Are Japanese Nominal Wages Downwardly Rigid? (Part I): Examinations of Nominal Wage Change Distributions

Sachiko Kuroda and Isamu Yamamoto

This paper examines downward nominal wage rigidity in Japan at the individual level using Japanese longitudinal data. By observing the nominal wage change distributions and applying several statistical tests for asymmetry to them, we obtain the following findings. First, using 1993–98 data, the nominal wage change distributions are statistically skewed to the right with large spikes near the zero points, which indicates that downward nominal wage rigidity does exist in Japan. Second, the extent of the downward nominal wage rigidity is sensitive to the choice of nominal wage measures. While the extent of the downward rigidity for the hourly wages of part-time female employees is substantial, those for the regular monthly salaries and annual earnings of full-time male and female employees are limited in the sense that approximately one-fourth of the full-time employee samples experience nominal cuts. Third, for the regular monthly salaries of male employees only, the observed right-skewness of the nominal wage distributions tends to decrease as the inflation rate rises, although the analysis is limited to a period with an extremely low inflation rate.

Keywords: Downward nominal wage rigidity; Inflation rate; Monetary policy; Longitudinal data; Nominal wage change distributions
JEL Classification: C15, C24, E50, J30

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I. Introduction

Following the collapse of the bubble economy at the beginning of the 1990s, Japan has experienced low inflation and mild deflation. The inflation rate, as measured by the consumer price index (CPI), dropped below zero in 2000. Since then, prices have continued to decline at a rate on the order of 1 percent per year. Meanwhile, the Japanese unemployment rate has risen to an unprecedented level.

It was often said in the 1970s and 1980s that the Japanese unemployment rate during recessions is relatively low since Japanese real wages are effectively adjusted via labor-management cooperation. However, many now suggest that such a flexible adjustment was only possible under relatively high inflation, because firms could easily cut real wages by just keeping the nominal wage change rate below the inflation rate. Of course, even under extremely low inflation or deflation, real wages can be adjusted by simply cutting nominal wages. But if firms are unable to cut nominal wages due to downward nominal wage rigidity, they may resort to dismissal to adjust their personnel costs. In this case, the unemployment rate rises as the inflation rate decreases. This kind of argument can often be seen in the statements attributing recent increases in the unemployment rate to the difficulties of implementing nominal wage cuts under low inflation or deflation.[1,2]

To consider the validity of this argument, this paper empirically examines whether or not downward nominal wage rigidity exists in Japan. To the best of our knowledge, the only prior research on downward nominal wage rigidity in Japan is Kimura and Ueda (2001). Using 1978–98 aggregate time-series data and the nominal wages of 18 industries from the *Basic Survey on Wage Structure* (Ministry of Health, Labour and Welfare), they conclude that downward nominal wage rigidity exists in Japan. However, when they extend the data to the first quarter of 2000 by using different aggregate time-series from the *Monthly Labour Survey* (Ministry of Health, Labour and Welfare), they obtain the opposite result that there is no downward nominal wage rigidity.[3]

Analyses using aggregate time-series, however, might not be suitable for examining downward nominal wage rigidity, because the observed nominal wage flexibility at the aggregated level might reflect quantitative adjustments within firms. Such quantitative adjustments include reducing working hours and substituting low-wage for high-wage employees. For instance, even if nominal wage decreases are observed at the aggregated level, this observation is consistent with quantitative adjustments whereby costly full-time employees are replaced by cheaper part-time employees under constant nominal full-time and part-time wages.[4] In other words, nominal

1. The advocates of this argument further insist that the Bank of Japan should target a small but positive rather than zero inflation rate to facilitate real wage adjustments.
2. This argument for fostering inflation under certain circumstances is also found in earlier literature such as Pigou (1933), Keynes (1936), and Tobin (1972).
3. Kimura and Ueda (2001) argue that if there is no downward nominal wage rigidity, nominal wage changes have a linear relation with real GDP and indices of labor market tightness. Based on this assumption, they find a non-linear relation when using data from 1978 to 1998. However, when they extend the data until the first quarter of 2000, they obtain a linear relation. Kimura and Ueda state numerous possible interpretations for their results, but do not reach any definitive conclusions.
4. In Japan, it is often said that the labor market is segmented between full-time employees with relatively high wages and part-time employees with relatively low wages (i.e., that Japan has "dual labor markets"). Many studies suggest

wage decreases at the aggregated level do not necessarily mean that there is no downward nominal wage rigidity at the individual level.

To address such aggregation bias in nominal wage changes, this paper uses Japanese longitudinal data and examines nominal wage changes at the individual level. Since this paper is the first attempt to use Japanese longitudinal data to examine this issue, it is useful to review the prior research that investigates downward nominal wage rigidity using longitudinal data in other economies.

Many of the research papers examine the shape of nominal wage change distributions, and conclude that nominal wages are downwardly rigid since there are a considerably large number of samples with zero nominal wage changes, as well as more samples with positive nominal wage changes than with negative ones.

For example, McLaughlin (1994, 1999, 2000), one of the pioneering empirical analyses, examines the shape of the nominal wage change distribution by using the U.S. *Panel Study of Income Dynamics* (PSID). He shows that there are a large number of samples with zero nominal wage changes and that the shape of the distribution appears to be skewed away from nominal wage cuts. Lebow *et al.* (1995) argue that the nominal wage change distribution is statistically skewed to the right based on their own measure of the skewness of the nominal wage change distribution. Card and Hyslop (1997) nonparametrically calculate the counterfactual distribution of real wage changes in the absence of wage rigidities. They then use the counterfactual distributions to measure the fraction of negative real wage changes "prevented" by nominal wage rigidities. Kahn (1997) estimates the heights of histogram bars through regression to examine whether the height becomes significantly lower in cases where the nominal wage change rate is negative with a given distance from the median.

It is important to note, however, that most of the prior research was implemented in environments with relatively high inflation rates. Under such an environment, nominal wages on average must grow at a relatively high positive rate as well. Thus, it may not be possible to identify downward nominal wage rigidity using data during periods of relatively high inflation since it may not be binding.

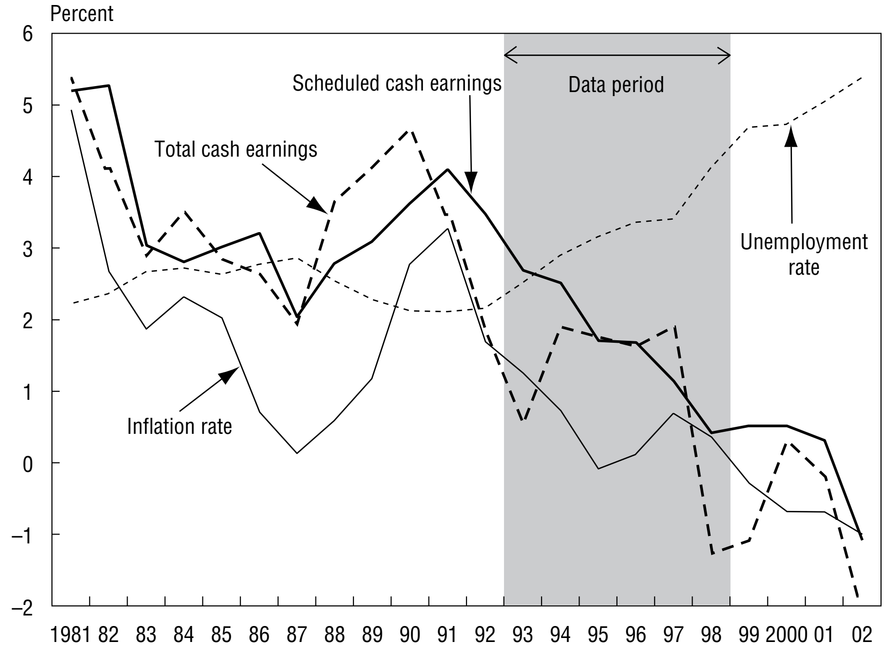
The longitudinal data used in this paper range from 1993 through 1998. As shown in Figure 1, Japan's inflation rate during this period held at a low level of –0.1 to 1.24 percent in the CPI.[5] This recent Japanese experience provides a unique chance to consistently identify downward nominal wage rigidity, if it exists.[6]

The main findings we obtain in this paper are as follows. First, the nominal wage change distributions during 1993–98 have large spikes near the zero points, and are skewed to the right, indicating infrequent nominal wage cuts. The right-skewness is also confirmed through several statistical tests for asymmetry. Thus, judging from the shape of the nominal wage change distributions, downward nominal wage rigidity does exist in Japan. Second, the extent of the downward nominal wage rigidity is

that Japanese institutional systems, particularly the tax and social security system, prevent part-time employees' wages from rising relative to those of full-time employees. Fujiki *et al.* (2001) show that the average hourly wage of part-time employees is about 70 percent of that of full-time employees.

5. The GDP deflator was at –1.34 to 0.787 percent during the same period. These figures are not adjusted for the 2 percentage point rise in the consumption tax from April 1997.
6. One may infer the existence of downward nominal wage rigidity from Figure 1, which shows higher growth rates for nominal wages than for prices.

Figure 1 Inflation Rate, Unemployment Rate, and Nominal Wage Change



Notes: 1. The total cash earnings and scheduled cash earnings are the percentage changes from the previous year. The inflation rate is the percentage change from the previous year in the overall CPI (adjusted for the April 1997 consumption tax increase).
2. The total cash earnings and scheduled cash earnings are per capita for workplaces with at least 30 employees.

Sources: Ministry of Health, Labour and Welfare, *Monthly Labour Survey*; Ministry of Public Management, Home Affairs, Posts and Telecommunications, *Consumer Price Index*, *Labour Force Survey*.

sensitive to the choice of nominal wage measures. The hourly wages of part-time female employees exhibit fairly strong downward rigidity, while the downward nominal wage rigidities for the regular monthly salaries and annual earnings of full-time male and female employees are limited. It is worth noting that nearly one-fourth of the samples of full-time male and female employees experience nominal cuts in their regular monthly salaries and annual earnings. Third, for the regular monthly salaries of male employees only, the observed right-skewness of the nominal wage distributions tends to decrease as the inflation rate rises although the analysis is limited to a period with an extremely low inflation rate. This may provide one piece of evidence to support monetary policy targeting a small but positive inflation rate rather than a zero inflation to "grease the wheels" of the labor market.

The structure of this paper is as follows. Section II describes the longitudinal data used for the analyses herein. After explaining our definition of downward nominal wage rigidity, Section III shows the nominal wage change distribution for the regular monthly salaries of full-time employees. Section IV examines downward nominal wage rigidity for other types of wages, such as annual earnings and hourly wages by employment status and sex. Section IV also considers the differences in individual characteristics and the relationship between nominal wage rigidity and wage differentials. Section V discusses the distinction between downward nominal wage rigidity and downward real wage rigidity, and then examines the correlation between downward nominal wage rigidity and the inflation rate. Finally, Section VI presents the concluding remarks of this paper based on the results obtained in Sections III–V.

II. Data

We use the data from the 1993–98 waves of the *Japanese Panel Survey of Consumers* (JPSC). The JPSC, which has been conducted by the Institute for Research on Household Economics (IRHE) since 1993, is the only Japanese longitudinal data at the individual level, and is available to researchers upon application to the IRHE. The survey population comprises Japanese females residing nationwide who were in the 24–34 age group in 1993. The samples were selected at random using a two-stage sampling process. While males are excluded from the survey population, the survey does include information on the husbands of those females in the sample who are married. Thus, the survey provides nearly equivalent information on males and females. The JPSC covers a wide array of information including employment status, income, expenses, assets, and liabilities.[7]

We use the samples who worked at the same firm for two consecutive years.[8] Those who are self-employed, working in family businesses, switching jobs, or unemployed are excluded. Since the 1993 data on males are not available, the analyses for male employees are limited to the period from 1994–98.

It is important to note the following caveats when using the JPSC data for our analysis. First, these data are surveyed from very limited age groups. Specifically, the female respondents were in the 24–34 age group in 1993 and 29–39 age group in 1998.[9] Second, the male data are limited to the spouses of the female respondents, and are

7. According to the IRHE (1995), the JPSC samples have the following properties. First, they basically reflect the population of Japanese females in the 24–34 age group. Second, the characteristics of the JPSC samples essentially match those compiled in other statistical surveys. Those surveys include the *Population Census* and the *Family Income and Expenditure Survey* (both from the Ministry of Public Management, Home Affairs, Posts and Telecommunications), and the *Employment Status Survey* (Ministry of Health, Labour and Welfare). Third, the major differences from the other survey samples are as follows: (1) the number of females living in single-member households is small; (2) a somewhat large number of couples are living together with their parents; (3) the number of couples with no children is somewhat small; (4) the average educational level is slightly higher; and (5) the average household income is slightly lower.
8. To be specific, the samples are those who responded "yes" to the question "Were you working at the same company where you are presently employed, one year ago?"
9. Females with these characteristics account for about 30 percent of the entire population of Japanese female employees. More specifically, according to the *Labour Force Survey* (Ministry of Public Management, Home Affairs, Posts and Telecommunications), there were 7.2 million female employees between the ages of 25 and 34 on average in 1993, equivalent to 34.8 percent of the total population of 20.7 million female employees. Furthermore, by restricting the samples to those who had been employed at the same company for two consecutive years, the samples used in this paper comprise about 29.8 percent of the total number of female employees (according to the *Survey on Economic Trends* [Ministry of Health, Labour and Welfare], on average 14.4 percent of regular employees left their jobs within less than one year in 1993).

therefore not selected using statistical sampling methods.[10] In addition, the sample does not include single men. Third, the only available data are those from 1993 to 1998. Since the inflation and nominal wage increase rates were extremely low or even negative throughout this period, this is an appropriate period for examining downward nominal wage rigidity. However, it does not allow us to further investigate the existence of downward nominal wage rigidity under the continued deflation period since 1999. Moreover, the empirical evidence obtained from this data set is not directly applicable to evaluate the extent of downward nominal wage rigidity during the 1980s, when the inflation and nominal wage increase rates were both relatively high in Japan.[11]

III. Downward Nominal Wage Rigidity of Regular Monthly Salaries: Skewness of the Nominal Wage Change Distribution

A. Definition of Downward Nominal Wage Rigidity

Here we define downward nominal wage rigidity in relation to the shape of the nominal wage change distribution in longitudinal data.

First, nominal wages are defined as "flexible" whenever the shape of the nominal wage change distribution approaches that of a normal distribution. This is because if nominal wages are completely flexible, some individuals' nominal wages should decline while those of others rise, in accordance with individuals' skills and labor market conditions.

Second, we define nominal wages as "rigid" whenever a spike near the zero point is observed in the nominal wage change distribution, that is, whenever the nominal wages of a very large number of the individuals are virtually unchanged.

Third, we define nominal wages as "downwardly rigid" when they are "rigid" and the nominal wage change distribution has an asymmetric shape whereby the right-hand side of the spike near the zero point is bigger than the left-hand side. This comes from the idea that nominal wage increases must be more frequently observed than decreases when there is downward rigidity in nominal wages.[12] Nevertheless, our definition of downward rigidity in nominal wages does not exclude the possibility that the nominal wages of certain employees may decrease.

When downward nominal wage rigidity is defined in this manner, the degree of the downward nominal wage rigidity can be measured based on the percentage of the samples with negative nominal wage changes. For example, when the spike near the zero point is conspicuously large and almost no samples show negative wage changes, the degree of the downward nominal wage rigidity is judged as substantially large.

10. The ages of the males in our sample vary between 23 and 54. Approximately 10 percent of these males were in their 20s, 65 percent in their 30s, and 23 percent in their 40s, and the sample includes very few males 50 or older. Therefore, it is important to note that the age band in our sample is rather narrow for both sexes.
11. An additional limitation is the difficulty in distinguishing between downward nominal and real wage rigidity, as explained below, because the data do not cover any periods with high inflation.
12. Many prior research papers also interpret nominal wages as downwardly rigid if the observed nominal wage distribution shows these properties.

B. Changes in Regular Monthly Salaries

We calculate the changes in regular monthly salaries as follows. First, we extract the monthly salaries of full-time employees from each wave of the JPSC.[13] Next, since the monthly salary in the JPSC includes overtime pay, we adopt only those samples whose overtime working hours did not change significantly from the previous year. Removing the samples whose overtime working hours changed eliminates the effects of changes in overtime working hours on reported regular monthly salaries.[14,15] As a result of this data selection, 1,292 samples are available for the following analyses on the regular monthly salaries of full-time employees.[16]

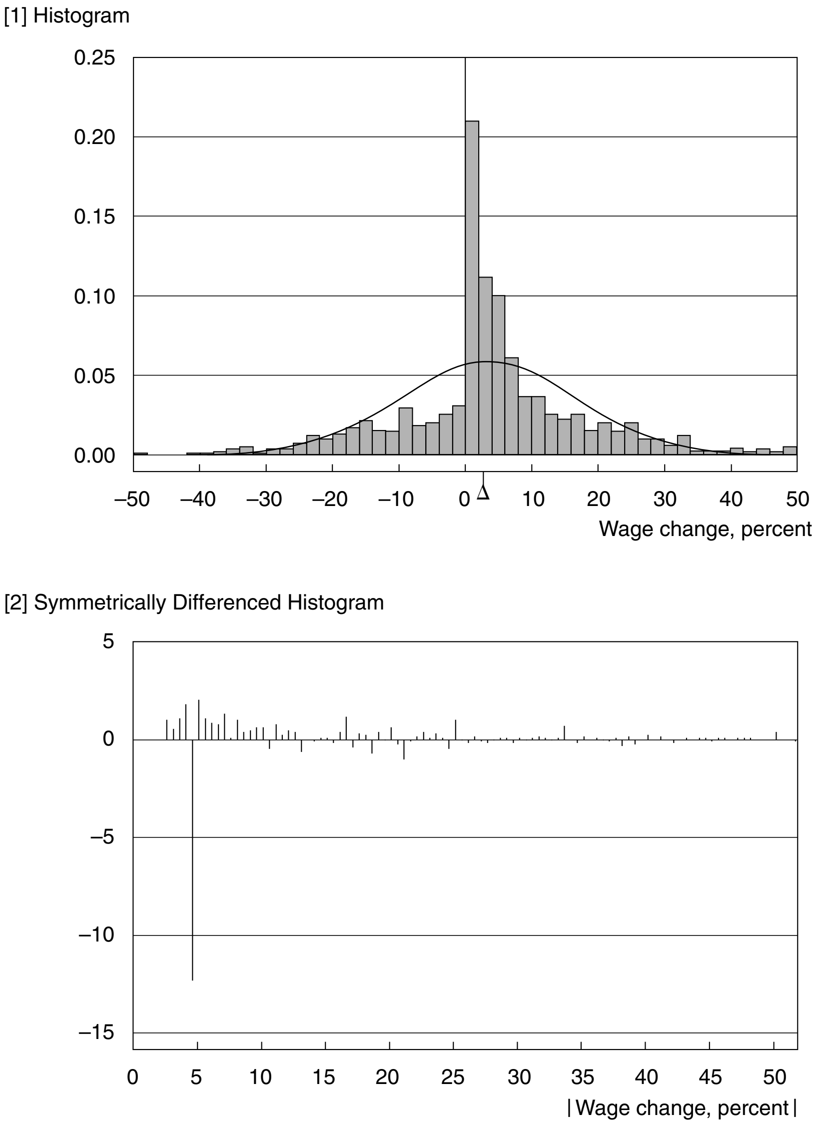
Figure 2 [1] presents the nominal wage change distribution (histogram) of the regular monthly salaries of full-time employees. The bell-shaped line on the histogram shows the normal distribution calculated from the mean and the standard deviation of the data. The small triangle (Δ) located on the horizontal axis slightly above the zero point indicates the median.

Looking at this figure, we see that (1) its shape is clearly different from the normal distribution whose mean and standard deviation are equal to those of the empirical nominal wage change distribution; (2) more than 20 percent of the samples have a nominal wage change rate around zero, forming a high spike around the zero point; and (3) the distribution looks skewed to the right, as the number of samples to the right of the spike is greater than the number to the left. Thus, based on our definitions, we may conclude that the nominal wages measured by the regular monthly salaries of full-time employees are downwardly rigid.

Figure 2 [2] presents the symmetrically differenced histogram. The symmetrically differenced histogram, which is proposed by McLaughlin (1999), is computed by taking equal-sized intervals around the median and subtracting those on the left-hand side from those on the right. If there is no nominal wage rigidity and the median and

13. The monthly salaries are expressed in units of ¥1,000. We assume that the possible effects of rounding errors in reported nominal wages are negligible.
14. We use those samples who gave the same responses in consecutive years to the question asking how many overtime working hours per week were included in their monthly salaries (0, 1–3, 4–5, 6–10, 11–15, 16–20, or 21 or more). To eliminate the influence from assignments to differing tasks during the survey period, we also limit the samples to those who responded that they had not been transferred and that their working duties had remained unchanged from the prior year (we adopt this same restriction for the hourly wages of part-time female employees in Section V). It is important to note that the samples, extracted in this fashion, may include a disproportionately large percentage of employees engaged in routine work. In addition, it is important to consider that many Japanese employees may be engaged in unpaid overtime work, and this may affect the accuracy of the analyses. For example, even when an employee's nominal wage remains unchanged, if the number of unpaid overtime working hours increases, the employee's actually-worked-base hourly wage may be considered to have decreased. Although the JPSC provides multiple-choice information regarding the number of unpaid overtime working hours (0, 1–3, 4–5, 6–10, 11–15, 16–20, or 21 or more), it is impossible to accurately calculate the number of unpaid overtime working hours. We therefore ignore the unpaid overtime.
15. Since detailed data on working hours are not available, we do not convert the monthly salaries and annual earnings to an hourly wage basis. Some of the prior research (e.g., McLaughlin [1999]) intentionally does not convert salaries into hourly wage rates because of the high possibility of measurement errors in reported working hours. Also, in Japan, because of the amendment of the Labour Standards Act, the number of scheduled working hours was rapidly reduced from the late 1980s through the early 1990s. According to the *Basic Survey on Wage Structure* (Ministry of Health, Labour and Welfare), however, the number of regular hours actually worked by full-time workers had stopped declining by 1993. Therefore, we assume that reductions in scheduled working hours have no significant impact on the analyses herein.
16. Approximately 2,200 to 2,500 males and females are available from each wave, but the number of samples adopted here is narrowed down, as described above. To eliminate the influence from obvious measurement errors, samples whose wage change rates have absolute values of over 100 percent are also excluded.

Figure 2 Nominal Wage Change Distribution: Histogram and Symmetrically Differenced Histogram



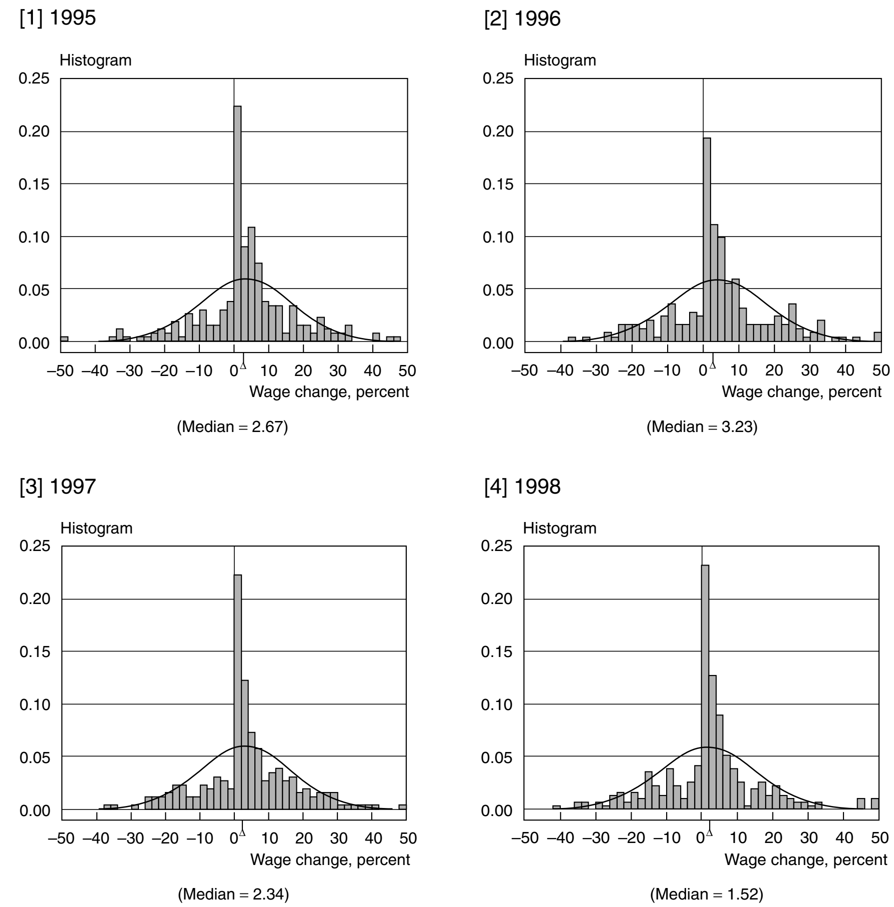
Note: The bell-shaped line on the histogram shows the normal distribution calculated from the mean and standard deviation of the data. The small triangle (Δ) located on the horizontal axis slightly above the zero point indicates the median.

mean values of the nominal wage changes are equal, the values of the symmetrically differenced histogram should be zero at all points. Alternatively, if there is downward nominal wage rigidity, most of the values of the symmetrically differenced histogram should be positive, since they reflect the right-skewness of the distribution.

Looking at the symmetrically differenced histogram in Figure 2, we see that the majority of the values are positive, which means the nominal wage change distribution is skewed to the right.[17] This reconfirms our conclusion that downward nominal wage rigidity does exist for the regular monthly salaries of full-time employees.

The histograms in Figure 3 present the distributions of the changes in regular monthly wages year by year. Each of these histograms seems to be right-skewed with a large spike near zero. Furthermore, comparing the heights of the spikes near the zero point in different years, we find that the spikes increase, although just slightly, as the median values of the nominal wage changes decrease. Of the four years 1995–98, the

Figure 3 Nominal Wage Change Distributions by Survey Year



Note: The bell-shaped line on each of the histograms shows the normal distribution calculated from the mean and standard deviation of the data. The small triangle (Δ) located on the horizontal axis slightly above the zero point indicates the median.

17. The symmetrically differenced histogram in Figure 2 has a large downward spike. This is because the spike near the zero point of the original histogram is located to the left of the median.

median is highest at 3.23 percent in 1996, and in that year the spike near the zero point comprises less than 20 percent of all the samples. As the median declines, the spike grows larger, and in 1998 the spike comprises about 23 percent of all the samples. This tendency whereby the percentage of samples near the zero point increases as the nominal wage change distribution moves toward the left could be another piece of supporting evidence for the existence of downward nominal wage rigidity.

C. Statistics Measuring the Skewness of the Distributions

Next, we compute skewness statistics to examine whether the nominal wage distributions are statistically skewed to the right. Since Lebow *et al.* (1995) point out that the conventional skewness coefficient is sensitive to the inclusion of outliers in the samples, we also use four other statistics which are robust to outliers: the mean-median difference, the sign statistics, the sign rank statistics, and the thinness statistics proposed by Lebow *et al.* (1995).[18]

The definitions and the asymptotic distributions for these statistics are summarized in Table 1. These statistics asymptotically approach zero under the null hypothesis that the nominal wage change distribution is symmetric. If the null hypothesis is rejected by the test using asymptotic distribution, the nominal wage change distribution can be judged as being statistically skewed.

When the nominal wage change distribution is skewed to the right, the skewness coefficient has a positive value. The mean-median difference is calculated by subtracting the median from the mean. It takes a positive value when the distribution is skewed to the right because in such cases the mean lies to the right of the median. The sign statistics indicate the number of samples between the mean and the median. This number increases as the extent of right-skewness in the nominal wage change distribution increases. The sign rank statistics assign a rank, in ascending order, to each sample based on its distance from the median, and subtract the sum of the ranks below the median from the sum of the ranks above it. When the nominal wage change distribution is skewed to the right, many of the high-ranked samples are located above the median. Therefore, the sign rank statistics are positive if the nominal wage change distribution is skewed to the right.

The thinness statistics are presented in Lebow *et al.* (1995), and hereafter referred to as the LSW. The LSW is calculated by subtracting the proportion of samples below zero from the proportion above twice the median. Because twice the median and zero are equidistant from the median, the LSW becomes zero when the nominal wage change distribution is symmetric. The LSW is positive when there are relatively few samples with negative nominal wage changes and the distribution is skewed to the right. The LSW not only measures the right-skewness of the nominal wage change distribution but also detects the asymmetry generated by downward nominal wage rigidity in the distribution, since it calculates the samples less than zero.

Table 2 presents these statistics for the regular monthly salaries of full-time employees, along with the probabilities (the *p*-value) that the null hypotheses are rejected. The statistics are positive, and the null hypotheses are mostly rejected at a

18. These statistics are not greatly influenced by the spikes near the zero point.

Table 1 Definition of Statistics Measuring the Skewness of the Nominal Wage Change Distribution

	Statistics	Asymptotic distribution under H_0
Skewness coefficient	$\dfrac{\frac{1}{n}\sum_{i=1}^{n}(y_i-\bar{y})^3}{\sigma^3}$	$N\left(0, \dfrac{9}{n}+\dfrac{(y_i-\bar{y})^6-6(y_i-\bar{y})^4\sigma^2}{n\sigma^6}\right)$
Mean-median difference	$\bar{y}-y^m$	$N\left(0, \dfrac{\sigma^2}{n}\right)$
Sign statistics	$\sum_{i=1}^{n} I(y_i<\bar{y})-\dfrac{n}{2}$	$N\left(0, \dfrac{n}{4}\right)$
Sign rank statistics	$\sum_{i=1}^{n} S(y_i-y^m)R(\lvert y_i-y^m\rvert)$	$N\left(0, \dfrac{n(n+1)(2n+1)}{6}\right)$
LSW (thinness statistics)	$[1-F(2y^m)]-F(0)$	$N\left(0, \dfrac{1}{n}\left(F(0)[1-F(0)]+F(2y^m)[1-F(2y^m)]+2F(0)[1-F(2y^m)]\right)\right)$

Notes: 1. See McLaughlin (2000) for detailed explanations of all the statistics.
2. y_i expresses the nominal wage change, $\bar{y}$ the mean value of y_i, and y^m the median value of y_i, σ is the standard deviation of y_i, and n is the number of samples. $I(c)$ is the index function of 1 (0) when the condition c holds (doesn't hold). $S(a)$ is a sign function with a value of 1 (–1) when the variable a is non-negative (negative). $R(a)$ is a rank function showing the ascending rank order of variable a. $F(\bullet)$ expresses the normal distribution when the cumulative density function $N(0, \sigma^2)$ has a mean value of zero and a variance of σ^2.
3. The null hypothesis, H_0: $F(y_i)=1-F(2y^m-y_i)$, $\forall i$, indicates that the distribution of y_i is symmetric.
4. For the mean-median difference, the asymptotic distribution is derived by treating the median as known.
5. For the sign rank statistics and the LSW, the asymptotic distributions are derived by invoking the normal approximation to the binominal.

Table 2 Statistics Measuring the Skewness of the Nominal Wage Change Distributions for the Regular Monthly Salaries of Full-Time Employees

	Pooled	By survey year			
	1994–98	1995	1996	1997	1998
Skewness statistics					
Skewness coefficient	1.63 (0.000)	3.01 (0.000)	1.28 (0.000)	0.85 (0.000)	1.46 (0.000)
Mean-median difference	1.77 (0.000)	1.52 (0.073)	2.01 (0.027)	1.58 (0.039)	1.23 (0.088)
Sign statistics	0.10 (0.000)	0.07 (0.008)	0.12 (0.000)	0.09 (0.002)	0.08 (0.001)
Sign rank statistics	0.03 (0.024)	0.03 (0.230)	0.03 (0.235)	0.04 (0.150)	0.02 (0.282)
LSW	0.11 (0.000)	0.10 (0.000)	0.10 (0.000)	0.13 (0.000)	0.11 (0.000)
Fraction of nominal wage change rates (percent)					
Positive	60.84	59.41	62.26	60.23	55.76
Zero	14.63	16.24	13.62	15.15	15.58
Negative	24.54	24.35	24.12	24.62	28.66
Median (percent)	2.78	2.75	3.33	2.45	1.60
Number of samples	1,292	271	257	264	321

Notes: 1. Figures in parentheses are p-values.
2. Data for 1994 are not presented because no male data are available for that year.
3. Sign statistics are divided by n, and sign rank statistics are divided by n^2.

significance level of less than 5 percent.[19] Thus, it can be said that all the nominal wage change distributions are skewed to the right for the entire period and for the individual survey years.

IV. Downward Nominal Wage Rigidity by the Type of Nominal Wages, Employment Status, and Sex

In this section, we examine the downward rigidity of other types of nominal wages, such as the annual earnings of full-time workers, and hourly wages of part-time workers, while separating the samples by sex. The types of nominal wages we examine include (1) the regular monthly salaries of full-time male employees; (2) the annual earnings of full-time male employees; (3) the regular monthly salaries of full-time female employees; (4) the annual earnings of full-time female employees; and (5) the hourly wages of part-time female employees.

As in the previous section, we restrict the samples to individuals employed at the same firm for two consecutive years. The regular monthly salaries are the same samples we used in the previous section, although we break down the samples into male and female employees. We break down the samples by sex because the Japanese labor markets for males and females may have different characteristics, and because the JPSC is conducted solely on females.[20]

In Japan, the ratio of bonus payments to regular monthly salaries is higher than in other countries, and the fluctuations in bonus payments are far larger than those of regular monthly salaries. This suggests that the extent of the downward nominal wage rigidity may differ between regular monthly salaries and annual earnings that include bonus payments.[21]

The annual earnings consist of regular salaries, bonuses, and overtime pay.[22] The majority of the changes in overtime pay reflect quantitative adjustments in the number of overtime working hours. Thus, ideally we should use annual earnings net of overtime pay for examining downward nominal wage rigidity. However, firms that reduce bonus payments during recessions may simultaneously reduce overtime working hours as well. Thus, if we only use the annual earnings samples in which overtime working hours did not change significantly from the previous year, this could cause some bias in the annual earnings changes. Therefore, the analyses in this paper view the changes in annual earnings as the outcome of the overall adjustment of personnel expenses, covering regular salaries and bonus payments as well as overtime pay.

Furthermore, taking into account Japan's "dual labor markets," in which full-time and part-time employees are segmented, we consider the possibility that the extent of

19. Since the hypothesis tests are based on the asymptotic variance, they are subject to small sample bias. The results show that the *p*-value of the sign rank statistics increases when the sample is divided into each survey year, which might be because the sign rank statistics are especially vulnerable to the influence of small samples.
20. Because the survey respondents (females) answer wage-related questions both for themselves and for their husbands, the measurement errors in the reported nominal wages may well vary by sex.
21. For example, Suruga (1987) states that bonuses account for over 20 percent of wage fluctuations in Japan, and that wage adjustment by bonuses is far more prevalent during recessions than during booms.
22. As for the nominal wage units, the regular monthly salaries are expressed in ¥1,000, the annual earnings in ¥10,000, and the hourly wages of part-time employees in ¥1.

the downward nominal wage rigidity may differ between full-time and part-time employees. Since most of the part-time employees in Japan are females and those workers earn income by hourly wage, we limit the hourly wage samples to part-time female employees. Moreover, for the hourly wages of part-time female employees, samples below the minimum wage are excluded.

The number of samples in each nominal wage type are (1) 735 for the regular monthly salaries of full-time males (1994–98 waves), (2) 1,384 for the annual earnings of full-time males (1994–97 waves),[23] (3) 557 for the regular monthly salaries of full-time females (1993–98 waves), (4) 804 for the annual earnings of full-time females (1993–97 waves), and (5) 436 for the hourly wages of part-time females (1993–98 waves).

A. Downward Nominal Wage Rigidity for Regular Monthly Salaries, Annual Earnings, and Hourly Wages

Figure 4 presents the histograms and the symmetrically differenced histograms from the nominal wage change distributions for the five types of nominal wages explained above. As in Section III, each histogram has very large numbers of samples forming spikes near the zero points. The spike for the regular monthly salaries is bigger than that for the annual earnings, and the spike for the hourly wages is even larger. As for the skewness, each histogram looks skewed to the right in the sense that the left-hand sides of the distributions are smaller than the right-hand sides, with a relatively small number of nominal wage cuts.

The symmetrically differenced histograms also exhibit a trend toward positive values, confirming that the distributions are skewed to the right. Similar to the size of the spikes, this tendency is particularly notable for the regular monthly salaries and hourly wages.

Table 3 presents the statistics measuring the skewness of the nominal wage change distributions and the probabilities that the null hypotheses are rejected for each type of nominal wages. The statistics are all positive, and the null hypotheses are rejected at a significance level of less than 5 percent except for the sign rank statistics for the regular monthly salaries of full-time male and female employees and the annual earnings of full-time female employees. These findings demonstrate that the nominal wage change distributions for both males and females and for both full-time and part-time employees are all statistically skewed to the right.

The extent of downward nominal wage rigidity is particularly strong for the hourly wages of part-time female employees. For this group, nearly 60 percent of the samples have zero nominal wage changes, and almost none of the samples experience wage cuts. In contrast, about 25 percent of the males and females in the sample for the regular monthly salaries and annual earnings experience wage cuts. Thus, it is worth noting that while downward nominal wage rigidity exists for monthly salaries

23. Since the survey questions ask employees about their earnings in the past year, there is a one-year time lag for these data. For example, the responses to the 1998 survey indicate the earnings received during 1997. As a result, the annual earnings data are effectively one year shorter compared with the regular monthly salaries and part-time hourly wage data. The sample for the annual earnings of full-time male and female employees includes employees temporarily transferred to other companies (*shukko*), and those who experienced job rotation within the same firm (*haiten*). The numbers of such cases are 6 males and 2 females for *shukko*, and 263 males and 108 females for *haiten*.

and annual earnings, its extent is not strong enough to rule out negative nominal wage changes in some samples.

Figure 4 Nominal Wage Change Distributions by Nominal Wage Type

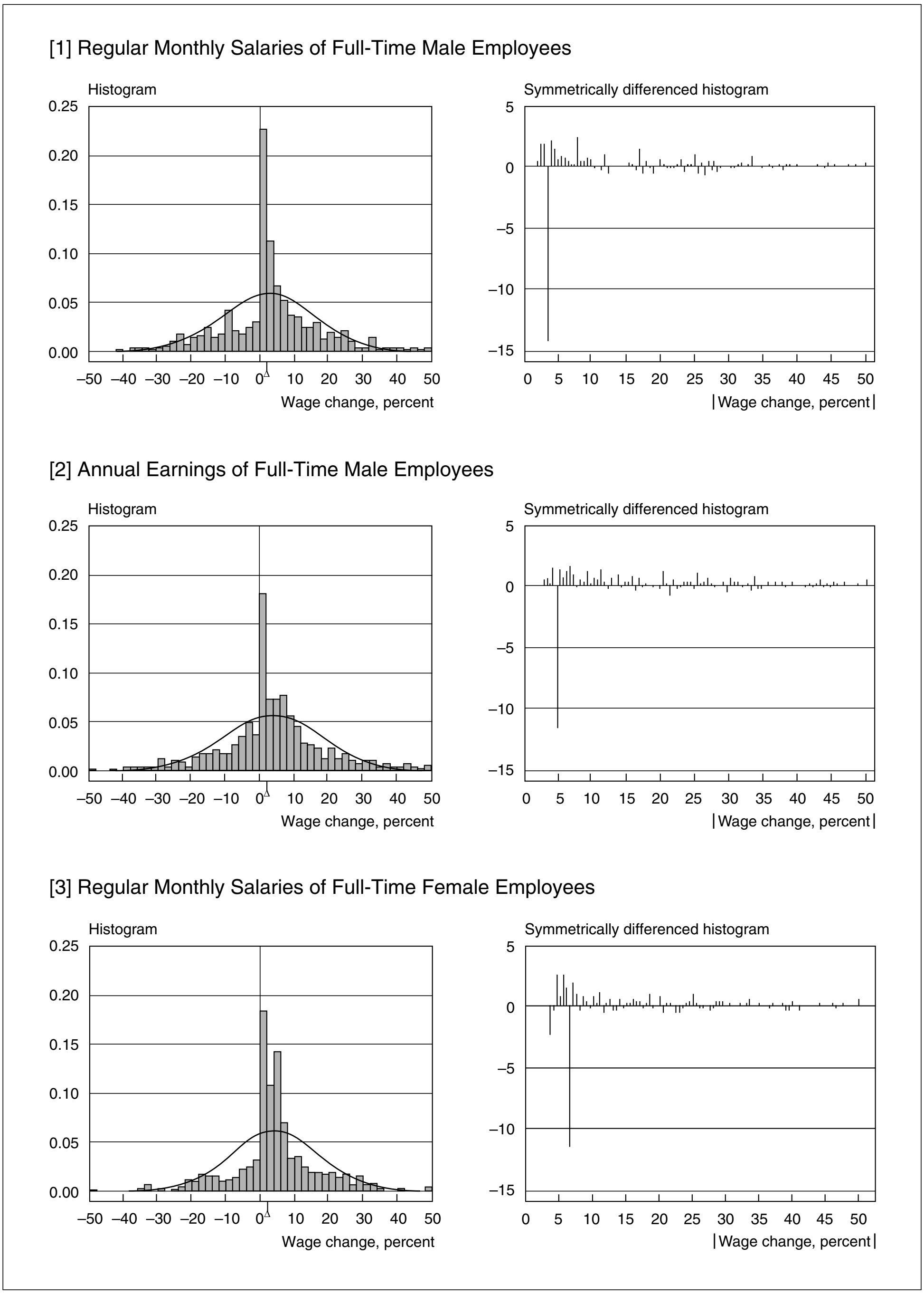
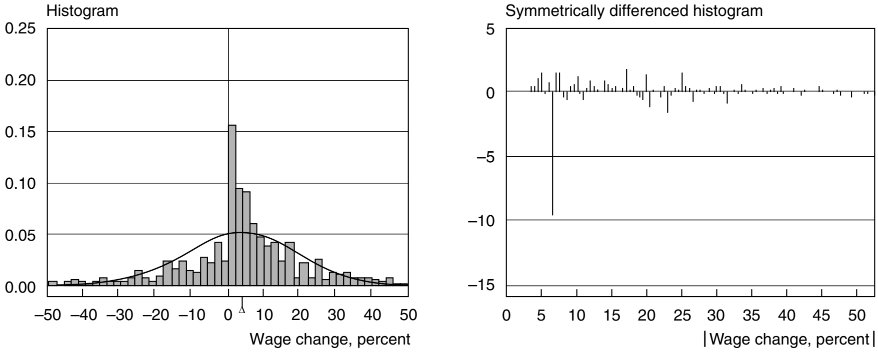
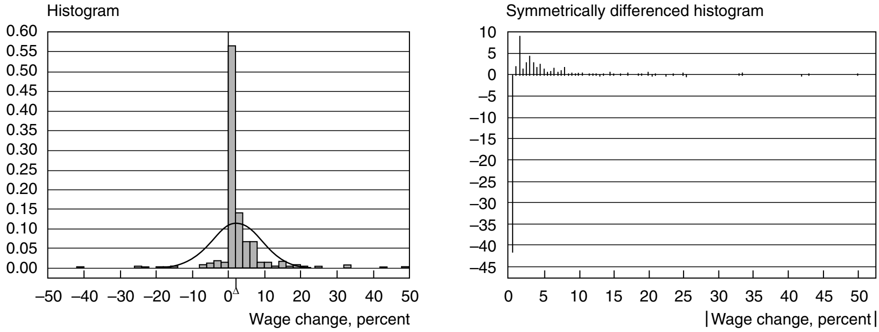


Figure 4 (continued)

[4] Annual Earnings of Full-Time Female Employees



[5] Hourly Wages of Part-Time Female Employees



Note: The bell-shaped line on each of the histograms shows the normal distribution calculated from the mean and standard deviation of the data. The small triangle (Δ) located on the horizontal axis slightly above the zero point indicates the median.

Table 3 Statistics Measuring the Skewness of the Nominal Wage Change Distributions for Each Nominal Wage Type

	Male employees		Female employees		
	Full-time		Full-time		Part-time
	Regular monthly salaries	Annual earnings	Regular monthly salaries	Annual earnings	Hourly wages
Skewness statistics					
Skewness coefficient	1.83 (0.000)	1.32 (0.000)	1.33 (0.000)	1.33 (0.000)	1.28 (0.000)
Mean-median difference	1.91 (0.001)	1.68 (0.000)	1.38 (0.018)	1.30 (0.029)	1.70 (0.000)
Sign statistics	0.10 (0.000)	0.06 (0.000)	0.10 (0.000)	0.07 (0.000)	0.14 (0.000)
Sign rank statistics	0.03 (0.057)	0.03 (0.015)	0.01 (0.372)	0.02 (0.183)	0.18 (0.000)
LSW	0.12 (0.000)	0.11 (0.000)	0.07 (0.000)	0.07 (0.000)	0.40 (0.000)
Fraction of nominal wage change rates (percent)					
Positive	57.14	58.96	65.71	62.94	50.46
Zero	16.19	12.07	12.57	9.95	41.97
Negative	26.67	28.97	21.72	27.11	7.57
Median (percent)	2.15	2.90	3.83	3.70	0.57
Number of samples	735	1,384	557	804	436

Notes: 1. Figures in parentheses are p-values.
2. Sign statistics are divided by n, and sign rank statistics are divided by n^2.

B. Skewness of the Nominal Wage Change Distributions after Controlling Individual Characteristics

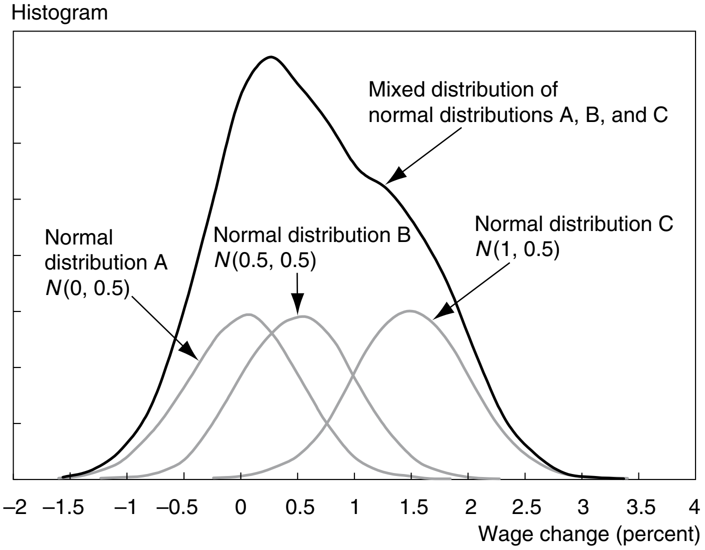
So far, we have not considered the possibility that the observed right-skewness in the nominal wage change distributions could be a statistical artifact from mixing several symmetric distributions with different mean values.[24] For example, when three normal distributions with different mean values are mixed in one distribution as shown in Figure 5, the mixed distribution is skewed to the right even though the three original distributions are all symmetric. Accordingly, we should examine the nominal wage changes net of the mean value in each group.

To consider this mixing issue, we regress the nominal wage changes on the individual characteristics, and compute residuals from the regression. By examining the distribution of the residuals, which are expected to have no significant difference in individual characteristics, we can confirm the robustness of the right-skewness in the nominal wage change distributions after controlling individual characteristics.

As regressors, we employ the following variables from the JPSC: a constant, age, tenure, labor market experience, years of education, 13 big cities dummy (a value of one for those who live in Japan's 13 biggest cities and a value of zero for those

24. This is also noted by McLaughlin (1999, 2000).

Figure 5 Skewness Resulting from Mixing Normal Distributions with Different Mean Values



who live elsewhere), firm size dummies (indicating the number of employees at the company where the individual is employed as less than 30, 30–99, 100–999, or 1,000 or more), industry dummies (indicating the industry at the firm where the individual is employed as construction, manufacturing, wholesaling or retailing, finance, insurance, real estate, transportation or telecommunications, or services), occupational dummies (manager, expert, engineer or faculty member, clerical worker, sales or service worker, technician or laborer), and year dummies.[25]

Table 4 presents the statistics measuring the skewness of the distributions calculated from the regression residuals for the five types of nominal wages.[26] Aside from the sign rank statistics for the regular monthly salaries and annual earnings of full-time male and female employees, the statistics are all significantly positive. Therefore, using the definition adopted in this paper, we conclude that downward nominal wage rigidity exists, even after controlling the individual characteristics.

25. The age variable is included in the regressors to consider the annual wage accrual (*teisho*), which is a distinctive characteristic of Japan's employment practices.

26. Note that since the mean values of the residuals is zero by definition, the median becomes negative when a distribution is right-skewed. In this case, the LSW is not an appropriate measure because the LSW is always negative. One possible way to use the LSW in this case is to view the mode as the spike near the zero point, and consider the proportion below the mode. However, it is difficult to apply this method because the mode in the residuals is not distinct. Therefore, we simply show the four statistics aside from the LSW in Table 4.

Table 4 Statistics Measuring the Skewness of the Nominal Wage Change Distributions from the Regression Residuals

	Male employees		Female employees		
	Full-time		Full-time		Part-time
	Regular monthly salaries	Annual earnings	Regular monthly salaries	Annual earnings	Hourly wages
Skewness statistics					
Skewness coefficient	1.77	1.29	1.33	1.36	1.19
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Mean-median difference	1.46	1.48	1.35	1.24	1.06
	(0.008)	(0.001)	(0.018)	(0.033)	(0.001)
Sign statistics	0.09	0.07	0.08	0.05	0.16
	(0.000)	(0.000)	(0.000)	(0.004)	(0.000)
Sign rank statistics	0.02	0.02	0.02	0.02	0.07
	(0.204)	(0.067)	(0.168)	(0.153)	(0.008)
Fraction of nominal wage change rates (percent)					
Positive	41.36	43.14	42.01	45.27	34.17
Negative	58.64	56.86	57.99	54.73	65.83
Number of samples	735	1,384	557	804	436

Notes : 1. Figures in parentheses are p-values.
2. Sign statistics is divided by n, and sign rank statistics are divided by n^2.
3. The statistics are applied to the residuals from regressions of nominal wage changes on individual characteristics.

C. Relation between Nominal Wage Changes and Wage Levels

Lastly, we briefly examine the relationship between nominal wage changes and wage levels. Suppose that the downward nominal wage rigidity forces firms to leave the wage level unchanged even when it should be cut. If the zero spike samples are mainly from low wage-level samples, this would indicate that the downward nominal wage rigidity tends to narrow the wage *level* differentials.[27]

To examine whether or not such a mechanism is at work, we divide the data sets into six quantiles based on the wage levels (the group below the 1st quantile receives the lowest wages, and that in the 6th quantile receives the highest).[28] We then present the relationships between wage changes and wage levels for each stratum in Table 5.

According to the table, the percentages of samples with nominal wage changes of zero are basically the same among all wage strata (across all quantiles) for all five types of nominal wages. In other words, the observed spikes near the zero points of the nominal wage change distributions include samples from all wage strata. This result confirms that downward nominal wage rigidity is by no means more distinct for lower wage levels.

27. If nominal wages for the employees at a given firm are downwardly rigid, and if that firm finds it impossible to retain the wage levels, then the company might fire its costly full-time employees to replace them with cheaper part-time workers. If this is the case, the wage differential could increase at the macro level. Therefore, it is important to note that the influences on wage differentials considered in this paper are strictly limited to those among employees who continue working at the same firms.
28. The wage levels are converted to a real basis using the overall CPI (adjusted for the effects of the April 1997 consumption tax increase).

On the other hand, Table 5 shows that a large percentage of the samples in the low-wage stratum experience wage cuts for each type of nominal wages. There is also a slight tendency for a large percentage of the samples in the high-wage stratum to experience wage increases. Judging solely from the samples used in this paper, these results indicate that wage differentials are expanding, rather than shrinking. Therefore, the conclusions reached in Table 5 provide no evidence that downward nominal wage rigidity contributes to narrowing wage differentials.

Table 5 Downward Nominal Wage Rigidity and Wage Differentials

[1] Full-Time Male Employees

	Number of samples	Average wage change rate (percent) (standard error)	Wage change distribution		
			Negative	Zero	Positive
Regular monthly salaries					
(Current level)					
1st quantile	130	–3.74 (15.27)	8.57	3.40	5.71
2nd quantile	119	–0.37 (14.07)	5.31	3.27	7.62
3rd quantile	119	1.06 (13.71)	4.76	2.86	8.57
4th quantile	123	6.15 (15.42)	3.40	2.04	11.29
5th quantile	122	7.75 (13.42)	2.04	2.59	11.97
6th quantile	122	6.40 (14.57)	2.59	2.04	11.97
Annual earnings					
(Current level)					
1st quantile	233	–5.57 (20.79)	9.25	1.73	5.85
2nd quantile	229	2.51 (15.29)	4.77	2.60	9.18
3rd quantile	236	3.59 (13.94)	4.99	2.02	10.04
4th quantile	226	4.40 (13.39)	4.62	2.31	9.39
5th quantile	231	6.34 (12.64)	2.89	2.10	11.71
6th quantile	229	8.22 (13.80)	2.46	1.30	12.79

Note: All the samples are rearranged into ascending order by wage level and divided into six groups, so that the samples in the 1st quantile receive the lowest wages and those in the 6th quantile receive the highest. When there are multiple samples at the dividing point between two quantiles, all of these samples are categorized in the lower quantiles, and thus the quantiles do not have the same number of samples. The wage level is converted to a real basis using the annual CPI (adjusted for the April 1997 consumption tax increase).

(Continued on next page)

Table 5 (continued)

[2] Full-Time Female Employees

	Number of samples	Average wage change rate (percent) (standard error)	Wage change distribution		
			Negative	Zero	Positive
Regular monthly salaries					
(Current level)					
1st quantile	93	–4.25 (15.61)	7.36	2.87	6.46
2nd quantile	93	3.56 (11.03)	4.31	2.33	10.05
3rd quantile	93	4.94 (14.50)	2.87	2.69	11.13
4th quantile	93	3.79 (10.57)	2.87	1.62	12.21
5th quantile	93	8.81 (12.75)	1.80	0.72	14.18
6th quantile	92	7.50 (16.73)	2.51	2.33	11.67
Annual earnings					
(Current level)					
1st quantile	134	–8.16 (26.70)	7.84	2.11	6.72
2nd quantile	137	2.10 (19.69)	5.35	2.36	9.33
3rd quantile	132	3.34 (13.65)	4.73	2.24	9.45
4th quantile	133	6.05 (15.47)	3.48	0.87	12.19
5th quantile	137	7.80 (13.48)	3.36	1.00	12.69
6th quantile	131	8.15 (13.67)	2.36	1.37	12.56

Table 5 (continued)

[3] Part-Time Female Employees

	Number of samples	Average wage change rate (percent) (standard error)	Wage change distribution		
			Negative	Zero	Positive
Hourly wage					
(Current level)					
1st quantile	76	0.82 (4.02)	1.83	8.03	7.57
2nd quantile	79	1.03 (7.49)	1.15	9.40	7.57
3rd quantile	66	2.22 (3.55)	0.92	5.28	8.94
4th quantile	70	1.46 (6.17)	0.92	7.57	7.57
5th quantile	74	2.60 (6.96)	1.38	6.19	9.40
6th quantile	71	4.16 (9.67)	1.38	5.50	9.40

Note: All the samples are rearranged into ascending order by wage level and divided into six groups, so that the samples in the 1st quantile receive the lowest wages and those in the 6th quantile receive the highest. When there are multiple samples at the dividing point between two quantiles, all of these samples are categorized in the lower quantiles, and thus the quantiles do not have the same number of samples. The wage level is converted to a real basis using the annual CPI (adjusted for the April 1997 consumption tax increase).

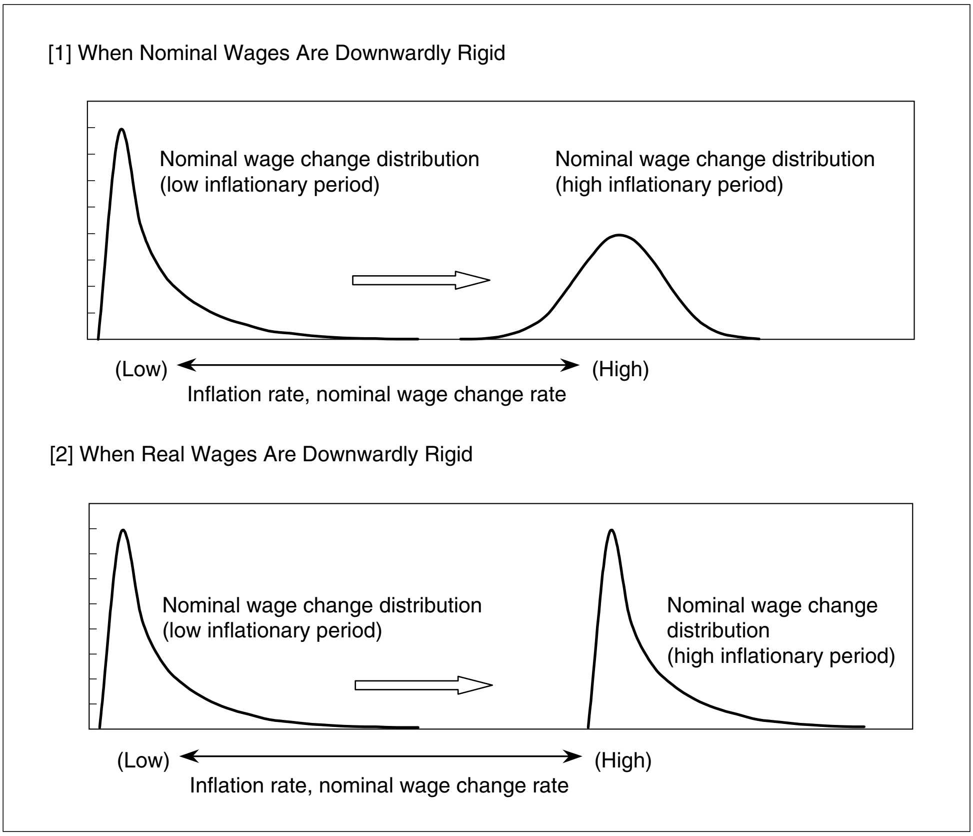
V. Relation between the Skewness of the Nominal Wage Change Distribution and the Inflation Rate

A. Downward Nominal Wage Rigidity and Downward Real Wage Rigidity

Does our evidence of downward nominal wage rigidity provide grounds for a monetary policy targeting a small but positive rather than a zero inflation rate to "grease the wheels" of the Japanese labor market? In our view, it is premature to say yes at this stage, since we need to distinguish downward nominal wage rigidity from downward real wage rigidity.

Let us first consider the case where the downward wage rigidity exists only on a nominal basis. The relationship between the nominal wage change distribution and the inflation rate can be illustrated as shown in Figure 6 [1]. As shown on the left-hand side of this diagram, when the inflation rate is low, the distribution is skewed to the right since the nominal wage changes hit the zero floor. In this case, from a firm's perspective, the wage costs (real wages) are fixed at higher levels than what they would be if the distribution were not skewed. As shown on the right-hand side of this diagram, however, when the inflation rate is high, the distribution is not skewed to the right since the left tail of the distribution is above zero. In this case, a firm finds it easier to implement real wage cuts by setting nominal wage increase rates

Figure 6 Relationship between Downward Nominal Wage Rigidity and the Inflation Rate



lower than the inflation rate. Thus, if downward wage rigidity exists on a nominal basis only, or if the right-skewness of the distribution is a unique phenomenon under low inflation, a monetary policy targeting a small but positive inflation rate could prevent the nominal wage change distribution from being skewed to the right, and thus help firms to implement real wage adjustments. This kind of argument is seen in Akerlof *et al.* (1996).[29]

On the other hand, it is also possible to view the downward wage rigidity as associated with the rational choices of real wages made by firms, as assumed by efficiency wage theories. When downward wage rigidity exists on a real basis, as shown in Figure 6 [2], the downward nominal wage distribution will always be skewed to the right, regardless of whether the inflation rate is high or low. In this case, a monetary policy targeting a small but positive rather than a zero inflation rate cannot provide any additional latitude for firms to implement real wage adjustments. That is to say, when there is downward real wage rigidity, the observed downward

29. They state that the skewness of the nominal wage change distribution simply reflects the fact that people do not like to accept negative wage changes in nominal terms, and that therefore monetary policy should aim at positive inflation to avoid nominal wage cuts. This idea often appears in discussions of money illusion.

nominal wage rigidity does not provide a basis for targeting a small but positive inflation rate. This kind of argument is seen in McLaughlin (1994, 1999, 2000).

The implications for monetary policy are completely different when the downward wage rigidity is only nominal, and when it is both nominal and real. The findings obtained in this paper thus far correspond to the left-hand sides of Figure 6 [1] and [2]. To determine the implications for monetary policy, we need to know what happens to the nominal wage change distributions when the inflation rate rises as indicated by the right-hand sides of these diagrams. Will the right-skewness of the nominal wage change distributions disappear when inflation rises as shown in the upper diagram, or remain as shown in the lower one?

To answer this question, we need to analyze data from a period of high inflation. In the previous literature, Card and Hyslop (1997), for example, conclude that the nominal wage change distribution becomes increasingly skewed to the right as the inflation rate declines, and that there is no skewness during periods of high inflation, as illustrated in Figure 6 [1]. In contrast, McLaughlin (1994, 1999, 2000) shows that there is no statistically significant correlation between right-skewness and the inflation rate. Then, he concludes that the skewness of the nominal wage change distribution exists regardless of the inflation rate level, as illustrated in Figure 6 [2].[30] He argues that this happens because firms make rational decisions not to reduce real wages, as posited by efficiency wage theories, or that the real wage change distribution itself may be right-skewed due to skill-biased technological progress.[31]

Unfortunately, it is difficult to determine whether the right-skewness in the nominal wage change distributions identified in this paper indicates downward rigidity only in nominal wages. This is because the data used in this paper are limited to a period with an extremely low inflation rate.[32] In fact, when we compute real wage change distributions by converting the nominal wages into a real basis,[33] it turns out that the shapes of the real wage change distributions are nearly identical to those of the nominal wage change distributions. Therefore, the observed right-skewness in the nominal wage change distributions might reflect downward real wage rigidity.

Nonetheless, it is still possible to provide one piece of evidence regarding the relationship between downward nominal wage rigidity and monetary policy by focusing on the differences in inflation rates not only by time period, but also by region. Therefore, we now investigate the correlation between the statistics measuring nominal wage change distribution and regional inflation rates.

30. Lebow *et al.* (1995) reach a conclusion similar to McLaughlin's. Using Canadian data, Crawford and Wright (2001) also show that the skewness of the nominal wage change distribution cannot be associated with the inflation rate because the variance of the nominal wage changes may differ depending on the inflation rate.
31. Fares and Hogan (2000) make a similar argument. McLaughlin (1999) also points out the possibility of sample selection bias whereby negative nominal wage changes may be difficult to observe.
32. To the best of our knowledge, there are no longitudinal data readily available to researchers covering a period of high inflation in Japan.
33. Real wages are computed by using the overall CPI for each year (adjusted for the April 1997 consumption tax increase).

B. Correlation between the Skewness of the Nominal Wage Change Distribution and the Inflation Rate

The upper half of Table 6 presents the correlation coefficients for statistics measuring the skewness of the nominal wage change distributions and the annual inflation rate calculated by survey year and region[34] (adjusted for the April 1997 consumption tax increase). The inflation rate during this period varies from –0.60 to 1.53 percent.[35]

Table 6 Correlations between the Skewness Statistics and the Inflation Rate

	Full-time male employees		Full-time female employees	
	Regular monthly salaries	Annual earnings	Regular monthly salaries	Annual earnings
Correlation with inflation rate				
Skewness coefficient	–0.048	0.185	–0.274	0.083
	(0.784)	(0.356)	(0.096)	(0.630)
Mean-median difference	0.225	0.060	–0.175	0.167
	(0.194)	(0.768)	(0.294)	(0.332)
Sign statistics	–0.123	–0.037	–0.304	0.099
	(0.483)	(0.853)	(0.064)	(0.567)
Sign rank statistics	0.025	0.128	–0.147	0.131
	(0.889)	(0.523)	(0.378)	(0.445)
LSW	–0.023	0.053	–0.193	0.191
	(0.898)	(0.794)	(0.246)	(0.263)
Correlation with lagged inflation rate				
Skewness coefficient	–0.303	–0.046	0.217	0.132
	(0.077)	(0.818)	(0.190)	(0.444)
Mean-median difference	–0.523	–0.137	0.008	–0.175
	(0.001)	(0.496)	(0.962)	(0.309)
Sign statistics	–0.443	–0.110	–0.038	–0.159
	(0.008)	(0.586)	(0.821)	(0.354)
Sign rank statistics	–0.379	–0.202	–0.065	–0.052
	(0.025)	(0.312)	(0.698)	(0.765)
LSW	–0.062	–0.139	–0.115	–0.108
	(0.722)	(0.489)	(0.491)	(0.531)
Number of samples	35	27	38	45

Notes: 1. Figures in parentheses are *p*-values.
2. The inflation rates are the year-to-year changes in the overall CPI by regional bloc, adjusted for the April 1997 consumption tax increase.
3. Some regions are excluded from our analysis because of the shortage of samples.

34. This is based on the JPSC respondents' residential information by prefecture. However, since the number of samples for some prefectures is extremely small, we use regional blocs. These regional blocs follow the categorization used in the CPI, which divides Japan into 10 regions: Hokkaido, Tohoku, Kanto, Hokuriku, Tokai, Kinki, Chugoku, Shikoku, Kyushu, and Okinawa. Okinawa is excluded from our analysis because we have few samples in this bloc. Therefore, we compute the correlation coefficients for the remaining nine regions over a period of five years. It should be noted that this analysis is based on the residence locations of the respondents, which may not exactly match the data on the locations of their workplaces.
35. These figures are the lowest and highest inflation rates recorded in the regional blocs in our data. As explained in Section II, there are no male data for 1993. We also lack 1998 data for the annual earnings of both male and female full-time employees. Thus, the lowest and highest inflation rates slightly vary by the nominal wages analyzed herein.

The statistics are those explained in Section IV for the following nominal wages: (1) the regular monthly salaries of full-time male employees; (2) the annual earnings of full-time male employees; (3) the regular monthly salaries of full-time female employees; and (4) the annual earnings of full-time female employees.[36]

If the nominal wage change distributions are only skewed to the right during periods of low inflation, then the correlation coefficient should have a statistically significant negative value. If the right-skewness of the distributions remains regardless of the inflation rate, then the correlation coefficient should not be significantly different from zero.

Looking at the upper half of Table 6, we find no statistically significant correlation in any cases. While the negative correlations for the regular monthly salaries of full-time female employees are somewhat high, they are not statistically significant. For the other cases, the correlations are mostly positive.

Yet it is important to note that under Japan's annual spring wage offensive (*shunto*), collective bargaining on the nominal wage increase is frequently based on the prior year's inflation rate. Considering this, the lower half of Table 6 presents the correlation coefficients computed using one-year lagged inflation rates. The results are substantially different. For example, the correlation coefficients for the regular monthly salaries of full-time male employees are around –0.4, and these negative figures are statistically significant for three out of the five statistics.

To visually confirm this point, Figure 7 plots the skewness coefficients and mean-median differences for the regular monthly salaries of full-time male employees against the lagged inflation rate. Looking at this scatter diagram, while there are some negative figures for the skewness coefficients and mean-median differences, it does appear that there are negative correlations between the skewness statistics and the lagged inflation rates. Regardless, no clear correlation is found for the annual earnings of full-time male employees, or for the monthly salaries or annual earnings of female employees.

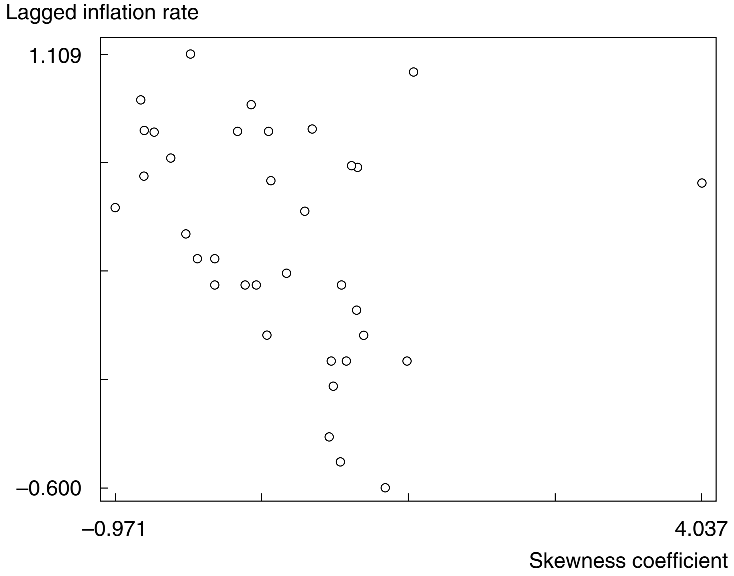
To summarize, while the analyses in this section indicate no strong correlation between the right-skewness of the nominal wage change distributions and the inflation rate, they do show a negative correlation for the regular monthly salaries of full-time male employees. This may suggest that the downward wage rigidity in the regular monthly salaries of full-time male employees only exists on a nominal basis.

Nevertheless, we must remember that although there were some variations in the inflation rates in the different regional blocs, they only range between –0.60 and 1.53 percent. Therefore, it is important to note that the tentative conclusions derived here cannot be used to determine, *a priori*, how the right-skewness of the nominal wage change distribution might change under a high inflation rate.

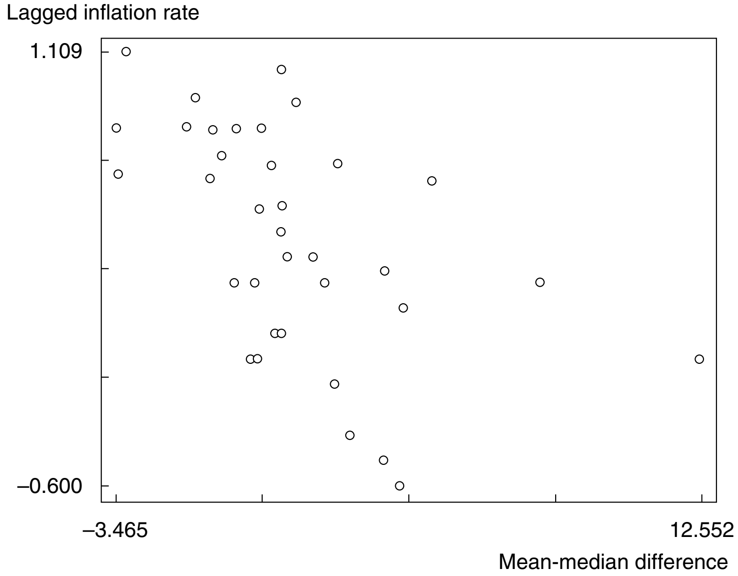
36. The hourly wages of part-time female employees are excluded from the analyses in Table 6 because few observations are available.

Figure 7 Correlations between the Skewness Statistics and the Lagged Inflation Rate

[1] Skewness Coefficient and Lagged Inflation Rate



[2] Mean-Median Difference and Lagged Inflation Rate



Note: The inflation rates are the year-to-year changes in the lagged overall CPI by regional bloc, adjusted for the April 1997 consumption tax increase.

VI. Concluding Remarks

In this paper, as the first attempt to verify downward nominal wage rigidity in Japan based on longitudinal data, we examine the shape of the nominal wage change distribution from various perspectives using the 1993–98 data provided by the JPSC.

Observing the nominal wage change distributions by several types of nominal wages, we obtain the following findings. First, the right-skewness is particularly pronounced for the hourly wages of part-time female employees. There are a large number of samples located in the spike near the zero point, and few samples show negative wage changes. If there were absolutely no nominal wage rigidity, then the distributions should be symmetric on both sides of the medians. Thus, the observed right-skewness can be interpreted as suggesting the existence of strong downward rigidity for the hourly wages of part-time female employees. Second, for the nominal wage change distributions of the regular monthly salaries and annual earnings of full-time male and female employees, we also find a substantial number of samples in the spikes near the zero points, suggesting downward nominal wage rigidity. Nevertheless, we also find a sizable number of these samples experiencing wage cuts.

The formal tests based on statistical methods confirm the right-skewness of the nominal wage distributions. The statistics measuring the right-skewness include the skewness coefficient, the mean-median difference, the sign statistics, the sign rank statistics, and the LSW. Our findings indicate that all of the nominal wage change distributions are statistically skewed to the right. Based on these findings, we conclude that Japanese nominal wages are downwardly rigid, as judged by the shape of the observed nominal wage change distributions.

As for monetary policy implications from these findings, it is necessary to confirm that the nominal wage change distribution is right-skewed during low inflationary periods and not right-skewed during high inflationary periods. If that is the case, then monetary policy targeting a small but positive rather than zero inflation rate can be justified to "grease the wheels" of the labor market by assisting the downward flexibility of real wages. The correlations between the right-skewness and the regional inflation rates are examined to see if the right-skewness disappears under high inflation. Although the highest regional inflation rate in the data is merely about 1 percent, we find that, for the regular monthly salaries of full-time male employees only, the right-skewness of the nominal wage change distribution does tend to disappear as the inflation rate rises. It should be noted, however, that further investigations of this issue using data from higher inflation rate periods are necessary before we can obtain a general conclusion that monetary policy should target a small but positive inflation rate because of the existence of downward nominal wage rigidity.[37]

37. In discussing the optimal inflation rate that monetary policy should target, broader issues aside from downward nominal wage rigidity must also be addressed. For example, the social costs of deflation include the influence on the financial system from debt deflation, and the reduced effectiveness of monetary policy under the zero bound constraints on nominal interest rates. Conversely, the social costs of high inflation include the existence of so-called "shoe leather costs," the diminished signaling function of prices, and misallocation of resources resulting from difficulties in distinguishing between relative and overall price level movements, as well as problems related to the non-neutrality of tax systems with regard to inflation. For details, see Shiratsuka (2001).

In closing, we would like to make a few comments regarding the potential future research on downward nominal wage rigidity. One natural extension is to identify the extent of the downward nominal wage rigidity via model estimations. This enables us to control individual characteristics and measurement errors in reported nominal wages, and to provide a precise and comparable estimate of the extent of downward nominal wage rigidity. Kuroda and Yamamoto (2003a) follow this approach by using the same data adopted in this paper.

Another direction for future research is to quantify the effects of downward nominal wage rigidity on other macroeconomic variables, especially those that are closely followed by policymakers. For instance, if the influence on unemployment is deemed negligible, then this by no means provides a sufficient basis to justify a monetary policy targeting a small but positive inflation rate. Investigating this issue could require research based on both partial equilibrium models and on a general equilibrium model, since downward nominal wage rigidity may not only increase unemployment but also affect such factors as consumption and income.[38]

38. Kuroda and Yamamoto (2003b) examine whether downward nominal wage rigidity affects employees' quit decisions by survival analysis. In addition, Kuroda and Yamamoto (2003c) simulate a New-Keynesian macro model that incorporates the downward rigidity, and see how the downward rigidity affects the male unemployment rate in Japan.

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