment deflators. Annual investments are taken to be the amount of increase in the nominal capital stock. Their deflators are the estimates by the Ministry of Agriculture and Forestry in its *Nōgyō oyobi Nōka no Shakai Kanjō* (*Social Accounts of Agriculture and Farm Households*).

---

[42] For instance D_1 is a dummy variable which was unity for region 1 in 1953～61 while it was zero for region 1 in 1962～65 and for regions 2～10 in both periods. E_2 was unity for region 2 in 1962～65 while it was zero for region 2 in 1953～61 and for regions 1 and 3～10 in both periods.

[43] Buildings and structures are excluded from capital stock. Residential buildings were included in the figures for buildings and structures, and since the writer was unable to extract the figures for the residential buildings from the total building and structure figures, he was forced to exclude the total building and structure figures.

L=gross cropped land area (total of cropped land area for two or more seasons), paddy field equivalent:—This is the weighted total of gross cropped land area for various commodities. These commodities are comprised of 1) paddy field rice, 2) upland field rice, 3) barley, 4) naked barley, 5) wheat, 6) soybeans and *azuki* (beans), 7) sweet potatoes, 8) white potatoes, 9) rapeseed, 10) others. The weights are ratios of the land productivities of these various commodities 1)~10) to that of paddy field rice 1).

The use of labor hours and of gross cropped land area as indexes of labor and of land inputs respectively is a device to measure the factor inputs in terms of service flow. It is also a device for making factor inputs as homogeneous as possible in order to convert labor hours and cropped land area into those of capacity equivalent. The results of the estimation of the production funtion which was obtained by using these statistics are shown in Table 11. Two things should be noted here.

TABLE 11. ESTIMATES OF THE PRODUCTION FUNCTION FOR POSTWAR AGRICULTURE

	II	III	IV	V
a	2.87* (4.73)	2.46* (4 25)	3.42* (6.84)	3.19* (6.41)
λ	.009 (.69)	.022*(2.28)	.045*(4.82)	.037*(4.24)
α	.592*(4.12)	.864*(7.20)	.848*(6.82)	7.62* (6.18)
β	.328*(3.12)	251*(3.12)	.119 (1.75)	.213 (3.74)
$\bar{R}^2$	.788	.796	.806	759

Remarks: See Table 10.
Estimates of the parameters (δ_r and ε_r) of dummy variables (D_r and E_r respectively) are omitted.

1) The output elasticity of labor is much larger and that of capital much smaller in the classes which have higher rates of growth of real value added.[44] In other words, in the classes with higher rates of growth technology is much more inclined to be labor using and capital saving.
2) The rates of technological progress are much higher in the classes with higher rates of growth.

Previously, we calculated the output elasticity of each factor for the farm classes II~V. Therefore in order to obtain the average figures over four classes for three factors we will use a rather simple method and will use the number of farm households by classes in 1960 as weights. The averages are

α	β	γ
.709	.275	.016.

On the other hand, according to the cross-sectional estimates by Y. Yuize, the output elasticities are [Yuize 1964, pp. 17~23]

[44] The annual rates of growth of real value added Y are as follows:

II	III	IV	V
3.2	3.8	4.4	3.7 per cent.

	α	β	γ
1952	.562	.159	.429
1955	.697	.186	.318
1960	.698	.189	.311
1962	.648	.188	.370
(Simple Averages)	.651	.181	.357.[45]

Comparison of his estimates with ours shows that differences between the two sets of estimates are not large for α but are large for β and γ. Large differences may be rather natural since the two estimates used completely different estimation methods. That is to say, our estimation is a time-series one and his is a cross-sectional one.

If we calculate a weighted average for the estimates of rates of technological progress by the four classes, it turns out to be 1.88 per cent per year. (Weights once more are the number of farm households by classes.) This is larger than the rate of technological progress for the prewar era (1.25 per cent). This difference between the pre and the postwar years should be kept in mind. Now the writer would like to compare his estimates with those by other writers. H. Ueno and S. Kinoshita estimated the rate of technological progress as 3.0 per cent per year [Ueno & Kinoshita 1965, p. 44]. H. Kaneda estimated the *CES* production function with neutral technological progress by classes, by pooling the time-series and the cross-sectional data from the *Survey of Farm Household Economy*. According to his estimation [Kaneda 1965, p. 169], the rates of technological progress are

I	II	III	IV	V
3 9	1.2	1.4	3.7	5.4 per cent.[46]

In order to make the comparison between our estimates and his much easier, let us calculate an average for the estimates of the rate of technological progress by the five classes. This turns out to be 1.8 per cent. Therefore we can state that our estimate of the rate of technological progress (1.88 per cent) is very different from Ueno and Kinoshita's estimate (3.0 per cent), but similar to Kaneda's estimate (1.8 per cent).

Thus it would seem that our estimation of the agricultural production function for the postwar period is much better than our estimation for the prewar period. However some problems still exist in the postwar estimation.

1) Our production function is not general in the sense that the output elasticities of inputs are assumed to be constant. (This is an assumption of the Cobb-Douglas function with the neutral technological progress.)

2) The Output variable in a production function should be one which represents production capacity in normal conditions. In spite of this, we used the actual series of value added as the variable, when we should have attempted to take account of the effects of abnormal wheather conditions (e.g., good and bad harvests) on the value added series. Calculating moving averages for this may be one possible way around this problem. It is but because the estimation period was not long enough we did not use moving average.

3) Capital input is the only variable not expressed in terms of service flow; i.e., changes in the number of hours of operating capital stock were neglected in our study.

---

[45] The figures cited here are the nation wide estimates (including Hokkaidō).

[46] They are the estimates in the case where the real value added was used as an index of output.

TABLE 12. AVERAGE AND MARGINAL PRODUCTIVITIES OF LABOR AND REAL WAGES IN AGRICULTURE (1934~36 PRICES)

Year	Average Productivity	Marginal Productivity	Real Wages	Output Elasticity of Labor	Relative Income Share of Labor	Ratio of Wages to Marginal Productivity
	(1)	(2) (1)×(4)	(3)	(4)	(5) (3)/(1)	(6) (3)/(2)
	(yen per year)					
1880	71.6	24.6				
1885	82.5	28.3				
1890	91.9	31.5				
1895	97.2	33.3				
1900	104.5	35.8				
1905	115.7	39.7	95	.343	.821	2.39
1910	129.9	44.6	99	.343	.762	2.22
1915	150.5	51.6	104	.343	.691	2.02
1920	169.9	58.3	122	.343	.718	2.09
1925	173.9	59.6	149	.343	.857	2.50
1930	187.1	64.2	165	.343	.882	2.57
1935	192.4	66.0	134	.343	.696	2.03
1937	194.0	66.5	125	.343	.644	1.88
1952	151.2	107.2	116	.709	.767	1.08
1955	170.2	120.7	124	.709	.729	1.03
1960	227.5	161.3	156	.709	.686	.97
1964	265.0	187.9	190	.709	.716	1.01
				.709		

Remarks: Seven year averages centered on indicated years in the prewar period, and five year averages in the postwar period.

(1) = real gross value added in agriculture / the number of workers employed in agriculture.

(3) = annual contract worker wages in agriculture price index of agricultural products.

(4) = the estimates in Sections (1) and (2).

Sources: Real gross value added in agriculture: [Umemura & others 1966, pp. 226~27]. After 1964, statistics for the real gross value added in agriculture are estimated by linking them with statistics for the gross value added which are obtained from the *Norin-sho* (Ministry of Agriculture and Forestry) *Nōgyō oyobi Nōka no Shakaikanjō* (*Social Accounts of Agriculture and Farm Households*) (mimeo., 1968, p. 37) divided by the price index of agricultural products obtained from the Ministry of Agriculture and Forestry, *Nōson Bukka Chingin Tōkei* (*Statistics of Prices and Wages in Rural Villages*) (1968, p. 17).

Number of workers employed in agriculture: Prewar: This is obtained by deducting the number of workers employed in forestry [Umemura & others 1966, p. 236] from the number of workers employed in agriculture and forestry [Umemura 1968, p. 329]. The figure for the number of workers employed in agriculture employment for 1921~40 is estimated by making use of the figures contained in [Umemura & others 1966, pp. 218~19] for this period. *Postwar:* Until 1964 the estimates by the Ministry of Agriculture and Forestry as cited in [Umemura & others 1966, p. 219] are used. After 1964 the estimates in the Ministry of Agriculture and Forestry, *Social Accounts of Agriculture and Farm Households, op. cit.*, p. 94 were used.

Annual contract worker wages: The same as Figure 1.

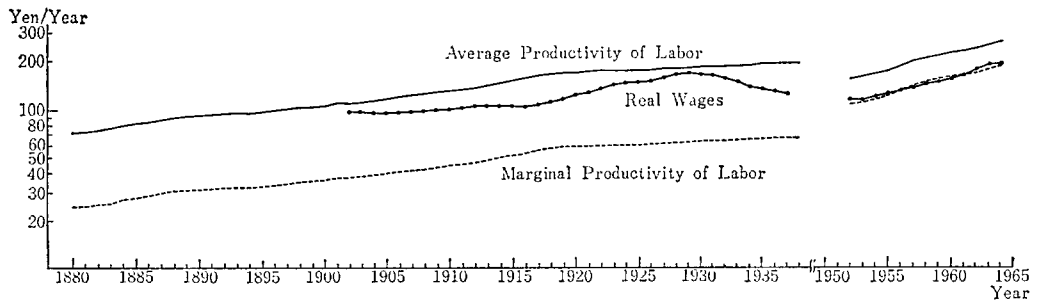
Price index of agricultural products: 'Link index' in [Ohkawa & others 1967, p. 165]. After 1964 the price index is estimated by linking it with the estimates by the Ministry of Agriculture and Forestry.

(3) *Changes in the Marginal Productivity of Labor and Determinants of These Changes*

Let us now take a look at long-term changes in the marginal productivity of agricultural labor. In Column (1) of Table 12, the average productivity of labor is shown for every five years. This is obtained by dividing the real value added by the number of employees. These statistics are those which were used in estimating the production function in Section (1). Column (4) shows the figures of the output elasticity of labor. The prewar figure is the one which we estimated in Section (1). The postwar figure is the weighted average of the estimates of the four classes of farm households. (See Section (2).) By multiplying the figures in Column (1) with those in Column (4), the marginal productivity of labor is obtained in Column (2).

In Figure 10 the annual figures (moving averages) for the average and marginal productivities of labor are depicted.[47] Here the marginal productivity shows a steady increase for

FIG. 10. AVERAGE AND MARGINAL PRODUCTIVITIES OF LABOR AND REAL WAGES IN AGRICULTURE (1934~36 PRICES)



Remarks: Seven year moving averages and five year moving averages respectively for the pre and the postwar years.
Source: The same as Table 12.

the period 1880~1919. The annual compound rate of growth of the marginal productivity of labor between the two years, 1880 and 1919 is calculated as 2.1 per cent. The steady increase stops around 1919. The annual rate of growth is only .8 per cent between the years

[47] In examining the changes in the marginal productivity of labor, one should pay special attention to the fact that marginal productivity was estimated under the assumption of constant output elasticity of labor. However this assumption does not seem to be such an unrealistic one. For the postwar period, according to Kaneda's estimation, elasticity of substitution seems to be nearly unity for all farm classes [Kaneda 1965, p. 167]. If technological progress is neutral, this proves our assumption. For the prewar period we do not have any estimate for the elasticity of substitution. However the following facts tend to show indirectly that the shape of the production function was almost constant.

1) There were no differentials in the organization of agricultural production among farm classes.
2) There was little change in the organization of production between the end of the Tokugawa era and World War II. The small family farm, land fragmentation, major crops, all these traditional features remained nearly intact [Ohkawa & Rosovsky 1965, p. 67].
3) Substitution between production factors was not as marked as it has been in the postwar period.

1919 and 1938.[48] (The average rate of growth is 1.83 per cent for the entire prewar era, 1880~1938.) For the postwar period the marginal productivity of labor shows an unprecedented and remarkable increase. The rate of growth is 4.7 per cent between 1952 and 1964.

TABLE 13. AVERAGE AND MARGINAL PRODUCTIVITIES OF LABOR AND REAL WAGES IN POSTWAR AGRICULTURE (1960 PRICES)

Year	Average Productivity	Marginal Productivity	Real Wages	Output Elasticity of Labor	Relative Income Share of Labor	Ratio of Wages to Marginal Productivity
	(1)	(2) (1)×(4)	(3)	(4)	(5) (3)/(1)	(6) (3)/(2)
	(yen per hour)					
1953	42.4	30.1	26.7	.709	.688	.89
1954	50.3	35.7	31.3	.709	.678	.88
1955	60.5	42.9	32.9	.709	.596	.77
1956	61.3	43.5	37.4	.709	666	.86
1957	60.6	43.0	37.2	.709	675	.87
1958	63.9	45.3	41.4	.709	.712	.91
1959	65.6	46.5	41.7	.709	.691	90
1960	70.3	49.8	43.0	.709	.666	86
1961	74.0	52.5	46.2	.709	.678	.88
1962	86.5	61.3	51.6	.709	.649	.84
1963	87.5	62.0	49.2	.709	.611	.79
1964	97.9	69.4	52.7	.709	.598	.76
1965	99.1	70.3	51.0	.709	.568	.73

Remarks: (1)=real gross value added in agriculture/labor hours (male worker equivalent) in agriculture.

(3)=agricultural wages/implicit deflator for gross value added. (Implicit deflator=nominal gross value added/real gross value added)

(4)=the estimate in Section (2).

Sources: See text in Section (2).

[48] The fact that the marginal (and therefore the average) productivity increase was retarded in the end of the 1910's has been mentioned previously by other writers. For example

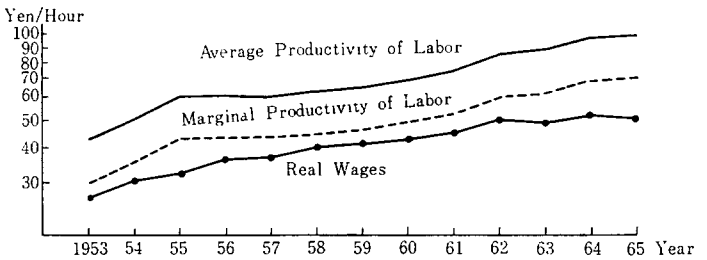
a) B. F. Johnston and K. Ohkawa and H. Rosovsky pointed out this fact and gave an explanation for it. In the 1920's food imports from Taiwan and Korea increased conspicuously. They satisfied most of the increase in demand for agricultural products after 1920 and had an unfavorable impact on Japanese agriculture [Johnston 1962, pp. 242~43] [Ohkawa & Rosovsky 1964, pp. 58~61].

b) J. Nakamura asserted that early official statistics for agricultural production have large under-estimations of agricultural output and therefore the so-called Hitotsubashi series of agricultural production, which is mainly dependent on these official statistics, must contain under-estimations in the early years [Nakamura 1966, Chaps. 2~4]. However, the Hitotsubashi series, which was criticized by Nakamura, was the 'old series' published in [Ohkawa & others 1956; 1957]. The statistics of agricultural production used in this paper are the 'new Hitotsubashi series' which were published after Nakamura's criticism. Consequently his criticism does not apply to the new series. For the early years the values for the new series exceeded those of the old series. (Nakamura's criticism has been refuted by such writers as S. Yamada and Y. Hayami (estimators of the Hitotsubashi series), H. Rosovsky, H. Kaneda and so forth. Rosovsky's paper only is cited here [Rosovsky 1968].)

c) S. Yamada distinguished two periods 1882~1917 and 1917~37 and labelled them 'the phase of modernization' and 'the phase of relative stagnation' respectively [Yamada 1967, p. 387].

This is twice and six times as large as the respective growth rates of the periods 1880~1919, and 1919~1938. A big increase in the marginal productivity of labor can also be confirmed from estimates in Table 13, Column (2) of which Figure 11 is a diagrammatic representation. The estimate of marginal productivity per hour is obtained from the statistics which were used in estimating the production function in Section (2). In this case the annual compound rate of growth of the marginal productivity of labor turns out to be 7.2 per cent for 1953~65.

FIG. 11. REAL WAGES IN POSTWAR AGRICULTURE AND AVERAGE AND MARGINAL PRODUCTIVITIES OF LABOR IN POSTWAR AGRICULTURE (1960 PRICES)



Sources: See Table 13

The next step in our study is to clarify the factors which explain the changes in marginal productivity. For the prewar period we have the following production function

$$Y=e^{-2.62+\ .0125t}+N^{.343}K^{.657}.$$

From this the marginal productivity MP is obtained.

$$MP=.343e^{-2.62+\ .0125t}(K/N)^{.657}.$$

Rewriting this in terms of rate of growth, we have

$$G(MP)=\underset{\substack{\text{(technological}\\ \text{progress effect)}}}{.0125}+\underset{\substack{\text{(non-labor inputs}\\ \text{effect)}}}{.657G(K/N)}.$$

The first item in the right hand side of this relation signifies the increase in marginal productivity caused by technological progress. Let us call this the 'technological progress effect' on the increase in the marginal productivity of labor. The second item is the increase in marginal productivity stemming from the increasing per capita fixed assets. This may be called the 'non-labor inputs effect'. According to the statistics of per capita fixed assets (the sum of capital stock and land assets) shown in Table 14, Column (1), the average rate of growth for capita fixed assets $G(K/N)$ for the period 1880~1938 is .87 per cent per year. Therefore the non-labor inputs effect is calculated to be .57 per cent (.657×.87 per cent). $G(MP)$ has already been calculated as 1.83 per cent. Accordingly we have the following:

Total, $G(MP)$	1.83 per cent	(100)
The Technological Progress Effect	1 25	(68)
The Non-Labor Inputs Effect	57	(31)
Residuals	.01	(1)

Figures in parentheses are indexes which total 100. From these indexes we know that 68 per cent of the increase in the marginal productivity of labor for the prewar era came from

TABLE 14. PER CAPITA FIXED ASSETS AND PER CAPITA CURRENT INPUTS IN AGRICULTURE (1934~36 PRICES

(in yen)

Year	Per Capita Fixed Assets (1)	Per Capita Current Inputs (2)
1880	1078	15.7
1885	1106	16.3
1890	1137	16.6
1895	1165	17.7
1900	1191	19.2
1905	1226	20.7
1910	1290	25.0
1915	1391	29.3
1920	1543	35.4
1925	1578	40.3
1930	1614	44.7
1935	1659	49.4
1938	1674	52.7

Remarks: Seven year averages centered on indicated years.

(1)=fixed assets (land assets+capital stock) in agriculture / the number of workers employed in agriculture.

(2)=real current inputs in agriculture / the number of workers employed in agriculture.

Sources: Fixed assets in agriculture: See text in Section (1).

Real current inputs in agriculture: [Umemura & others 1966, pp. 226~27].

The number of workers employed in agritulture: See Table 12.

technological progress and 31 per cent stemmed from increasing per capita fixed assets. Technological progress, which explained about two thirds of the increase in marginal productivity, was dependent on various factors. Such as changes in the composition of various products, seeds improvement, increasing fertilizer inputs and so forth. Per capita current inputs in constant prices which are shown in Table 14, Column (2), showed a conspicuous increase in the prewar years.

We now turn to a discussion of the postwar period, which will follow a similar pattern to that which we used for the prewar period. For the aggregate of our classes (II~V Classes) of farm households, we have

$$G(MP) = \underset{\text{(the technological progress effect)}}{.0188} + \underset{\text{(the non-labor inputs effect)}}{[.275G(K/N)+.016G(L/N)]}$$

The non-labor inputs effect could be obtained by substituting the values for $G(K/N)$ and $G(L/N)$ which are shown in Table 15, Columns (1) and (2). But $G(K/N)$ cannot be used, because the series for K is not continuous between 1961 and 1962. However we can indirectly estimate the non-labor inputs effect as the difference between $G(MP)$ and the technological progress effect. It should be noticed that this difference includes residuals as well. Thus we have

TABLE 15. FACTOR RATIOS IN POSTWAR AGRICULTURE

Year	Capital-Labor Ratio (1)	Land-Labor Ratio (2)	Current Inputs-Labor Ratio (3)
	(yen/hour)	(10^{-3} ha/hour)	(yen/hour)
1953	21.2	21.8	13.2
1954	25.7	22.7	14.5
1955	29.2	22.5	15.4
1956	33.5	23.2	17.5
1957	38.5	23.6	18.7
1958	42.7	23.7	19.8
1959	45.2	23.8	21.2
1960	51.5	25.7	25.1
1961	61.1	28.5	27.8
1962	66.0	33.0	38.1
1963	79.7	33.0	44.8
1964	96.5	35.4	52.9
1965	115.0	38.0	59.1

Remarks: Averages of the figures for Classes II~V.

(1)=real gross capital stock (excluding buildings, in 1960 prices)/ labor hours (male worker equivalent).

(2)=gross cropped land area (paddy rice field equivalent) / labor hours (male worker equivalent).

(3)=current inputs (in 1960 prices) / labor hours (male worker equivalent).

Sources: See Section (2).

Total, $G(MP)$	7.20 per cent	(100)
The Technological Progress Effect	1.88	(26)
The Non-Labor Inputs Effect	5.32	(74).

In comparing these figures with those from the prewar periods, it should be noticed that the relative contribution of technological progress to the increasing marginal productivity of labor in the postwar period is much smallar than for the prewar period. Let us now repeat this same estimation for the various classes of farm households. This will give us

	II		III		IV		V	
Total, $G(MP)$	7.11 per cent	(100)	6.80 per cent	(100)	6.98 per cent	(100)	6.81 per cent	(100)
The Technological Progress Effect	.94	(13)	2.21	(33)	4.46	(64)	3.68	(54)
The Non-Labor Inputs Effect	6.17	(87)	4.59	(67)	2.52	(36)	3.13	(46)

The table above shows that the relative contribution of technological progress is much bigger in those classes with higher rates of growth. Table 15, Column (3) gives current inputs in constant prices per labor hour. They show a remarkable increase in all years. Figures for current inputs by classes, which are not included in the estimation of the production function, demonstrate that current inputs per labor hour have increased to a greater extent in those classes with higher rates of growth. This may seem to imply that some part of technological progress is due to the increase in current inputs.

VI. *Determinants of the Subsistence Sector Wages (Test Depending on Criteria 1 & 2)*

(1) *Comparison between Wages and the Marginal Productivity of Agricultural Labor (Test Depending on Criterion 1)*

A comparison in the levels between wages and marginal productivity of the subsistence sector labor force, which is the most direct test of the turning point, will be attempted here. Table 12, Columns (1), (2) and (3) give the average productivity, marginal productivity and real wages respectively. Wages are those for the annual contract agricultural workers which were used in Chap. III, and the deflator is the price index for agricultural products. In Column (4) the output elasticity of labor is shown. Column (5) gives the ratio of real wages to average productivity. This ratio may be taken as an index for the relative income share of labor. Column (6) shows the ratio of real wages to marginal productivity.

To begin with, let us look at the figures in Column (6). They exceed 2 in value for almost all of the prewar years, whereas they remain nearly unity for the postwar years. That is to say, in the prewar era wages twice as large as the marginal productivity would warrant were paid. On the other hand in the postwar period, wages have been paid in accordance with marginal productivity. Such a contrast between the two eras may be seen also in Fig. 10, which shows the annual figures for real wages and for the maginal productivity of the agricultural labor. Here also, real wages exceed marginal productivity to a great extent in the prewar period, while real wages become almost equal to marginal productivity in the postwar period.[49] Turning to Table 12, let us comare the relative income share in Column (5) with the output elasticity of labor in Column (4). The relative income share is twice as high as the output elasticity in the prewar period, while in the postwar they are almost equal to each other. (The results of comparison between the relative income share and output elasticity of labor are exactly equal to that of a comparison between wages and marginal productivity)

For the postwar period the same test may be repeated by using statistics from the *Survey of Farm Household Economy*. In Table 13, the real wages in Column (3) are almost equivalent to the marginal productivity in Column (2) while the relative income share in Column (5) is almost equal to the output elasticity in Column (4). The equality of wages and marginal productivity may be confirmed also in Fig. 11.

These findings above seem to suggest that wages have been determined in accordance with marginal productivity in the postwar period, but that this was not the case in the prewar period. In other words the marginal productivity wage theory has been the one used in the postwar period and the subsistence theory of wages was dominant in the prewar period.

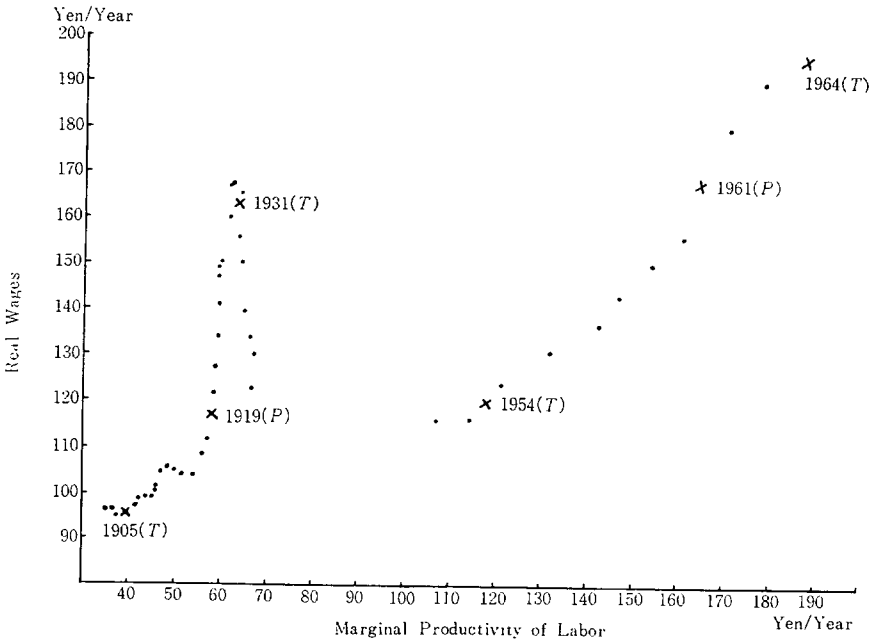
---

[49] One might feel that our assumption of equality between market wages and implicit wages for familly workers might give rise to over-estimation in the wage statistics. If this is so, the true differential between wages and marginal productivity might well be smaller than what it appears to be in the prewar period. In the postwar period true wages may be larger than the marginal productivity to some extent. In the writer's opinion, however, these changes, if any, would not be large enough to affect our conclusion in the text, since he feels that our assumption is not unrealistic.

(2) *Relationship between Wages and Marginal Productivity of Agricultural Labor (Test Depending on Criterion 2)*

Here the relationship between changes in wages and those in marginal productivity which were examined in Section (1) will be studied.[50] First of all, let us look at Fig. 10. According to this figure, real wages remained almost constant until around 1916, increased in the period 1916~30, and then decreased after 1930. On the other hand the marginal productivity is not subject to such great changes as those in real wages. 1) Before 1916, when real wages were constant, marginal productivity increased. 2) After 1916, when real wages increased and later decreased, marginal productivity, continued to slightly increased at the same speed as before. In other words real wages in the prewar period changed almost independently of changes in marginal productivity. On the other hand, for the postwar period, real wages have increased along with the steady increase in marginal productivity. (Such a fact is much more easily seen in Fig. 12, which plots real wages and marginal productivity on the vertical

FIG. 12. RELATIONSHIP BETWEEN THE REAL WAGES AND THE MARGINAL PRODUCTIVITY OF LABOR IN AGRICULTURE (1934~36 PRICES)



Remarks: See Figure 10.
Sources: The same as Figure 10.

and horizontal axes respectively.) The coefficient of determination (adjusted by the degree of freedom) is calculated as .679 and .955 for the prewar (1902~37) and postwar (1952~64) periods respectively. The postwar figure is extremely high compard with the prewar one.

[50] See footnote 47 in Chap. V.

Such a difference in the degree of correlation between the two periods suggests that structural change occurred sometime in the early postwar period.

(3) *Relationship between Wages and Productivity in Agriculture: Regional Analysis*

1. *Analysis for the Pre-World War II Period*

In Section (2) we studied the relationship between wages and marginal productivity in agriculture by using time-series data. In this section we are attempting a similar sort of analysis, but in this case, by using cross-sectional or regional statistics. It shold be noted here that the analysis in this section is made under the very important assumption that the same production function is dominant among all of regions for a certain year.[51] Under this assumption the relationship between wages and average productivity is equivalent to the relationship between wages and marginal productivity. Thus our study below on the relationship between regional wages in agriculture and regional productivity in agriculture will provide an examination into the relationship between wages and marginal productivity or a test of the turning point.

For the prewar analysis two sets of statistics are available. They are *Nōgyō Keiei Chōsa* (*Agricultural Management Survey*) and the *Kome Seisan-hi Chōsa* (*Rice Production Cost Survey*) both by the *Teikoku Nōkai* (Imperial Agricultural Association). The *Agricultural Management Survey*, available from 1924, is compiled for eight regions and in three farm classes which are based on the size of the area cultivated. The farm classes are large classes (10 *chō* and more), middle classes (2~10 *chō*) and small classes (less than 2 *chō*). Regions are Tōhoku, Kantō, Hokuriku, Tōkai, Kinki, Chūgoku, Shikoku and Kyūshu. This survey provides very detailed descriptions of item of production costs. However the sample size of this survey is so limited that care should be taken when using it.[52] In particular the sample size of large class farms is extremely small, so that we will omit this class from our study.

From this data both wages and average productivity of labor are estimated by year, by farm classes and by regions.

1) Estimation of wages:—Daily wages are obtained by dividing total wage payments by the number of labor days in agriculture (both per year and per farm household). Total wage payments are from the table of agricultural working expenses. The number of labor days is taken to be the total for wage earners. Wage earners are comprised of '*jō-yatoi*' (regular workers) and of '*rinji-yatoi*' (temporary workers). Regular and temporary workers in this survey may be regarded as correspoding to the annual contract workers and the daily workers respectively in our terminology.

2) Estimation of average productivity:—Average productivity (per day) is calculated by dividing gross value added by the number of total labor days in agriculture. The gross value added is estimated as follows:

Gross value added=total agricultural revenue−(agricultural working expenses−wage payments−rents for tenancy−interests).

Figures in parenthesis are the values of current inputs. The total number of labor days is the sum of labor days for family workers and those for wage earners. The results of estimations

---

[51] On this point, refer to Chap. V, Section (2).

[52] Both the small and middle class farm sample surveys are comprised of only 50~90 farm householsd.

in 1) and 2) are shown in Appendix Table 6.[53] (In this table average figures for all classes and for all regions are also given. They are the averages of the figures by classes and by regions weighted with the number of farm households by classes and by regions)

The *Rice Production Cost Survey*, a survey by farm households on the cost of and revenue from rice production, is available from 1922. This is compiled for three types of farm households and by prefectures. The three types of farm households are '*jisaku-sha*' (owner farmers), '*kosaku-sha*' (tenant farmers) and '*jisaku ken kosaku-sha*' (a combination of owner farmers and tenant farmers). In the case of tenant and of combination-type farms, however, statistics are not available for some years. Therefore we will use the data for owner-farmers only.[54]

1) Estimation of wages:—In this survey, unlike the *Agricultural Management Survey*, wage payments (per year, per farm household and per *tan*) include implicit wages for family workers. (The latter wages were estimated by assuming all wages for wage earners to be the same [Ishibashi 1961, p. 29].) Therefore daily wages can be calculated simply by dividing wage payments by the number of working days (per year, per farm household and per *tan*).

2) Estimation of average productivity:—The average productivity of labor is obtained by dividing gross value added by the number of working days. Gross value added is obtained from the following relation,

Gross value added=value of production−(direct production costs−wage payments).

Here direct production costs are the total costs for seeds, fertilizer and other current inputs, wage payments and the costs of maintaining livestock.

Wages and average productivity are estimated by prefectures in the first step. In the next step the estimates by prefectures are recompiled by eight regions. The eight regions are the agricultural regions in the *Survey of Farm Household Economy* from 1962. They are Tōhoku, Hokuriku, Kantō & Tōsan, Tōkai, Kinki, Chūgoku, Shikoku, and Kyūshū.[55] In this recompilation the number of farm households is used as a weight. However the number of farm households is not available for 1932, 1933 and 1935. Thus the figure for 1931 is assumed for 1932 and 1933 and the figure for 1934 is applied to 1935. Results of these estimates are shown in Appendix Table 7.

In Table 16 the coefficients of determination of the relationship between daily wages and average productivity per day in agriculture are shown. Columns (1) and (2) are for the *Agricultural Management Survey*. Column (1) represents middle class farms and Column (2) small class farms. Among the figures in the two columns none are statistically significant, with the exception of middle class farms for 1937.[56] That is to say, there is no relationship between wages and average productivity. But, on the other hand, in Column (3) which gives the figures which are calculated by using the statistics in the *Rice Production Cost Survey*, the figures are statistically significant for six years, mainly in the 1930's, out of the nineteen

[53] 1924 is omitted because the number of working days of regular workers is unknown. For 1926, 1928 and 1929 original cards only are available. As it takes a very long time to compile them, these years are omitted from our study.

[54] The number of surveyed farm households was 60～160 before 1929. It increased to 400～800 in 1930.

[55] In regard to which prefectures are included in each region, see the remarks of Appendix Table 7. Hokkaidō, which is included in the original statistics, is omitted in our recompilation.

[56] There seems to be no feasible reason why 1937 should show such a conspicuously high correlation for middle class farms. On this point, one should note that small class farms in the same year do not show any significant correlation.

TABLE 16. COEFFICIENTS OF DETERMINATION OF THE RELATIONSHIP BETWEEN AGRICULTURAL WAGES AND AVERAGE PRODUCTIVITY OF AGRICULTURAL LABOR BY REGIONS (PRE-WORLD WAR II)

Year	*Agricultural Management Survey*		*Rice Production Cost Survey*
	Middle Class Farms (1)	Small Class Farms (2)	Owner Farmers (3)
1922			.559*
1923			.105
1924			△ .117
1925	△ .105	.077	.101
1926			△ .145
1927	.109	.094	△ .152
1928			044
1929			△ .017
1930	.374	△ .166	358
1931	△ .025	△ .136	.276
1932	△ .029	△ .088	.165
1933	.098	.052	.569*
1934	△ .141	.098	.774**
1935	△ .137	.504	.727**
1936	.025	.214	.702**
1937	.949**	△ .139	.372
1938	△ .117	△ .120	.644*
1939	.079	△ .139	.261
1940	.608	.077	.139

Remarks: Figures in this table are coefficients of determination (adjusted by degree of freedom) of the relationship between annual wages per capita and annual gross value added per capita.

* means that the coefficient of determination is statistically significant at the 95 per cent level and ** means that it is significant at the 99 per cent level.

△ signifies negative figure.

Source: Appendix Tables 6 and 7.

observation years. Does this mean that the Japanese economy passed the turning point during these years? The writer doubts that this is the case.

1) As was mentioned earlier for all of these years a significant statistical relationship does not exist in the case of the *Agricultural Management Survey*.

2) Even if the study depending on the *Rice Production Cost Survey* is much more reliable than the one depending on the *Agricultural Management Survey*, we cannot necessarily conclude that the turning point has been passed, since the six years in which significant correlation was found are concentrated in the upward phase of long swings. 1922 is the only

exception to this. No significant correlation is found for any years in the downward phase.[57] This signifies that the labor supply becomes temporarily limited in the upward phase of long swings. In other words, the significant relationship between wages and average productivity for particular years is a result of cyclical fluctuations in the labor market, and does not seem to suggest any structural changes in the labor market in the 1930's.

2. *Analysis for the Post-World War II Period*

In the postwar era the *Survey of Farm Household Economy* provides very good statistics for such a study.

1) Estimation of wages:—Hourly wages are obtained by dividing wage payments contained in the table of agricultural working expenses by the number of working hours of wage earners (annual contract workers and daily workers) which are contained in the table of working hours in own farms.

2) Estimation of average productivity:—Average productivity of labor is calculated by dividing gross value added (in current prices) by the total number of working hours. For the concept and way of estimation of gross value added, see Chap. V, Section (2).

Table 17 shows the coefficients of determination of the relationship between hourly wages and average productivity per hour in farm households by years and by farm classes. From these figures the following observations may be made:

1) Significant statistical relationships exist in only one farm class in 1953 and in only one class in 1954. It is found in two farm classes in 1955 and 1956, in three farm classes in 1957 and 1958, and in four or five farm classes after 1959 (excluding 1964). The correlation between them is weak in the early years and becomes stronger as time goes on. In other words it is after the end of the 1950's that one can safely state that there is a correlation between them.

(2) Significant correlation in the early years tends to be found in large classes, but not in small classes. It is only after 1959 that the correlation becomes significant in Class I, while in Class II this occurs only after 1957. In Class III significance appears only after 1959 if we exclude 1953. Contrary to these, correlation is significant after 1954 or 1955 in Classes IV and V.

Under the assumption that output elasticity of labor is equivalent among regions, the following conclusions may be introduced from these observations:

1) It was from the late 1950's or early 1960's that the marginal principle of wage determination came into play in agriculture or in other words, it is at that time that the Japanese economy passed the turning point.

2) Modernization of agriculture began in the large farm classes (in the middle 1950's) and

[57] There might be another interpretation for the appearance of high correlation after 1933; i.e., it is a result of a rise in the reliability of statistics. Such an interpretation might seem to be reasonable, in view of the increase in the number of farm households surveyed in 1930. (See footnote 54.) However the writer does not accept this interpretation for the following reasons:

a) In 1922, when the sample size is still small, significant correlation does exist. This means that the non-existence of correlation does not necessarily come from data unreliability.

b) The sample size increased in 1930. However, there are no significant correlations for the five years, 1930~32 and 1939~40. This fact may suggest that the existence of any correlation was not always a result of data reliability.

has spread to the smaller classes.

VII. *Elasticity of Labor Supply from the Subsistence Sector to the Capitalist Sector (Test Depending on Criterion 6)*

(1) *Statistical Settings*

The elasticity of supply of primary sector laborers to non-primary sector industries, as an index of the elasticity of labor supply from the subsistence to the capitalist sectors, will be estimated and examined in this chapter. (The primary sector is defined here as being comprised of the agriculture and forestry industries.)

The elasticity of labor supply η was defined in the relation

$$(7) \qquad \eta=\frac{\partial w}{\partial N_i}\Big/\frac{w}{N_i},$$

TABLE 17. COEFFICIENTS OF DETERMINATION OF THE RELATIONSHIP BETWEEN BY REGIONS AND BY FARM CLASSES

Farm Class \ Year	1953	1954	1955	1956	1957	1958
I	.093	△ .098	△ .123	△ .018	△ .093	.031
II	△ .068	.059	.207	△ .017	.481*	.356*
III	.331*	.021	△ .044	.075	.007	.180
IV	.215	.051	.396*	.526*	.398*	.339*
V	.322	.621*	.781**	.361*	.515*	.629**

Remarks: See remarks in Table 16.

where w and N_i signify real wages (wages deflated by *CPI*) and capitalist sector labor force respectively. Therefore, if we plot w and N_i on the horizontal and vertical axes respectively of a logarithmic diagram, we can get η as the slope of this regression. The statistics for w and N_i are estimated as follows:

1) Estimation of w:—Here w is the price of labor supply to the non-primary sector. Unfortunately, average wages in the non-primary sector cannot be used as a substitute for it in our calculations since part of the non-primary sector labor force is composed of skilled workers, and consequently this part must be omitted in a study of the turning point. Nevertheless, we still have two good substitutes for this price of labor supply to the non-primary sector.

a) The first is female wages in the textile industry. This is a direct index for unskilled worker wages in the capitalist sector.

b) The second, agricultual wages, is an indirect index for unskilled wages in non-agriculture if we assume free migration of the labor force between the agricultural and non-agricultural industries. Accordingly agricultural wages can be taken to represent the supply price of agricultural laborers to non-agricultural industries.

Here we will adopt the second substitute. That is to say, if we assume equality of wages between the two industries, agriculture and forestry, we can use agricultural wages for the annual contract workers together with those for the daily workers deflated by CPI as an index

for w.[58]

2) Estimation of N_t:—As a substitute for N_t, the number of workers in the capitalist sector, the number of workers employed in non-primary industries cannot be used. The reason for this is that non-primary industries may have a number of skilled workers in them who may not be migrants from primary industries, but who instead have been supplied from within non-primary industries themselves. As w is agricultural (primary sector) wages, N_t should therefore be the total number of workers who originally came from primary industries. This figure can be estimated adding up the annual figures for net migration, and can be symbolically represented by the following relation.

$$N_t(t)=N_t(0)+\sum_{t=1}^{t} M(t).$$

Here $N_t(0)$ is the initial value for $N_t(t)$, while $M(t)$ is the number of migrants from primary industries. As is obvious from the relation above, we need two sets of statistics for the estimation of N_t.

a) The first is $M(t)$. This will be estimated in Chap. VIII, Section (2). The estimation

AGRICULTURAL WAGES AND AVERAGE PRODUCTIVITY OF AGRICULTURAL LABOR (POST-WORLD WAR II)

1959	1960	1961	1962	1963	1964	1965
.459*	.407*	.432*	.162	.363*	.246	.324*
.502*	.678**	.516*	.706**	.664**	.625**	.253
.440*	.399*	△ .080	.523*	.471*	.659**	.442*
.168	.045	.468*	.568**	.443*	.724**	.585**
.626**	.752**	.695**	.375*	.504*	.273	.375*

period covers the years 1873～1967 with the exception of the war-time years 1941～48.

b) The second is $N_t(0)$. The estimation of N_t will have to be made separately for the pre and postwar eras, because statistics for $M(t)$, which are to be added to $N_t(0)$, are not available for the war-time years. Thus need two sets of statistics for $N_t(0)$, one for the prewar period, and one for the postwar period. For the prewar period, 1872 is assumed to be the initial year. 1872 precedes by one year the time from when statistics for M are available. Let us assume that all of the non-primary sector labor force in this particular year is composed of migrants from primary industries. Consequently $N_t(0)$ then becomes the number of workers in the non-primary sector. In the writer's opinion, such an assumption seems to be quite realistic and justified since we are dealing with early stages of economic development. For the postwar period it is not quite so simple. The initial year should be 1948, as M is known from 1949. However, there are no reliable statistics which tell how many workers in the non-primary sector in this year originally came from the primary sector. Therefore let us assume that out of the total number of workers in the non-primary sector in 1948 the proportion of workers who originally came from the primary sector happened to be the same

[58] As has been pointed out earlier, female wages in the textile industry change in close relationship with agricultural wages. (See Chap. III, Section (2).) Accordingly if we use female wages in the textile industry in place of agricultural wages, our conclusions will not be affected.

as that in 1940. We can calculate N_i from 1873 to 1940, and it turns out to be that N_i comprised 70 per cent of the total non-primary sector labor force in 1940. Thus the product of this figure and the number of non-primary sector workers in 1948 will give us $N_i(0)$ for the postwar period. Then by adding up $M(t)$ to $N_i(0)$, $N_i(t)$ can be estimated.

It might be prudent here to point out some problems associated with such an estimation of $N_i(t)$.

1) The estimation of $N_i(0)$ for the postwar period is one of the weakest points in our estimation of $N_i(t)$. It cannot be denied that this estimation is arbitrary and could possibly be questioned from the statistical point of view. However, if we make a different assumption for $N_i(0)$ for instance, 50 per cent or 80 per cent of the non-primary sector labor force, this does not seem to seriously affect the value of the elasticity of labor supply.

(2) Over a period, death and retirement will decrease the number of workers who originally came from primary industries. Therefore one may criticize our estimates of $N_i(t)$ for not taking account of this point. However, our estimates are not affected by this at all, since we are concerned with examining the degree of response, expressed in terms of annual migration out of the primary sector, of primary sector laborers to changes in wages. Therefore there is no need to deduct the annual number of retirements and deaths of the people who are now non-primary sector laborers from the annual figures for net migration out of the primary sector $M(t)$.

3) The figure for net migration out of the primary sector $M(t)$, which is used in estimating $N_i(t)$ includes not only occupational migration from primary sector to the non-primary sector, but also includes the number of new workers from farm households who found their first job in the non-primary sector. However this is not necessarily unfavorable to our study, since there seems to be no big difference in the supply price of labor between primary sector laborers and those workers seeking their first job.[59]

(2) *Analysis*

In Fig. 13 $N_i(t)$, the number of non-primary sector workers who came originally from the primary sector, is regressed on the real wages of the annual contract workers in agriculture w, both in logarithmic scale. The slope of this regression is the elasticity of labor supply from the primary sector to the non-primary sector.

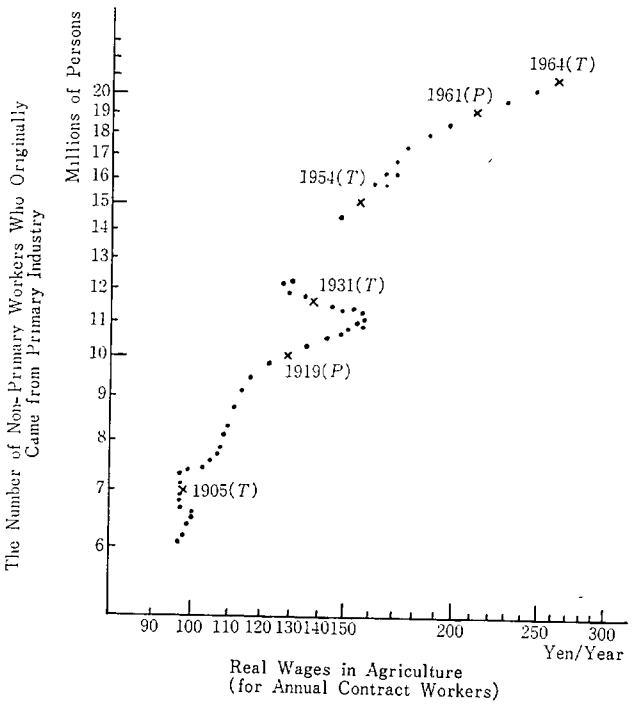
The supply elasticity may fluctuate in various phases of the long swings. However we are not interested here in these short-term fluctuations but rather in long-term changes or trends. Therefore we have to distinguish trends from cyclical fluctuations and attempt to extract the former. There are two possible ways of doing this.

1) The first is to compare the figures for the supply elasticity in the various upswings (or downswings) with each other.

2) The second is to calculate a figure for average elasticity over a long period, a period which would include some phases of the long swings. (In both methods the supply elasticity can be calculated by applying the relation $\log N_i(t)=a+b\log w(t)$ to the annual statistics.)

[59] It should be noted, however, that there is a difference in behavior between the heads of households and their dependent family workers in regard to migration out of the primary sector. In Japan the main body of out-migration from the primary sector has consisted of the latter workers [Ohkawa & Minami 1964, p. 4] and the theory of the turning point is concerned with these workers only.

FIG. 13. THE RELATION BETWEEN THE NUMBER OF NON-PRIMARY SECTOR WORKERS WHO ORIGINALLY CAME FROM THE PRIMARY SECTOR AND THE REAL WAGES OF THE ANNUAL CONTRACT WORKERS IN AGRICULTURE (1934~36 PRICES)

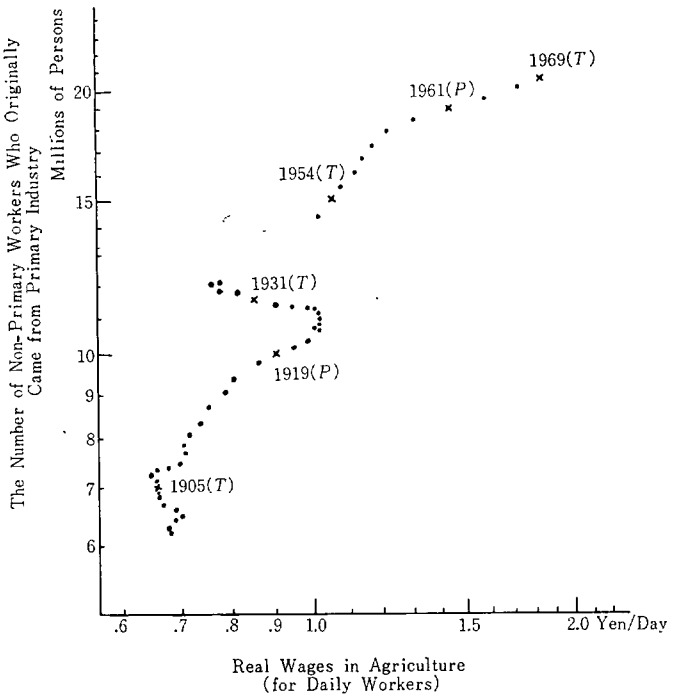


Remarks: The primary sector is comprised of agriculture and forestry.
Real wages are wages deflated by CPI.
Both the number of workers and the real wages are seven year moving averages and five year moving averages for the pre and postwar eras respectively.
Sources: See text.

1) To bigin with let us try the first method. In our observation period, two upswings and two downswings are included. Upswings occur in the years 1905~19 and 1954~61. Average elasticities for these sub-periods are calculated to be 1.4 and .2 respectively, the postwar figure being quite obviously the smaller. Downswings occur in the years 1919~31 and 1961~64. Average elasticities for these phases are .3 and .1 respectively. The former parameter (.3) is not statistically significant.[60] Thus, in the case of downswings, we cannot state that the supply elasticity is much smaller in the postwar period. Nevertheless it should be noted that the supply elasticity in the postwar period is a very low figure .1~.2.
2) Next let us try the second method. Fig. 13 demonstrates that the slope of the regression decreases stepwise between 1958 and 1959. Therefore we will estimate the average elasticity before 1958 and after 1959 separately. It is calculated to be 1.3 for the years 1897~1958 and

[60] Refer to footnote 62.

FIG. 14. THE RELATION BETWEEN THE NUMBER OF NON-PRIMARY SECTOR WORKERS WHO ORIGINALLY CAME FROM THE PRIMARY SECTOR AND THE REAL WAGES OF THE DAILY WORKERS IN AGRICULTURE (1934~36 PRICES)



Remarks: See remarks of Figure 13.
Sources: See text.

.1 for the years 1959~64, that is, it is extremely small in the latter period.

Fig. 14 demonstrates the relationship between $N_t(t)$ and real wages—in this case, for the daily agricultural workers. Average elasticities are calculated as 1.1 and .2 respectively for the periods of upswings 1905~19 and 1954~61. They are −.2 and .1 respectively for the periods of downswings 1919~31 and 1961~64. If we exclude the period 1919~31,[61] we can safely state that the elasticity declined sometime in the postwar period. Furthermore, in Fig. 14 the regression line shows a kink between the years 1958 and 1959. When we calculate average elasticities for the years 1897~1958 and 1959~1964 separately, they turn out to be 1.2 and .1 respectively. Once latter is much smaller than the former.[62]

Conclusively then, one may state that the elasticity of labor supply, apart from short-term fluctuations corresponding to the long swings, decreased at the end of the 1950's. If one follows Criterion 6, this finding suggests that the turning point was passed at that time.

[61] The parameter (−.2) for 1919~31 is not statistically significant. (See footnote 62.) It should be taken as zero.

VIII. (Appendix) *Changes in the Size of the Subsistence Sector Labor Force*

(1) *Estimation of the Number of Workers Employed in Agriculture and Forestry (1872~1940 and 1948~67)*

In Chap. V we examined long-term changes in the marginal productivity of labor in agriculture, as an index for the marginal productivity of labor in the subsistence sector. It was suggested there that the conspicuous increase in marginal productivity during the post-World War II period depended greatly on the unprecedented decrease in the number of workers in agriculture. What was not examined, however, was how the size of the agricultural work force has changed during the long period of Japanese economic development, and it is to this point that we now turn.

Let us use the number of workers employed in agriculture and forestry as a substitute for the size of the subsistence sector labor force. For the postwar period, statistics for the number of workers employed in these two industries are available from the *Kokusei Chōsa* (*Population Census*) which is published every five years by the *Sōri-fu, Tōkei-kyoku* (Bureau of Statistics, Office of the Prime Minister) and from the *Rōdōryoku Chōsa* (*Labor Force Survey*) which is published annually by the *Rōdō-shō* (Ministry of Labor). On the other hand, for the prewar period no reliable national surveys are available other than the *Population Census* for the years 1920, 1930 and 1940. Therefore, for both the pre-census years and the inter-census years, an appropriate method is needed to estimate the number of workers employed by industry groups.

Estimates have been made previously by a number of authors.

1) Hijikata-Yamada estimates
2) Henmi estimates
3) Minami estimates
4) Umemura estimates.

1) The Hijikata-Yamada estimates mentioned above mean the series which were compiled in Y. Yamada, *Nippon Kokumin Shotoku Suikei Shiryō* (*Sources for Estimating National Income in Japan* [Y. Yamada 1951, p. 152]. They were cited in K. Ohkawa and others,

[62] Coefficients of determination adjusted by degree of freedom are calculated as follows:

	Annual Contract Worker Wages	Daily Worker Wages
1905~1919	.937*	.963*
1919~1931	.178	△.049
1954~1961	.945*	.888*
1961~1964	.991*	.968*
....	.....	.....
1897~1958	.883*	.780*
1959~1964	.997*	.988*

* signifies that coefficients of determination are statistically significant at the 95 per cent level. △ designates negative figure.

Nippon Keizai no Seichō-ritsu (*The Growth Rate of the Japanese Economy*) [Ohkawa & others 1956, pp. 130~31] and its English version, *The Growth Rate of the Japanese Economy since 1878* [Ohkawa & others 1957, p. 245]. The series is comprised of the census figures for the years 1920, 1930 and 1940 and the Hijikata estimates made in 1929 [Hijikata 1929] for the pre-census years (1878~1919). For the inter-census years (1921~1929) the estimates were obtained by linear interpolation while for the inter-census years (1931~39) the estimates by the *Kōsei-shō, Jinkō Mondai Kenkyū-sho* (Institute of Population Problems, Ministry of Health and Welfare) and others are used. The Hijikata estimates for pre-1919 were the first attempt in Japan to estimate a long-term series for the number of workers employed by industry groups. He obtained the estimates by fitting a parabola to the annual figures for the number of workers employed in agriculture by prefectures, which were available from the *Naikaku, Tōkei-kyoku* (Bureau of Statistics, Office of the Cabinet), *Genjū Jinkō Seitai ni kansuru Tōkei Zairyō* (*Statistical Sources of Resident Population*) in 1913. Annual figures used by Hijikata were those for some selected prefectures which were considered to give continuous statistics. Thus the estimation resulted in an almost perfectly shaped parabola with a peak in about 1896.

2) K. Henmi who was sceptical of the Hijikata estimates attempted a quite different estimation. In this estimation he obtained the number of workers employed in agriculture and forestry by linking it with the number of farm households. He used the following procedure in his estimation. First of all he calculated the number of workers employed in agriculture and forestry per farm household by using the census figures for 1920, 1930 and 1940. Next he estimated the number of workers employed per farm household for the inter-census years (1921~29 and 1931~39) by means of linear interpolation. The number for the pre-census years (before 1919) was obtained by linear extrapolation from the trend for 1920~30. Lastly he obtained the number of workers employed in agriculture and forestry by multiplying the estimates for the number of workers employed per farm household by the number of farm households. The result of this estimation [Henmi 1956, p. 415], in contrast to the Hijikata estimates, demonstrated that the number of workers employed in these industries was almost constant as far as any long-term trend in population shift was concerned.[63]

3) The Minami estimates are similar to the Henmi estimates. The differences in method between the two estimates are as follows: a) The Minami estimates were made by sexes and by prefectures while the Hijikata estimates were national estimates for both sexes. b) Unlike the Henmi estimates, in which the number of workers employed per farm household for the pre-census years was estimated simply by extrapolation, the Minami estimates also took into consideration the semi-census figures for Yamanashi prefecture in 1879 and for Yamagata prefecture in 1887.[64,65] The result of the estimation [Minami 1966, p. 278] confirms the finding made in the Henmi estimation that the number of workers employed in agriculture and forestry has remained almost constant. However estimations of the Henmi-Minami type which are dependent on the number of farm households, might be lacking in reliability. It

[63] Both the Hijikata estimates and the Henmi estimates have been critically analysed by the present writer [Minami 1966, pp. 275~76].

[64] For Yamanashi Prefecture (1879): *the Kai no Kuni Genzai Jinbetsu Shirabe* (*Census of Individuals in the Province of Kai*) is used. For Yamagata Prefecture (1887): the *Yamagata-ken Shokugyō Tōkei-sho* (*Occupational Statistics in Yamagata Prefecture*) is used.

[65] For details of the estimating procedure, see [Minami 1966, pp. 276~78].

is assumed in this type of estimation that the number of workers employed in agriculture per farm household changes only in an arithmetical ratio, or that the number of workers employed in agriculture is closely related to the number of farm households. There is possibly room for doubt about the reliability of this assumption, but at least it seems that any short-term fluctuations (even those corresponding to the long swings) in the number of workers employed in agriculture are caused by changes in the number of workers employed per household. They do not come from changes in the number of households. Thus these short-term changes in the number of workers employed tend to be neglected in Henmi-Minami estimation.[66]

4) M. Umemura attempted to avoid this defect of the Henmi-Minami estimates in his newest estimates.[67] In the first place he estimated the following three series; i.e.,

a) the size of the total population by sexes and by age groups,

b) the ratio of workers to the total population (labor participation ratio) by sexes and age groups, and

c) the number of gainfully-employed workers as a product of series a) and b).

For series a) Umemura used the official statistics by the Bureau of Statistics, after some errors in them were adjusted. In Series b) the assumption was made that the labor participation ratios (by sexes and by age groups) were increasing functions of the farm household population ratio (the ratio of farm household population to total population). That is to say that, using the 1920 census figures, he estimated an equation which represented the relationship between the labor participation ratios by prefectures and the farm household population ratios by prefectures. Assuming that this cross-sectional relationship would hold true also for the time-series, he substituted the annual figures for the farm household population ratio (national figures) for this relationship and obtained the annual labor participation ratios.

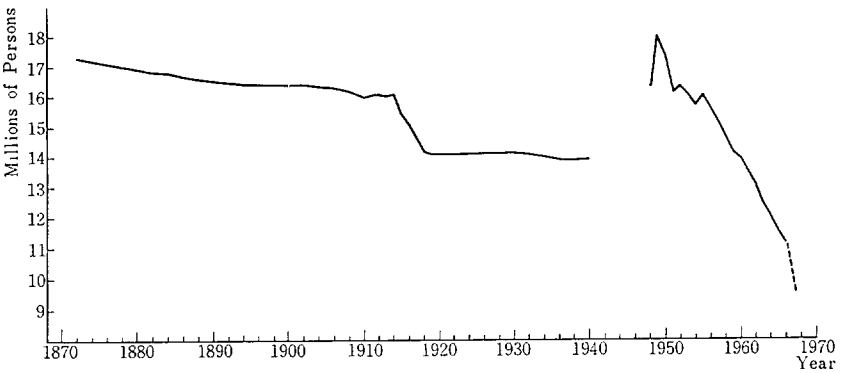
Then he divided the total number of gainful employed workers by industry groups. This division was made for two separate periods, 1906~1919 and 1872~1905. For the period 1906~1919 a unique estimation was made by using the statistics for the number of deaths of industrial laborers as contained in the Bureau of Statistics, *Nippon Teikoku Shiin Tōkei* (*Statistics for the Causes of Deaths in the Japanese Empire*). Namely he calculated the ratios of the number of deaths in agriculture and in forestry to the total number of deaths in the national work force, multiplied these ratios by the total number of grainfully employed workers and obtained the number of workers employed in agriculture and forestry (as well as the number in other industries). For the period 1872~1905 he extrapolated the number of workers employed in agriculture and forestry by taking into consideration the Minami estimates described in 3). The number of workers employed in other industries was the residual obtained after subtracting the figure for the number of workers employed in agriculture and forestry from the figure for total number of gainfully employed workers [Umemura 1968, p. 329].

Considering that the Umemura estimates are the best among the various attempts, we will use these in our study. As these estimates cover only the period 1872~1920, we should extrapolate them by linking them with the Minami estimates. The result of such an estimation is depicted in Fig. 15. For the period 1949~67 the *Labor Force Survey* by the Ministry

[66] This fact was pointed out by the estimator himself [Minami 1966, p. 278].

[67] An outline of the estimating procedure was published in [Umemura 1968]. A more detailed discussion will appear in the forthcoming *Jinkō to Rōdōryoku* (*Population and Labor Force*) by M. Umemura and others, *Chōki Keizai Tōkei* (*Estimates of Long-term Economic Statistics of Japan since 1868*), Vol. 2.

FIG. 15. THE NUMBER OF WORKERS EMPLOYED IN AGRICULTURE AND FORESTRY



Remarks: For the postwar period, workers are more than fifteen years old.

Sources: Prewar: For the period 1872~1920, the Umemura estimates [Umemura 1968, p. 329] are used. Values for the period 1921~40 are estimated by linking them with the Minami estimates [Minami 1966, p. 278] [Umemura and others 1966, pp. 219 & 236]. This is done by multiplying the Minami estimates by a constant whose value is .99801. This constant is a ratio of the Umemura estimates to the Minami estimates in 1920.

Postwar: Figures from the *Labor Force Survey* [*Rōdō-shō* 1966, p. 23] and the *Rōdō Daijin Kanbō, Rōdō Tōkei Chōsa-ka* (*Division of Labor Statistics and Research, Ministry of Labor*), *Rōdō Tōkei Nenpō* (*Year Book of Labor Statistics*) are used. However, there is a problem here. The *Labor Force Survey* for 1948~52 is for workers who are more than fourteen years old, while that after 1953 is for workers more than fifteen years old. We will use the official statistics for the post-1953 period and will use those for 1948~52 also, after making the following adjustment to the latter. In the population census of 1955 the number of workers employed by industry groups and by age groups is available. Where we calculate the ratio of workers employed in agriculture and forestry who are more than fifteen years old to those employed in agriculture and forestry who are more than fourteen years old, it turns out to be .99638 [*Sōri-fu, Tōkei-kyoku* 1960, pp. 334 & 338]. When we multiply this ratio by the official figures for employment in the *Labor Force Survey* for 1948~52, we obtain the number of workers employed in agriculture and forestry who are more than fifteen years old. It also happens that the *Labor Force Survey* is not continuous between 1966 and 1967, because of a change in the way of estimation, but adjustment for this discontinuity is not made here, since this figure is drawn by a dotted line after 1967.

of labor is used.

This figure has a number of notable features.

1) The curve for the changes in the number of workers employed in agriculture and forestry is quite different for the pre and the postwar periods. For the prewar period, there were no remarkable changes, except for a big decline during the period 1914~18. For the postwar period, on the other hand, a conspicuous decline has continued right up to the present. Annual compound rates of growth are calculated as $-.4$ per cent and -2.1 per cent for the periods 1872~1940 and 1948~66 respectively. We also separately calculated the rate of growth for the period 1914~18, and this turned out to be -2.9 per cent, which one could consider

to be comparable to the decline for the postwar period. However, there is a substantial difference in the characteristics of the decline in the period 1914~18 and that in the postwar period. The former lasted only a few years and the latter has continued for around two decades. In other words the former was a short-term phenomenon in the upward phase of a long swing, while the latter has been a trend phenomenon or has reflcted a structural change in the labor economy. Accordingly it cannot be denied that the postwar decline in agricultural employment has been an unprecedented one.

2) The big decline in the period 1914~18, which does not show up in the Henmi-Minami estimates, is one of the most remarkable features in the Umemura estimates. This decline seems to be feasible when we consider the economic conditions prevailing in those years. That is to say that, during these boom years, in which economic activity was accelerated, the demand for labor increased greatly. Out-migration of agricultural laborers was accelerated and led to a decline in the absolute number of workers in agriculture. This tends to show that the Umemura estimates are much more reliable than the Henmi-Minami estimates.

(2) *Estimation of Net Out-migration of the Number of Workers Employed in Agriculture and Forestry (1873~1940 and 1949~67)*

Column (1) in Table 18 gives quinquennial figures for the annual increase in the number of workers employed in agriculture and forestry. The statistics for the number of workers employed are the same as those which were used in Figure 15. The annual decrease is very large for 1911~15, 1916~20 and for the postwar period. This point has already been noted in regard to Fig. 15. The purpose of this section to try to clarify the determinants of these changes.

Changes in the number of laborers in a certain industry depend, firstly, on natural increases (entries, retirements and deaths) and, secondly, on social increases (≡net in-migration ≡in-migration−out-migration). We can estimate the social increase by first estimating the natural increase, and then deducting it from the increase in the number of laborers. Denoting the number of workers employed in agriculture and forestry by P, annual increase in this number of workers by $\triangle P$, the natural increase in the number of workers employed by V, rate of natural increase by v ($\equiv V/P$), and the figure for net out-migration (≡−net in-migration) by M, we have the relation

$$M \equiv V - \triangle P$$
$$\equiv vP - \triangle P.$$

Here we will make the assumption that the rate of natural increase in employment is equivalent among the various industry groups, in which case the rate of natural increase in employment in agriculture and forestry is equal to that for the natural increase in total employment for all industries combined $\bar{v}$. Thus the last relation becomes

$$M \equiv \bar{v}P - \triangle P.$$

It we substitute the values of the annual statistics for $\bar{v}$ and P in this relation, we can obtain

TABLE 18. CHANGES IN THE NUMBER OF WORKERS EMPLOYED IN AGRICULTURE AND FORESTRY AS DETERMINED BY THEIR CAUSES

Period	Increases in Employment in		Natural Increase (V) in	Volume of Net Out-migration (M) out of	Rate of Net Out-migration (m) (%) out of	Ratio of Net In-migration to Total Increase in Workers Employed in Other Industries (%)
	Agriculture & Forestry $\triangle P$	Other Industries	Workers Employed in Agriculture and Forestry			
	(1)	(2)	(3)	(4)=(3)−(1)	(5)	(6)=(4)/(2)
1876～1880	△ 45	132	68	113	.67	85.6
1881～1885	△ 40	130	69	109	.65	83.8
1886～1890	△ 46	195	109	155	.94	79.5
1891～1895	△ 22	163	100	122	.74	75.5
1896～1900	6	117	84	78	.47	66.7
1901～1905	△ 33	146	78	111	.68	76.0
1906～1910	△ 54	158	64	118	.73	74.7
1911～1915	△ 142	317	99	241	1.56	76.0
1916～1920	△ 236	398	100	336	2.33	84.4
1921～1925	—	255	129	129	.92	50.6
1926～1930	—	254	124	124	.88	48.8
1931～1935	△ 29	355	152	181	1.30	51.0
1936～1940	△ 7	283	121	128	.92	45.2
1951～1955	△ 261	1,369	451	712	4.44	52.0
1956～1960	△ 426	1,110	182	608	4.40	54.8
1961～1965	△ 474	1,048	141	615	4.94	58.7

Remarks: Figures are yearly figures.
△ signifies negative value.
Sources: See text.

the annual figures for M.[68] Columns (3) and (4) in Table 18 show the figures for the natural

[68] Special attention should be paid to the fact that our estimates of net out-flow include occupational migration (shift of agricultural laborers to non-agricultural industries) as well as migration by new workers from the farm households. Occupational migration has been estimated by the *Rodo-shō* (Ministry of Labor). Below are the five yearly estimates of the volume and the rate of net out-migration from agriculture and forestry to other industries [*Rōdō-shō*, *Rōdō Tōkei Chōsa-bu*, 1968, p. 30].

	Volume of Net Out-migration (thousands of persons)	Rate of Net Out-migration (per cent)
1950～55	161	1.01
1955～60	145	.98
1960～65	158	1.27

(These are annual figures. The rate of net out-migration is defined as the ratio of net out-migration to the number of workers employed in agriculture and forestry. The number of workers employed in agriculture and forestry is taken as the average of the figures for the first and last years of each five year period.) Our estimates in Table 18 are four times as large as the estimates cited above. This means that the number of new workers in the non-agricultural sector who came from the agricultural sector has been extremely large.

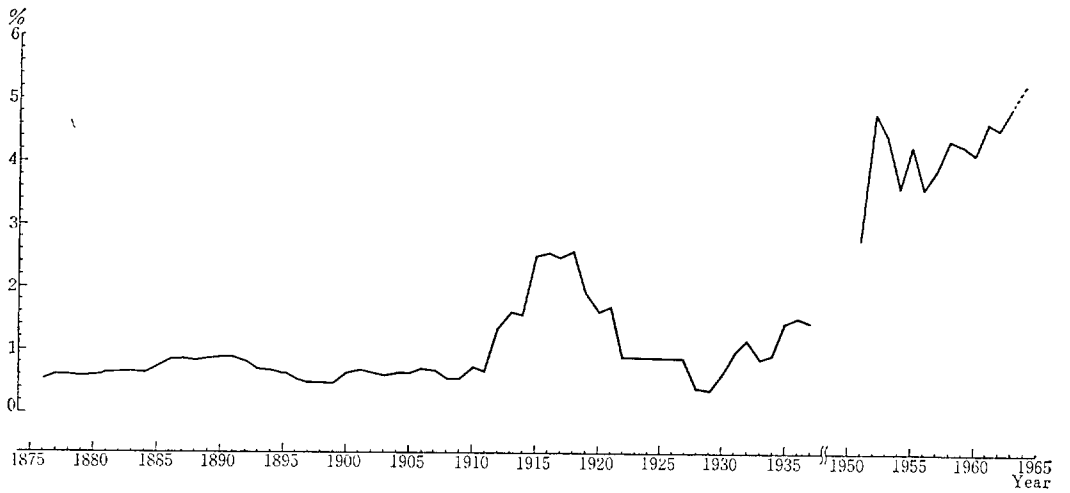
increase in employment in and net out-migration out of agriculture and forestry. The rate of net out-migration m ($\equiv M/P$) is calculated in Column (5).

Regarding this table, we can make the following observations:

1) The net out-migration has exceeded the natural increase in all five year periods, the period 1896~1900 being the early exception to this, and consequently, this is one of the reasons for the decline in the number of workers employed in agriculture and forestry.

2) While the rate of natural increase has been comparatively stable, there have been remarkable changes in net out-migration. These changes have been the determinants of the changes in the number of workers employed.

FIG. 16. THE RATE OF NET OUT-MIGRATION OF WORKERS EMPLOYED IN AGRICULTURE AND FORESTRY



Remarks: Seven year moving averages and five year moving averages for the pre and the postwar periods respectively.

The *Labor Force Survey*, on which the postwar estimates are dependent, is not continuous between 1966 and 1967. Therefore the curve in this figure which is in terms of five year moving averages is not continuous between 1963 and 1964, and so the curve after 1964 is drawn by a dotted line.

Sources: See text.

3) The changes in the size (and the rate) of net out-migration have been closely related to economic fluctuations.

Let us examine this last point in much more detail by using Fig. 16 which depicts the annual figures (moving averages) of the rate of net migration, and from which the following findings were derived:[69]

1) The big change with a peak in 1915~19 was a consequence of the accelerated economic

[69] The rate of net out-migration was stable before 1910. This may be because of the difficulty in assigning the total number of gainfully employed workers into their correct industry groups before 1906. This problem arises because the division of gainfully employed workers into industry groups relies on the Minami estimates for the number of workers employed in agriculture and forestry, and these estimates are ones in which short-term fluctuations are not easily observable.

growth caused by World War I. (According to the periodization of long swings by Ohkawa and Rosovsky shown in our Table 1, 1919 is a peak year.) During this period the demand for labor expanded rapidiy in non-agriculture industries and out-migration of agricultural laborers also increased rapidly to cope with this demand.

2) The change with a trough in 1928~29 reflects the depression in the latter half of the 1920's. (According to Ohkawa-Rosovksy's periodization, 1931 is a trough year.)

3) The increase in net out-migration in the 1930's was a consequence of accelerated economic growth. (The long swing reached its peak in 1938.)

4) For the postwar period the rate of net out-migration has increased and at present is running at the high figure of more than 4 per cent. The big difference between the levels of the pre and the postwar periods may be partly explained by the difference in the rate of economic growth between the two periods.

5) The rate of net out-migration shows a change with a trough in 1954~56. This change corresponds to a change in economic activity at that time. (In the Ohkawa and Rosovsky's periodization of long swings, 1954 appears as a trough.)

6) The rate of net out-migration shows a big increase during the upswing in economic activity in the period 1954~61.[70]

From these findings we may safely conclude that the changes in the rate of net out-migration of agricultural laborers have been closely associated with changes in economic growth or have been a consequence of it.

Let us return to Table 18, and look at Column (6) which gives the ratio of net in-migration to the total increase in employment in industries other than agriculture and forestry.[71] This ratio shows a long-term decreasing trend. It was 86 per cent in the period 1876~80 and had decreased to 45 per cent by the period 1936~40. This implies that labor supply to non-agriculture came mainly from in-migration from agriculture in the early stages of economic development, while labor supply from within non-agriculture increased as economic development progressed. However, the ratio increased slightly in the postwar era.

---

[70] According to Ohkawa and Rosovsky's periodization, 1961~64 is the downward phase of a long swing (Table 1). However, the increasing trend in the rate of net out-migration of agricultural laborers which began at the end of the 1950's has continued during this phase. If both the periodization of the long swings and our estimates of the net out-flow are correct, the continuous increase in the rate of net out-flow during this particular period would have to be explained by some other factors. As yet has not had time to carry out enough detailed research which would provide a solution to this problem.

[71] The number of workers employed in industries other than agriculture and forestry is estimated by using a similar method to that used for estimating the number of workers employed in agriculture and forestry (see text). Namely, for the period 1872~1920 the Umemura estimates [Umemura 1968, p. 329] are used. For the period 1921~40, the number of this period is estimated by linking it with the figures in the Hijikata-Yamada estimates [Ohkawa & others 1957, p. 246]. For the postwar period, the figures from the *Rōdōryoku Chōsa* (*Labor Force Survey*) are used. However these figures are not continuous between the years 1952 and 1953 since in the figures up to and including 1952 workers in the labor force were taken to be more than fourteen years old, while in the figures from 1953 onwards, workers are regarded as being more than fifteen years old. Therefore we will adjust the official pre-1952 figures by multiplying them by a constant 0.99877, and this will give us the number of workers in the labor force who are older than fifteen years. This constant figure is the ratio of the number of fifteen year olds employed in industry groups other than agriculture and forestry to the number of fourteen year olds in the same industry groups, both figures being available from the *Population Census* of 1955 [*Sōri-fu, Tōkei-kyoku* 1960, pp. 334 & 338].

(3) *Changes in the Number of Unpaid Family Workers*

In the preceding section we analyzed changes in the number of workers employed in agriculture and forestry, and used these changes as an index for the number of subsistence sector laborers. The number of unpaid family workers could also be used as an index for this purpose because almost all subsistence sector laborers are unpaid family workers.[72] In Table 19 both the pre and the postwar series for the number of unpaid family workers are

TABLE 19. THE NUMBER OF UNPAID FAMILY WORKERS

(thousands of persons)

Year	*Population Census* and Ishizaki Estimates	Year	*Labor Force Survey*
	(1)		(2)
1920	10,113	1948	12,430
1930	10,247	1950	12,970
1940	10,268	1952	12,950
1950	12,250	1954	13,540
1955	11,894	1956	13,240
1960	10,509	1958	12,410
1965	9,222	1960	11,510
		1962	10,940
		1964	10,250
		1966	

Remarks: Figures in (1) are those for October 1st of the designated year. Those in (2) are the averages for twelve months.
Figures in (2) for 1948~52 are for workers who are more than fourteen years old, while for the years after 1954, they are for workers who are more than fifteen years old.

Sources: (1) *1920~1930*: Estimates by T. Ishizaki [*Shōwa Dōjinkai* 1957, p. 40].
1940~1965: Figures from the *Population Census* are used. 1940; [*Shōwa Dōjin-kai* 1957, p. 42]. 1950~1955; [*Sōri-fu, Tōkei-kyoku* 1960, pp. 434 & 435]. 1960; [*Sōri-fu, Tōkei-kyoku* 1963, p. 474]. 1965; *Sōri-fu, Tōkei-kyoku* (Bureau of Statistics, Office of the Prime Minister), *Shōwa 40-nen, Kokusei Chōsa, Dai 2-kan, 1% Chūshutsu Shūkei Kekka, Sono-2, Rōdōryoku Jōtai, Sangyō, Jūgyō-jō no Chii (1965 Population Census of Japan, Volume 2, One Percent Sample Tabulation Results, Part 2, Labor Force Status, Industry and Employment Status)*, 1967, p. 150.
(2) The *Labor Force Survey* [*Rōdō-shō* 1966, pp. 22~23].

[72] On one occasion the writer used unpaid family workers as well as self-employed workers as indexes for the number of subsistence sector laborers [Minami 1968, p. 391]. The reason was that self-employed workers could almost be considered to be self-employed operators of small scale enterprises [Minami 1968, p. 393]. In this paper, however, we consider the theory of the turning point to be useful in explaining the activities of workers such as the second and third sons, and daughters of farm households. In other words it is assumed that migrants from the subsistence to the capitalist sector comprise mainly workers such as these. In this sense self-employed workers can not be considered to be a good substitute for subsistence sector laborers.

shown. For the *Population Census* series we have both the pre and postwar series, while for the *Labor Force Survey* we have only the postwar series.

According to the *Population Census* figures the number of unpaid family workers increased somewhat in the postwar period. The annual rate of growth of the number of unpaid family workers is calculated as .1 per cent and −1.8 per cent for the periods 1920~40 and 1950~60 respectively. Although the *Labor Force Survey* is compiled annually, in the table above, however, figures from that survey are shown for every other year. The table demonstrates that the number of unpaid family workers increased in the first half of the 1950's, and then decreased extremely quickly in the latter half of the 1950's.

When we compare changes in the number of unpaid family workers to changes in the number of workers employed in agriculture, the following points can be made.

1) We are unable to tell whether or not there was a big decrease in the number of unpaid family workers after World War I which would compare with the large decrease mentioned earlier which occurred at that time in the number of workers employed in agriculture. This is because statistics are not available for the number of unpaid family workers before 1920. However the number of unpaid family workers and the number of workers employed in agriculture do have a common feature in that both show a full-scale decrease after World War II.

2) The number of workers employed in agriculture had already began declining by 1950, while the decline in the number of unpaid family workers began seversl years later.

(4) *Estimation of the Farm Household Population (1920~40 and 1950~68)*

In Sections (4) and (5) respectively, the size of the *nōka jinkō* (farm household population) and the size of net-migration from this population will be estimated and changes in both these figures will be studied. In a number of ways, such a study should serve to collaborate our analysis on agricultural employment made in Sections (1) and (2).

1) The number of workers employed in agriculture for the period 1920~40 was estimated by linking it with the number of farm households for the period 1920~40 using the years 1920, 1930 and 1940 as bench-marks (Minami estimates). The size of the farm household population in the prewar period (1920~40) will be estimated also by linking it with the number of farm households for the period 1920~40. However, since five yearly bench-marks are used in this estimation, short-term fluctuations, if any, should tend to be much more easily visible from estimates for the farm household population than from the number of workers employed in agriculture.

2) When we estimated the size of the net out-flow of workers employed in agriculture, we were faced with the difficulty of estimating the rate of natural increase of the number of workers employed in agriculture. However we made this estimation by adopting the rather arbitrary assumption that the rate of natural increase between the agricultural and the non-agricultural labor force was equal. On the other hand, in estimating the net out-flow of the farm household population we are not faced with such a difficulty, and, therefore this estimation should be much more reliable.

To begin with, in this section, we wish to estimate the size of the farm household population. Estimation will be made using different methods for the pre and the postwar eras.

1) Estimation for the prewar era (1920~40):—Data for the size of the farm household population are not available at all. The only exception to this is the data regarding the family size of *nōgyō shotai* (agricultural households) or the households of which the heads are engaged in agricultural activities, this data being compiled by prefectures in the *Population Census* for 1920 and 1930. We assume that this family size is equivalent to the family size of farm households by prefectures. Also, in the censuses of 1920, 1925, 1930, 1935 and 1940, the family size of the *gunbu jinkō* (rural population) is known by prefectures. Now we assume that changes in the family size of the rural population are closely related with those in the size of farm households. Under this assumption, and using the family size of farm households in 1920 and 1930 as bench-marks, we can estimate the family size of farm households in 1925, 1935 and 1940 by linking it with the size of the rural population by prefectures. Thus we obtain five yearly figures for the family size of farm households by prefectures for the period 1920~40. Figures for the inter-census years are estimated by linear interpolation. Multiplying the estimates for annual size of farm households by prefectures by the number of farm households by prefectures, the annual size of the farm household population by prefectures is obtained. For the number of farm households by prefectures, the Umemura-Yamada estimates are used. These estimates are based on the *Nōkai Chōsa* (*Agricultural Association Survey*) by the *Teikoku Nōkai* (Imperial Agricultural Association) [Umemura & Yamada 1962].

2) Estimation for the postwar period (1950~68):—A few surveys on the farm household population have been conducted by the Ministry of Agriculture and Forestry. As they stand, they are not comparable year by year because their coverage and method of measurement vary from year to year. But for four years—1950, 1955, 1960 and 1965—the data from the *Nōgyō Census* (*Census* of *Agriculture*) seem to be substantively comparable. They are shown in Column (1), Table 20. Figures for the farm household population in the intervening years

TABLE 20. COMPARISON BETWEEN THE FARM HOUSEHOLD POPULATION AND THE RICE PRODUCER'S HOUSEHOLD POPULATION

(thousands of persons)

Year	Farm Household Population	Rice Producer's Household Population	Ratio between the Two Populations
	(1)	(2)	(3) = (1)/(2)
1950	*37, 811	34, 156	11, 070
1955	*36, 468	*33, 227	10, 975
1960	*34, 546	*31, 745	10, 882
1965	*30, 114	*28, 430	10, 592

Remarks: Figures noted by * are official statistics. Other figures are estimated values. Figures exclude Amami Ōshima both in (1) and (2).
The figures for (1) are the population on February 1st of the current year.
The figures for (2) are the population on November 1st of the previous year.

Sources: (1): Survey by the Ministry of Agriculture and Forestry which appears in [*Nōrin-shō* 1961, pp. 71~73] and the *Nōrin-shō*, *Shokuryō-chō* (*Food Agency, Ministry of Agriculture and Forestry*), *Shokuryō Kanri Tōkei Nenpō* (*Year Book of Food Control*), 1967, p. 521.
(2): The *Idō Jinkō Chōsa* (*Registration for Rice Rationing*) in the *Year Book of Food Control*. In regard to the estimation for 1950, see text.

are estimated by linking it with the figures for the *seisan shotai jinkō* (rice producer's household population which are contained in the *Idō Jinkō Chōsa* (*Registlation for Rice Rationing*) by the *Nōrin-shō, Shokuryō-chō* (Food Agency, Ministry of Agriculture and Forestry). This survey resembles a census, so to speak, in that it is comparatively detailed and has continuity. Furthermore, the rice producer's household population in this survey comprised about 90 per cent of the total farm household population for these years and consequently we believe it realistically reflects changes in the farm household population. In Column (2) the rice producer's household population is known for census years.[73] In Column (3), the ratio of the farm household population to the rice producer's household population is calculated and shown, and it shows a slightly declining trend over the years. If we assume that this decline goes on in an arithmetical ratio, we can estimate this ratio for the intervening years by linear interpolation. For 1950~54 and 1966~68 we estimated the ratio by extrapolation. By multiplying the annual estimates for this ratio by the annual rice producer's household population, the annual farm household population is obtained.

Estimates of the farm household population are shown in Appendix Table 8 and are demonstrated in Figure 17. Regarding Figure 17 the following should be noticed:

1) Prewar changes in the farm household population are relatively small when compared

FIG. 17. THE FARM HOUSEHOLD POPULATION

Sources: Appendix Table 8.

[73] There is a time lag between the date of the survey of the rice producer's household population (November 1st) and that of the farm household population (February 1st). Therefore we have taken the rice producer's household population in the previous year as the population at the beginning of the current year. Also the farm household population in the current year is taken as the population at the beginning of the year.

The statistics for the rice producer's household population are not continuous between 1951 and 1952. Before 1951 all rice producer's households were surveyed, whereas since 1952 only those households operating a rice field of .2 *tan* or more have been surveyed. Therefore we have use the post-1952 official statistics only. Estimation of 1950~52 figures is made in the following way: The ratio in Column (3), Table 20 is estimated retrospectively to 1950 in the manner described in the text. When we divide the official statistics for the farm household population in 1950 (Column (1), Table 20) by this ratio, this gives us the rice producer's household population as 34,156,000 persons. The population for 1951~52 is estimated by linear interpopulation.

with those for the postwar period. Nevertheless, the increase in the farm household population in the 1920's and its relatively constant level in the 1930's do provide a constant. The former was a consequence of decreasing out-flow over time of the farm household population, this decreasing out-flow being caused by the depression of the 1920's. The latter comes from the accelerated outflow of population stemming from increasing economic activity in the 1930's.
2) In the postwar period a conspicuous decrease in the farm household population has continued over the past 10 or more years. The decrease is much more remarkable in the 1960's rather than it was in the 1950's. The annual rate of this decrease in population is −.7 per cent, −1.1 per cent, and −2.8 per cent for the periods 1951~55, 1956~60 and 1961~65 respectively. Such a rapid decrease in the postwar period has no parallel in the prewar period. This decrease in the farm household population is an unprecedented phenomenon in the process of the economic development of Japan, and is a consequence of Japan's remarkable economic growth in the postwar period.[74]

(5) *Estimation of the Net Out-migration of Farm Household Population (1921~40 and 1952~67)*

The net out-migration M of farm household population is estimated by using a similar method to that used for estimating the net out-migration of workers employed in agriculture in Section (2). Namely, the estimation is made by using the relation

$$M \equiv vP - \triangle P,$$

where P and v designate the farm household population and its rate of natural increase respectively. If we substitute the values for P and v in the relation above, M can be estimated. The values for P were obtained in Section (4), and v is estimated in the following way:
1) Estimation for the prewar period (1920~40):— No data are available for the rate of natural increase in farm household population in the prewar period. Therefore we have been forced to substitute the Tachi and Ueda estimates for the crude birth rate and the crude death rate of the rural population as a whole for the estimates of the crude birth rate and the crude death rate of the farm household population. The former estimates are available for each census year and are shown in Table 21. For the inter-census years, figures for the crude birth rate and the crude death rate are estimated by linking them with the crude birth and death rates of the total population respectively taken from the *Jinkō Dōtai Tōkei* (*Vital Statistics*) by the *Kōsei-shō* (*Ministry of Health and Welfare*). These estimates are given in Appendix Table 9.
2) Estimation for the postwar period (1952~67):— Information is available for the postwar period from numerous surveys conducted by the Ministry of Agriculture and Forestry. As a substitute for the rate of natural increase in the farm household population, we will use the rate of natural increase in the rice producer's household population which can be derived from the *Registration for Rice Rationing*. The rate of natural increase in the rice producer's

[74] As is clearly shown in Figure 17, the farm household population expanded greatly just after the end of World War II. This was because most of the repatriates from abroad and a considerable number of urban dwellers went back to rural areas. Thereafter they began returning to urban areas in large numbers, thus accounting for the initial decline in the 1950's in the farm household population. The decline continued even after the farm household population fell below the level it reached in the years immediately preceding the war. This signifies that the decline cannot be explained only by the drift back to urban areas of repatriates and those who left the cities in the immediate postwar period.

TABLE 21. THE RATE OF NATURAL INCREASE IN THE RURAL POPULATION IN THE PREWAR PERIOD

(per cent)

Year	Crude Birth Rate	Crude Death Rate	Rate of Natural Increase
	(1)	(2)	(3) = (1) − (2)
1920	3.79	2.57	1.22
1925	3.65	2.07	1.59
1930	3.42	1.87	1.55
1935	3.41	1.78	1.63
1940	3.08	1.74	1.34

Remarks: Figures exclude Okinawa.

Since the writer has counted fractions of 0.5 and over as a whole number and disregarded those fractions which are less than 0.5, Column (3) may not be exactly equal to the difference between Column (1) and Column (2).

Sources: Estimates by M. Tachi and M. Ueda [Tachi & Ueda 1952, p. 159].

household population is obtained by dividing the annual natural increase in this population by the size of the rice producer's household population. The figure obtained is an average of the figure for the previous year and of that for the current year. The rate estimated is given in Appendix Table 10.

The estimates for the size and the rate of net out-migration of farm household population are given in Appendix Table 11. Table 22 shows the changes in farm household population by their causes (natural increase and net out-migration). From this table one can see quite clearly that the rapid decline in the farm household population during the postwar years has been mainly caused by a big increase in net out-migration. Net out-migration which stood at 360,000[75] persons per year in the prewar period increased to 700,000~1,000,000 persons per year in the postwar period. The rate of net out-migration was about 1 per cent per year for the prewar period and 2~3 per cent per year for the postwar period. In other words

[75] The comprehensive estimation in this paper for net out-migration of the farm household population in the prewar period is a revision of our estimate made some years previously by A. Ono and the writer [Minami & Ono, 1962a]. The estimation by T. Honda [Honda 1952, p. 59], popular but not comprepensive, was a rather interesting one. He used the following method: First of all he noted that the number of farm households was constant at 5,500,000 in the prewar period. He assumed that a farm couple on the average gave birth to five children during their lifetime. It was assumed that one of the children would die before he reached the age when he could be termed a productive worker. The other four children could be considered as two couples. One couple would follow their parent's occupation (agriculture) and the other would migrate out of agriculture. This situation would occur as long as the number of households remained constant. Assuming the average interval among generations to be thirty years, alternation of generations was estimated to occur in 180,000 farm households (5,500,000 households ÷30) annually. Therefore a farm household population of 360,000 (180,000 farm households×2) was estimated to leave the farm households annually. From this calculation, Honda concluded that the annual net out-flow of the farm household population was about 400,000 persons. This conclusion is nearly the same as ours. However, using Honda's method M. Namiki estimated the net out-flow of the farm household population as 400,000~450,000 persons per year in the prewar period [Namiki 1959, p. 57~59].

TABLE 22. CHANGES IN THE FARM HOUSEHOLD POPULATION BY THEIR CAUSES

(thousands of persons)

Year	Total Increase	Natural Increase	Volume of Net Out-migration	Rate (%)
	(1)	(2)	(3) = (2) − (1)	
1921~1925	△ 91	237	328	1.09
1926~1930	273	478	205	.66
1931~1935	14	479	465	1.47
1936~1940	△ 63	387	450	1.42
1952~1955	△ 218	508	726	1.97
1956~1960	△ 384	278	662	1.87
1961~1965	△ 886	122	1,008	3.16

Remarks: Figures are per year figures.
△ signifies negative value.
Sources: See text.

the net out-migration of the farm household population in the postwar period has become twice as large as it was in the prewar period, both in terms of the rate of net out-migration and in the absolute of out-migrants as well. Figure 18 depicts the annual figures for the rate of net out-migration of the farm household population, a rate which has shown remarkable fluctuations.

FIG. 18. THE RATE OF NET OUT-MIGRATION OF THE FARM HOUSEHOLD POPULATION

Sources: Appendix Table 11.

1) In the prewar period, the rate decreased during the downswing in the 1920's, and recorded its lowest figure (.5 per cent) in 1930, the year of the great depression, so that for all practical purposes the net out-migration can be considered to have stopped at that time. During the upswing which followed the rate increased.

2) In the postwar period, the rate was at a high level before 1952. There are two reasons for this. The first is that there were a considerable number of repatriates (soldiers as well as settlers who returned from the prewar Japanese colonies) returning to Japan at that time. The second is that there was an acceleration of economic activity in the country caused by the so-called Korean War boom. However, the rate of net out-migration reached a bottom a few years later although this bottom year came later than the year of the trough in the long swing 1954. Then, during the phase of the following upswing, the rate once again steadily increased.[76]

Conclusively then, we can state that the size of the farm household population has been greatly affected by fluctuations in economic activity in the country.[77] This fact has already been pointed out by the writer in a much more strict and comprehensive manner in his estimates of the statistical relationship between the rate of net out-migration of farm household population and the rate of economic growth [Minami 1967].

(6) *Conclusions and Their Implications*

From our studies in this chapter, we may conclude two things.

1) There are some cyclical fluctuations in the net out-flow of subsistence sector laborers. These fluctuations are closely associated with the long swings in economic activity. That is to say, the out-flow of subsistence sector laborers increases in the upswings and decreases in the downswings. These associations arise because the increase in the demand for labor in the capitalist sector is large in the upswings and small in the downswings.

2) Apart from these fluctuations, the number of subsistence sector laborers was almost constant in the prewar period while there has been a steady and continuous decrease in number in the postwar period. Such a decrease is unprecedented in the long history of economic development in Japan.

Conclusion 1) signifies that subsistence sector laborers migrate to the capitalist sector because of an increase in the demand for labor in the latter sector. In the theory of the turning point also, which provides the theoretical framework for our studies in this paper, labor migration between the subsistence and capitalist sectors is assumed to be determined by the demand for labor in the latter sector. Therefore the conclusions derived in 1) can be considered as providing proof of the applicability to the Japanese economy of the theory of the turning point.

On this point, we should mention two hypotheses which are widely spread among agricultural economists in Japan, although their influence seems to have declined in recent years. These hypotheses are the so-called 'constant farm household population hypothesis' and 'the constant farm household population migration hypothesis'. The first one ('the constant farm household population hypothesis') is based on the fact that the farm household population was almost constant from the long-term point of view in prewar Japan. In this hypothesis the generally constant size of the farm household population in the prewar period is explained by the existence of the social structure of farm households which keeps family size relatively

[76] The rate of net out-migration of the farm household population did not decline during the downswing after 1961. (On this point, see footnote 70).

[77] Cyclical fluctuations in regional population migration which correspond to fluctuations in economic activity have also been found [Minami 1967].

constant. Social structure here means the traditional family system. In this system the eldest son inherits the family property (land and houses) and carries on the family agricultural activities. On the other hand the other children, both sons and daughters, are expected to leave the agricultural industry, with the natural exception of course of those daughters who get married with workers in the agriculture industry. (One should note the very important fact that these out-flows are supposed to be quite independent of the economic conditions in non-agriculture.) That is to say, that part of the farm household population which is equal to its natural increase is continuously pushed out of agriculture. Thus the farm household population is maintained at a constant level.[78] Accordingly the first hypothesis necessarily leads us to another hypothesis, the 'constant farm household population migration hypothesis', since in the first hypothesis, the net out-migration is supposed to be equal to the natural increase in the farm household population. This second hypothesis states that firstly, the farm household population migration was almost constant in the prewar period and that secondly, as a consequence of this, it is not related, in any way, with fluctuations in economic activity.

These two hypotheses imply that farm household population migration is independent of economic conditions, that is to say of changes in the demand for labor in non-agriculture. In this respect they differ from the theory of the turning point. However studies in this chapter have demonstrated that such hypotheses are not realistic. Viewed from theory of the turning point, the constant level in the farm household population is an *ex post facto* phenomenon. That is to say, the increase in the demand for labor in non-agriculture happened to be equal to the natural increase in the farm household population.

It was pointed out in conclusion 2) that while the number of subsistence sector laborers was almost constant in the prewar period, there has been a steady and continuous decrease in the number in the postwar period. This steady and continuous decrease in the number in the postwar period followed from the outflow of subsistence sector laborers. This outflow has been dependent on a big increase in the demand for labor in the capitalist sector. This increase has been caused by the rapid economic growth of Japan in the postwar period. The big decline in the number of subsistence sector laborers has made a great contribution to the rise in the marginal productivity of labor in this sector. The rise in marginal productivity gave rise to an increase in real wages for laborers in this sector, and as a concomitant of this increase in real wages, the supply price of labor to the capitalist sector also increased. Therefore we can safely state that the conspicuous increase in real wages in the postwar period has been brought about by the increasing demand for labor in the capitalist sector, which led to a decrease in the size of the subsistence sector labor force, which, in turn, led to an increase in the marginal productivity of labor in the subsistence sector.

Before closing this section, the writer feels that a brief review of the various arguments concerning 'the constant farm household population hypothesis' may be in order. This hypothesis may be considered to have come from Namiki's statement that farm household population migration in prewar Japan was almost constant both from the short run and long-run points of view and that this constancy can be contrasted with the experience of the United States, where farm population migration fluctuated in accordance with business cycles [Namiki 1956, pp. 198~201; 1959, pp. 63~66]. Although his statement was not dependent on comprehensive statistical works, it became popular among agricultural economists. The first

[78] This viewpoint has been expressed by a number of writers such as M. Namiki [Namiki 1959], T. Inoue [Inoue 1963], K. Henmi [Henmi 1963], S. Masui [Masui 1969] and others.

challenge to this hypothesis was made by A. Ono and the present writer. That is, we estimated farm household population migration annually, and found a close relationship between the rate of migration and the rate of economic growth for both the pre and postwar periods [Minami & Ono 1962a; 1962b]. However this estimation involved a problem. It was that the farm household population in the prewar period was estimated by assuming the family size of the farm households to be constant for the entire prewar period M. Namiki and M. Shinohara pointed out this difficulty and criticized us [Namiki 1962] [Shinohara 1963]. According to Namiki, the increase in the number of farm households is dependent on the Japanese social system known as *bunke*. This can best be described in English as the situation wherein the young persons leave the original household and set up a new household which is then regarded as a new branch of the old family. Therefore even if the number of farm households increases as it did in the depression in 1930, the total farm population tends to be kept constant because of decreasing family size. We criticized such an understanding, and estimated the family size of farm households for the years including the great depression in 1930 in the six prefectures in the Tōhoku district in which the number of farm households increased, and pointed out that, contrary to Namiki's supposition, the family size did in fact *increase* [Minami & Ono 1963]. At the same time another writer Y. Hatai presented his own independent analysis. This analysis, which was also critical of Namiki, showed that the family size of farm households changes in accordance with the number of farm households [Hatai 1963]. Our comprehensive estimation of the farm household population in this paper shows that the family size did in fact *increase* when the number of the farm households increased. Namiki's assertion that changes in the number of farm households mainly relied on creating new families does not have any statistical backing. The writer doubts the feasibility of the assertion that new families were created even during the time of the depression. It would seem more realistic to assume that the families would prefer to stick together in such a time of hardship. And if this were the case, fluctuations in economic activity would tend to affect the size of families rather than the number of farm households.

In spite of these defects, Namiki's other assertion that changes in the farm household population migration in Japan had somewhat different patterns from those in the farm population migration in the United States should be dealt with here. As was pointed out by T. W. Schultz [Schultz 1945], whom Namiki refers to [Namiki 1956, p. 201; 1959, p. 64; 1966, p. 32], the net out-flow of farm population in the United States decreased around 1930 and then became negative.[79] In Japan, on the other hand, the net out-flow of farm household population decreased around 1930, but still remained positive. That is to say that even during the great depression in Japan the out-flow of farm population exceeded the in-flow. Two possible reasons for such a contrast between Japan and the United States are given here. a) In Japan, besides agriculture small scale enterprises in secondary and tertiary industries also acted as so-called 'pools of disguised unemployment'. Accordingly, unemployed workers did not necessarily need to go back to the rural areas. b) The depression in 1930 was not as serious in Japan as it was in the United States. If Japan had a depression as serious as the one in the United States, the out-flow in the farm household population should have decreased and the in-flow should have increased to a larger extend than they actually

[79] A statistical analysis of the farm household population migration in the United States has been made by H. L. Parsons [Parsons 1952, p. 34].

did. Therefore, in spite of the fact that the net out-flow was positive even during the depression, one cannot safely infer that the labor market in Japan was different to other countries in this period.

One of the positive contributions of 'the constant farm household population migration hypothesis' seems to be that it forced people to reconsider the so-called '*dekasegigata rōdō-ryoku ron* (hypothesis of seasonal workers who work in another part of the country away from their own farm households)'. In this hypothesis (see [Shinohara 1968, pp. 34~43]) expressed by K. Ōkōchi and other Marxian economists, rural villages were understood to be pools of disguised unemployment, and unemployed workers in non-agricultural industries could be absorbed into these pools. Statistics in the *Kōjō Rōdōsha Idō Shirabe* (*Survey on the Turnover in Factory Workers*) show that the percentage of people who returned to agriculture to the total number of unemployed factory workers was from 30 to 50 per cent during the period 1923~36, with a sharp increase at the time of the great depression [*Rōdō Undō Shiryō Iinkai* 1959, pp. 208~09]. Since the reliability of these statistics cannot be guaranteed, however, we are unable to come any firm conclusion as to whether or not the decrease in the rate of the net out-flow of the farm household population during the depression was greatly affected by the increasing number of unemployed workers who returned to rural areas. In the writer's opinion, however, the decrease in the rate of the net out-flow was mainly dependent on the decrease in the number of out-migrants from agriculture.

IV. *Summary and Conclusion*

In this article, comprehensive studies have been made on the existence and the date of the turning point in the Japanese economy. In summarizing the findings which were made in these studies, we will attempt to draw some conclusions regarding the turning points in the Japanese economy. Among the findings which we made and which are closely related with the subject of our concern here, are the following:

(Chap. III: Test depending on Criterion 3)

1) Real wages (deflated by the consumer price index) in agriculture in the prewar period increased in the upward phase (1905~19) of the long swing and decreased in the downward phase (1919~31). However, the trend in real wages over the entire prewar period was a slightly increasing one. In contrast to this, in the postwar era, real wages have increased conspicuously.

2) Real wages increased much faster in the downswing (1961~64) than they did in the upswing (1954~61), a phenomenon which did not occur in the prewar years.

3) The wages for female production workers in the textile industry have changed in a parallel fashion to agricultural wages. Therefore the conclusions in 1) and 2) are applicable to wages for female production workers in the textile industry. The fact that there has been constant wage differentials between the agricultural industry (subsistence sector) and the textile industry (capitalist sector) justifies our assumption that laborers move freely between the subsistence and the capitalist sectors.

(Chap. IV: Test Depending on Criterion 4)

4) Real wages in the modern sector, that is, those for skilled workers, increased at the same

rate in both the prewar and postwar eras. They continued to increase even during the downward phase (1919~31) of the longswing, in which phase real wages in agriculture declined.
5) Wage differentials between skilled workers and unskilled workers (that is, the subsistence and the capitalist sector labor force) appeared in the 1920's and began to decline at the beginning of the 1960's. Indexes for wage differentials which were examined were a) ratio of the wages of manufacturing industry workers to the wages of agricultural industry workers, b) the ratio of the wages for workers receiving the highest wages (male production workers in the machinery industry) to the wages for workers receiving the lowest wages (female production workers in the textile industry), c) the ratio of the wages of male workers to the wages of female workers in manufacturing industries, and d) the ratio of the wages for workers in large establishments to the wages for workers in small establishments in manufacturing industries.
6) Wage differentials tended to increase and to decrease in the downward phases and in the upward phases respectively of the long swings. In spite of this tendency, however, they declined in the downward phase of 1961~64.
(Chap. V: Test Depending on Criterion 5)
7) The marginal productivity of agricultural labor increased slightly up until 1919, and thereafter it remained almost constant until the end of the prewar era. It has shown a remarkable increase during the postwar era.
(Chap. VI: Test Depending on Criteria 1 and 2)
8) Agricultural wages were twice as large as the marginal productivity of labor would warrant in the prewar years. In the postwar period wages have been almost equivalent to the marginal productivity.
9) The relationship between real wages in agriculture and marginal productivity in agriculture has been much closer in the postwar period than it was in the prewar period.
10) Inter-regional relationship between wages and average productivity of agricultural labor did not exist in the 1920's. It was found for some years of the 1930's, but the relationship in these years seems to be a phenomenon which corresponded to the long swings.
11) For the postwar years, an inter-regional relationship between wages and average productivity of agricultural labor seems to have appeared at the end of the 1950's. Strictly speaking the date of this appearance differs among various scales (in terms of land area) of farm households. In large scale farm households, this inter-regional relationship appeared somewhat earlier, about the middle of the 1950's.
(Chap. VII: Test Depending on Criterion 6)
12) The supply elasticity of agricultural labor to non-agricultural industries declined stepwise between 1958 and 1959.
(Chap. VIII)
13) Agricultural employment remained at a constant level during the prewar years, with the exception of a big decline in 1914~18. It has shown a big and steady decrease during the postwar years. This decrease has been one of the major determinants of the big increase in the marginal productivity of agricultural labor. This contrast in the number of workers employed in agriculture between the pre and the postwar eras can be confirmed by examining the farm household population and the number of unpaid family workers.
14) The big declines in agricultural employment during the years 1914~18, and in the postwar period have been caused by big increases in the net out-flow of laborers from agriculture.

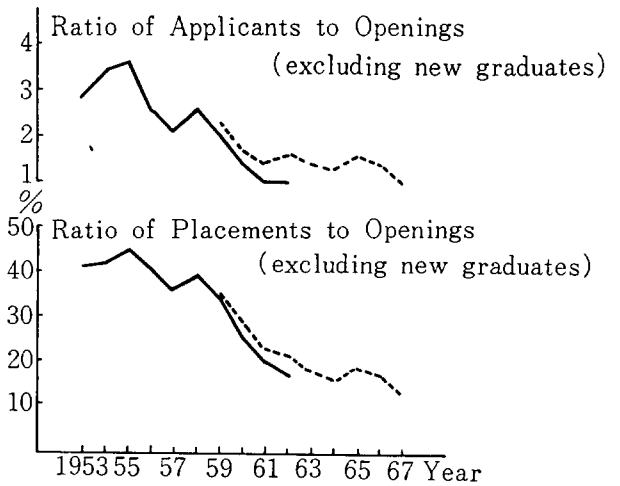
For the farm household population, the same explanation is applicable.

15) The net out-flow of agricultural laborers as well as the net out-flow in farm household population tend to be closely related with the long swings. This means that labor migration out of agriculture is determined by changes in the demand for labor in non-agricultural industries. This implies, therefore, that our theory of the turning point is applicable to the dual ecenomy (here agriculture vs. non-agriculture) of Japan.

In the first place, special attention should be paid to the finding in 8), because this was arrived at after undergoing our most rigorous test (Criterion 1). From this finding we can fairly safely state that the turning point did not occur in the prewar period but that it occurred sometime in the postwar period. The finding in 12), which was arrived at after undergoing our second most rigorous test (Criterion 6), tends to support such a conclusion. Furthermore the findings in 1), 2), 3), 5), 6), 7), 9), 10), 11) and 13) may be taken as collaborations of this conclusion.

The next problem is to date the turning point exactly. The findings in 5), 6), 11) and 12) tend to suggest that the turning point was passed at the earliest in 1959, at least during the several years around 1960.

FIG. 19. INDEXES FOR THE EXCESS DEMAND FOR LABOR



Sources: The *Advance Report on Local P. E. S. O. Employment Activities*, compiled by the *Rōdō-shō, Shokugyō Antei-kyoku* (Bureau of Employment Security, Ministry of Labor), [*Rōdo-shō* 1964; 1968, Appendix Tables].

Remarks: Statistics in regard to applications and openings in this figure are those which are termed in the original source as 'active applications' and 'active openings' respectively. Applications are 'active' in the sense that the process of applying for a job is still going on with the time limit specified by law. Openings are 'active' in the sense that the time limit for accepting these jobs has not yet expired.

Such a conclusion tends to correspond to the widely spread assertion that the basic conditions in the labor market were transfigured at that time.[80] Figure 19 demonstrates two indexes for the balance between the demand for and the supply of labor, or more correctly

[80] There are many references on this point; e. g. [Ishizaki 1967].

in this case, for the excess demand for labor. They are 1) the ratio of applications to openings and 2) the ratio of placements to openings. Changes in these indexes as well as changes in the rate of unemployment are often cited as signs of structural change in the labor market. The reason why the rate of unemployment is not used here is that although this rate is widely admitted as the best index for the excess demand for labor in the United States and European countries,[81] in the case where the unlimited supplies of labor exist, (as they do before the turning point) there is some doubt as to its reliability as an index of structural change in the labor market. Therefore any attempt at dating the turning point in terms of the rate of unemployment would appear to be open to error. Consequently, the two indexes in Figure 19 may be much better indexes of structural change in the labor market. Let us examine the changes in them. They began to decline after 1955, and reached a bottom around 1961 and have remained roughly at that level. At first glance it might seem that the declines in 1955~61 cerresponded to the upward phase of the long swing, while the relatively stagnant low level of the indexes corresponds to the downward phase of the long swing. In the writer's opinion, however, such an interpretation is not necessarily the best nor the correct one. Rather, he would emphasise the fact that the two indexes for the excess demand for labor reached their lowest limits around 1961. (If we exclude the figures for new graduates seeking employment, these indexes are approximately unity in 1961.) In other words the demand for and the supply of labor became equivalent to each other at the beginning of the 1960's for the first time in Japan's economic history. Shortly thereafter full employment was attained. This interpretation may be considered to be collaboration for our attempt at dating the turning point.

Strictly speaking, before one can categorically state that the terning point has been passed, it should be shown that it is impossible for the Japanese economy to return to the stage it was at before the turning point was passed. In other words, one should be able to state that the supply of labor in the economy as a whole will not exceed demand for labor in the capitalist sector, and that consequently real wages will not decline below the subsistence level in the foreseeable future. Naturally, there is considerable risk attached to attempting to forecast future economic conditions, although the writer feels that the following predictions can be safely made. Firstly, the labor supply will not increase to any great extent. Even should the crude birth rate rise as it did in the United States in the 1940's the effect of an increase in the supply caused by this rise in the birth rate will not be very serious. Furthermore, there is the possibility that the ratio of the labor force to the total population will decline somewhat. To date, this ratio has been at a very high level in comparison to other countries. Secondly, the demand for labor can be expected to decrease to any great extent. Although it is probable that increases in the demand for labor may be retarded in the downward phase of the long swings, and also that technological progress may become much more labor-saving when faced with rising wage levels, it seems fairly safe to assume that a continuing increase in the demand for labor will be heard from the labor-intensive tertiary industries. If this is the case, then the demand for labor in the economy as a whole will not decrease. Given these considerations the writer feels that it can be safely predicted that the Japanese economy will not return to the stage it was at before it passed the turning point.

However, since the period of time that we have experienced since the passing of the

[81] In the so-called Phillips-Lipsey curve, the rate of unemployment is considered to be an index for the excess demand for labor, and is regressed on the rate of growth in wage rates [Phillips 1958].

turning point is as yet of rather duration, our conclusions regarding the date of the turning point in Japan may have to be reexamined later in the light of further evidence or in view of any unforeseen changes in economic conditions in this country.

APPENDIX

APPENDIX TABLE 8. THE FARM HOUSEHOLD POPULATION

(thousands persons)

Year	The Farm Household Population	Year	The Farm Household Population
1920	29,819	1950	37,811
1921	29,796	1951	37,537
1922	29,829	1952	37,264
1923	29,915	1953	36,990
1924	30,081	1954	36,666
1925	30,273	1955	36,468
1926	30,502	1956	36,217
1927	30,746	1957	35,911
1928	31,038	1958	35,374
1929	31,307	1959	34,954
1930	31,636	1960	34,546
1931	31,747	1961	33,886
1932	31,809	1962	33,147
1933	31,761	1963	32,151
1934	31,728	1964	31,183
1935	31,708	1965	30,114
1936	31,719	1966	29,080
1937	31,667	1967	28,128
1938	31,430	1968	27,312
1939	31,354		
1940	31,391		

Remarks: Figures exclude Okinawa for the prewar years.

Figures are for October lst in the prewar years, and for February lst in the postwar years.

Sources: Figures for 1950, 1955, 1960, and 1965 are from the censuses by the Ministry of Agriculture and Forestry. Figures for other years are estimated values. For the method of estimation, see Chap. VIII, Section (4).

APPENDIX TABLE 9. THE RATE OF NATURAL INCREASE IN THE RURAL POPULATION

(per cent)

Year	Crude Birth Rate	Crude Death Rate	Rate of Natural Increase
1920	3.79	2.57	1.22
1921	3.67	2.31	1.36
1922	3.59	2.28	1.31
1923	3.68	2.34	1.34
1924	3.55	2.18	1.37
1925	3.65	2.07	1.59
1926	3.63	1.95	1.68
1927	3.51	2.02	1.49
1928	3.59	2.03	1.56
1929	3.45	2.04	1.41
1930	3.42	1.87	1.55
1931	3.41	1.97	1.45
1932	3.50	1.84	1.66
1933	3.37	1.86	1.51
1934	3.21	1.91	1.31
1935	3.41	1.78	1.63
1936	3.21	1.86	1.36
1937	3.29	1.81	1.48
1938	2.87	1.88	1.00
1939	2.80	1.88	0.93
1940	3.08	1.74	1.34

Remarks: Figures exclude Okinawa.

Because fractions of 0.5 and over have been counted as whole numbers and fractions of less than 0.5 have been disregarded, the rate of natural increase is not always equal to the difference between the crude birth rate and the crude death rate.

Sources: For 1920, 1925, 1930, 1935 and 1940, the estimates by M. Tachi and M. Ueda [Tachi & Ueda 1952, p. 159].
For other years see Chap. VIII, Section (4).

APPENDIX TABLE 10. THE RATE OF NATURAL INCREASE IN THE RICE PRODUCER'S POPULATION

(per cent)

Year	Rate of Natural Increase
1952	1.49
1953	1.23
1954	1.15
1955	1.12
1956	.97
1957	.76
1958	.82
1959	.79
1960	.63
1961	.56
1962	.47
1963	.46
1964	.44
1965	.35
1966	.06
1967	.37

Remarks: The rate of natural increase is the ratio of the annual increase in the rice producer's population to the total rice producer's population. The figure for the total rice producer's population is derived as an average of the figures for the current and previous years.

Sources: Figures for both the annual natural increase and the rice producer's population are from the *Idō Jinkō Chōsa* (*Registration for Rice Rationing*) by the *Shokuryō-chō* (Food Agency), in the *Shokuryō Kanri Tōkei Nenpō* (*Year Book of Food Control*) by the Ministry of Agriculture and Forestry.

APPENDIX TABLE 11. THE SIZE AND THE RATE OF NET OUT-MIGRATION OF THE FARM HOUSEHOLD POPULATION

Year	Size of Out-migration (thousands of persons)	Rate of Out-migration (%)	Year	Size of Out-migration (thousands of persons)	Rate of Out-migration (%)
1921	429	1.44	1952	827	2.22
1922	358	1.20	1953	729	1.97
1923	314	1.05	1954	744	2.03
1924	247	.82	1955	605	1.66
1925	291	.96	1956	601	1.66
1926	284	.93	1957	575	1.60
1927	215	.70	1958	821	2.32
1928	194	.62	1959	692	1.98
1929	172	.55	1960	622	1.80
1930	161	.51	1961	837	2.47
1931	349	1.10	1962	878	2.65
1932	468	1.47	1963	1,112	3.46
1933	527	1.66	1964	1,076	3.45
1934	447	1.41	1965	1,138	3.78
1935	536	1.69	1966	1,015	3.49
1936	431	1 33	1967	1,024	3.64
1937	519	1.64			
1938	550	1.75			
1939	367	1.17			
1940	383	1.22			

Sources: For the method of estimation, see Chap. VIII, Section (4).

REFERENCES

[41] Hatai, Yoshitaka, "*Nōka Jinkō Idō to Keiki Hendō: Minami-Ono, Namiki Ronsō ni tsuite* (Migration of the Farm Household Population and Business Cycles: On the Controversy between Minami-Ono and Namiki)," *Kikan Riron Keizai Gaku* (*Economic Studies Quarterly*), Vol. 14 No. 1, Sept. **1963**, pp. 28~32.

[42] Henmi, Kenzō, "*Yūgyō Jinkō no Suikei* (Estimation of the Size of Gainfully Occupied Population)," in Seiichi Tōbata and Kazushi Ohkawa (eds.), *Nippon no Keizai to Nōgyō* (*Economy and Agriculture of Japan*), Vol. 1, *Iwanami Shoten*, **1956**, pp. 412~16.

[43] ———, "*Nōgyō Yūgyō Jinkō no Sūsei* (Trends in the Number of Workers Employed in Agriculture)," in Kazushi Ohkawa (ed.), *Nippon Nōgyō no Seichō Bunseki* (*Analysis of Growth in Japanese Agriculture*), *Taimei Dō*, **1963**, pp. 14~26.

[44] Hijikata, Narumi, "*Shoku-gyō Jinkō no Hensen o tsūjite mitaru Shitsugyō Mondai* (Unemployment Problems as Seen through Changes in the Size of Gainfully Occupied Population)," *Shakai Seisaku Jihō* (*Social Policy Review*), No. 108, Sept. **1929**.

[45] Honda, Tatsuo, *Nippon Jinkō Mondai no Shiteki Kaiseki* (Historical Analysis of Population Problems in Japan) in *Nōson Jinkō Mondai Kenkyūkai* (Study Group on Population Problems in Agriculture) (ed.), *Nōson Jinkō Mondai Kenkyū* (*Study of Population Problems in Agriculture*), Vol. 2, *Nōrin Tōkei Kyōkai*, **1952**, pp. 3~68

[46] Inaba, Taizō, *Fukkoku Ban, Nōka Keizai Chōsa Hōkoku: Chōsa Hōhō no Hensen to Ruinen Hikaku* (*Reprinted Edition, Report of the Survey of Farm Household Economy: Changes in Surveying Method and Comparison Over Time*), *Nōrin-shō, Nōgyō Sōgō Kenkyū-sho* (National Research Institute of Agriculture, **1952**.

[47] Inoue, Tatsuo, "*Nōgyō no Sōtai-kakaku* (Relative Prices in Agriculture)," in K. Ohkawa (ed.), *Nippon Nōgyō no Seichō Bunseki* (*Analysis of Growth in Japanese Agriculture*), *Taimei Dō*, **1963**, pp. 57~71.

[48] Ishibashi, Sachio, *Teikoku Nōkai Kome Seisan-hi Chōsa Shūsei: Taishō 11-nen ~ Shōwa 23-nen* (*Compilation of the Rice Production Cost Survey by the Imperial Agricultual Association: 1922~1948*), *Nōrin-shō, Nōgyō Sōgō Kenkyū-sho* (National Research Institute of Agricultural Economy, Ministry of Agriculture and Forestry), **1961**.

[49] Ishizaki, Tadao, *Tenkeiki no Rōdō Keizai* (*Labor Economy in Transformation*), *Tōyō Keizai Shinpō Sha*, **1967**.

[50] Johnston, Bruce F., "Agricultural Development and Economic Transformation: A Comparative Study of the Japanese Experience," *Food Research Institute Studies*, Vol. 3, Nov. **1962**, pp. 223~76.

[51] Kaneda, Hiromitsu, "Substitution of Labor and Non-labor Inputs and Technical Change in Japanese Agriculture," *Review of Economics and Statistics*, Vol. 47, May **1965**, pp. 163~71.

[52] Masui, Sachio, "The Supply Price of Labor: Farm Family Workers," in K. Ohkawa, B. F. Johnston and H. Kaneda (eds.), *Agriculture and Economic Growth: Japan's Experience*, Tokyo University Press, **1969**, pp. 222~49.

[53] Minami, Ryōshin, "*Nōringyō Shūgyōsha-sū no Suikei*, 1872~1940 (Estimation of the Number of Workers Employed in Agriculture and Forestry, 1872~1940)," *Keizai Kenkyū* (*Economic Review*), Vol. 17, No 3, July **1966**, pp. 275~78.

[54] ———, "Population Migration Away from Agriculture in Japan," *Economic Development and Cultural Change*, Vol. 15, Jan. **1967**, pp. 183~201.

[55] Minami, Ryōshin and Shigeru Ishiwata, "*Nōgyō no Seisan Kansū to Gijutstu Shinpo*, 1953~1965 (Production Functions and Technological Progress in Agriculture, 1953~1965)," *Keizai Kenkyū* (*Economic Review*), Vol. 20 No. 3, July **1969**, pp. 226~36.

[56] Minami Ryōshin and Akira Ono, "*Nōka Jinkō Idō no Suikei*, 1925~1960 (Estimation of Migration of the Farm Household Population, 1925~1960)," *Hitotsubashi Ronsō* (*Hitotusbashi Review*), Vol. 47 No. 6, June **1962a**, pp. 62~76.

[57] ———, "*Nōka Jinkō Idō to Keiki Hendō to no Kankei ni tsuite no Oboegaki: Shōwa Kyōkō-ki*

no Jinkō Idō ni kansuru Namiki Masayoshi-shi no Shoken ni tsuite (A Note on the Relationship between the Migration of Farm Household Population and Business Cycles: On the View of M. Namiki on the Population Migration During the Great Depression Period)," *Kikan Riron Keizai Gaku* (*Economic Studies Quarterly*), Vol. 12 No. 3, June **1962b**, pp. 64~66.

[58] ———, "*Nōka Jinkō Idō to Keiki Hendō: Namiki Masayoshi-shi no Han-hihan ni tsuite* (Migration of the Farm Household Population and Business Cycles: A Further Comment on M. Namiki's Rejoinder)," *Kikan Riron Keizai Gaku* (*Economic Studies Quarterly*), Vol. 14 No. 1, Sept. **1963**, pp. 64~66.

[59] Miyazawa, Kenichi, "*Nijūkōzō-ron no Hansei to Tenbō* (Reconsiderations and Surveys on the Theory of Dualistic Structure)," Hiroshi Kawaguchi and others, *Nippon Keizai no Kiso-kōzō* (*Basic Structure of the Japanese Economy*), *Shunjū Sha*, **1962**, pp. 141~67.

[60] Nakamura, James I., *Agricultural Production and the Economic Development of Japan, 1873~1922*, Princeton University Press, Princeton, New Jersey, **1966**.

[61] Namiki, Masayoshi, "*Nōka Jinkō no Idō Keitai to Shūgyō Kōzō* (Employment Structure and Pattern of Migration of the Farm Household Population) in Seiichi Tōbata (ed.), *Nōgyō ni okeru Senzai Shitsugyō* (*Disguised Unemployment in Agriculture*), *Nippon Hyōron Shinsha*, **1956**, pp. 195~214.

[62] ———, "*Nōson Jinkō no Idō* (Migration of Rural Population)," Shigeo Nojiri (ed.), *Nōson no Jinkō: Atarashii Kadai to sono Taisaku* (*Population in Rural Villages: New Proposals and Some Policies for Them*), *Chūō Keizai Sha*, **1959**, pp. 53~90.

[63] ———, "*Minami-Ono Ryō-shi no Hihan ni kotaeru* (Rejoinder to a Comment by Minami and Ono), *Kikan Riron Keizai Gaku* (*Economic Studies Quarterly*), Vol. 12, No. 3, **1962**.

[64] ———, *The Farm Population in Japan, 1872~1965*, *Agricultural Development Series No. 17*, Agricultural Policy Research Committee, **1966**.

[64] *Nōrin-shō, Tōkei Chōsa-bu* (Division of Statistics and Research, Ministry of Agriculture and Forestry), *1960-nen Sekai Nōringyō Census, Nippon no Nōgyō* (*World Census of Agriculture and Forestry in 1960, Agriculture in Japan*), *Nōrin Tōkei Kyōkai*, **1961**.

[65] Ohkawa, Kazushi, *Shokuryō Keizai no Riron to Keisoku* (*Theory and Measurement of Food Production and Food Consumption in the Economy*), *Nippon Hyōron Sha*, **1945**.

[67] Ohkawa, Kazushi and others, *Nippon Keizai no Seichō-ritsu* (*The Growth Rate of the Japanese Economy*), *Iwanami Shoten*, **1956**.

[68] ———, *The Growth Rate of the Japanese Economy since 1878*, *Kinokuniya Shoten*, Tokyo, **1957**.

[69] Ohkawa, Kazushi and Henry Rosovsky, "The Role of Agriculture in Modern Japanese Economic Development," *Economic Development and Cultural Change*, Vol. 9, Oct. **1960**, pp. 43~67. Reprinted in C. Eicher and L. Witt (eds.), *Agriculture in Economic Development*, McGraw-Hill, Inc., New York, 1964, pp. 45~69.

[70] ———, "A Century of Japanese Economic Growth," in William W. Lockwood (ed.), *The State and Economic Enterprise in Japan*, Princeton University Press, Princeton, New Jersey, **1965**, pp. 47~92.

[71] Parsons, Howard L., *The Impact of Fluctuations in National Income on Agricultural Wages and Employment*, *Harvard Studies in Labor in Agriculture No. 1-HL*, Harvard University Press, Cambridge, Massachusetts, **1952**.

[72] Phillips, A. W., "The Relation between Unemployment and the Rate of Changes of Money Wage Rates in the United Kingdom, 1861~1957," *Economica*, Nov. **1958**.

[73] *Rōdō-shō. Rōdō Tōkei Chōsa-bu* (Division of Labor Statistics and Research, Ministry of Labor), *Rōdō Hakusho: Rōdō Keizai no Bunseki* (*White Paper on Labor: Analysis of the Labor Economy*), *Rōdō Hōrei Kyōkai*, **1964**.

[74] ———, *Sengo Rōdō Keizai-shi: Shiryō Hen* (*History of the Labor Economy in the Postwar Period: Source Materials*), *Rōdō Hōrei Kyōkai*, **1966**.

[75] ———, "*Rōdōryoku Iten-hyō niyoru Shūgyō Kōzō no Hendō Bunseki* (Analysis of the Changes in Employment Structure by the Labor Force Flow Matrix)," *Keiryō Bunseki Shiryō* (*Quantitative Analysis Data*) *No. 12*, mimeo., **1968**.

[76] Rosovsky, Henry, "Rumbles in the Ricefields: Professor Nakamura vs. the Official Statistics," *Journal of Asian Studies*, Vol. 27, Feb. **1968**, pp. 347~60.

[77] Schultz, Theodore W., *Agriculture in an Unstable Economy*, McGraw-Hill Book Co., Inc., New York, **1945**.

[78] ———, "*Sangyō Kōzō Nyūmon, No. 9; Nōgyō to Rōdōryoku Idō* (No. 9 of Introduction to Industrial Structure Series: Agriculture and Labor Force Migration), *Kinyū Journal* (*Journal of Finance*), Vol. 4 No. 2, Feb. **1963**, pp. 72~76.

[79] ———, "A Survey of the Japanese Literature on Small Industry," in Bert F. Hoselitz, *The Role of Small Industry in the Process of Economic Growth*, Mouton and Co., The Hague and Paris, **1968**, pp. 1~113.

[80] *Shōwa Dōjin-kai* (Showa Study Group), *Waga Kuni Kanzen-koyō no Igi to Taisaku, Dai 4-bu, Tōkei: Tōkei kara mita Koyō to Shitsugyō* [*Significance of and Policies for Full Employment in Japan, Vol. 4* (*Statistics: Employment and Unemployment as Seen from the Statistical Standpoint*)], *Shōwa Dōjinkai*, **1957**.

[81] *Sōri-fu, Tōkei-kyoku* (Bureau of Statistics, Office of the Prime Minister), *Nippon no Jinkō: Shōwa 30-nen Kokusei Chōsa no Kaisetsu* (*Population of Japan 1955: Summary of the Results of 1955 Population Census of Japan*), *Sōri-fu, Tōkei-kyoku*, **1960**.

[82] ———, *Nippon no Jinkō: Shōwa 35-nen Kokusei Chōsa no Kaisetsu* (*Population of Japan, 1960: Summary of the Results of 1960 Population Census of Japan*), *Nippon Tōkei Kyōkai*, **1963**.

[83] Tachi, Minoru and Masao Ueda, "*Nippon no Jinkō* (Population of Japan)," in Hiroshi Satō and Misao Watanabe (eds.), *Nippon Chiri Shin-taikei, Dai 2-kan, Shakai Keizai* [*A New Framework for Geography of Japan, Vol. 2* (*Society and Economy*), *Kawade Shobō*, **1952**, pp. 115~68.

[84] Torii, Yasuhiko, "*Nōgyō-Bumon no Genkai Seisan-ryoku Sokutei* (Measurement of Agricultural Marginal Productivity)," *Kikan Riron Keizai Gaku* (*Economic Studies Quarterly*), Vol. 16 No. 3, June **1966**, pp. 52~66.

[85] Tsuchiya, K., "*Nippon Nōgyō no Keiryō Bunseki: Tenbō* (Economic Analysis of Japanese Agriculture: Survey)," *Kikan Riron Keizai Gaku* (*Economic Studies Quarterly*), Vol. 17 No.3, March **1967**, pp. 50~64.

[86] Tsujimura, Kōtarō and Tsunehiko Watanabe, "*Seisan Kansū to Gijutsu Shinpo: Tenbō* (Production Functions and Technical Progress: Survey)," *Kikan Riron Keizai Gaku* (*Economic Studies Quarterly*), Vol. 16 No. 2, March **1966**, pp. 12~26.

[87] Ueno, Hiroya and Sōshichi Kinoshita, *Nippon Keizai no Seichō Model* (*Model of Economic Growth in Japan*), *Tōyō Keizai Shipō Sha*, **1965**.

[88] ———, "*Yūgyōsha-sū no Shin-suikei, 1871~1920-nen*, (New Estimation of the Number of Gainfully Occupied Workers, 1871~1920)," *Keizai Kenkyū* (*Economic Review*), Vol. 19 No. 4, Oct. **1968**, pp. 322~29.

[89] Umemura, Mataji and Saburō Yamada, "*Nōka Kosū no Suikei, 1880~1940-nen* (Estimation of the Number of Farm Households, 1880~1940)," *Hitotsubashi Daigaku, Keizai Kenkyū-sho, Kenkyū Shiryō* (Reseach Data Paper D-12, Institute of Economic Research, Hitotsubashi University), mimeo., **1962**.

[90] Yamada, Saburō, "Changes in Output and in Conventional Inputs in Japanese Agriculture since 1880," *Food Research Institute Studies*, Vol. 7 **1967**, pp. 371~413.

[91] Yamada, Yūzō, *Nippon Kokumin Shotoku Suikei Shiryō* (*Sources for Estimating National Income in Japan*), *Tōyō Keizai Shinpō Sha*, **1951**.

[92] Yuize, Yasuhiko, "*Nōgyō ni okeru Kyoshiteki Seisan Kansū no Keisoku* (Estimation of Aggregate Production Functions of Agriculture)," *Nōgyō Sōgō Kenkyū* (*Quarterly Journal of Agricultural Economy*), Vol. 18 No. 4, Oct. **1964**, pp. 1~53.