TIME-SERIES ANALYSIS OF THE CONSUMPTION FUNCTION IN JAPAN BY OCCUPATIONAL GROUP

By TOSHIYUKI MIZOGUCHI*

In Japan consumption function analysis has progressed quite a bit since the middle of the 1950’s. Today various models are examined using the national accounts statistics in the same way as is done in western developed countries. However, distinguished characteristics can be found between these examinations if we make use of certain survey data. Luckily, in Japan there is abundant data for family incomes and savings according to occupational group. For instance, we can know the family incomes and the savings by components of worker’s households for every year since 1951, by using the Family Income and Expenditure Survey, published by the Statistical Bureau of Prime Minister’s Office of Japanese Government. In addition, the Family Saving Survey of the Statistical Bureau gives us annually information on the family savings of non-farm households since 1959. In the case of farmer’s households, since 1950 we can use the Farm Household Economic Survey which is published by the Department of Agriculture and Forestry. Many papers have been published on this topic by using the above mentioned surveys. Especially interesting are the time-series analyses done according to occupational group, because there are few attempts to do this type of analysis in many countries due to lack of data. In this paper, we will attempt to develop an empirical analysis of this topic.¹

I. A Review of Previous Studies

1. The Worker’s Consumption Function

The analysis of the consumption function by occupational groups is most developed for worker’s households. When we calculate the saving ratio using the Family Income and Expenditure Survey data, a noticeable upward trend can be seen. It is very interesting to note that the time-series change of the saving ratio in the national accounts statistics is very similar to that found in worker’s households. With such data we can get a good fit for the linear Keynesian type consumption function,

\[ C(t) = a + bY(t) \]  

¹ In addition to the time-series analysis, we can find some attempts regarding the cross-sectional analyses of saving behaviors of Japanese households. This type of analysis has been remarkably developed since the publication of the large scaled sample survey, called the 1959 National Survey of Family Income and Expenditure, by the Statistical Bureau. Though the present writer has also carried out some studies in this field, they will be published in the future because of space limitations.
where $C$ and $Y$ represent real per-capita consumption and real per-capita income, respectively. The estimated values of $a$ are significantly positive. It is well known that the saving ratios in both the United States and the United Kingdom have been stable; thus, many Japanese economists are interested in this upward trend for worker's households.

Another approach with which we are concerned is the comparison of cross-section consumption functions of form (1) at various times. Because this survey has annual data for

**FIG. 1. CHANGES OF REAL PER CAPITA DISPOSABLE INCOMES AS RELATED TO WORKER'S SAVING RATIO, 1951-1965**

![Graph showing changes in real per capita disposable incomes and saving ratio from 1953 to 1965.]


**TABLE 1. COMPARISON OF CROSS-SECTION CONSUMPTION FUNCTIONS (1960 year's price)**

<table>
<thead>
<tr>
<th>Year</th>
<th>$a$</th>
<th>$b$</th>
<th>$R^2$</th>
<th>Year</th>
<th>$a$</th>
<th>$b$</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1951</td>
<td>1,852</td>
<td>0.5224</td>
<td>0.984</td>
<td>1959</td>
<td>2,159</td>
<td>0.5913</td>
<td>0.9976</td>
</tr>
<tr>
<td>1952</td>
<td>1,941</td>
<td>0.5534</td>
<td>0.983</td>
<td>1960</td>
<td>2,304</td>
<td>0.5808</td>
<td>0.9987</td>
</tr>
<tr>
<td>1953</td>
<td>1,841</td>
<td>0.6096</td>
<td>0.994</td>
<td>1961</td>
<td>2,749</td>
<td>0.5426</td>
<td>0.9980</td>
</tr>
<tr>
<td>1954</td>
<td>1,750</td>
<td>0.6098</td>
<td>0.991</td>
<td>1962</td>
<td>2,814</td>
<td>0.5566</td>
<td>0.9979</td>
</tr>
<tr>
<td>1955</td>
<td>1,748</td>
<td>0.6133</td>
<td>0.992</td>
<td>1963</td>
<td>2,789</td>
<td>0.5733</td>
<td>0.9969</td>
</tr>
<tr>
<td>1956</td>
<td>1,981</td>
<td>0.5823</td>
<td>0.997</td>
<td>1964</td>
<td>3,081</td>
<td>0.5564</td>
<td>0.9971</td>
</tr>
<tr>
<td>1957</td>
<td>2,032</td>
<td>0.5848</td>
<td>0.997</td>
<td>1965</td>
<td>3,434</td>
<td>0.5253</td>
<td>0.9976</td>
</tr>
<tr>
<td>1958</td>
<td>2,066</td>
<td>0.5970</td>
<td>0.998</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

consumptions and savings according to income class, the function can be estimated for each year. The values in Table 1 tend to prove the decreasing trend of \( b \), but with some fluctuations. Starting with this fundamental observation, it is important to answer the following two questions: (1) why is the upward trend significant and (2) can we explain the variations in the saving ratios in time-series and in cross-section simultaneously.

The pioneering work on this topic was first done by Shinohara in 1958. At the time of his analysis, the worker's consumption level was nearly equal to or a little higher than the pre-war level at its highest. He, then, went ahead and applied the Duesenberry-type consumption function,

\[
\frac{C(t)}{Y(t)} = a + b \frac{Y(0)}{Y(t)}
\]

where \( Y(0) \) is the highest previous value of the per-capita real income. He considered \( Y(0) \) as the highest pre-war income before the year 1958, including the pre-war period. In that case, the consumption function was of a linear Keynesian type until \( Y(t) \) exceed the pre-war highest values. This requires some additional explanations because the saving ratio has continued to increase despite the recent significant rises in real income, which have obviously surpassed the highest pre-war levels. His additional comments are as follows. In post-war period, \( Y(0) \) should be fixed a little higher than the highest real incomes of the pre-war period. This is because the consumption patterns have changed through the introduction of large scale consumer durables and other items.

Another type of approach depends upon the liquid assets hypothesis. As the Family Income and Expenditure Survey does not include the data for liquid assets, a direct check is impossible. Shibuya used this hypothesis and tried to measure the effects of liquid assets on saving by using the relationship between stocks and flows. He used the formula

\[
C(t) = a + b Y(t) + c J(t) + d C(t-1) + et
\]

and induced

\[
\Delta C(t) = e + b \Delta Y(t) + c L(t) + d \Delta C(t-1)
\]

where \( J(t) \) and \( L(t) \) are financial assets and liquid type savings, and \( \Delta X(t) = X(t-1) - X(t) \). According to his calculation, the estimated value, \( c \), is not statistically significant. In other words, his analysis is interesting because it proves that the liquid assets' effect on savings is not significant.

Shibuya's paper is also interesting because it presents a third type of approach. It is generally agreed that in the high growth economy, consumption increases with a certain degree of lag which coincides with the changes in income. This hypothesis has been used for the analysis of the national accounts statistics. According to his paper, the coefficient, \( d \) is significant and this support his hypothesis. A similar attempt was made by Shinohara using

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3 It is very difficult to compare the standard of living in pre- and post-war Japan, because of the violent inflation which took place from 1945 to 1950. There are some indices which attempt to fill this gap, but they do not necessarily coincide with each other. Nevertheless, it can be safely said that the consumption levels in 1958 exceeded the highest pre-war levels.

with the consideration that the saving would increase when the growth of income becomes high.\(^5\)

The fourth and last type of approach tries to explain the increase in the saving ratio by the changes in the income components in worker’s households. The income in Japanese worker’s households is composed of four different components: (1) the regular income of the head of household, (2) his income from bonus and over-time work, (3) the wage and salaries from other members of family and, (4) other sources. Shinohara pointed out\(^6\) that the share of bonus type income in worker’s households has been increasing. Since the bonus type income is of a more transitory nature than the regular incomes, the increase in the share of this element is considered to cause an increase in the average saving ratio. In fact, two cross-section analyses have proved that the coefficient of the marginal propensity to consume is larger for the household head’s regular income than for other income. This is done by using the multiple regression method.\(^7\)

2. The Farmer’s Consumption Function

Generally speaking, in Japan the analysis of the consumption function for farmer’s households is more complicated and less developed than is the same analysis for the worker’s households. Although the percentage of personal income occupied by farm income has been decreasing, it was nearly 20% in 1964. Thus the analysis of this group is very important for an understanding of consumption behavior in present-day Japan.

The data for the analysis of the consumption function in Japanese farmer’s households, can be found in the *Farm Household Economic Survey*, (Nōka Keizai Chōsa), hereafter abbreviated as FHES. This survey has been carried out yearly since 1950 with large changes in method being made in 1953, 1957 and 1962. Because of this we cannot use this data as a time-series without some adjustments, and, as might be expected the time-series analysis of the farmer’s consumption function has been less developed.

First, let us look at the problem of fluctuations over time in the saving ratios of farmer’s households. First, there is the problem of how to define the saving ratio in the FHES. For now let us adopt the definition which has been generally adopted. If we undertake an examination of this kind, there is the question about whether we should adjust the incomes and the savings by deducting the depreciations on houses and farm equipments. This problem arises from the concern over whether or not the depreciation rates adopted in the FHES are suitable for our analysis.\(^8\) This problem has not completely been solved, but the net concept will be used in this section. When we examine Figure 2, we can see that the saving ratios for the farmer’s households displayed irregular movements before 1958, and this is different

\(^5\) Shinohara, *Secrets of High Speed Growth* (Kōdo-Seichō no Himitsu), Nihon Keizai Shinbun, 1961, pp. 204-5. See also *Growth and Cycles in the Japanese Economy*, Kinokuniya Shoten, Chap. 10.

\(^6\) See footnote 5 of this chapter.

\(^7\) Kei-ichirō Obi and Yōko Sano, “Income Composition and the Marginal Propensity to Consume” (Shotoku-Kōsei to Genkai Shōhi Seikō), 1960, (mimeographed), Iwao Ozaki, “Changes of Income Composition and Its Effects on Consumer Behavior” (Shotoku Közōhenkwa to Shōhisha Kōdō), 1960 (mimeographed).

\(^8\) The FHES has made specific mention of depreciation rates for the main fixed assets used only in this survey. Kawaguchi pointed out that these ratios are not necessarily reasonable, and he suggested that the analysis should be carried out in gross concepts. See, Hiroshi Kawaguchi, *A Structural Analysis of Savings*, (Chochiku Közō no Bunseki), Zenkoku Chihō Ginkō Kyōkai, 1961.
from the pattern of time-series changes found in the worker’s saving ratios. Shinohara tried to apply the Duesenberry-type consumption function in his earlier paper. However, this type of approach cannot explain the recent upward trend in the farmer’s saving ratio.

In order to explain the change of movements in the farmer’s saving ratios, we should note the increasing occurrence of work (Kengyōkwa) in the farmer’s households in Japan. The rapid growth of the post-war Japanese economy brought about the development of this type of secondary or tertiary sector, thus causing an increase in the income differentials between the town and the countryside. As a result, not only were surplus laborers increasingly absorbed by the non-agricultural sector, but, from the end of the 1950’s, even the core labor force in countryside have been successively diverted to wage and salaried employment. Thus, agricultural activities have been increasingly performed by the farmer’s wives or by aged family members. In fact, the area occupied by farm income in the farmer’s family budgets has fallen of in recent years. This tendency seems to correspond to the beginning of the upward trend in the saving ratio as shown in Figure 2. Needless to say, it is very important to explain this correspondence.

The first approach in explaining this factor is to relate the change in income composition to saving behavior. While it may indeed be true that incomes from outside of agriculture have been increasing, it is also true that the major source of income in farmer’s households is still agriculture. Thus, we may suppose that income from sources other than agriculture has, to a large degree, the character of transitory income. This kind of explanation may be considered unorthodox given the Permanent Income Hypothesis because agricultural income is supposed to be more transient than wage-type income. But when we consider the farmer’s consumption behavior in Japan, the above suggestions cannot be ignored. Regarding such a hypothesis, several attempts have been made at analysis by using indirect methods. The pioneer work in this field is the Kubo-Murakami cross-section analysis using the multiple

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9 Shinohara, Consumption Function, op.cit. or “The Structure of the Savings and Consumptions in Post-war Japan,” op. cit.
regression method.\textsuperscript{10} They tried to apply the equation,

$$S = a + bF + cO$$

(6)

where $S$ is per capita saving, $F$ and $O$ are incomes from agriculture and other, respectively. Their results show that the estimated parameters are not stable for each year. Perhaps of more interest is the time-series analysis by Shinohara who used the same formula.\textsuperscript{11} His analysis is important because of the suggestion that the parameters $b$ and $c$ are systematically different according to classes of cultivated lands as found in the FHES; i.e., $b$ is larger than $c$ in farmer's households with small cultivated plots, but the reverse fact can be found for households with relatively large cultivated plots. The cultivated area per household is small in Japanese agriculture, but, nevertheless, there are a fair number of relatively large size holdings. Thus, the household's behavior is different depending upon the size of the farm. The FHES classifies the farmer's households according to size of farm and regional location.

**FIG. 3. CHARACTERISTICS OF FARMER'S HOUSEHOLDS BY SIZES OF FARMS (1960 CALENDAR YEAR)**


\textsuperscript{10} Machiko Kubo and Yoshiteru Murakami, “Trends in Consumption Patterns in Farmer's Economy, Part I to III” (Nōka Keizai ni okeru Shōi-pattern no Dōkō), Fabian Kenkyū, Vol. 11, Nos. 5 and 10, and Vol. 12, No. 7, 1960 to 1961. In their original papers, some additional variables are used.

so there is some research which points out the differences in saving behavior according to sizes of farms. However, it seems to the writer that Shinohara's suggestion is the most important because the marked differences in classes of sizes of cultivated land can be found in the composition of farm household incomes.

The second type of explanation starts with the increases in the cash income in farmer's households. Before World War II, a very large part of farmer's consumption was supplied by self-produced products. However, with the introduction of part-time work, this consumption pattern has changed rapidly. Shishido pointed this tendency out in 1960, and tried to explain the rise in the saving ratio by the increase in the percentage of household incomes occupied by cash income. But it is exceedingly difficult to decide whether we should adopt the first or the second approach because they are closely related with each other.

3. The 'Other' Households Consumption Functions and a Comparison of Saving Behavior by Occupational Groups

The analysis of the consumption functions for the households other than worker's and farmer's is the least developed field. The household group may be sub-divided into five occupational groups: (a) merchants and artisans, (b) managers in unincorporated firms, (c) managers in incorporated firms, (d) those in the professional services, and (e) those without occupations.

The less developed status of the analysis of consumption for this group originates in the scarcity of data. The Family Income and Expenditure Survey gives us the figures for consumption expenditures in the non-farm households, but the income data is restricted only for worker's households. In Japan research in this area started around the end of the 1950's when three surveys were published: (A) the Survey of Consumer Behavior (Shōhi Dōkō Yosoku Chōsa), (B) the Family Saving Survey, and (C) the 1959 National Survey of Family Income and Expenditure. According to these surveys, the average saving ratio in the groups (a) to (d) was higher than in worker's households as was suggested by Shinohara in 1958. Using (A) Yasunaga pointed out that the liquid-type saving ratios in these groups were not much different from those found in worker's households. This suggests that the high saving ratio in these groups may be caused by the high investment ratio in real assets.

12 The pioneer work in this area is that of Kawaguchi's Structural Analysis of Savings, op. cit. He pointed out that the linear Keynesian type consumption function can be applied to the households with small size farms, and the Duesenberry consumption function should be used for those with large farms. An attempt was done by the writer to introduce differences of income composition into the time-series analysis by class of sizes of farms before Shinohara's paper, but the latter is more interesting. As for the writer's paper, see Mizoguchi, Statistical Analysis of Consumption Function, (Shōhi Kansū no Tōkeiteki Bunseki), Iwanami-Shoten, 1964, Chap. 4.

13 An interesting cross-section analysis using the original cards of the FHES can be found in Yasuhiko Yuize, "Farmer's Consumption Function and Main Farm Products" (Gyōtai betsu Nōka no Shōhi-kansū) Nōgō-Sōgō Kenkyū, Vol. 15, No. 2, 1961.


15 Before the publications of these surveys, Shinohara attempted to estimate indirectly the average saving ratios of the households other than the worker's and the farmer's by comparing the saving ratio in the national accounts statistics with that in the Family Income and Expenditure Survey and in the FHES. See Shinohara, Consumption Function, op. cit.

16 Takeshi Yasunaga, Consumption Economics, (Shōhi Keizai Gaku), Shiseido, 1960.
far as the writer knows, there is no other significant research regarding these subjects.

One interesting attempt has been the comparison of the saving ratio with occupational groups. The papers on this topic may be divided into two groups. The first is the comparison of saving ratios in worker’s and farmer’s households. In the early studies, repeated attempts were made to find out the causes for the fact that the net saving ratio in the farmer’s households exceeds that of worker’s households.17 However, since the period when the saving ratio comes to exceed the net saving ratio in the farmer’s households according to the definition used by the FHES, comparative studies of the two household groups have been carried out using the income class data.18 As a result of the latter studies, it has been made clear that the saving ratio is higher in the worker’s households when the comparison is made in net term in the FHES. But it was found that when the comparison is made in gross terms, the reverse is obtained. Because the rates of depreciation in the FHES are determined under a rather arbitrary formula, this result causes us some trouble. The second type of analysis is concerned with the comparison between the saving ratio in urban households (including worker’s households) and the household groups (a) to (e) mentioned in this section. The analysis in this type is rather rare in Japan and only Kinoshita19 and the writer associated with Kanda have done any work in this field.20

II. Analysis of the Urban Household Consumption Function

1. Worker’s Saving Ratios and Income Composition

As was mentioned in the previous section, it is very important to explain why the saving ratio of the worker’s households has been increasing in Japan, especially because the upward trend in the personal savings ratio seems to be closely related to it. For this purpose, let us use the time-sequence of the cross-sectional tables, called “Yearly Average of Monthly Receipts and Disbursements by Worker’s Households by Money Income Quintile Groups”, as found in the Family Income and Expenditure Survey. Even though these tables include only five income classes per year, we can enlarge the size of sample by pooling the time-series and the cross-sectional data.

Before going any further, some comments should be made regarding the correspondence between the theoretical variables and the concept used in the Family Income and Expenditure Survey. In our analysis, the disposable income is defined as the “total income” minus “non-living expenditures” similar to that found in the survey.21 When we compare the saving ratio

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19 Sōshichi Kinoshita, “Factorial Analyses of Saving Behavior” (Chochiku Kōdō no Yōin-Bunseki), Keizai Kagaku, Vol. 10, No. 4, 1963. This type of analysis was developed in his doctoral dissertation.
21 Though each item includes minor items which are different from the theoretical definitions, it is very difficult to adjust them in our analysis. Nevertheless the effect of this are so minor as to be insignificant for our purposes.
as shown in Figure 4, we find that the ratios have been increasing for each group since 1951. Therefore, the upward trend in the saving ratio for worker’s households is not due to any unique activities of certain quintile groups.

There have been some attempts to examine this factor as was shown in Section (1), however the writer thinks that the changes in income compositions of the worker’s households is one of the most important factors for the increase in saving ratio. The worker’s income can be divided roughly into four categories as was mentioned in Section I. Among these categories, the major ones are (1) the regular income of the head of the household from his main job, (2) the “temporary” income from his main job, (3) other family member’s income from their various employments, (4) other sources of income. Since our study is restricted to worker’s households, we shall be mainly concerned with income derived from category (1). In this section we will refer to this first category as 'regular income'. Each worker in Japanese wage system can usually forecast, rather accurately, the value of category (1) and this can be used as an indicator for planning of household consumption. Bonus payments make up the largest portion of category (2). These bonus payments are considered as a kind of semi-regular wage or salary, because nearly all workers receive a bonus at least twice a year and its average value can usually be predicted on the basis of the amounts of category (1). However, the amount of the bonus payments fluctuate around the expected average level depending on the firm’s profit for the year and the employer’s evaluation of a worker’s contribution to the company. It is very likely that workers are rather conservative in their effort to raise the expected ratio of the bonus to the regular income when they make their consumption plans. This is true even if the actual bonus income ratio is higher than their expected ratio for the previous years. The source of category (3) has not played an important role in the family budget of worker’s households in Japan. Although some Japanese wives have engaged in supplementary employment, the amount of their income has usually been insignificant when compared with their husband’s income—except for the lowest income classes. Therefore, we don’t have to pay too much attention to the effect of this type of income in the household’s consumption planning. However, we would not be able to neglect the analysis of this effect in the near future because recently the share of this type income in the total worker’s household’s income has been increasing rapidly. Incomes from category (4) are rather irregular in Japanese worker’s households. For the above reason, it may safely be said that the main indicators of worker’s consumption planning is the income of the type (1) and the effect on the planning would decrease as the value for the categories increases from (2) to (5).

Now, let us calculate three ratios, \( c/y_1 \), \( c/(y_1+y_2) \) and \( c/(y_1+y_2+y_3) \), where \( c \) is the consumption expenditure and \( y_t \) \((i=1, 2, 3)\) is the income for number \((i)\) after deduction of taxes.\(^{22}\) The result is very interesting because the first ratio is fairly constant (except for the lowest income group). As is shown in Figure 5 this holds true for both the time-series and cross-section. Regarding the other two ratios there are no significant findings to be reported. These results contrast rather sharply with the variations of consumption income ratios which are shown in Figure 4. This finding suggests that one of the main reasons for the variations in the income consumption ratios for worker’s households is the difference in the percentage of the worker’s household income occupied by the ‘regular income’ of the head of household.

\(^{22}\) Since we cannot estimate what part of taxes comes from \((i)\)-th income, \(y_i\) is calculated by the formula \((\text{disposable income}) \times (i\text{-th income}) - (\text{total income})\).

FIG. 4. **TIME-SERIES CHANGES OF SAVING RATIOS BY QUINTILE GROUPS**

[Graph showing time-series changes of saving ratios by quintile groups]

*Note:* 1) I, II, ..., V indicate the numbers of the Quintile Groups.

This can be shown numerically by using a definitional equations:

\[ \frac{c}{y} = \left( \frac{c}{y_1} \right) \times \left( \frac{y_1}{y} \right) \]

or

\[ \log \left( \frac{c}{y} \right) = \log \left( \frac{c}{y_1} \right) + \log \left( \frac{y_1}{y} \right) \]

where \( y \) is the disposable income. From these identities, we can easily derive

\[ \text{Var}(\log \left( \frac{c}{y} \right)) = \text{Var}(\log \left( \frac{c}{y_1} \right)) + \text{Var}(\log \left( \frac{y_1}{y} \right)) + 2 \text{Cov}(\log \left( \frac{c}{y_1} \right), \log \left( \frac{y_1}{y} \right)) \quad (7) \]

where \( \text{Var}(X) \) and \( \text{Cov}(X, Y) \) indicate the variance of \( X \) and the covariance between \( X \) and \( Z \) respectively. The figures in Table 2 show that the percentage of the variance of \( \log \left( \frac{y_1}{y} \right) \) is very significant.\(^{23}\) Another interesting approach is to examine in detail the variation of \( \frac{c}{y} \). When we look at Figure 5, we can see that there are few differences in this ratio according to year and quintile group. Regarding the annual variation, the most important question is whether there exists a trend of this ratio in each group, as found significantly in case of \( \frac{c}{y} \). When Kendall’s \( t \) test for the time trend is applied, no statistically significant trends are found for \( \frac{c}{y_1} \), though \( \frac{c}{y} \) has a significant trend in each group. Next, when we examine the variations of \( \frac{c}{y_1} \) by using the variance analysis, we find that both group- and time-effects are statistically significant. The significance of the group effect seems to be explained by the difference in the average of the ratio between the V-th and the II-IV-th quintile group. In fact, when the group II-V are sub-divided into these sub-groups, the group effects among II to IV-th groups are not significant. The time-effect seems to originate in

\(^{23}\) The writer knows that this calculation is rather problematic from the viewpoint of mathematical statistics, because the explanatory variables are not independent of each other. But a broad check can be done by this calculation, because the covariance is relatively small.
FIG. 5. TIME-SERIES CHANGES OF CONSUMPTION REGULAR INCOME RATIOS BY QUINTILE GROUPS

Source: Statistical Bureau of Prime Minister's Office, Family Income and Expenditure Survey.

TABLE 2. EXPLANATION OF VARIANCE OF $\log(c/y)$

<table>
<thead>
<tr>
<th></th>
<th>absolute value ($10^{-4}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\text{Var}(\log(c_{1}y_{1}))$</td>
<td>2.358</td>
</tr>
<tr>
<td>$\text{Var}(\log(y_{1}y))$</td>
<td>0.233</td>
</tr>
<tr>
<td>$2\text{Cov}(\log(c_{1}y_{1}), \log(y_{1}y))$</td>
<td>$-0.912$</td>
</tr>
<tr>
<td>$\text{Var}(\log(c_{y}))$</td>
<td>1.679</td>
</tr>
</tbody>
</table>

Note: 1. The calculation of formula (7) is applied for the cross-table of II-nd to V-th quintile groups and years from 1951 to 1965.

Source: The quintile group data in the Family Income and Expenditure Survey.
various cyclical fluctuations. Nevertheless, we should notice the recent tendency of the increase of this ratio.

It is also important to re-examine the above results using other information. As mentioned earlier, nearly all Japanese workers receive bonuses twice a year. It is interesting to examine the effect of the bonus payments on worker's consumption expenditures. We can analyse this by indirectly using the table, called "the Yearly Average of Monthly Receipts and Disbursements by Monthly Income Classes (from January to December)" in the Family Income and Expenditure Survey. This table is calculated for worker's households by averaging the corresponding tables for each month without regard to seasonal variations in incomes and expenditures. When we compare $c/y_1$ as calculated from this table with the corresponding ratios in December, the former is significantly lower than the latter. But it is interesting that the ratio, $c/y_1$, in both tables is stable over the years. This seems to indicate that the expenditure on consumption from bonus incomes depends upon the amounts of the regular income for that year. Let us define $K$ as the ratio of these expenditures to the regular income. The important fact is why the ratio $K$ is stable in the time-series as well as cross-section analysis.

Why have the values, $K$, remained rather constant during the rapid growth of the Japanese economy? One explanation may be the conservative nature of the planning of consumption by the households of Japanese workers. Since bonus income is not so stable as the regular income and also the amount of regular income is much larger than the bonus income, the worker's households hesitate to raise the value, $K$, in their consumption planning even when the actual shares of the bonus income in total family income is increasing. The less developed situation of consumer financings in Japan may accelerate this tendency. Moreover it is very important to note that the bonus shares has not increased steadily for all families. Since bonus payments fluctuate depending upon firm's profits the change in bonus-regular income ratio is different according to each firms, though the average bonus-regular income ratio has been steadily increasing. For example, very large bonus payments in security companies contributed to the increase in the bonus-regular income ratios in one period, but the same changes to the light electric industries in the other periods. This can be partially demonstrated by using "Yearly Average Monthly Receipts and Disbursements of Worker's Households by Industry of Household Heads" in the Annual Report of Family Income and Expenditure Survey. The fluctuations in the ratio seems to correlate with the business cycles, but there are some differentials according to industry. When we look at the differences in this ratio both according to firms among industry groups and according to the differences of people among the firms, the increasing trend of the bonus-regular income ratio for each worker's households is much more unstable than the impression we got from the average figures. These facts help to explain the long-term stability of $K$.

Now let us consider this problem in greater detail. The first problem is how to explain the different behavior in the lowest income group. This may be partially explained by the composition of households belonging to the first quintile group. The writer thinks that these households can be divided into two sub-groups: i.e., (1) those who earn little income over the months but have some liquid assets, (2) those who should be called the lower income households in the usual sense of the term. It is important to note that the percentage of the number of households occupied by those without occupations is very low in Japan. Some retired people are engaged in the low-paying jobs in order to get additional income. Because
these people are defined as workers in the *Family Income and Expenditure Survey*, they are considered to be included in the first quintile group. In such households, the consumption expenditures are high when compared with their regular incomes. The existence of other group helps to explain the decreasing trend both in \( c/y \) and \( c/y_i \) for the first quintile group. Because of their low income level, they are forced to dis-save, although they would try to decrease this amounts as much as possible. When total income rises, they would try to decrease their dis-saving rather than raise their standard of livings.

We cannot deny some systematic movements of \( c/y_i \), when we apply the variance analysis. The explanation of this movement is very difficult, and the writer has tried to correlate this movement with several economic variables which are said to be important in consumption analysis. But the results are very pessimistic. Another problem is how to explain the high value of \( c/y_i \) in the highest income group. Though it is difficult to analyse this problem, the writer thinks that the effect of income from assets is very important. Since the percentage of this kind of incomes is large in the high income group, the consumption expenditures from this incomes may be relatively large as compared with that in the lower income groups.

2. ‘Other’ Urban Household Consumption Functions

The non-farm households other than the worker’s households are composed of (1) non-farm self-employed households including non-farm entrepreneur’s, (2) Managers of corporate firms and other professionals, and (3) households without occupations. Of late the percentage of the number of households occupied by the third group has been small. In this section we will be concerned mainly with the former category of households.

As compared with the worker’s and farmer’s households, the data for the analysis of the consumption function is scarce for this group of households. We can get only reliable data for savings (excluding the change of cash holdings), by using the *Family Saving Survey* annually since 1959.24 When we compare the saving ratio by occupational groups, we find a higher ratio in the self-employed households, than the worker’s saving ratio as is shown in Figure 6. It should be mentioned here that this difference is caused by the high investment ratio on the real assets by the self-employed households. According to the result in Figure 7, there are small differences of the liquid type saving ratio between the worker’s and the non-farm entrepreneur’s households. Though the saving ratio is very high in the professional’s households, this can be explained by the high income level as compared with worker’s or non-farm entrepreneur’s households.

Regarding the time-series changes, there are no significant trend in the saving ratio. This is consistent with the calculation for worker’s households when one uses the *Family Income and Expenditure Survey*. Nevertheless, we can find an upward trend of the investment ratio on the real assets in the period. This is very interesting if we remember the unique characteristics of Japanese saving ratio.25 According to the international comparisons of the saving ratios, the liquid type saving ratio is very high in Japanese urban households but the investment income ratio on the real assets is relatively low in Japan. The writer tried to relate

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24 Because the coverage of the *Family Saving Survey* was not uniform before 1962, some adjustments are necessary in order to use this data as a time-series. In our analysis in this section, works have been carried out, but they are too troublesome to be described in detail here.

this phenomenon to the less availability of the consumer finance or the bank loan in Japan. In fact, we can find a correlational relation between the investment ratio and the increase of liabilities divided by income. This suggests that the unique characteristics will be gradually vanishing in the future.

Another interesting topic is to decompose the financial assets and the liquid type saving to analyse them from the point of view of the theory of the Portfolio Selection. Nevertheless, we cannot deal with this problem because of the limitation of space, though some discussions are possible by using the *Survey of Consumer Finance*, published by the Economic Planning Agency. However, a remarkable characteristics should be mentioned here. In the 1950's there was a tendency to increase the percentage of the liquid type savings occupied by the increase of the stocks and the bonds. This tendency is interesting because the percentage of financial assets in the private sector occupied by the stocks and the bonds is very low in Japan as compared in western developed countries. But this tendency was not too remarkable in the 1960's. This may be explained by the decline in the stock prices before the mid-1960 in Japan. Such a tendency should be carefully examined in the future because this may affect the investment ratio etc.
FIG. 7. SAVING RATIOS ACCORDING TO THEIR COMPONENTS AND OCCUPATIONAL GROUPING

(a) Liquid Type Saving

(b) Real Investment

(c) Increase of Liabilities

- Worker's Household
- Professionals
- Unincorporated Entrepreneur's Household
- Household without Occupations
- Managers of Incorporated Enterprise
III. Farmer's Consumption Function

For the analysis of the farmer's consumption function, we can use the Farm Household Economic Survey as a basic data. Because this survey has been carried out since 1950, we can investigate the time-series change of the saving ratio. This can be done if we link the discontinuities caused by the revision of the survey methods in 1952, 1957 and 1962 by using some approximate method. To begin with let us investigate the time-series changes in the average saving ratio. According to Figure 2, though the saving ratio was stable in its average with fluctuations before 1957, the ratio has been increasing afterwards. The writer suggested this fact in 1964 by using the data before 1961, and it is now confirmed by the more remarkable tendency in the data after 1961. It is important to re-examine the farmer's consumption here by using the recent data, because the upward trend in the farmer's saving ratio is very significant.

In the formulation of the farmer's consumption function, we should consider at least three factors. The first is the composition of the farm household income which we must divide into the farm income, the wage type income and the "other sorts" of income. This model depends on the Kubo-Murakami and Shinohara's suggestion. Secondly, the effects of holding assets on the consumption behavior should be considered. A major contribution to this subject is Tobin's liquid assets hypothesis. Though this analysis is restricted to the financial assets, we must enlarge our analysis to the examinations of the effects of the various kinds of assets. With this considerations in mind let us examine the effects of three variables: i.e., (1) financial assets, (2) financial assets minus liabilities, (3) net worth. Thirdly, the examination of the continuity of previous consumption behavior is also important. Since recently the growth rate of income in the farming households has risen we can explain the increase in the farmer's saving ratio if we assume the persistent effect of the consumption pattern.

We can formulate these three hypothesis independently as

\[ C = F(Y_f, Y_w, Y_0) \]  
(8. a)

\[ C = F(Y, A) \]  
(8. b)

\[ C = F(Y, C(-1)) \]  
(8. c)

where \( Y \) is the disposable income, \( Y_f, Y_w, Y_0 \) each respectively indicates the farm income, the wage type income and the "other sort" of income after taxes, \( A \) is the various kinds of assets, and \( C \) and \( C(-1) \) indicate the consumption expenditures without and with a time-lag. Further all variables have been deflated by the corresponding price indices and the number of families. One of difficulties with this analysis is that these three hypotheses are not independent from each other and we can form several combinations. However, because the sample size in our time-series analysis is not large enough to include all combination of theories, we are forced to select the model using some of comparisons.

Firstly let us examine the model which is related to the formula (8.a) and (8.b). Because

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26 The main content of this section was done as a joint work with Mr. Tsutomu Noda, which is included in the Report for the Department of Agriculture and Forestry.


28 Because of the convenience of calculations, we assumed that the amount of taxes is proportional to the amount of three kinds of income.
the rise of the consumer price, \( P \), is remarkable in recent years, we also include this variable in our analysis. That is to say, the model is defined as

\[
C(t) = a + b_1 Y_f(t) + b_2 Y_{n}(t) + b_3 Y_o(t) + cY(t-1) + dP(t) 
\]

(9)

where all variables are estimated by adopting the gross concepts. The results shown in Table 3 are rather different from our previous conjecture. According to Shinohara’s calculation by using data from 1953 to 1961, the marginal propensity to consume for the farm income is larger than that for the other kinds of farmer’s household’s income, and his result is consistent with the explanation that the recent rise of the farmer’s saving ratio originates from the increase of the percentage of farmer’s household income occupied by the “other” kind of income. However, our conclusion contradicts with his suggestions. Shinohara’s results using the formula

\[
S(t) = a + b_1 Y_f(t) + b_4 Y_n(t) 
\]

(10)

where \( Y_n \) is the farmer’s household income other than the farm income, are shown in Table 4. A part of this contradiction can be explained by the different method of the estimation. Though we used all the data as classified by the regions and the sizes of the farms, Shinohara’s
Table 4. A Comparison of Consumption Functions of the Formula (10)

<table>
<thead>
<tr>
<th></th>
<th>( b_1 )</th>
<th>( b_2 )</th>
<th>( b_1 )</th>
<th>( b_2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>under 0.5 ha</td>
<td>0.1961(0.2395)</td>
<td>0.2630(0.0440)</td>
<td>0.3494(0.0965)</td>
<td>0.4437(0.1874)</td>
</tr>
<tr>
<td>0.5-1.0</td>
<td>0.3464(0.1516)</td>
<td>0.4235(0.0566)</td>
<td>0.4471(0.0829)</td>
<td>1.1479(0.4157)</td>
</tr>
<tr>
<td>1.0-1.5</td>
<td>0.1352(0.1364)</td>
<td>0.5131(0.1781)</td>
<td>1.1479(0.4157)</td>
<td></td>
</tr>
</tbody>
</table>

M. Shinohara “Saving Behavior of the Farm Household,” op. cit.

calculation is restricted only for the average figures according to the sizes of farms. Nevertheless a more important reason should be found in the changes in consumption pattern of the farmer’s households. Noda and Egaisu have suggested that there remain systematic residuals in the time-series analysis, when we apply the model of the type of the formula (8. a).29 If this is true, the difference between Shinohara’s and our results can be explained by the changes in the consumption patterns. When the consumption function of the formula (9) is estimated according to the different periods, we can find a gradual change in the marginal propensities to consume in this table. This suggests us that the rise in the saving ratio can be related to the decreasing tendency of the percentage of the farm income in the period in the end of the 1950’s but we need to seek some other reasons for trend of the saving ratio in the recent period. The writer thinks that the most important reason may be the rapid increase of the farm household income. In fact, the real consumption level of the farm household has been rapidly converging to the average level of the urban households. In this sense, the significance of \( c \) in the formula (9) is very important.

Regarding the model (8. b) we applied the formula,

\[
C(t) = a + b_1 Y_f(t) + b_2 (Y_n(t) + Y_e(t)) + e \Delta f(t)
\]

where \( \Delta f \) corresponds the following kinds of assets: (1) financial assets, (2) financial assets minus liabilities, (3) the net worth. Judging from the multiple correlations and the signs of parameters, the most reliable one is the model adopting the financial assets as \( \Delta f \), which is shown in Table 6. Nevertheless, the effect of the assets on the consumption expenditure is not too much significant. For instance, the sign of \( \Delta f \) is inconsistent with the theoretical hypothesis and the parameter is not statistically significant in the two classes. But it should be noted that the estimators of \( b_1 \) and \( b_2 \) are more stable among the classes in this formula than the case of the formula (9).

In order to explain the change of the saving behaviors in the farmer’s households, it is necessary to examine the farmer’s saving ratio according to their components, as was tried for the urban households. By investigating the figures in Table 5 (which are derived from the linked data for all farm households for the whole country excluding Hokkaido), we find an interesting change in the saving according to their components. First, the liquid type saving ratio (the increase of the financial assets divided by income) has increased remarkably since the end of the 1950’s. Second, the investments on real assets versus income ratio has

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29 Tsutomu Noda and Norio Egaisu, “Consumption Structure and Propensity to Consume” (Shōhi Közō to Shōhi Seikō), Keizai Bunseki, No. 15, 1965.
Table 5. Time-series Changes in the Saving Ratios According to Their Components in the Farmer’s Households (net for all Japan, excluding Hokkaido) (unit: percent)

<table>
<thead>
<tr>
<th></th>
<th>1953</th>
<th>1957</th>
<th>1960</th>
<th>1965</th>
</tr>
</thead>
<tbody>
<tr>
<td>net increase in land</td>
<td>-0.3</td>
<td>0.3</td>
<td>-5.9</td>
<td>-6.0</td>
</tr>
<tr>
<td>building</td>
<td>-1.0</td>
<td>-1.3</td>
<td>0.4</td>
<td>4.0</td>
</tr>
<tr>
<td>farm equipments</td>
<td>-0.1</td>
<td>-0.7</td>
<td>0.9</td>
<td>0.7</td>
</tr>
<tr>
<td>vegetation and animals</td>
<td>-0.8</td>
<td>0.2</td>
<td>0.6</td>
<td>1.2</td>
</tr>
<tr>
<td>inventories</td>
<td>1.9</td>
<td>2.0</td>
<td>1.3</td>
<td>1.3</td>
</tr>
<tr>
<td>financial assets</td>
<td>8.9</td>
<td>9.8</td>
<td>15.6</td>
<td>20.6</td>
</tr>
<tr>
<td>decrease in liabilities</td>
<td>-3.4</td>
<td>-3.7</td>
<td>-2.3</td>
<td>-2.8</td>
</tr>
</tbody>
</table>

Source: The Linked Data of the Farm Household Economic Survey, op. cit.

remained at a constant level, because on the one hand the changes in landholdings show a negative value but on the other hand the other investments indicate positive value in the recent period. Third the changes in liabilities does not seem to display any trend though it does fluctuate. This finding is supported by the more detailed time-series analysis which is not shown here due to limitations of space. That is, the recent upward trend of the saving ratio for farm households can be explained by the increase of the liquid type saving ratio. This is very interesting because a very similar tendency can be found in the upward trend of saving ratio in the worker’s households. As mentioned earlier, because the depreciation rate in the Farm Household Economic Survey is very high, the low level of the investment ratio on real assets can partially explained when we adopt the gross-concept. However, there remain the question of the upward trend of the saving ratio supported by the rise of the liquid type saving ratio even in the case of the analysis using the gross concept.

Before the detailed examination, let us compare the saving ratio both according to their components and the sizes of farms. Some contrasts are shown in Table 6. In the smaller sized farming households the investment on land has been negative since 1952 and this corresponds to the increase in non-farm income of these households. Generally speaking, because

Table 6. Time-series Change of Saving Ratios by Their Components According to Sizes of Farms

<table>
<thead>
<tr>
<th></th>
<th>Under 0.5 ha</th>
<th>1.0—1.5 ha</th>
<th>Over 2.0 ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>increase of land</td>
<td>-0.6 -0.9 -4.9 -3.8</td>
<td>0.1 1.6 -3.8 -3.5</td>
<td>0.7 -0.3 -3.1 0.8</td>
</tr>
<tr>
<td>building</td>
<td>-0.9 -0.2 0.0 3.5</td>
<td>0.5 -1.9 0.8 5.3</td>
<td>0.7 -0.6 1.7 3.7</td>
</tr>
<tr>
<td>farm equipment</td>
<td>-0.3 -0.6 0.1 0.4</td>
<td>0.0 -1.1 1.9 0.8</td>
<td>-0.1 0.6 0.9 1.2</td>
</tr>
<tr>
<td>vegetation, animal</td>
<td>0.1 0.0 0.4 0.6</td>
<td>-2.4 -0.3 1.0 1.6</td>
<td>0.1 -0.4 1.0 1.7</td>
</tr>
<tr>
<td>stocks of goods</td>
<td>2.0 1.2 0.7 0.5</td>
<td>2.9 2.2 1.6 1.5</td>
<td>3.4 1.9 1.5 2.3</td>
</tr>
<tr>
<td>liquid assets</td>
<td>7.3 11.1 14.1 16.9</td>
<td>9.1 9.0 14.8 18.2</td>
<td>9.6 12.0 19.9 20.3</td>
</tr>
<tr>
<td>decrease of liabilities</td>
<td>-2.4 -2.3 -0.4 -1.8</td>
<td>-2.4 -2.3 -2.8 -3.8</td>
<td>-1.1 -4.6 -3.5 -2.9</td>
</tr>
<tr>
<td>Total</td>
<td>5.2 8.3 10.0 15.3</td>
<td>6.8 7.2 13.5 20.1</td>
<td>13.2 8.6 18.4 27.1</td>
</tr>
</tbody>
</table>

Source: The Linked Data of Farm Household Economic Survey, op. cit.
the productivity of farm labor is low for these households, the farmers tend to work in the urban sector and to keep their farming activities as their part-time works at an earlier period. If we adopt the definition in the net concept, the investment ratio for real assets (excluding the investment for their private residences) has been very low. It is commonly said that the depreciation rates for the real assets in the Farm Household Economic Survey are rather high in order to proceed with the analysis of the farmer’s behaviors. Therefore, we had better consider that some amounts of net investments on farming equipments etc. has been done during this period. In fact, the real farm income per labor time has been increasing even for the smaller sized farm households, though the growth rate of the real farm income is not significant. This means that the real investment has been done in order to save labor time in the farm and make it possible to work in the urban sector. A significant change can be found in the liquid type saving ratio. We can find a remarkable upward trend of this ratio in the smaller sized farming households. It is interesting to point out that this tendency can be related to the increase in the percentage of the farm household income occupied by the wage type income at least at the earlier time. In the pre-war Japan, cash income were generally low in farm households and they supported themselves mainly with self-produced products. This condition improved remarkably after the Second World War, but we cannot deny that the financial assets were small when compared with the total household income or the real assets. Since the increase of wage type income induce the cash income, the farmer felt it easier to increase their liquid type saving ratio. Further, it is also important to explain this factor by the difference in the growth rates of two kind of income. Since the farmer made the plan for consumption depending on the growth rate of farm income at earlier period, the higher rate of growth of non-farm income increase the saving. Because they cannot expect any rapid increase in productivity of farming through investments on farming equipment, they tend to save remainder of their income as the financial assets. Nevertheless, it should be mentioned that the consumption pattern of smaller sized farming households has gradually been changing. Recently the position of the non-farm income is too important to be neglected in the plan for consumption. Further, the dominant part of the income in the smaller sized farming households is occupied by the cash income, and this means that the increase of the cash income does not necessarily increase the liquid type savings. We will examine in detail this change of consumption pattern in these households in the latter part of this section.

A very similar tendency can be found in the changes of the saving components in the middle sized farming households after 1960, though the pattern was different from that in the small sized farming households before the 1960’s. That is to say, the investments on real assets were relatively high and the liquid type saving ratio had been nearly constant for the 1950’s. After the end of the 1950’s, the investments on land became negative even in the middle sized farming households and we find an upward trend both in the liquid type saving ratios and in the percentage of farm household income occupied by the wage type income. This means that the income differentials between the urban and the rural sectors are large enough to draw the labor force from the nuclear part of farm households. Explanation for the behavior of these households can be made in a similar manner as that for the smaller sized farming households.

The time-series changes in the saving ratio according to their components is rather different in the large sized farming households. It is generally said that these households will
be able to continue as the full-time farmers in the future, because the sizes of farm is large enough to be able to increase productivity by the investments on capital. According to the figures in Table 6, the net increase in land for these households is positive even in the recent period while they were negative in the latter part of the 1950's. The investments in real assets is large when compared with other type of farming households. It is important to note that recently the liquid type saving ratio has been increasing. However, we cannot apply the same type of explanation as were used in the case of small or medium sized farming households to the large scale farming households because there is no upward trend in the percentage of farm household income occupied by the wage type income. The writer thinks that this tendency can be related to the rapid rise of farm income in these households, which originates an increase in the farm products' prices, especially the price of rice in the recent years. That is to say, the wholesale price of rice has increased steadily since 1960, because the Japanese government supported this price as an important economic policy. This induces the unexpected high growth of the farm income, especially for the large scale farming households.

Regarding the functions determining the amounts of the savings according to their components, we started to analyse them as a part of the comprehensive studies of the farm-household behaviors by using as much information as in the Farm Household Economic Survey. Because this work has been carried out as the project lead by Prof. Mataji Umemura, to which the writer belongs as a member, the detailed examination will be postponed until the publication of the report of this project, though some tentative results have been completed.

IV. Conclusion

In concluding this paper, let us re-consider the time-series changes in the personal saving ratios of the National Accounts Statistics concerning the post-war period in Japan, and also consider some possible future changes. As was pointed out in the first part of this paper, the rise of the saving ratio in the 1950's originated mainly in the increase of the ratio in the worker's households. This is explained by the increase in the percentage of the worker's income occupied by the bonus type payments. In recent years, the saving ratio in the farmer's households has been increasing significantly, and this tendency explains the slight rise of the personal saving ratio in the recent period. Because the percentage of the number of households occupied by that of farmer's households is not too large in recent Japan, the rise of the saving ratio in the farmer's households induces only a slight rise of the personal saving ratio. But this is a factor to consider in the further increase of the personal saving ratio. The saving ratio in the non-farm self-employed households is important to explain the high level of the personal saving ratio, but this is not too much important in the explanation of the upward trend of the personal saving ratio in the time-series analysis.

There are some negative factors acting on the future increase in the personal saving ratio. First, the percentage of personal income occupied by the non-wage type income has been decreasing in recent Japan. Since the marginal propensity to save for this type of income is larger than that for wage-type income, the decrease of this percentage affects negatively on the personal saving ratio. We can not expect a sharp increase of the bonus-type income in the near future, the worker's saving ratio should remain stable. Further, the recent developing in the consumer financings should be considered as one important factor. Considering
these facts, it is impossible to forecast a future significant rise of the personal saving ratio in Japan. However, the writer cannot agree in the opinion that in the near future the saving ratio in Japan decrease sharply when we investigate the past tendency of the saving ratio.