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SIZE DISTRIBUTION OF WORKERS' HOUSEHOLD INCOME AND MACROECONOMIC ACTIVITIES IN JAPAN: 1963–88

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An attempt is made to examine empirically the relationship between the size distribution of workers' household incomes and the variables expressing macroeconomic activities. As a preliminary implementation, the income shares are first estimated by decile groups and several subdivided top income groups. Applying Blinder and Esaki's regression approach to the estimated data, the ratio of job offers to applicants, inflation rate, and the terms of trade are found to significantly affect the distribution. Of these variables, the terms of trade should be taken into account to ascertain precisely the income distribution in Japan where foreign trade heavily affects economic conditions.

I. INTRODUCTION

The influence of macroeconomic conditions should be sufficiently explored to ascertain fully the observed changes occurring in the size distribution of household income. A number of previous studies have examined the actual changes happening in the observed time series in the size distribution and have attempted to relate these changes to fluctuations in the macroeconomic conditions. Of the more recent studies on the effect of changes arising in macroeconomic conditions on the size distribution, a time-series approach was adopted by several researchers, most prominently by Schultz (1969), Metcalf (1969), Thurow (1970), Beach (1976 and 1977), Blinder and Esaki (1978) and Blank and Blinder (1986); studies almost all of which were based on U.S. data. A number of other studies using data for the U.K. have been added to this area. For Japan, however, no attempts have yet been made to trace the complex process whereby changes in macroeconomic activity over time have led to changes in the size distribution mainly because of the lack of long-term data concerning the latter.

In Section II of the present paper, an attempt is made to empirically contribute to this rather uncultivated area by presenting estimated data for the size distribution in Japan for the 1963–88 period. Particular attention is focused on estimating decile yearly income shares (including some top shares) of worker's households which constitute the major portion of income-receiving family units. In Section III, the equation for the estimation using these data is explained. Section IV presents the estimated results analyzed using the straightforward regression approach which Blinder and Esaki (1978) and Nolan (1987) respectively applied to U.S. and U.K. data.

The general problem arising with such time-series analysis is that many different, and sometimes opposite, effects on the size distribution are suggested for several macroeconomic variables such as unemployment rate and inflation

Note: The helpful comments of the editor and two anonymous referees are greatly appreciated.

rate. However, emphasizing the feasibility of precise comparison with these results, labor market conditions and inflation are considered in a regression model. Clearly, many different influences are operating simultaneously to change the size distribution over the given period, and the approach adopted here reflects the difficulty in separating out the processes through which the effects of aggregated macroeconomic factors may present themselves. It is therefore necessary to shed light on the impact on the distribution generated by several different factors, for example, institutional as well as macroeconomic fluctuations.

The final section offers a summary and assessment of the results.

II. Data and Estimation Methods

There are currently no income distribution data in Japan that are directly related to the SNA system. The same drawback of lacking or insufficient data can be found in personal and family income distribution. Accordingly, the information used on income distribution has been extracted from several sample surveys. The data source used here is the *Annual Report on the Family Income and Expenditure Survey* (FIES) reported by the Statistics Bureau of the Management and Coordination Agency. The FIES was selected as the data source for two principal reasons. First, among other sources, it contains the most reliable data on annual incomes of workers' households (households whose heads are on a payroll) which make up the largest part of the income-receiving units of the whole economy. Second, it allows the use of family data rather than individual data, which, in turn, enables welfare implications to be discussed.

Successful application of the approach with which Blinder and Esaki first attempted to relate the actual changes occurring in the size distribution over time to various macroeconomic variables clearly necessitates estimating decile income shares, and, if possible, several upper income (e.g. the top 1 percent and the top 5 percent) shares for a much longer time series. With regard to the estimated shares of the size distribution, since the upper income groups tend to be small in sample size, it is essential to clarify whether or not the estimated data match those of other large sample surveys and which estimation methods are used. These points will be discussed in detail later.

The concept of income adopted here is yearly income (in amounts of 1,000 yen for 1963–78 and of 10,000 yen from 1979 on), which consists of: (1) wages and salaries (including bonus payments); (2) earnings of other household members; (3) rents, interests and dividends; (4) returns from assets; and (5) social security benefits. This concept, however, does not take into account the imputed rent for owner-occupied houses. It also excludes an allowance in kind and capital gains (or losses). Therefore, this income, as expressed, is brought closer to the definition of pretax personal income in national income accounts.

To analyze the long-term income distribution using annual data, it is appropriate to adopt the yearly average observation per household by yearly income groups. It was with the intention to obtain yearly income figures (including bonus payments) that the FIES survey was enlarged and revised in July 1962. In the previous surveys conducted, only the yearly average of monthly receipts was reported, and, with these figures, the families were classified by income groups.

This procedure did not account for the fact, however, that a family might enter a different income group jumping from one income range to another one with different month-to-month receipts. The FIES has successfully overcome this deficiency by introducing yearly income groups accompanied by the revisions stated above.[1] Moreover, the survey coverage, which formerly covered all of the urban areas, was extended to include the entirety of Japan from 1963 on. Consequently, from 1963, researchers can now use continuously the published tabulations by yearly income groups classified into 16 groups, and, following the 1979 report, the number of classified groups has increased to 18.

All attempts to construct the size distribution of income from the grouped FIES data in this paper start with the estimation of decile data for the entire periods. In addition, the estimates of the figures for the top 1 percent and 5 percent shares are prepared for the following analyses.

For estimating income shares, a new functional form for estimating the Lorenz curves presented by Ortega *et al.* (Ortega, Martín, Fernández, Ladoux, and García, 1991) is used. In their article in this *Review* they proposed the functional form

$$(1) \qquad f(x)=x^{\alpha}[1-(1-x)^{\beta}], \qquad \alpha\geq 0,\ 0\leq\beta\leq 1.$$

Applying the non-linear least squares procedure, here we can calculate the value of parameters α and β, and then estimate the shares of workers' household income from (1). In addition, Ortega *et al.* shows that the Gini index is

$$(2) \qquad G=1-2\int_0^1 x^{\alpha}[1-(1-x)^{\beta}]\,dx$$

$$=\frac{\alpha-1}{\alpha+1}+2B(\alpha+1,\beta+1),$$

where B represents the beta function which has been tabulated, for example, by Pearson and Johnson (1968). The Romberg integral method is directly applied here to the first formula in (2) above to compute the Gini index for the given parameters of (1).[2]

With respect to the time series data, the income shares of the top 1 percent and 5 percent have never been previously available in either published or estimated figures. In order to confirm the reliability of our data, the estimated shares of these richest groups are compared with the estimates derived from the *National Survey of Family Income and Expenditures* (NSFIE) published by the Statistics Bureau, Management and Coordination Agency, which offer several advantages over those in the FIES. First, having a sample size of approximately 53,000 households, the NSFIE can be expected to produce more stable estimates for the top 1 percent and 5 percent groups than those provided by the FIES based on only about 8,000 samples. Second, the NSFIE for 1974 reported a table featuring

[1]See Appendix 4, "Yearly Income Groups," in the 1964 *Annual Report on the Family Income and Expenditure Survey*, pp. 507–508.

[2]The order of partition in the trapezoidal rule is 2^6. See Press *et al.* (1986, p. 114). The estimated results of the shares are available from the author upon request.

TABLE 1

COMPARISON OF ESTIMATED SHARES FOR SELECTED DECILES FROM TWO DATA SOURCES

	1974		1979		1984	
	FIES	NSFIE	FIES	NSFIE	FIES	NSFIE
Top 1%	4.11	3.69	3.42	3.28	3.26	3.27
Top 5%	13.21	12.33	11.78	11.45	11.49	11.50
Top 20%	35.95	34.68	33.84	33.38	33.69	33.64
80–51%	31.82	32.08	32.21	32.35	32.68	32.59
50–21%	22.71	23.32	23.72	23.95	23.79	23.82
Bottom 20%	9.52	9.92	10.23	10.33	9.83	9.95
Bottom 10%	3.89	4.08	4.23	4.27	3.97	4.04
α	0.2659	0.2599	0.2531	0.2559	0.2890	0.2805
β	0.7073	0.7321	0.7482	0.7593	0.7632	0.7616
SSR	0.000024	0.000055	0.000074	0.000058	0.000064	0.000067

Notes:

1. SSR means the sum of squared residuals.
2. The results for 1969 are not given due to the lack of data for the mean income within each income range.
3. While FIES and NSFIE show different numbers of yearly income classes tabulated for 1974 and 1979, for 1984 both sources indicate the same number of classes of 18, and thus give quite close estimates of shares. FIES for 1974 is tabulated in 16 income classes, and has two classes for households with less than 6 hundred thousand yen of yearly income and also seven classes for more than 2 million yen. On the other hand, NSFIE for 1974 is tabulated in 18 classes, and has only one class for less then 6 hundred thousand yen and ten divided classes for households with yearly income exceeding 2 million yen. For the 1979 survey, FIES and NSFIE present tabulations classified in 18 and 19 groups respectively, with the former having only one class for the richest households with an 8 million or more yearly income, while the latter partitions those housholds in two groups with 8–10 million yen and with more than 10 million yen of yearly income. Looking at these different grouping patterns, a difference in the number of income groups may explain to some extent the discrepancy between the estimates derived from the the two sources.

18 yearly income groups (FIES with 16) and 19 groups for 1979 (FIES with 18), with these increases in the number of income groups being expected to improve the accuracy of the estimated parameters.

On the other hand, since the NSFIE survey is conducted every five years, and because no observation was made of yearly income groups for 1964, the surveys only for the four years of 1969, 1974, 1979 and 1984 are available for comparative purposes (See Table 1.). Moreover, approximately the same estimates occur for 1974 in which the share of the top 1 percent is 3.7 percent from the NSFIE and 4.1 percent from the FIES, and for 1984 in which the same figures of 3.3 percent and 11.5 percent are respectively derived for the top 1 percent and 5 percent shares. It can therefore safely be said that the shares estimated for these classes using the FIES can be effectively used in the present analysis.[3]

Several features of the estimated data for the distribution are found in Figures 1 and 2 which graphically show the movements in the shares of selected decile groups and the calculated Gini index respectively. The movements of the share of the top 5 percent are balanced by those of the 80–51 percent and the lowest 20 percent groups, with most of this balance being clarified in the bottom 30 percentile. As demonstrated in the behaviour of the Gini index, inequality diminished during the 1960s, mainly through the fall in the shares of the top groups of

[3]See notes on Table 1.

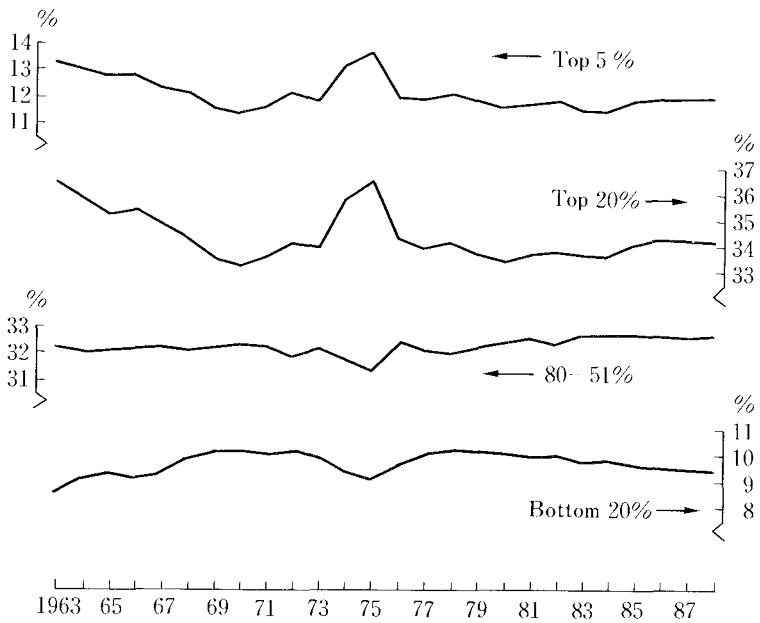

Figure 1. Shares of selected decile groups in workers' households income distribution, 1963–88.

the distribution and the increase in that of the lowest 20 percent group. In the 1970s, the Gini index shows a slight rising trend with the exception of the 1974–75 period. This extraordinary jump in the Gini index and also in the shares of the top groups in the distribution represents the dip in the Japanese economy triggered by the first oil crisis. This irregular pattern in the distribution shares for the 1974–75 period will be explained in detail later in reference to macroeconomic performance. In the 1980s, income inequality measured by the Gini index marked an increasing trend accompanied by a decrease in the share of the bottom 20 percent.

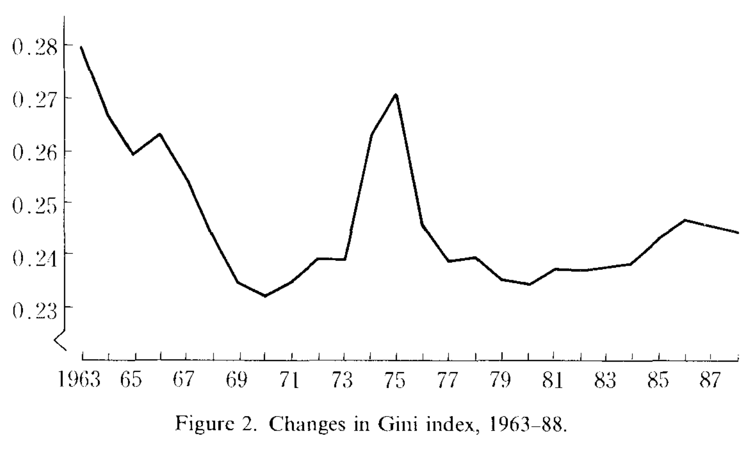

Figure 2. Changes in Gini index, 1963–88.

III. Estimation Procedure and Variables

Analyses of the impact that the actual macroeconomic changes over time may specifically have on the size distribution of income have been attempted by Metcalf and Schultz followed by Beach, Blinder and Esaki, Blank and Blinder, and Nolan. Among these researchers, Schultz has made a good start toward the approach to the problem by applying an econometric method. He intended to explain the changes over time of the inequality measure indicated by the Gini index using several variables representing macroeconomic conditions. However, his attempt yielded insufficient results in explaining the year-to-year movements in the U.S. inequality measure using such variables as the unemployment rate, inflation, growth rate of real ouput, and the time trend.[4]

From the presumption that using only an aggregate inequality measure such as the Gini index may be inadequate or misleading, Metcalf and Thurow fit a particular equation form to the distribution and related the changes over time in the parameters of this form to macroeconomic variables.[5] Recently, Basmann *et al.* (1983), Shackett *et al.* (1987), Black *et al.* (1989), Haslag *et al.* (1989), and Slottje (1989) followed almost the same approach applying a multi-dimensional joint distribution function, a beta distribution of the second kind, chosen because its computed distribution closely fit the observed data. They have shown that the parameters of the joint distribution affect inequality in the marginal distribution of income, and that changes in macroeconomic variables affect the parameters of this function as well.

On the other hand, Beach, Blinder and Esaki, Blank and Blinder, and Nolan avoid the imposition of a particular functional form on income distribution, and explore the relationship between the quintile income levels (or shares) and macroeconomic activities using the data for the U.S. and the U.K. For the estimation on the same time-series approach, Nolan adds to dependent variables more detailed income shares of the fifth quintile subdivided into the top 1 percent, 2–5 percent, 6–10 percent, and 11–20 percent groups.

The history of Japanese economic fluctuations over the sample periods can be summarized by the changes occurring in several variables: the rate of inflation, the terms of trade, and the ratio of job offers to applicants—an indicator of the labor market condition. Obviously, the behavior of these macroeconomic variables can be considered to affect the actual movements in the time series in the size distribution. However, the relationship between the fluctuation in these macroeconomic variables and the changes in the actual movements in the time series on the size distribution in Japan has been scarcely analyzed largely due to the lack of both official and estimated income distribution data which give the number

[4]Schultz (1969, p. 87) produced some significant results applying the same approach to data for the Netherlands.

[5]In this approach, we cannot avoid the imposition of a particular functional form on the distribution. In order to evaluate the goodness-of-fit, Suruga (1982) has fitted several distributional functions, namely, the Pareto, log-normal, Gamma, log-logistic, Beta, and Singh-Maddala to the FIES data (all households), and has demonstrated that the log-logistic function is relatively preferable in meeting several criteria of explanatory power. Since the scale parameter of this function is equivalent to the Gini coefficient, if we wish to adopt Schultz's approach, it may be convenient to estimate the parameter of this function.

of income shares accruing to each decile of the population. Therefore, it would be a contribution to the analysis of Japanese income distribution to provide in this paper an empirical study undertaken with the intention of estimating the Blinder–Esaki approach using the estimated decile, the top 1 percent, and the 5 percent income shares obtained in the previous section as the dependent variables.

The estimated results derived by Blinder and Esaki as well as those by Blank and Blinder show for the U.S. size distribution that the increase in the unemployment rate raises the inequality degree, having negative effects on the income shares of low income groups and yielding a much larger positive effect on the fifth quintile group. With the U.K. size distribution data, Nolan derived a significant negative sign on the unemployment variable for the lowest quintile and a significant positive sign for the fourth quintile, but, to the contrary, a significant negative and rather large effect was obtained for the top 5 percent.

Among the major channels whereby changes in the macroeconomy are likely to feed through to the size distribution of income, changes in the level of unemployment generally have been seen to have a relatively large impact. Concerning the Japanese labor market, however, it has been widely said that the observed unemployment rate serves as a poor measure for ascertaining the labor market conditions because of its narrower range of fluctuation. As an indicator of labor market conditions, the ratio of job offers to applicants (henceforth JOA) is used. Since the numerator of this ratio (jobs offered) is responsive to business fluctuations, this ratio varies more than does the unemployment rate. The official unemployment rate is often replaced by the ratio because it gives a better fit to the estimated Phillips curves for the Japanese economy, and it also performs better as a measure of excess demand in the labor market in a large number of empirical wage equations.[6]

Looking over the 1963–88 period, the JOA reported by the Ministry of Labor varied from its lowest of 0.54 in 1977 to its highest of 1.76 in 1973, while the unemployment rate moved during the same sample period from 1.1 to 2.7 percent in its yearly average figure which was much lower compared with other industrial countries.

As far as the impact of inflation on the size distribution is concerned, Blinder and Esaki as well as Blank and Blinder have demonstrated the existence of equalizing effects of aggravating inflation between the quintile income groups. Furthermore, Metcalf has obtained an adverse estimated effect on the lower income groups.

The results regarding the effect of inflation were much more indefinite for both the U.S. and U.K. size distributions. While commonly for these two countries the inflation variable showed a positive effect on the lowest quintile, these results were not in line with the a priori expectation, and the coefficients were much smaller than those for unemployment. In addition, the number of income distribution groups for which significant coefficients on the inflation variable were found was much smalller than the case for unemployment. In the same context, Buse (1982) found no significant impact of inflation on the Canadian distribution series.

[6]See, for example, Perry (1975, p. 416), Hamada and Kurosaka (1986, p. S289), and Tachibanaki (1987, p. 673).

Following these experimental results, the influence accruing from the inflation rate on the size distribution might be crucially different depending on the concepts of income, and it should be borne in mind that the data should speak for themselves.

The sample data used in this paper cover only the workers' households, and the concept of income is considered to be constructed typically of wages and salaries. Accordingly, we can expect to specify the effect of inflation on various income groups whose incomes have qualitatively the same components. (In the FIES, the ratio of wages and salaries to income in the first and the last tenth decile groups with an average yearly income in each cell for 1987 are 90.9 percent and 92.7 percent respectively, such that it may be concluded that little difference exists in income components between the lower and higher income groups).

It can easily be supposed that expectations regarding the rate of inflation will heavily affect the income distribution of employees' households through the impact generated on the rate of change in wages. In Japanese wage negotiations, the trade unions have been demanding that at least the level of real wages established in the last year be maintained and that some upward shift in the standard of living be gained in a degree parallel with the rate of growth of the economy. As a result, the unions negotiate on the criterion that the rate of increase in wages should match "the rate of increase of inflation plus some additional rate of increase in the standard of living." Additionally, a pattern of wage-setting is assumed in nationwide wage negotiations called "Shunto," or the spring labor offensive, with subsequent agreements in force for one year.

In periods when inflation accelerates, however, wage earners suffer disadvantages from lags in recovering real wage levels as long as negotiations are made on the basis of the criterion stated above. From the employee's viewpoint, therefore, a reasonable strategy seems to be to demand that wages increase by at least the same rate as that of inflation to include the expected inflation rate. In the same context, moreover, wage earners will have keen concerns about unexpected inflation (the difference between expected and actual inflation rate) to adjust their wage increases to the inflated cost of living.[7]

One important question remains, however: Can employees and employers reach agreement on a presumed value concerning expectations of price changes? The expected rate of inflation may, in fact, be a psychological variable for each side at the negotiation table, and one that cannot be observed.

In more definite terms, what kind of statistical observations should be used to form an expectation, and what kind of equations should be selected to calculate the expected value? From the labor supply perspective, the rate of increase in consumer prices should be borne in mind. On the other hand, the prices of products, the prices of goods which enter into competition with these products in the market, and the prices of fuel or raw materials should principally be taken into account in the determination of the labor demand.

Therefore, both the consumer prices and GNP deflator are applied as independent variables reflecting the inflation rate, and the adaptive expectation

[7]Blank and Blinder (1986, p. 185) earlier specified their regression model with inflation variables separated into anticipated and unanticipated components.

formula is used to calculate the expected rate of inflation. This formula, written as

$$P_t^e = P_{t-1}^e + \lambda(P_{t-1} - P_{t-1}^e),$$

is most widely used in both theoretical and empircal studies. P^e is the expected rate of inflation and P represents the observable actual rate of increase in prices. Quarterly observed data are used, and an appropriate initial value is first proposed to enable the sequential quarterly expected rate of inflation to be calculated. Next, annual figures are produced as the geometric mean value with these calculated quarterly series of data.

When considering the fact that price movements remained in a steady state of about 0 percent for the period from the latter half of 1955 to the first half of 1956, the initial value is assumed to be 0 for the fourth quarter of 1955. For the adjustment coefficient λ, two cases in which $\lambda = 0.2$ and 0.8 are proposed. As a result, while the observed annual rate of inflation moved during the sample period from the highest of 20.1 percent in 1974 to the lowest of 0.0 percent in 1987, the computed annual rate of expected inflation fluctuated from the highest of 14.5 percent in 1975 to the lowest of 0.6 percent in 1988 with $\lambda = 0.2$, and from the highest of 19.0 percent in 1974 to the lowest of 0.2 percent in 1988 when $\lambda = 0.8$ is applied.

One of the most distinct features of the Japanese economy witnessed over the observed period is its distinguished changes in the terms of trade (ratio of deflator on exports to deflator on imports). In fact, after the terms of trade slightly deteriorated from 1963 to 1970, it marked a 9 percent improvement by 1972, and then sharply deteriorated by about 30 percent during the first oil shock. In 1978, it featured a short-lived improvement, but again started to deteriorate in 1979 when the second oil crisis hit the Japanese economy. Looking at the broad trend, it fell from 1.8 in the late 1960s to about 1.0 in the first half of the 1980s. After 1986 it turned markedly upwards, reflecting the rapid appreciation of the yen and steady state or slight downward movement of the prices of crude oil and raw materials.

From a macroeconomic standpoint, an improvement in the terms of trade has a positive effect on increasing real income, and, at the same time, it allows the rate of change in wages to rise more quickly than the rate of growth of productivity. Looking at this fact, it is quite reasonable to introduce this variable of the terms of trade in explaining changes occurring in the size distribution of workers' household income.

Finally, to bring in a capability of income shares to adjust to macroeconomic fluctuations with a lag, a partial adjustment model is introduced. In specifying a regression equation, using a simple geometric distributed lag model, a regression equation is formulated to include a lagged dependent variable.

The basic statistical model to be estimated is thus simply given as

$$S_{i,t} = a_i + b_i V_t + c_i P_t^e + d_i UP_t^e + e_i T_t + f_i S_{i,t-1} + \varepsilon_{i,t}, \tag{3}$$

where $S_{i,t}$ denotes the estimated shares of the i-th decile groups in the income distribution (including the top 1 percent and 5 percent shares) for workers' households in year t; V_t is the ratio of job offers to applicants (JOA); P_t^e is the expected rate of change of inflation measured by the GNP deflator or by consumer prices; UP_t^e is the unexpected inflation rate calculated as the difference between the expected and actual inflation rates; T_t indicates the terms of trade; and ε_t represents the error terms. The model has been regressed on an annual time series by OLS.

Of particular interest is that Japan's historical economic story unfolding during the periods covered in this paper is, in a sense, a coincidental misfortune of the Japanese economy. During the Shunto of 1974, the Japanese did not realize that the terms of trade deterioration arising from the first oil crisis would so seriously damage real purchasing power and productivity.[8] The labor market was in a state of excess demand; the ratio of job offers to applicants was close to 1.8. In addition, the jump in crude oil prices was forcing an extreme rise in wholesale prices, and exhibited a clear tendency to put upward pressure on consumer prices. Management responded to increased union demands by raising the standard nominal wages during the Shunto by 32.9 percent in 1974, and this triggered the stagflation depicted by a negative growth rate in real GNP experienced only once in Japan's postwar economy. To identify the misfortune befalling the Japanese economy in 1974–75, regressions using a dummy variable for these two years were also run, with the results not given in this paper due to limited space.[9]

IV. Empirical Results

Estimated results for the selected shares of income groups are shown in Table 2. In general, most of the independent variables give considerably satisfactory esimated results.

Looking first at the JOA variable, we can see that it is significant in the equations for higher income groups. The coefficients for higher yearly income groups are significantly negative and are in line with a priori expectations. Of the JOA coefficients, those on the top 1 and the top 5 percent are large and negative, and this means that a rise in JOA redistributes relatively large income away from these top groups toward lower income groups. In other words, the JOA represents a progressive tax on workers' households. This progressive tax effect turns out to be much weaker and insignificantly positive for the 80–51 percent groups.

For the lower middle income (50–21 percent) groups, the relative gaining effects on income shares with one point each in the JOA variable are found to be relatively large and significant. On the other hand, the positive insignificant

[8]In an open economy, the domestic production possibilities set can shift inwardly by means of deteriorations in the economy's terms of trade. Japan experienced a minimal number of very poor productivity growth years around the first oil crisis and then snapped back relatively quickly, although not completely. See Morrison and Diewert (1990).

[9]For the most regressed equations, the results appear to be relatively better than those obtained by estimating equation (3), exhibiting slightly higher coefficients of determination. However, the coefficients of the independent variables except of the dummy variable result in minor changes in their sizes, and the coefficients of the expected inflation variable turn out to give reverse signs to those obtained by equation (3) for almost all regressed equations except for the 80–51 percent group.

TABLE 2

ESTIMATION RESULTS FOR SELECTED DECILES, 1964–88

Variable	Top 1%	Top 5%	Top 20%	80 ~ 51%	80 ~ 51%	50 ~ 21%	Bottom 20%	Bottom 10%
Constant	2.414	7.742	18.436	41.461	32.831	12.377	2.720	1.031
	(5.01)	(4.78)	(4.27)	(4.83)	(231.53)	(3.94)	(2.37)	(2.03)
JOA	−0.588	−1.224	−1.644	0.140	0.184	0.787	0.255	0.089
	(−3.29)	(−3.31)	(−3.11)	(0.60)	(1.24)	(3.12)	(1.15)	(0.69)
Expected inflation	0.039	0.071	0.075	−0.073	−0.060	−0.035	−0.008	−0.002
	(3.18)	(2.90)	(2.36)	(−3.75)	(−6.32)	(−2.33)	(−0.67)	(−0.27)
Unexpected inflation	0.036	0.081	0.127	0.004	−0.005	−0.061	−0.038	−0.017
	(3.01)	(3.35)	(3.87)	(0.20)	(−0.50)	(−3.90)	(−3.05)	(−2.35)
Terms of trade	0.341	0.654	0.678	−0.289	−0.251	−0.324	0.126	0.096
	(2.25)	(2.07)	(1.51)	(−1.70)	(−2.25)	(−1.51)	(0.72)	(0.96)
Lagged dependent	0.268	0.338	0.466	−0.266	—	0.470	0.687	0.693
	(1.74)	(2.31)	(3.55)	(−1.02)	—	(3.64)	(6.11)	(5.69)
R^2	0.689	0.702	0.727	0.401	0.688	0.731	0.734	0.688
Standard error	0.162	0.330	0.456	0.207	0.146	0.217	0.172	0.098
Durbin h-statistic	−0.51	−0.48	−0.26	$\rho=-0.043$[a] (−0.17)	2.39	−0.19	0.83	0.57

Notes:

1. Parentheses give t-statistics.
2. In the fifth equation for the 80-51 percent group, the absence of a lagged dependent variable requires the use of the Durbin-Watson rather than the Durbin h-statistic.

[a]In this case, $T(\mathrm{Var}\, f_i) > 1$, where T is the sample size, and $(\mathrm{Var}\, f_i)$ is estimated as the square of the standard error of the coefficient of the lagged dependent variable. Here, then, an equation with E_t as the dependent variable is run using as independent variables the same variables as in the original equation plus the lagged residual E_{t-1} with a coefficent of ρ.

coefficients are found to be as considerably slight as 0.26 and 0.09 for both the bottom quintile and decile groups.[10]

Concerning the results for the variable of the rate of expected inflation, Table 2 presents only the regressed results for the variable to which an adjustment coefficient $\lambda=0.2$ is applied. This is because the coefficients for the variable for which $\lambda=0.8$ mostly appear to be insignificant without changing the sizes and significance at conventional levels of the coefficients for the other independent variables.[11] Furthermore, the estimated results using the inflation variable measured by consumer prices substituted for the GNP deflator are not shown principally because less satisfactory results having insignificant coefficients for the variable arise for most income classes.[12]

The findings on the expected inflation variable measured by the GNP deflator are out of line with the other experimental results, for instance, those derived by Blank and Blinder, Buse, and Nolan, and it evidently appears that the expected inflation is a regressive tax in the sense that the rich classes lose relatively less than

[10]Regressions using the unemployment rate substituted for JOA were also run, with major changes being observed in the results. In all decile groups, the goodness-of-fit declined, and the independent variables turned out to be insignificant for almost all share groups. These alternative results are available from the author upon request.

[11]When looking into several estimations of wage equations using the rate of expected inflation formed with the adaptive scheme for price change expectations, no final and rigorous views are obtained on what value of λ is better. Toyoda (1972) said that the higher value of λ the better, and in contrast to this, Matsukawa (1975) yielded the best result with $\lambda=0.2$.

[12]The importance of the GNP deflator as opposed to consumer prices for wage equations is explained, for instance, by Perry (1975).

the middle and poor. Compared to the sizable JOA coefficients, the coefficients for the inflation variable are very small, especially for the lower income classes. Of the expected inflation coefficients, only those for the lowest 20 and 10 percent groups are insignificant.

The coefficients for the unexpected inflation variable result in being significant for all equations except for the 80–51 percent group. The regression model includes this variable either because wages are considered to be adjusted for the expected changes in living costs or because the expected real wages are the object of the bargaining for the employees for whom the greater part of their income consists of wages.

In the almost simultaneous wage negotiation process under way during the Shunto for leading industries (consisting of the iron and steel, motor car, electrical machinery and shipbuilding industries), wage-setting is formulated on a nation-wide scale taking into account macroeconomic variables such as expected inflation and productivity. This acts as a frame of reference for individual unions in firm-by-firm negotiations in which they determine their own wages and bonus payments. The determined wage increases for individual unions, however, vary depending on the profits attained by the firms. Accordingly, the high wage earners of particular households can be considered to enjoy a large degree of the response of wages to the rate of fluctuations of expected inflation (and/or unexpected inflation) compared to those who receive relatively low wages being employed in small- and medium-sized companies with a much lower unionization rate.

As described in the last section, the terms of trade have been widely fluctuating in Japan, with a recent considerable rise being witnessed from 1986 on. In 1988, they did not recover to the level recorded in the second half of the 1970s. During this history of the economic environment including the oil crises which crippled the Japanese economy twice, many experimental studies have provided widely accepted results indicating that the deterioration in the terms of trade has reflected the depressed effect on wage agreements reached during the Shunto.

In the wage structure of employees, employment tenure plays an important role, and also earnings-tenure profiles show more steeply sloping curves than those, for instance, of the U.S. [Hashimoto and Raisian (1985); Mincer and Higuchi (1988)]. Under these circumstances, when a Japanese worker is compelled to change his job due to involuntary discharge, he will suffer some disadvantage by accepting a reduction in wages or must pay a considerably high turnover cost, essentially constituting an opportunity cost, which necessarily accompanies his job turnover. In addition, for workers with greater tenures in firms, this cost is more likely to be expensive. The specific capital hypothesis also indicates that senior workers with greater amounts of firm-specific skills are more likely to incur greater loss of specific capital caused by turnover. As a result, the decrease in real national income and productivity brought about by appreciable deterioration in the terms of trade may particularly make workers with greater tenure, and thus greater amounts of firm-specific skills, experience the fear of "blackmail," leading to reduced pressure in demanding wage increases for them.

Therefore, the shares of upper income groups receiving higher wages with greater tenure (and, in addition, with relatively steeply sloped earnings profiles) are more likely to move procyclically in step with the fluctuations in the terms of

TABLE 3

INDICATORS OF MACROECONOMIC PERFORMANCE FOR THE FIRST AND SECOND OIL CRISES PERIODS IN JAPAN

	Rate of Increase in Nominal Wages[a]	Rate of Increase in Real Wages[b]	Rate of Increase in Consumer Prices[c]	Rate of Increase in Productivity[d]
1973	21.41%	6.83%	11.7%	6.03%
1974	26.07	3.13	23.2	−0.17
1975	15.64	6.86	11.7	2.61
1978	7.17	2.89	4.2	3.88
1979	5.90	1.47	3.7	4.69
1980	6.23	−1.31	7.7	2.66

Sources: Annual Report on National Accounts (Economic Planning Agency), 1989, and Annual Report on the Consumer Price Index (Statistics Bureau, Management and Coordination Agency), 1988.

[a]Compensation of Employees/Employees.

[b]Nominal Wages/Deflator on Private Final Consumption Expenditure.

[c]Includes Imputed Rents.

[d]Real GNP/Employed Persons.

trade. The results for the variable of the terms of trade shown in Table 2 provide the higher income classes with obviously significant positive coefficients, which are in line with the discussion above.

Compared with the results for the JOA variable, it is of considerable interest that the magnitude of the coefficients are found to be a little more than a half of the former for the richest 1 and 5 percent groups of the income shares exhibiting a positive sign. For the 80–51 and 50-21 percent groups, while the coefficients fail to attain significance at conventional levels, the suggestion is that the terms of trade produce disequalizing rather than equalizing effects for them. The lowest quintile and decile groups seem to be almost unaffected by the fluctuations in the terms of trade.

This pattern was disturbed for 1974–75, however, when the first oil crisis shocked the Japanese economy. In Japan, the wage increase rates jumped to a new plateau with an average rate of around 14 percent in 1968. The rapid growth in nominal wages resulted largely from an excess demand for labor. In fact, the ratio of job offers to applicants (JOA) was close to 1.4 in 1969, climbing to 1.8 in 1973. In 1974, management responded to increased demands by raising standard nominal wages during the Shunto by 32.9 percent, a much higher rate than that of the increase seen in consumer prices. (See Table 3.) This triggered the stagflation which led to a rapid drop in profits of firms and hence to a painful unemployment problem.[13] In these macroeconomic performance movements, the shares of higher income groups made a sharp gain in 1974–75 at the expense of the shares of the lower income groups.

Conversely, by the time the second oil crisis struck the Japanese economy in 1979, Japanese workers had well learned the lesson that aggressive wage demands would actually create serious unemployment problems. Accordingly, they choose a modest wage policy with the expectation that in the presence of the reduction

[13]In fact, the JOA ratio sharply dropped from 1.8 in 1973 to 1.2 and to 0.6 in 1974 and 1975, respectively.

in real national income due to deterioration in the terms of trade, workers particularly with greater firm-specific skills could hope to dampen the degree of employment variability by agreeing on procyclical contracts.[14] In this way, the real wages showed relatively stable or a slight decline in 1979–80, which allowed the Japanese economy to lead itself out of stagflation during the period of the second oil crisis.[15]

The lagged dependent variables are almost all highly significant except for the richest 1 percent and 80–51 percent groups. For the other income share groups, estimated adjustment speeds with significant findings range from 66 to 31 percent per year descending gradually as the income classes move to lower ones.

V. Conclusion

This paper examined the movements in the distribution of the workers' household income series for Japan from 1963 to 1988. Initially, income shares of decile groups in family yearly income were estimated using a new functional form for the estimation of the Lorenz curves which has been proposed by Ortega *et al.* in this *Review*. The estimated shares were next related to macroeconomic variables such as the changes in the ratio of job offers to applicants (JOA), inflation rates—rates of expected and unexpected inflation, and the terms of trade, applying the straightfoward regression approach. The results derived are fairly firm, and a number of substantial macroeconomic effects on the distribution were suggested.

A rise of one point each of the JOA ratio reduces the shares of the top 20 percent groups, taking about 1.6 percentage points from them. The coefficients for other upper middle and lower income groups are not significant except for the 50–21 percent group which shows a significant positive gaining effect.

For the expected inflation variable, significant positive coefficients are found for higher income classes, suggesting, in a sense, that the lower income groups lose relatively much more than the rich. More to the point, the effects of expected inflation on the income distribution of workers' households simply are much less important than those of the JOA. Almost the same facts can be said for the third variable, the unexpected rate of inflation.

The findings on the variable of the terms of trade are interesting in the context of the magnitude of the coefficents. For the upper income groups, there is very definite evidence—in the form of highly significant positive coefficients for this term—exhibiting procyclical reducing effects on the shares of income distribution through a deterioration in the terms of trade. This shows that higher wage earners with greater tenure in a firm, and thus with greater amounts of firm-specific skills, prefer employment stability to great wage variability in the presence of real shocks such as energy crises. Thus, wages in Japan are often said to be relatively flexible, and are therefore capable of accommodating themselves to changes in productivity or external shocks such as the terms of trade deterioration. If wages are not

[14]See Raisian (1983).

[15]At the time of the first oil crisis, the expansionary fiscal and monetary policy implemented (to prevent the appreciation of the yen) should bear the responsibility for the serious damage to the macroeconomic performances for the years subsequent. In the 1979–80 time period, to the contrary, the fiscal and monetary policymakers dealt with the second crisis with a greatly tightened belt.

cyclically sensitive for any tenure level, much greater procyclical employment variability would have occurred for workers with low tenure.

Finally, the lagged dependent variables are almost all highly significant, indicating that the adjustment speeds for the income shares range between the highest 66 percent per year for the top 5 percent group and the lowest 31 percent for the bottom decile group.

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