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Heterogeneity and Wage Growth of Full-time Workers in Japan: An Empirical Analysis Using Micro Data*

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Abstract

In this paper we examine the driving forces behind fluctuations in wage growth of full-time workers in Japan, taking into account the heterogeneity of wage structures among the workers, using micro data including those from the *Basic Survey on Wage Structure*. Specifically, we first divide the workers into two classes with distinct wage structures, based on a finite mixture model estimated using various characteristics of the workers and the firms they work for. We find that the two classes correspond to what previous studies have called an "internal labor market," where, under long-term employment practices, labor is reallocated within firms and wages follow a seniority-based system, and an "external labor market," where labor moves across firms and wages are mainly determined by supply and demand in the market. We next analyze the effects of economic factors on individual full-time workers' wage growth rates. We show that, in the internal labor market, neither labor market conditions at the industry and firm-size level nor the output gap at the macro level have had an effect on the wage growth rates in recent years, while higher potential growth has had a positive effect. By contrast, in the external and the overall labor markets, improvements in labor market conditions and the output gap have accelerated the wage growth rates, even in recent years.

JEL Classification: E24, J30, J40

Keywords: Full-time worker, Heterogeneity of wage structures, Internal and external labor markets

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1. Introduction

In Japan, labor market conditions and the output gap have tended to improve since 2013, when the Bank of Japan introduced Quantitative and Qualitative Monetary Easing, although they were adversely affected by the COVID-19 outbreak in 2020, as shown in Figure 1. Wages of part-time workers (or non-regular employees) have also tended to rise, reflecting tightening labor market conditions. However, wage growth of full-time workers (or regular employees), who make up most of the labor force, has been remarkably sluggish. As background to this difference in wage developments, it has been pointed out that the wage structure of full-time workers differs from that of part-time workers: that is, full-time workers' wages follow a seniority-based system under long-term employment practices and are therefore insensitive to changes in labor market conditions (Bank of Japan, 2018).

An approach that analyzes wage developments by dividing workers into full-time and part-time workers can grasp the considerable difference in wage structure across types of employment in the Japanese labor market and provide a useful insight into wage developments using publicly available data from official statistics.[1] However, that approach considers full-time workers, who constitute the majority of workers, to be homogeneous and examines only their average wages, which may not provide a detailed representation of actual wage developments. Indeed, the Bank of Japan (2023) indicates that not all full-time workers' wages are necessarily insensitive to labor market conditions, and that there are considerable differences in the sensitivity by industry and firm size. In light of these observations, it would be useful to take into account the heterogeneity of wage structures among full-time workers in order to examine the driving forces of fluctuations in their wage growth in more detail.

The view that the labor market consists of worker groups with distinct wage structures has been discussed in labor economics.[2] This view suggests that it is important, particularly in Japan, to analyze wage structures by dividing workers into two groups: an "internal labor market," in which labor is reallocated within firms and wages follow a seniority-based system under long-term employment practices, and an "external labor market," in which labor moves across firms and wages are mainly determined by supply and demand in the market. This focus on differences between types of employment has been much discussed recently amid concern about the increasing number of non-regular employees in Japan.[3] However, as Yamaguchi (2017) and Suzuki (2020) argue, the notion of internal and external

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[1] The *Monthly Labour Survey*, a representative monthly indicator of wages in Japan, provides wage indices for full-time and part-time workers.

[2] See, e.g., Dickens and Lang (1985) and Ishikawa and Dejima (1994).

[3] See, e.g., Bank of Japan (2017), Ohta (2020), Hoshi and Kashyap (2021), and Aoyama et al. (2022).

labor markets is not defined simply by a dichotomy based on the type of employment, including full-time or part-time workers (regular or non-regular employees), but is considered to be a complex mixture of the two. In particular, it has been pointed out that a considerable proportion of full-time workers are in an external labor market, implying that even among full-time workers, there may be a mix of workers under different wage structures.

In light of these arguments, the notion of internal and external labor markets is a useful framework in accounting for the heterogeneity of wage structures among full-time workers. In this paper, we divide full-time workers into two classes with distinct wage structures and show that these two classes correspond to what previous studies have referred to as internal and external labor markets. To this end, we estimate a finite mixture model, which has been used in previous studies such as Dickens and Lang (1985), Ishikawa and Dejima (1994), and Suzuki (2020). This model can identify two classes with different wage structures through the combined effects of various characteristics of workers and the firms they work for, without relying on any single criterion, such as industry or firm size. In estimating the model, we use micro data from the *Basic Survey on Wage Structure* (*BSWS*) during the period 1989–2021, provided by the Ministry of Health, Labour and Welfare.

The *BSWS* is a large-scale survey over a long period but is also a repeated cross-sectional survey in which respondents have been resampled every year, whereas panel data available for Japan have a limited number of samples per year and a relatively short sample period. We thus follow Kambayashi (2011) and combine the micro data from the *BSWS* and establishment data from the *Economic Census* provided by the Ministry of Internal Affairs and Communications to extract workers who could be regarded as identical across survey years from the micro data.[4] We then construct a dataset that includes individual workers' wage growth rates. Using this dataset, we empirically investigate whether and to what extent economic factors affect individual full-time workers' wage growth rates in the internal and external labor market classes as well as the overall labor market and how these effects have varied over time.

The main empirical results of the paper are summarized as follows. Previous studies using macro data (i.e., average wage data) have argued that wages of full-time workers are insensitive to changes in labor market conditions. However, our paper uses the micro data, including those from the *BSWS*, and shows that the effects of economic factors on wage growth are different between internal and external labor market classes. In the internal labor

[4] We use establishment data from the *Establishment Census* for the period until 1991, the *Establishment Directory Maintenance Survey* for 1994, and the *Establishment and Enterprise Census* for the period 1996–2006. Hereafter, we refer to all of these statistics as the *Economic Census*.

market class, neither labor market conditions at the industry and firm-size level nor the output gap at the macro level have had an effect on individual full-time workers' wage growth rates in recent years, while higher potential growth has a positive effect on the wage growth rates. By contrast, in the external labor market class and the overall labor market, improvements in labor market conditions and the output gap have accelerated the wage growth rates, even in recent years.

In previous literature, an approach that considers the heterogeneity of labor markets or wage structures has been adopted by, for example, Dickens and Lang (1985) and Ahn, Hobijn, and Şahin (2023) for the U.S., and by Ishikawa and Dejima (1994) and Suzuki (2020) for Japan. Most of the literature has focused on a cross-sectional analysis of labor markets or wage structures; for example, what characteristics of workers (gender, educational background, race, etc.) help identify heterogeneous labor markets or wage structures, such as internal and external labor markets. Our paper uses large-scale micro data to divide full-time workers into internal and external labor market classes and shows that the effects of economic factors on wage growth differ between the two classes. This result suggests that the labor market class sorting employed in the previous literature is also useful in terms of time series analysis of wage growth.

The remainder of the paper proceeds as follows. Section 2 divides full-time workers in Japan into two classes with different wage structures and shows that these two classes correspond to what previous studies have called the internal and external labor markets. Section 3 constructs a dataset on wage growth rates of individual full-time workers and examines the effects of economic factors on the wage growth rates in each of the labor market classes. Section 4 concludes.

2. Dividing Full-time Workers into Labor Market Classes with Distinct Wage Structures

In this section, we divide full-time workers in Japan into two labor market classes with different wage structures using micro data from the *BSWS* and show that these two classes capture well the features of the internal and external labor markets identified in previous studies.

2.1. Data

Instead of macro data on average wages, which have been employed in many previous studies, this paper uses micro data on wages and attributes of individual workers to examine the driving forces of fluctuations in wage growth among full-time workers in Japan, taking into account the heterogeneity of wage structures among workers. Specifically, we use micro

data from the *BSWS* during the period 1989–2021, provided by the Ministry of Health, Labour, and Welfare.[5] This survey is one of the fundamental sources of statistics in Japan and covers private establishments (with five or more employees) and public establishments (with ten or more employees) nationwide, giving it a sample size of more than one million workers per survey year. Moreover, in addition to wages and hours worked at the individual worker level, information about characteristics of individual workers, such as gender, age, and educational background, as well as the industry and number of employees of the firms the workers are employed by, are also surveyed, making it possible to conduct thorough analysis that links detailed characteristics of individual workers and the firms they work for to their wages.[6]

In this paper, we use a sample of full-time workers during the aforementioned period, which is a total of approximately 34.2 million workers. The wages used in the analysis are monthly scheduled cash earnings, since for most full-time workers, wages are determined on a monthly salary basis.[7]

2.2. Econometric methodology

To sort full-time workers in terms of distinct wage structures, we estimate a finite mixture model, which has been employed in previous studies, such as Dickens and Lang (1985), Ishikawa and Dejima (1994), and Suzuki (2020). This model assumes that the observed wage data are made up of wages in two unobservable labor market classes,[8] and consists of two respective wage equations for the two classes and a classification equation, which calculates the probability of being in each labor market class for all full-time workers. This model has the advantage that the sorting of workers can be based on data without relying on any single criterion, such as regular or non-regular employees.

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[5] All analyses in this paper were done by the authors using the micro data provided by the Ministry of Health, Labour and Welfare and the Ministry of Internal Affairs and Communications.

[6] In the *BSWS*, monthly wages and hours worked are those in June of the current year, while special cash earnings are the total amount received in the previous year.

[7] Special cash earnings are not used in this paper because the *BSWS* does not cover such earnings in the current year, which makes it difficult to construct a dataset on wage growth rates of individual workers in Section 3. In addition, hourly wages are not (directly) employed in the paper, since such wages tend to fluctuate considerably, mainly due to differences in the number of workdays in each year. Yet in Section 3.3, our empirical analysis controls the effect of changes in hours worked by adding them to explanatory variables in regression equations.

[8] Although we can consider three or more classes in the model, Suzuki (2020) estimates a similar model with three classes and points out that in the estimated model, a wage equation for the third class has low explanatory power and large estimation errors, so it could be seen that the third class is not an independent class but captures some estimation errors in wage equations for the first and second classes. Indeed, when we estimate our model with three classes, we find that it leads to a very small sample of full-time workers sorted into a third class and does not provide stable estimation results. Thus, our paper considers the model with at most two classes.

Eq. (1) represents Mincer (1974)-type wage equations, which have been standard in labor economics, and assumes the same explanatory variables between two labor market classes, but with different coefficients on the variables.[9] The classification equation is specified as a logit model and given by eq. (2):

$$\ln W_i = X_i\beta_k + u_{k,i}, \qquad k \in \{in, ex\}, \tag{1}$$

$$\ln\left(\frac{\Pr(class_i = ex)}{\Pr(class_i = in)}\right) = Z_i\gamma + \varepsilon_i, \tag{2}$$

where W_i is monthly scheduled cash earnings of worker i; k is the index for the labor market class; *in*, *ex* represent the internal and external labor market classes explained later; and $class_i$ denotes the respective class to which a worker belongs. The vectors X_i and Z_i are those of explanatory variables, and Z_i in the classification equation (2) includes a constant term, firm size dummies,[10] a public establishment dummy, educational background dummies,[11] a female dummy, and an age 60 or above dummy. The vector X_i in the wage equation (1) contains not only the same explanatory variables as in Z_i but also industry dummies,[12] years of service (in the firm a worker is currently working for), squared years of service, years of external experience (equivalent to years of service in the firm a worker previously worked for),[13] and squared years of external experience.[14]

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[9] The wage equation proposed by Mincer (1974) has been a standard model for analyzing the relationship between investment in human capital and wages and is known to have a good fit to wage data in many countries, including Japan. In selecting explanatory variables of our wage equations, we refer to Kawaguchi (2011).

[10] For the firm size dummies, we define large firms as firms with 1,000 or more employees and small firms as firms with less than 100 employees, while medium firms are defined as intermediary ones between the large and small firms. The benchmark value is set for the medium firms.

[11] For the educational background dummies, there are four categories: junior high school graduates, senior high school graduates, upper secondary specialized training school or junior college graduates (or professional training college graduates since the 2020 survey), and university or graduate school graduates. The benchmark value is set for junior high school graduates.

[12] For the industry dummies, we choose 16 industries based on the *Japan Standard Industrial Classification* (mining and quarrying of stone and gravel; construction; manufacturing; electricity, gas, heat supply and water; information and communications; transport and postal services; wholesale and retail trade; finance and insurance; real estate and goods rental and leasing; scientific research, professional and technical services; accommodations, eating and drinking services; living-related and personal services and amusement services; education, learning support; medical, healthcare and welfare; compound services; and other services). They are connected to former standard classifications by reclassifying industries so as to minimize gaps caused by revisions.

[13] The years of external experience are defined as "age - years of tenure - years of education - 6," where the years of education are defined as 9 years for junior high school graduates, 12 years for senior high school graduates, 15.5 years for upper secondary specialized training school or junior college graduates, and 17 years for university or graduate school graduates.

[14] Although it would be useful to add information about the type of employment, that is, regular or non-regular employees, to explanatory variables, this information was not surveyed until 2004, so we do not

In this paper we do not include the years of service in the explanatory variables Z_i of the classification equation (2). Given that long-term employment practices are widely adopted in an internal labor market, it might be conceivable that such years are added to the explanatory variables. However, we assume that the sorting of full-time workers into each labor market class is basically invariant over time. That is, we assume that full-time workers are sorted into each class at the time of taking their jobs, but do not consider that the workers are more likely to be sorted into an internal labor market class as their years of service get longer. We also assume that the probability of being in each labor market class depends on the characteristics of workers and the firms in which they take jobs.[15] Yet, as an exception, for full-time workers aged 60 and above, whose wage structures are considered to change discontinuously mainly due to reemployment practices after mandatory retirement, we allow the possibility of switching to the other labor market class even for the same worker in the same firm, by including the age 60 and above dummy as an explanatory variable of the classification equation.

The above three equations, consisting of the two wage equations for the two labor market classes and the classification equation, are simultaneously estimated using the maximum likelihood method.[16] By estimating the samples separately for each survey year, we allow for structural changes in all the equations.[17]

Next, we consider which of the two labor market classes, as defined by their distinct wage structures, should be called "internal" and which should be "external." Many previous studies, such as Ishikawa and Dejima (1994), Yamaguchi (2017), and Suzuki (2020), have pointed out that the average wage level is higher in an internal labor market. Thus, we also refer to the labor market class with a higher average wage level as the internal labor market class. In the next subsection, we compare the two labor market classes' features other than their average wage levels with those of the internal and external labor markets identified by previous studies.

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use it in the baseline analysis for the sample period from 1989. Note that when we restrict the sample to the period from 2005, we confirm that the main empirical results presented in Sections 2 and 3 remain qualitatively unchanged, even with the added information.

[15] As shown in Section 2.4, although the years of service are not included in the criteria for the labor market class sorting, the average of the years of service over full-time workers sorted into the internal labor market class is considerably longer. As background to this, we can point to long-term employment practices under which full-time workers have long tenure.

[16] The EM algorithm is used in the maximum likelihood estimation. In addition, each sample is weighted by the reciprocal of the sampling rate to replicate the population (this adjustment is applied to all figures presented below that show the results of empirical analyses).

[17] This could induce a small number of cases in which the labor market class into which a worker with the same characteristics is sorted changes across survey years.

2.3. Estimation results for finite mixture model

Before accounting for the estimation results of the finite mixture model presented above, we compare the model with two labor market classes and that with only one class (i.e., only one wage equation) in terms of the fit to the data. The model comparison based on the BIC shows that the model with two classes fits better throughout the sample period than that with only one class, as can be seen in Figure 2.[18] This suggests the presence of multiple different wage structures among full-time workers in Japan.

Figure 3 shows how the estimated coefficients in the classification equation and the wage equation for each labor market class have evolved over the sample period. Panels (a)–(c) of the figure display the coefficients on the educational background dummies. In the classification equation, we can see that the probability of being in the internal labor market class becomes higher for more highly educated full-time workers throughout the sample period. In the wage equations for both classes, full-time workers with a higher educational background tend to receive higher wages, and this tendency is especially prominent in the internal labor market class. Panels (d) and (e) plot the coefficients on the firm size dummies. In the classification equation, although the absolute values of the coefficients have tended to decline, the probability of being in the internal labor market class increases with firm size throughout the sample period. In the wage equations, wages are apt to be higher in larger firms in the internal labor market class, whereas there is no such tendency in the external labor market class. Panel (f) exhibits the coefficients on the public establishment dummy, indicating that full-time workers in public establishments are more likely to be in the internal labor market class, although the sample size of such workers is relatively small. Panel (g) shows the coefficients on the age 60 and above dummy. For full-time workers aged 60 and above, the probability of being in the external labor market class is higher, and wages are lower, especially in the external labor market class. This may be because their wage structure changes as a result of reemployment practices after mandatory retirement. Panel (h) displays the coefficients on the female dummy. In the classification equation, although female full-time workers have a higher probability of being in the external labor market class, there has been a gradual downward trend in the probability against the backdrop of enhanced support for female workers to continue working. In the wage equations, female full-time workers tend to receive lower wages, especially in the external labor market class, but the gap between the two classes has become narrower in recent years. Panel (i) plots the coefficients on the years of service in only the wage equations and shows that the coefficient for the

[18] Even using the AIC, the model comparison results remain qualitatively unchanged (for example, regarding 2021, the AIC for the model with two classes is 547,022, which is smaller than 623,974 for the model with only one class).

internal labor market class is larger throughout the sample period. This indicates that wages in that class tend to follow a seniority-based system in which wages increase with the years of service.

These features of the classification equation regarding educational background, firm size, gender, age, etc. are consistent with those identified in previous studies, such as Ishikawa and Dejima (1994) and Suzuki (2020). Comparing the coefficients in the classification equation across explanatory variables, we find that almost all the coefficients are statistically significant throughout the sample period, and that the magnitude is not particularly large for any individual explanatory variable. This implies that the aforementioned factors all together have a combined effect on the probability of being in the internal or external labor market class.

Using the estimated classification equation, we can calculate the probability of being in the internal labor market class for all full-time workers. The distribution of the probability for 2021 is illustrated in Figure 4. In this paper we choose a probability of 50 percent as the threshold for dividing full-time workers into either the internal or external labor market class. That is, full-time workers with a probability of 50 percent and above are assigned to the internal labor market class, while those with a probability below 50 percent are assigned to the external labor market class.[19]

Figure 5 shows how the proportion of full-time workers assigned to the internal and external labor market classes has evolved over the sample period. The figure shows that the proportion has been roughly equal across the period, but that the proportion of full-time workers in the external labor market class has been increasing somewhat, except for periods when a discontinuity arose due to a change in the survey form and when there was influence from the COVID-19 outbreak.[20] As background to the increasing share, the labor force participation of women and seniors, who have relatively high probabilities of being in the external labor market class, has increased, partly due to initiatives introduced by the government and by firms, leading to an increase in the proportion of these workers in the overall labor market.

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[19] It may be thought better to choose the threshold more conservatively because setting it at the probability of 50 percent might risk assigning some workers to the wrong class. We therefore also analyze the case in which the threshold for the probability of being in the internal labor market class is set at 70 percent, that is, full-time workers with a probability of 70 percent and above are assigned to the internal labor market class, those with a probability below 30 percent to the external labor market class, and the rest into an indeterminate class. Even in this case, we have confirmed that the main empirical results presented in Sections 2 and 3 remain qualitatively unchanged (see Appendix A for details).

[20] In the *BSWS* questionnaire, the term for "part-time worker" in Japanese was changed from the 2005 survey, and new occupations were added to the coverage of the survey.

2.4. Features of internal and external labor market classes

In this subsection, we present the features of the internal and external labor market classes for full-time workers.[21] First, regarding the wage level, panel (a) of Figure 6 displays the wage curves in terms of the relationship between monthly scheduled cash earnings and the years of service. The wage curves confirm that the internal labor market class has a higher average wage level than the external one, and that the curve for the internal labor market class is steeper, suggesting that wages in that class follow a seniority-based system. It should be noted that although wages increase with the years of service even in the external labor market class, the characteristics of full-time workers with longer years of service in that class may be somewhat closer to those of full-time workers in the internal labor market class, and that the sample size of full-time workers with longer tenure in the external labor market class is small because the proportion of full-time workers who change jobs is larger in that class. In this regard, the wage curve based on age of full-time workers plotted in panel (b) of the figure exhibits a flatter slope in the external labor market class, thereby amplifying the difference between it and the wage curve for the internal labor market class.

Next, we consider the composition of the internal and external labor market classes by several characteristics of full-time workers and the firms they work for. In Figure 7, panel (a) shows the composition by the type of employment. In the internal labor market class, most full-time workers are regular employees, while there are a considerable number of non-regular employees in the external labor market class. Yet the proportion of regular employees is also high in the external labor market class, suggesting that the heterogeneity of wage structures among full-time workers cannot be explained only by the difference in the type of employment. This result is consistent with those of previous studies, including Suzuki (2020), although it should be noted that our analysis covers only full-time workers, and therefore the proportion of regular employees in the overall labor market is relatively high. Panel (b) of the figure shows the composition by years of service and suggests that this is short for many full-time workers in the external labor market class, whereas years of service is long for a relatively large number of full-time workers in the internal labor market class. Panel (c) shows the composition by educational background, in which about 60 percent of full-time workers in the internal labor market class are university or graduate school graduates, which is in contrast to only about 10 percent in the external labor market class.

In Figure 8, panel (a) shows the composition by the size of firms that full-time workers are employed by. More than 50 percent of full-time workers in the internal labor market class

[21] It should be noted that since the majority of part-time workers are considered to be in the external labor market for all workers, the external labor market class for full-time workers presented in this paper can have features somewhat closer to the internal labor market for all workers than to the external one.

work for large firms with 1,000 or more employees, while more than 60 percent of those in the external labor market class work for relatively small firms with fewer than 300 employees. Panel (b) of the figure shows the composition by industry. In the internal labor market class, full-time workers are mainly in industries, such as electricity, gas, heat supply and water; wholesale and retail trade; finance and insurance, professional and technical services; and information and communications. In the external labor market class, full-time workers are mainly in relatively labor-intensive industries, such as construction; medical, healthcare and welfare; amusement, accommodations, eating and drinking services; and transport and postal services.

The features of the two labor market classes presented above are consistent with those of the internal and external labor markets identified in previous studies, such as Ishikawa and Dejima (1994), Yamaguchi (2017), and Suzuki (2020). The next section shows the results of empirical analysis on the wage growth rates of individual full-time workers.

3. Wage Growth in Internal and External Labor Market Classes

In this section, we construct a dataset that includes the wage growth rates of individual full-time workers in the internal and external labor market classes presented in the preceding section and examine the effects of economic factors on the wage growth rates.

3.1. Calculation and developments of individual full-time workers' wage growth rates

When we examine the effects of economic factors on wage growth, the use of the wage growth rate calculated from the average wage in each labor market class leads us to include the impact of changes in the composition caused by the replacement of workers. To exclude this impact, our paper analyzes wage growth rates at the individual worker level.

In investigating wage growth of individual workers, it is desirable to use panel data that have continued to survey the same workers' wages for two or more consecutive years. However, panel data available for Japan have a limited number of samples per year and a relatively short sample period, although a wide range of questions are surveyed.[22] In this regard, the *BSWS* is a large-scale survey over a long period but it is also a repeated cross-sectional survey in which respondents have been resampled every year without fixed individual workers' codes, so we cannot directly calculate the wage growth rates of individual workers. Thus, following Kambayashi (2011), we connect sample full-time workers who could be regarded as identical across survey years, based on information about

[22] In Japan, one of the representative panel data that include wage information is the *Japan Household Panel Survey (JHPS/KHPS)* by Keio University, which has been conducted since 2004 and has a continuous sample size of about 4,000 respondents.

the code of the establishment they work for, their gender, educational background, age, and their years of service, in order to construct a large dataset on wage growth rates that can comprehensively cover full-time workers in Japan for a period of more than 30 years.

Specifically, we first identify identical establishments in the previous and current years, using the prefecture number, municipality number, survey area number, and establishments' serial numbers.[23] Although these numbers were discontinued in the years when the population sample frame of the *BSWS* was updated using new results of the *Economic Census*, we connect the numbers using a correspondence table from the *Economic Census* provided by the Ministry of Internal Affairs and Communications.[24] However, there is no correspondence table for private establishments from the *Economic Census* for the period between 1992 and 1993 or between 1997 and 1998, so we cannot identify identical establishments for these years or provide data on wage growth rates for 1993 and 1998 in the following analysis.[25]

Next, within the sample of full-time workers extracted from the identified identical establishments, we connect individual workers across two consecutive survey years by checking whether the information about gender and educational background is the same between the previous and current years and whether the age and years of service in the current year are equal to those in the previous year plus one. To reduce the risk of accidentally connecting a sample that is not an identical worker, we exclude samples for which there are two or more candidates in the identical establishments, and those whose rates of wage growth or changes in scheduled working hours are less than -35 percent or more than 60 percent. As a result, we obtained around 3.56 million identified samples of wage growth rates for the survey years excluding 1993 and 1998.

It is worth noting that the method explained above can be applied only to workers who have been employed in the same establishment for two or more consecutive years, so those who change jobs are absent from the sample. In addition, since the sampling rates of establishments and workers depend on prefecture, industry, and establishment size in the *BSWS*, there may be a risk of bias in the attributes of identified workers included in the sample for two or more consecutive years. Table 1 shows the average value of each indicator and composition of (i) all full-time workers and (ii) full-time workers who can be identified across the survey years. In this table we can see some biases in the probability of

[23] From 2013, fixed establishment codes are available, and we use them instead of the method explained here.

[24] For details of how to connect the numbers, see Murata and Ito (2016).

[25] Although there is also no correspondence table between 1995 and 1996, we can identify identical establishments using a list of establishments' telephone numbers.

identification, such as a higher proportion of large firms in both internal and external labor market classes in sample (ii).[26] With this in mind, we weight (iii) each full-time worker with the sampling rate that takes into account the identification rate of the same worker for each firm size-industry matrix. Comparing the results of (iii) with those of (i), although the years of service is longer in (iii) because the workers with less than one year of service cannot be identified, there is not much difference in the wage level or the composition ratio of worker attributes, suggesting that the sample selection bias in the following analyses is somewhat small.

Figure 9 plots the development of wage growth rates of full-time workers. First, we compare the median of wage growth rates of full-time workers in the overall labor market calculated in this paper and the overall average of monthly scheduled cash earnings of regular workers in the *Monthly Labour Survey*, which is a representative indicator of wages in Japan. In recent years, the latter average has been around 0 to 1 percent on a year-on-year basis, while the former median has been running at around 2 percent, which indicates a considerable discrepancy in wage growth. This is because the wage data in the *Monthly Labour Survey* contains the negative composition effect (i.e., the joint effect of the retirement of middle-aged and older full-time workers who receive relatively high salary and the hiring of young full-time workers who receive relatively low salary), while the median of individual full-time workers' wage growth rates includes no such effect.[27] In other words, the wage growth rates of individual full-time workers contain the effect of wage increases arising from a seniority-based system, which is offset with the composition effect in the macro data.[28] Next, regarding the medians of wage growth rates of full-time workers in the two classes, the median for the internal labor market class has consistently exceeded that for the external labor market class. One reason for this difference is that, compared with the external labor market, seniority-related wage increases are higher in the internal labor market, where wage growth follows a seniority-based system.

Taking into account these structural features and focusing on developments in wage growth rates, we can see that the median of wage growth rates in the internal labor market class increased somewhat after the Bank of Japan introduced Quantitative and Qualitative Monetary Easing (QQE) in 2013, albeit a small increase as a whole, whereas the median of

[26] As background to why full-time workers belonging to large firms are more likely to be included in the sample, in the sampling of surveyed establishments, large firms with fewer establishments in the population are more likely to be surveyed for two or more consecutive years.

[27] For the composition effect in the macro data, see Ueno and Kambayashi (2017).

[28] We also confirm that the discrepancy in wage growth between the macro and micro data is significantly reduced when we use a simple method to calculate individual workers' wage growth rates without seniority-related wage increases (see Appendix B for details).

wage growth rates in the external labor market class has risen significantly since 2013, when labor market conditions tightened.

3.2. Distributions of individual full-time workers' wage growth rates

In this section, we show the distributions of wage growth rates of individual full-time workers calculated in the preceding section, and present detailed features of the wage growth rates in the internal and external labor market classes.

Figure 10 shows developments in the distributions of wage growth rates from 1990 to 2021, while Figure 11 shows the changes in these distributions between the survey years. First, regarding the distribution for the overall labor market, its mode was around 5 or 6 percent in 1990, during the bubble economy. The distribution then shifted to the left (which means wage growth rates as a whole declined) and the mode became close to zero, with the density increasing in 2000, the so-called "employment ice age," and in 2012, just before the Bank of Japan introduced QQE. However, from 2012 to 2019, with improvements in labor market conditions and the output gap, partly due to the effects of QQE, the proportion of full-time workers with wage growth rates near zero decreased, while that of full-time workers with positive wage growth rates increased slightly.

Next, we examine developments in the distribution for each of the internal and external labor market classes. We find that the overall changes are similar between the two classes, but there are also some clear differences. For instance, during the period from 1990 to 2012, when wage growth rates declined, the distribution for the internal labor market class shifted to the left as a whole, but the level of its mode remained almost unchanged. By contrast, regarding the distribution for the external labor market class during the same period, the density at a zero rate of wage growth became significantly higher, with the proportion of positive rates declining. This is partly because in the external labor market class, where seniority-related wage increases were relatively low, full-time workers are more likely to be subject to downward nominal wage rigidities as their wage growth rates decline.[29] Furthermore, during the period of higher wage growth from 2012 to 2019, the distribution for the internal labor market class changed only modestly, whereas that for the external labor market class changed relatively more widely. Based on these changes in the distributions, or the developments of wage growth shown above, the effect on wage growth rates of an improvement in the output gap or labor market conditions may differ between the internal

[29] As noted above, the distribution of wage growth rates presented in this paper includes only full-time workers employed at the same establishment for two or more consecutive years, and does not cover those who change jobs. As a consequence, it is difficult to precisely assess downward nominal wage rigidity from the results reported in this paper.

and external labor market classes. In fact, when we focus on the changes between 2019 and 2021, or before and after the COVID-19 outbreak, although both classes saw a decline in the proportion of full-time workers with wage increases and a rise in the density near zero, the changes were substantially large in the external labor market class.[30]

3.3. Effects of economic factors on individual full-time workers' wage growth rates

Using the dataset including individual full-time workers' wage growth rates constructed in Section 3.1, we conduct empirical analyses of the effects of economic factors on the wage growth rates in the internal and external labor market classes.

3.3.1. Methods of empirical analyses

For full-time workers in the internal and external labor market classes and the overall labor market, we regress each of their wage growth rates (on the basis of monthly scheduled cash earnings) on economic factors. Specifically, we consider two types of economic factors: (i) the employment conditions DI from the *Tankan*, which represents sectoral labor conditions by industry and firm size, and (ii) the output gap and the potential growth rate, which represent macroeconomic factors.

We estimate the following two regression equations using weighted least squares that weight each full-time worker with the sampling rate that takes into account the identification rate discussed in Section 3.1:

$$\Delta W_{ijlt}^{k} = c^{eq3,k} + \alpha_1^k EMP_{jlt} + \alpha_2^k \Delta CPI_{t-1} + Z_{ijlt}^{k}\gamma^k + \lambda_{jl}^{eq3,k} + u_{ijlt}^{eq3,k}, \qquad (3)$$

$$\Delta W_{ijlt}^{k} = c^{eq4,k} + \beta_1^k GAP_t + \beta_2^k PG_t + \beta_3^k \Delta CPI_{t-1} + Z_{ijlt}^{k}\delta^k + \lambda_{jl}^{eq4,k} + u_{ijlt}^{eq4,k}, \qquad (4)$$

where ΔW_{ijlt}^{k} is the wage growth rate in year t for worker i assigned to labor market class k (the internal or external labor market class[31]), j is the industry of the firm the worker is

[30] The COVID-19 outbreak represented a sectoral shock that had a substantially large impact on face-to-face services, such as amusement, accommodations, and eating and dining services. As noted in Section 2.4, a large proportion of full-time workers in the external labor market class belong to such industries, which is one of factors for the large decline in wage growth in that class.

[31] In the sample here, we consider only full-time workers whose labor market classes do not change for two consecutive years. That is, we exclude those who were sorted into one labor market class in the previous year but into the other class in the current year. As noted above, data for 1993 and 1998 are not available.

employed by,[32] and l is the size of the firm.[33,34] The variable EMP_{jlt} denotes the employment conditions DI by firms' industry and size, while GAP_t and PG_t represent respectively the output gap and the potential growth rate (both estimated by the Bank of Japan). The vector Z_{ijlt}^{k} contains control variables, such as the firm's margin by industry and size (given by subtracting the input price from the output price),[35] the years of service, the squared years of service, an age 60 and above dummy, a female dummy, educational background dummies, and the year-on-year rate of scheduled working hours. In addition, as explanatory variables common to eqs. (3) and (4), $c^{eq3,k}$ and $c^{eq4,k}$ are constant terms, ΔCPI_{t-1} denotes the inflation rate of the consumer price index (CPI) (excluding fresh food, consumption tax adjusted) in the previous year, and $\lambda_{jl}^{eq3,k}$ and $\lambda_{jl}^{eq4,k}$ represent the firm's industry and size dummies. To examine changes in the coefficients over time, we divide the estimation period into three sample periods: 1990–1999, 2000–2012, and 2013–2021. We also show the estimation results with the whole sample of workers to confirm trends in the overall labor market for full-time workers.

3.3.2. Results of Empirical analyses

Figure 12 shows the coefficients on the employment conditions DI and the CPI inflation rate of the previous year in eq. (3) (see Table 2 for detailed estimation results, including coefficients of other explanatory variables). First, the employment conditions DI coefficients are statistically significantly positive for both the internal and external labor market classes and the overall labor market for full-time workers in the period from 1990 to 1999. Especially, the magnitude of the positive coefficient for the external labor market class is substantially large. Therefore, the tightening labor conditions at the time were a push factor for their wage growth. After that period, however, the coefficients became smaller for both the internal and external labor market classes; in particular, the coefficient for the internal labor market class was no longer statistically significant in the period from 2013 to 2021. The estimation result that the coefficient has become smaller for both the internal and external labor market classes and the overall labor market is consistent with results of previous studies which find that the wage Phillips curve for Japan has flattened in recent years.[36]

Next, the coefficient of the CPI inflation rate of the previous year is statistically significantly positive for both the internal and external labor market classes and the overall

[32] There are 7 industries: mining; construction; manufacturing; electricity, gas, heat supply and water; transport and postal activities; wholesaling and retailing; and services.

[33] There are three categories based on the *Tankan*: large, medium-sized, and small enterprises.

[34] The sign is reversed: a positive sign means "insufficient employment," while a negative sign means "excessive employment."

[35] The margin is calculated by subtracting the input price DI in the *Tankan* from the output price DI.

[36] See, e.g., Hirata, Maruyama, and Mineyama (2020) and Iwasaki, Muto, and Shintani (2021).

labor market for full-time workers in the period from 1990 to 1999, which suggests the presence of a spillover from prices to wages of full-time workers in the 1990s. However, in the period from 2000 to 2021, this spillover effect was no longer present.[37]

Figure 13 shows the coefficients on the output gap, the potential growth rate, and the CPI inflation rate of the previous year in eq. (4) (see Table 3 for detailed estimation results, including coefficients of other explanatory variables). As with the estimation result for the employment conditions DI in eq. (3), the output gap coefficient for the internal labor market class gradually declined and became statistically insignificant in the period from 2013 to 2021, whereas the coefficients for the external labor market class and the overall labor market for full-time workers continued to be statistically significantly positive. By contrast, the coefficient on the potential growth rate for the external labor market class was insignificant in the period from 2013 to 2021, while that for the internal labor market class was statistically significantly positive during the same period. Regarding the CPI inflation rate of the previous year, as with the estimation result of eq. (3), there was no spillover effect from prices to wages of full-time workers in the period from 2000 to 2021.

These results suggest that the effects of economic factors on wage growth differ between the internal and external labor market classes. First, for the internal labor market class, neither improvements in labor market conditions nor the output gap have had a direct effect on wage growth in recent years, whereas these factors continue to have a positive effect for the external labor market class, which demonstrates a clear difference between the two classes in their sensitivity to economic factors.[38] This result is consistent with the view of previous research that in the external labor market, labor moves across firms and wages are determined by supply and demand in the market. Second, there is a difference in the effect on wages of the potential growth rate: only in the internal labor market class has there been a boost in recent years from a higher potential growth rate.[39] Since the internal labor

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[37] The weakening relationship between wages and prices in Japan may be explained by the "rational inattention" hypothesis, which argues that since price increases had not exceeded seniority-related wage increases, individual households did not recognize the developments in prices (Bank of Japan Monetary Affairs Department, 2022). On this point, it should be noted that wages may rise nonlinearly if the inflation rate significantly exceeds seniority-related wage increases.

[38] The external labor market class is considered to have a higher proportion of full-time workers who change jobs than the internal one, which our dataset is not able to take into account as noted in Section 3.1. Since it has been pointed out that wages offered for such workers are more sensitive to labor market conditions (Furukawa, Hogen, and Kido, 2023), the sensitivity of wage growth in the external labor market class estimated in this paper may have a bias in the direction of underestimation. In light of this, we believe that the result of our empirical analysis that wage growth in the external labor market class is more sensitive to labor market conditions compared to the internal one has a certain robustness.

[39] There was no significant relationship between the wage growth rate and the potential growth rate in the internal labor market class during the period from 2000 to 2012. This is possibly because when the potential growth rate declined significantly around the time of the global financial crisis in the late 2000s,

market class is characterized by long-term employment practices, long-term growth expectations may have been taken into account when determining wages.[40] In light of this, to ensure that wage growth in the internal labor market class continues to increase, it is important to make further progress not only in improving labor conditions but also in raising growth expectations over the longer term.

4. Concluding Remarks

In this paper, we have examined the driving forces behind fluctuations in wage growth of full-time workers in Japan, taking into account the heterogeneity of wage structures among the workers. Using a finite mixture model estimated with micro data from the *BSWS*, we have divided full-time workers into two classes with distinct wage structures and shown that these two classes capture well the features of the internal and external labor markets identified in previous studies. We have also indicated that various factors, such as educational background, firm size, gender, and age, play a combined role in assigning full-time workers to either the internal or external labor market class. We have also examined the effects of economic factors on wage growth rates of individual full-time workers in the internal and external labor market classes and the overall labor market, and shown that in the internal labor market class neither labor market conditions at the industry and firm-size level nor the output gap at the macro level have had an effect on the wage growth rates in recent years, while higher potential growth has had a positive effect. By contrast, in the external labor market class and the overall labor market, improvements in labor market conditions and the output gap have accelerated the wage growth rates, even in recent years.

Our empirical results suggest the importance of taking into account the heterogeneity of wage structures among full-time workers to better understand their wage developments in recent years. As we have shown, the size of firms and the composition ratio of industries differ greatly between the internal and external labor market classes. Thus, when conducting analyses using macro data on average wages, it would be useful to examine wage developments by sorting full-time workers using information aggregated by these attributes. However, in light of our empirical results derived using the micro data, that the various attributes of workers and the firms they work for should be considered multilaterally in analyzing wage developments.

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wages in the internal labor market class did not decline substantially, due in part to their downward rigidity.

[40] Taking a similar approach to our paper, Fukunaga et al. (2023) examine the effect of an expected future growth rate on the wage growth rate using the data for individual firms and obtain the empirical result that the wage response to an expected future growth rate shock is greater in large firms than in small and medium-sized firms. This is consistent with our paper, given the high proportion of large firms in the internal labor market class, as noted above.

Finally, we would like to point to two issues for future research. First, individual workers' wage growth rates in our analysis are calculated for workers who appear to have been employed in the same establishment for two or more consecutive years, based on certain assumptions. As a result, full-time workers who change jobs are not included in the sample. Considering the importance of their wage developments in analyzing the effects of economic factors on wage developments in Japan, it would be beneficial to use continuous wage panel data that includes them. Second, the analyses in this paper deal with the effects of economic factors on wage growth, while the relationship between wage setting and price setting in firms is beyond the scope of the paper. Examining whether there is a relationship between rigidity in nominal wages and that in output prices at the firm level, or whether there is a causal relationship between them, would be important in analyzing the background to the fact that both wage growth and price inflation in Japan were sluggish in the 2000s and 2010s.

Appendix A. Robustness Check on Labor Market Class Sorting

In this appendix we examine the robustness of our main empirical results with regard to the setting of the threshold for dividing full-time workers into internal and external labor market classes. In the baseline analysis, if a full-time worker has the probability of being in the internal labor market class of 50 percent or above, which is given using the estimated finite mixture model, then we assign the worker to the internal labor market class; otherwise, we assign the worker to the external labor market class. While this sorting has the advantage of considering in our analysis the overall labor market for full-time workers, it also involves the risk of assigning some workers to the wrong class, which might affect our main empirical results.

To confirm the robustness of the results, in this section, we consider the case in which the threshold for the probability of being in the internal labor market class is set at 70 percent, that is, full-time workers with a probability of 70 percent and above are assigned to the internal labor market class, those with a probability below 30 percent to the external labor market class, and the rest to an indeterminate class.

In this case, Figure A.1 shows the proportion of full-time workers assigned to the internal and external labor market classes and to the indeterminate class over the sample period. The proportion of the workers in the indeterminate class is about 20–30 percent, with a moderately increasing trend throughout the sample period. This increase may be due to increasing diversity in the Japanese labor market, including labor force participation of women and seniors. However, the majority of full-time workers are still assigned to either the internal or external labor market class, and the time series trends of the proportions of workers in these two classes are largely similar to those in the baseline analysis, although the levels of the proportions are about 10 percent below those in the baseline analysis.

Next, we examine whether the features of the internal and external labor market classes presented in Section 2.4 remain even when the threshold for the labor market class sorting is altered. Figure A.2 plots the wage curves, which describe the relationships between monthly scheduled cash earnings and years of service or age of full-time workers, and shows that their slopes are steeper in the internal labor market class, as in the baseline analysis. Panels (a)–(c) of Figure A.3 show the compositions of each labor market class by attributes of full-time workers and demonstrate similar features to those in the baseline analysis. A reasonable number of regular employees are present in the external labor market class, although the proportion of regular employees is higher in the internal labor market class. There are more full-time workers with greater length of service and more highly educated full-time workers in the internal labor market class. Turning to the characteristics of the firms full-time workers are employed by, panels (a) and (b) of Figure A.4 show that the majority

of the workers in the internal labor market class are hired by large firms, while those in the external labor market class are employed by small and medium-sized firms in relatively labor-intensive industries. The features of the indeterminate class are between those of the internal and external labor market classes.

Figure A.5 shows the distributions of individual full-time workers' wage growth rates for the internal and external labor market classes, which are counterparts to those in Section 3.2. As in the baseline analysis, during the period from 1990 to 2012, when the wage growth rates declined, the distribution for the internal labor market class shifted to the left as a whole, keeping the density at the mode almost unchanged. By contrast, in the distribution for the external labor market class during the same period, the density at zero became significantly higher, with the proportion of positive values of the wage growth rate decreasing. In addition, during the period of higher wage growth from 2012 to 2019, the distribution for the external labor market class changed relatively more widely. The distribution for the indeterminate class is located between those for the internal and external labor market classes.

Moreover, we conduct the same empirical analyses regarding the effects of economic factors on wage growth in the internal and external labor market classes and the indeterminate class, as in Section 3.3 (for details of the estimation results, see Tables A.1 and A.2). Panel (a) of Figure A.6 and panel (a) of Figure A.7 show that for the internal labor market class, the coefficient on the employment conditions DI in eq. (3) and that on the output gap in eq. (4) both declined, and they became statistically insignificant in the period from 2013 to 2021, whereas those for the external labor market class continued to be statistically significantly positive. These results are almost the same as in baseline analysis. Note that the coefficients for the indeterminate class are also statistically insignificant in the period from 2013 to 2021. As for the coefficient on the potential growth rate in eq. (4), panel (b) of Figure A.7 shows the same result as in the baseline analysis, with only the coefficient for the internal labor market class in the period from 2013 to 2021 being statistically significantly positive. In addition, regarding the coefficients on the CPI inflation rate of the previous year in eqs. (3) and (4), panel (b) of Figure A.6 and panel (c) of Figure A.7 show that the spillover effect from prices to wages of full-time workers was absent for all labor market classes in the period from 2000 to 2021.

The analyses above suggest that the results obtained in this paper are reasonably robust even when the threshold for the labor market class sorting is altered.

Appendix B. Estimating Full-time Workers' Wage Growth Rates without Seniority-related Wage Increases

In this appendix we briefly calculate individual full-time workers' wage growth rates without seniority-related wage increases and give some consideration to the effect of seniority-related wage increases on wage growth rates.

In Section 3.1, we calculate individual full-time workers' wage growth rates by identifying the same workers across the current and previous survey years, based on the information of establishment's codes, workers' gender, educational background, age, and years of service. This method assumes that the age of identical workers and their years of service increase by one year in the next survey year. Therefore, the effect of seniority-related wage increases due to a one-year increase in the length of service of the same worker is included, which may be a factor in the discrepancy between individual full-time workers' wage growth rates and the macro wage data from the *Monthly Labour Survey*, or the difference between wage growth rates in internal and external labor market classes.

In this section, we recalculated individual workers' wage growth rates by comparing the wage level of workers whose gender, educational background, age, and years of service are all identical in the previous and current survey years. Wage growth rates of workers with the same conditions can be regarded as base pay increases, which does not include seniority-related wage increases. Note that in this method we compare wages of different workers, and therefore the calculated wage growth rates may include errors caused by various attributes other than workers' job type/course, job title, and ability. Although this can increase the variance in the calculated wage growth rate, the median wage growth rate of individual full-time workers would not be biased if we suppose that positive and negative errors are equally likely to occur.

Figure B.1 plots the medians of individual full-time workers' wage growth rates calculated by the aforementioned method. Comparing the growth rate of the monthly scheduled cash earnings from the *Monthly Labour Survey* and the median wage growth rates calculated here, we find that all these have ranged between zero to 1 percent in recent years, with no significant discrepancy. This figure differs from Figure 9 in Section 3.1. A comparison of median wage increases in the internal and external labor market classes also shows no significant difference. It is worth noting that, as can be seen in Section 3.1, the feature that the wage growth rates in the internal labor market class remained relatively low in the period from 2013 to 2021, while those in the external labor market class increased, is also detected here.

Based on the above analysis, we confirm that the discrepancy between individual workers' wage growth rates and the macro data from the *Monthly Labour Survey*, or the difference between the wage growth rates in internal and external labor market classes shown in Section 3.1, are mainly due to the inclusion of seniority-related wage increases.

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Table 1. Summary statistics for full-time workers in samples

		Internal labor market class			*External labor market class*		
		(i) All full-time workers	(ii) Identified Workers	(iii) Identification rate adjustment	(i) All full-time workers	(ii) Identified Workers	(iii) Identification rate adjustment
Sample average							
	Age	38.4	38.9	38.8	42.5	43.1	43.0
	Years of service	12.8	14.9	14.3	10.1	12.5	12.0
	Scheduled cash earnings per month (ten thousand yen)	35.9	36.9	36.5	23.6	24.4	24.3
	Scheduled working hours per month (hours)	161.7	160.1	161.2	167.6	167.9	168.8
Composition of workers (percent)							
by gender	Male	85.4	86.7	85.7	51.1	53.8	51.9
	Female	14.6	13.3	14.3	48.9	46.2	48.1
by firm size	1000 employees or more	53.0	59.8	53.6	9.5	10.7	8.0
	100 - 999 employees	36.8	30.6	36.4	32.3	30.8	32.4
	5 - 99 employees	10.2	9.7	10.0	58.3	58.5	59.7
by educational background	Junior high school graduates	3.6	3.5	3.4	12.6	12.6	12.6
	Senior high school graduates	33.4	37.3	34.6	60.8	64.1	62.1
	Junior college etc. graduates	12.6	9.9	11.4	19.1	15.8	18.0
	University etc. graduates	50.4	49.3	50.6	7.6	7.5	7.3
by industry	Manufacturing	30.5	37.0	30.5	27.2	34.1	27.7
	Services	45.0	42.4	45.5	47.8	44.6	47.0
	Retail and wholesale	16.9	12.3	16.6	14.6	11.7	14.7
	Construction	5.9	4.8	5.7	10.2	8.9	10.5
	Others	1.7	3.4	1.7	0.2	0.7	0.2

Notes: Figures are the averages over the period 1990–2021, excluding 1993 and 1998. The label "Junior college etc. graduates" represents junior college, upper secondary specialized training school, or professional training college graduates, while "University etc. graduates" represents university or graduate school graduates.

Table 2. Detailed estimation results for equation (3)

	Dependents: Monthly scheduled cash earnings (y/y chg.)								
	Sample period: 1990-1999			Sample period: 2000-2012			Sample period: 2013-2021		
	Overall	Internal	External	Overall	Internal	External	Overall	Internal	External
Employment conditions DI (inverse)	0.059***	0.053***	0.065***	0.025***	0.017***	0.035***	0.016**	0.004	0.023***
	(0.004)	(0.004)	(0.004)	(0.005)	(0.006)	(0.005)	(0.006)	(0.011)	(0.006)
CPI inflation rate in previous year	0.568***	0.637***	0.513**	-0.107	-0.189*	-0.013	0.028	0.040	0.024
(y/y chg.)	(0.100)	(0.089)	(0.200)	(0.075)	(0.104)	(0.071)	(0.140)	(0.114)	(0.219)
Control variables									
Firm's margin	0.007	0.006	0.006	-0.007	-0.014**	0.001	-0.000	-0.007	0.008
	(0.009)	(0.008)	(0.018)	(0.006)	(0.006)	(0.006)	(0.010)	(0.013)	(0.015)
Years of service	-0.149***	-0.106***	-0.208***	-0.127***	-0.069***	-0.180***	-0.113***	-0.107***	-0.122***
	(0.023)	(0.014)	(0.022)	(0.019)	(0.013)	(0.018)	(0.014)	(0.016)	(0.021)
Years of service (squared)	0.002**	0.000	0.004***	0.001**	-0.001	0.003***	0.001***	0.001*	0.001***
	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Aged 60 or above	-2.809***	-1.977***	-2.710***	-2.665***	-2.516***	-2.356***	-2.724***	-2.982***	-2.433***
	(0.284)	(0.510)	(0.319)	(0.174)	(0.321)	(0.162)	(0.235)	(0.256)	(0.289)
Female	-0.439***	-0.897***	0.148	-0.427***	-0.577***	-0.065	-0.180*	-0.130	-0.110
	(0.149)	(0.137)	(0.138)	(0.068)	(0.113)	(0.083)	(0.092)	(0.156)	(0.088)
Senior High school graduates	0.922***	1.026***	0.659***	0.471***	0.534**	0.386***	0.087	0.018	0.160
	(0.125)	(0.109)	(0.132)	(0.098)	(0.202)	(0.090)	(0.392)	(0.546)	(0.435)
Junior college etc. graduates	1.449***	1.494***	1.073***	0.752***	0.530**	0.597***	0.179	0.228	0.302
	(0.147)	(0.161)	(0.122)	(0.089)	(0.236)	(0.091)	(0.436)	(0.468)	(0.511)
University etc. graduates	1.676***	1.484***	1.661*	1.040***	1.099***	0.181	0.430	0.669	0.056
	(0.188)	(0.140)	(0.833)	(0.126)	(0.253)	(0.183)	(0.377)	(0.443)	(0.341)
Scheduled working hours (y/y chg.)	0.128***	0.039***	0.228***	0.144***	0.058***	0.230***	0.119***	0.058***	0.173***
	(0.034)	(0.005)	(0.047)	(0.022)	(0.006)	(0.027)	(0.014)	(0.006)	(0.016)
Constant	4.651***	5.102***	4.188***	3.061***	3.071***	3.058***	3.693***	3.957***	3.358***
	(0.327)	(0.231)	(0.692)	(0.293)	(0.330)	(0.232)	(0.467)	(0.530)	(0.555)
Observations	1,102,664	587,108	468,328	1,314,989	625,090	633,383	525,839	210,584	289,196

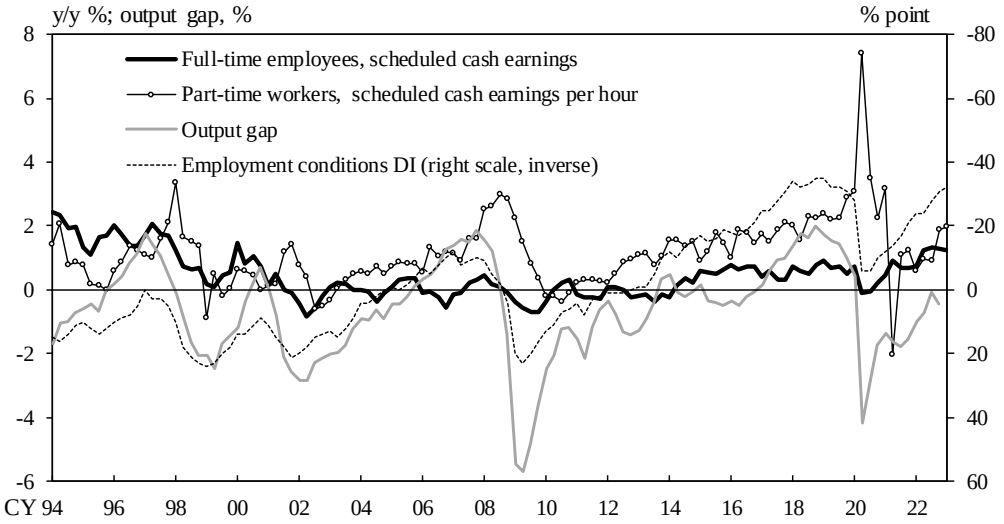
Notes: ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively. Standard errors (robust for clustering by industry and firm size) are in parentheses. The coefficients on industry and firm size dummies are omitted from the table. The label "Junior college etc. graduates" represents junior college, upper secondary specialized training school, or professional training college graduates, while "University etc. graduates" represents university or graduate school graduates.

Table 3. Detailed estimation results for equation (4)

	Dependents: Monthly scheduled cash earnings (y/y chg.)								
	Sample period: 1990-1999			Sample period: 2000-2012			Sample period: 2013-2021		
	Overall	Internal	External	Overall	Internal	External	Overall	Internal	External
Output gap	0.306***	0.208***	0.312***	0.159***	0.141***	0.171***	0.183**	0.040	0.301***
	(0.044)	(0.049)	(0.040)	(0.035)	(0.045)	(0.044)	(0.080)	(0.103)	(0.104)
Potential growth rate	0.690***	0.796***	0.737***	0.102	0.013	0.135	0.171	0.318*	0.132
	(0.061)	(0.080)	(0.080)	(0.098)	(0.107)	(0.149)	(0.165)	(0.171)	(0.241)
CPI inflation rate in previous year	0.573***	0.570***	0.516**	-0.009	-0.102	0.084	-0.000	0.008	-0.029
(y/y chg.)	(0.109)	(0.120)	(0.199)	(0.079)	(0.101)	(0.065)	(0.129)	(0.121)	(0.188)
Control variables									
Firm's margin	-0.004	-0.001	-0.001	-0.013**	-0.016***	-0.010	0.011	0.000	0.022
	(0.006)	(0.006)	(0.013)	(0.005)	(0.005)	(0.007)	(0.011)	(0.013)	(0.016)
Years of service	-0.148***	-0.105***	-0.207***	-0.128***	-0.070***	-0.180***	-0.113***	-0.108***	-0.122***
	(0.023)	(0.014)	(0.022)	(0.019)	(0.012)	(0.018)	(0.014)	(0.016)	(0.021)
Years of service (squared)	0.002**	0.000	0.004***	0.001**	-0.001	0.003***	0.001***	0.001*	0.001***
	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Aged 60 or above	-2.808***	-1.968***	-2.713***	-2.639***	-2.517***	-2.332***	-2.711***	-2.987***	-2.412***
	(0.282)	(0.502)	(0.316)	(0.174)	(0.320)	(0.156)	(0.236)	(0.251)	(0.291)
Female	-0.445***	-0.910***	0.144	-0.422***	-0.583***	-0.073	-0.180*	-0.136	-0.098
	(0.149)	(0.134)	(0.139)	(0.069)	(0.112)	(0.085)	(0.093)	(0.155)	(0.089)
Senior High school graduates	0.926***	1.038***	0.652***	0.521***	0.597***	0.432***	0.108	0.064	0.172
	(0.123)	(0.109)	(0.127)	(0.099)	(0.181)	(0.091)	(0.396)	(0.558)	(0.436)
Junior college etc. graduates	1.458***	1.516***	1.071***	0.808***	0.608**	0.648***	0.215	0.273	0.337
	(0.144)	(0.163)	(0.114)	(0.090)	(0.219)	(0.087)	(0.443)	(0.476)	(0.519)
University etc. graduates	1.684***	1.511***	1.665*	1.099***	1.178***	0.239	0.462	0.717	0.093
	(0.186)	(0.142)	(0.828)	(0.127)	(0.232)	(0.185)	(0.383)	(0.450)	(0.356)
Scheduled working hours (y/y chg.)	0.128***	0.038***	0.228***	0.144***	0.058***	0.230***	0.120***	0.058***	0.175***
	(0.034)	(0.005)	(0.047)	(0.022)	(0.006)	(0.027)	(0.015)	(0.006)	(0.017)
Constant	2.890***	3.124***	2.642***	2.885***	3.060***	2.656***	4.181***	3.970***	4.176***
	(0.246)	(0.203)	(0.519)	(0.230)	(0.309)	(0.243)	(0.475)	(0.416)	(0.612)
Observations	1,102,664	587,108	468,328	1,314,989	625,090	633,383	525,839	210,584	289,196

Notes: ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively. Standard errors (robust for clustering by industry and firm size) are in parentheses. The coefficients on industry and firm size dummies are omitted from the table. The label "Junior college etc. graduate" represents junior college, upper secondary specialized training school, or professional training college graduates, while "University etc. graduate" represents university or graduate school graduates.

Figure 1. Labor market conditions and scheduled cash earnings



Notes: Figures for scheduled cash earnings are from the *Monthly Labour Survey* (from 2016:Q1 onward are based on continuing observations following sample revisions). Figures for the output gap are those estimated by the Bank of Japan.
Sources: Ministry of Health, Labour and Welfare; Bank of Japan.

Figure 2. BIC for each specification of finite mixture model

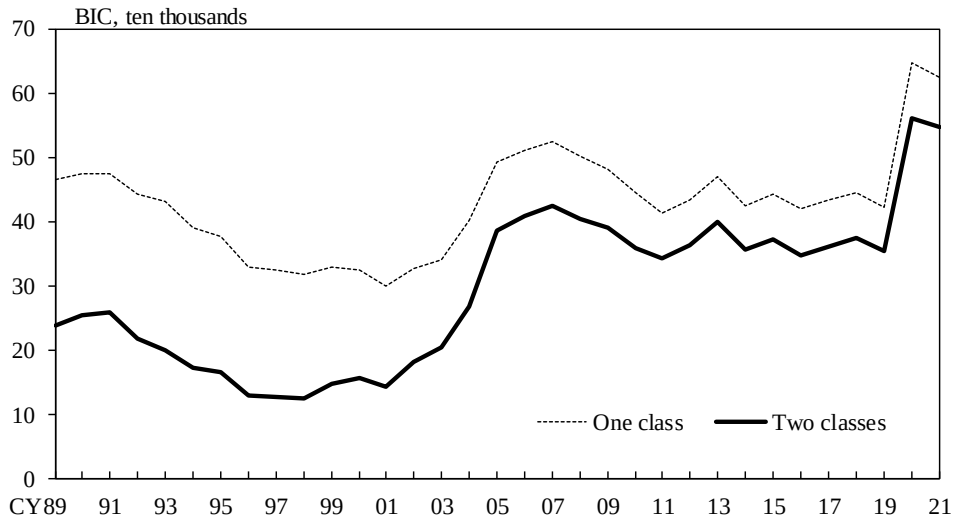


Figure 3. Estimated coefficients in finite mixture model

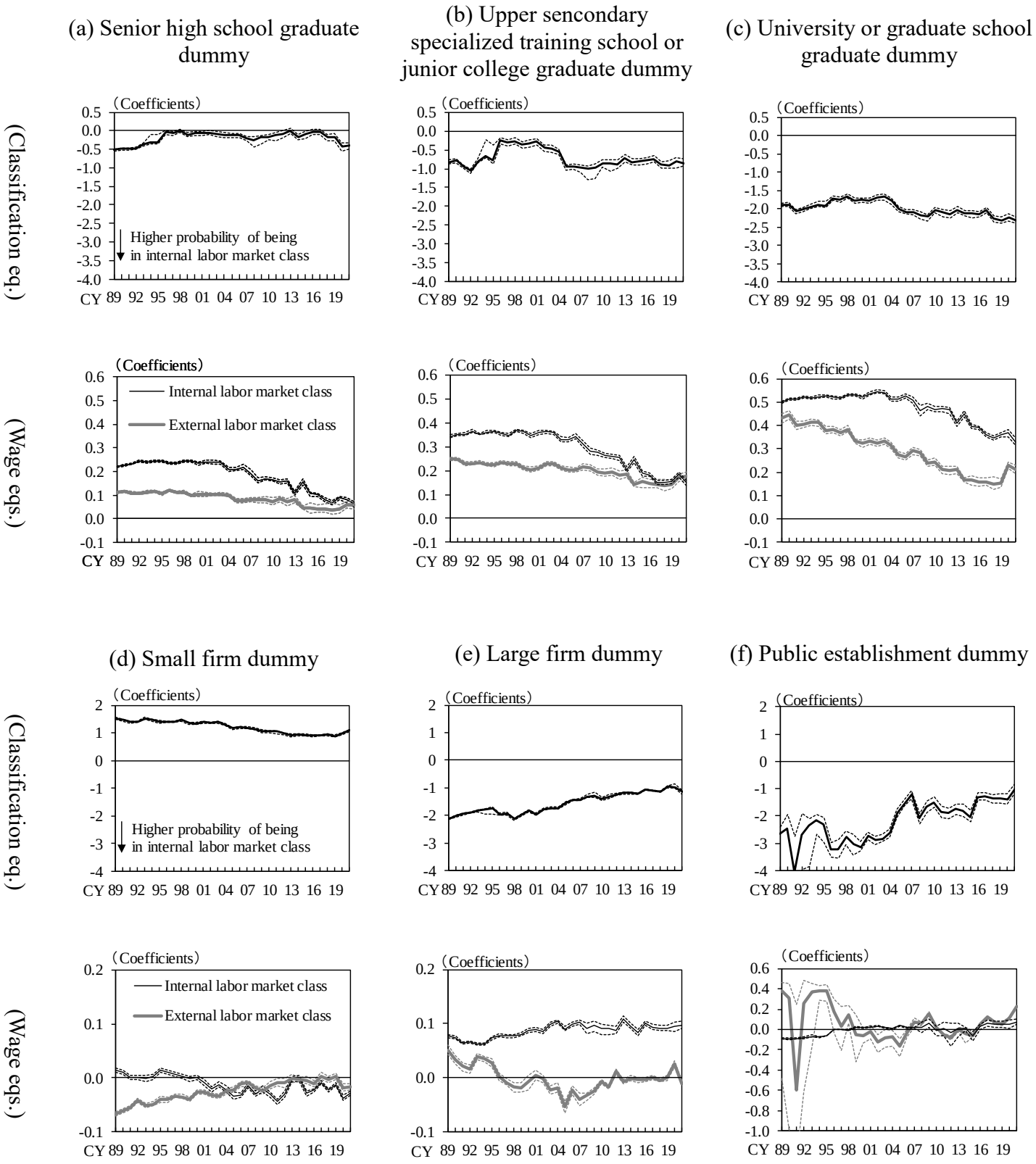
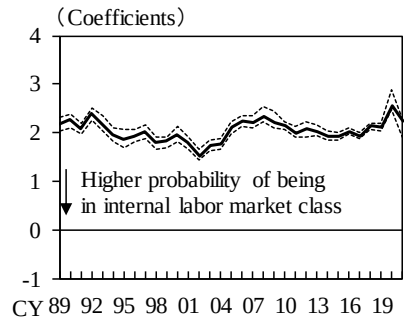


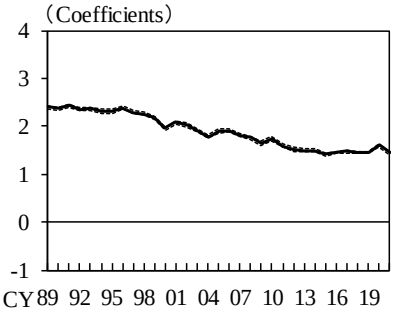
Figure 3. Estimated coefficients in finite mixture model (continued)

(g) Age 60 and above dummy

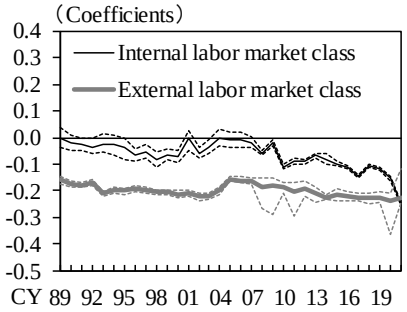
(h) Female dummy

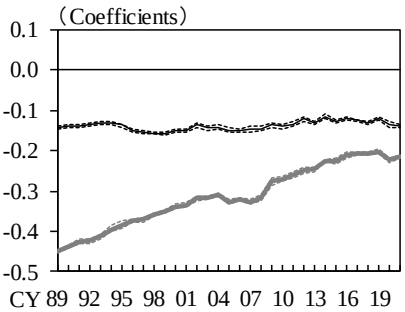
(Classification eq.)





(Wage eqs.)

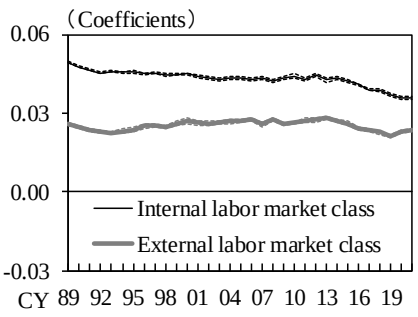


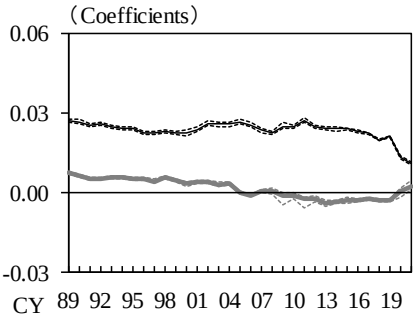


(i) Years of service

(j) Years of external experience

(Wage eqs.)





Notes: The dotted lines represent 95 percent confidence intervals estimated by bootstrap method. The constant terms and the coefficients on the squared years of service and on the squared years of external experience are omitted from the figure.

Figure 4. Distribution of probability of being in internal labor market class for 2021

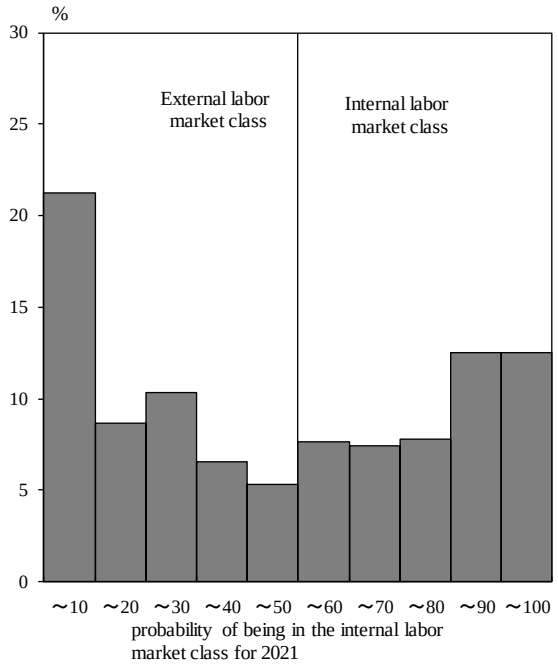
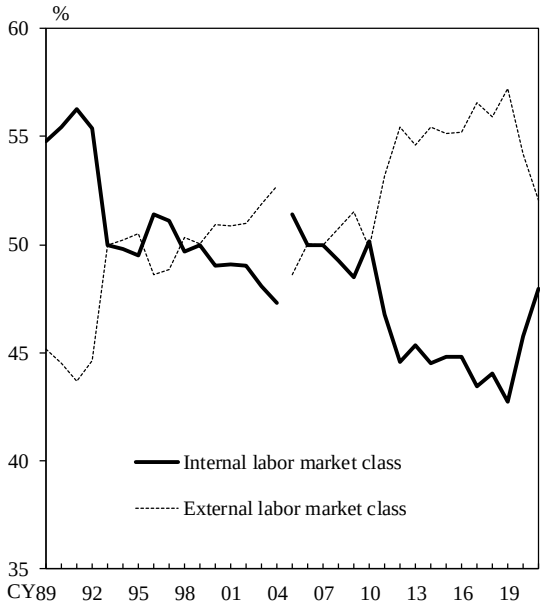


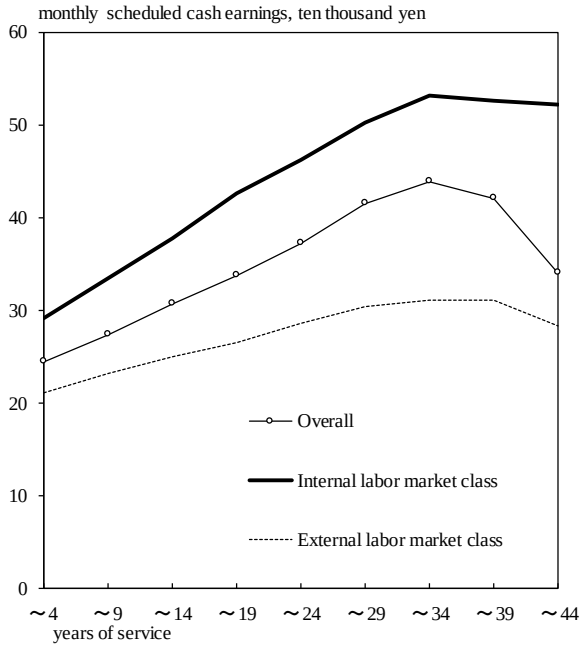
Figure 5. Proportion of full-time workers in internal and external labor market classes



Note: A discontinuity arises between 2004 and 2005 due to changes in questionnaire.

Figure 6. Wage curves in internal and external labor market classes: averages over 2017–2021

(a) Years of service based



(b) Age based

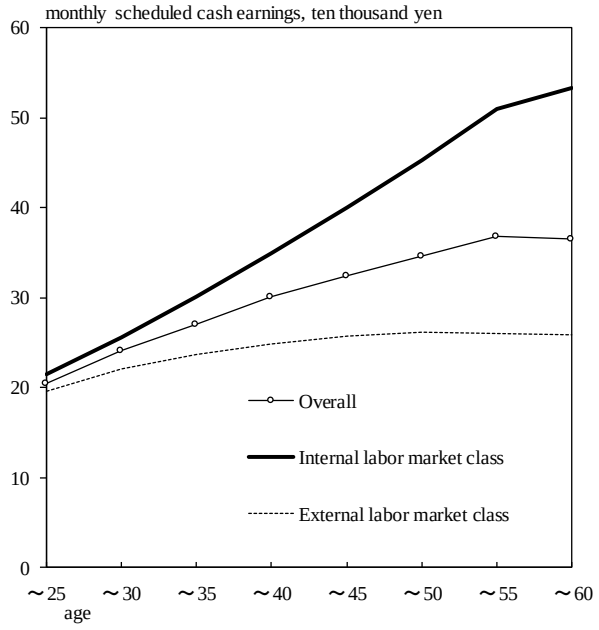
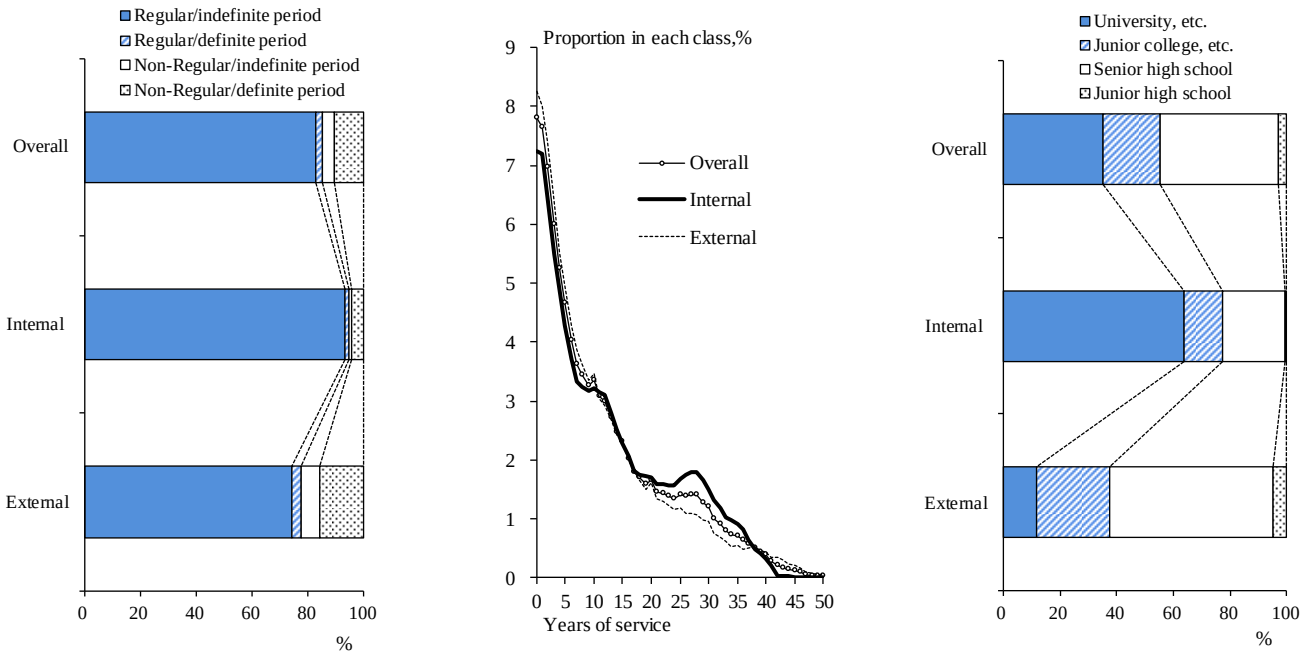


Figure 7. Composition of labor market classes by full-time workers' type: 2017–2021

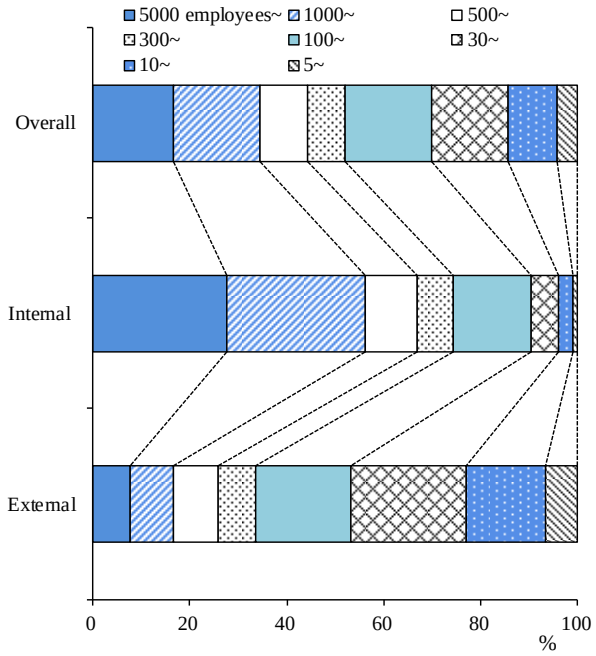
(a) Type of employment (b) Years of service (c) Educational background



Note: In panel (c), "University etc." represents university or graduate school graduates, while "Junior college etc. " represents junior college, upper secondary specialized training school, or professional training college graduates.

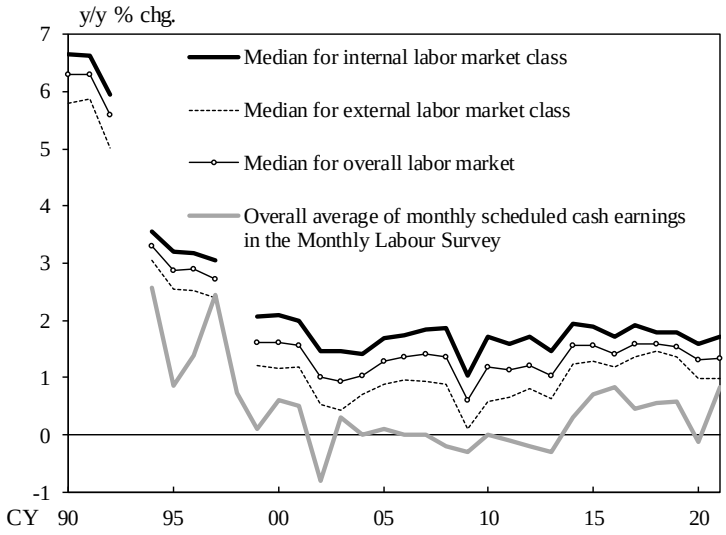
Figure 8. Composition of labor market classes by firms' type: 2017–2021

(a) Number of firms' employees (b) Industry



Industry	Proportion of workers in each class		
	Overall	Internal	External
Manufacturing	24.1	24.4	23.7
Construction	6.9	5.2	8.3
Electricity, gas, heat supply and water	0.8	1.4	0.3
Wholesale and retail trade	14.5	16.4	12.9
Services	53.7	52.6	54.8
Medical, healthcare and welfare	16.7	11.1	21.2
Amusement, accommodations, eating and drinking	4.0	3.1	4.7
Transport and postal	7.7	6.6	8.5
Finance and insurance, professional and technical	7.9	11.1	5.3
Information and communications	4.2	6.7	2.1
Others	13.4	14.0	12.9
Overall	100.0	100.0	100.0

Figure 9. Wage growth rates of full-time workers



Notes: Figures in each year are those in June. Figures from the *Monthly Labour Survey* from 2016:Q1 onward are based on continuing observations following sample revisions.
Source: Ministry of Health, Labour and Welfare.

Figure 10. Distributions of individual full-time workers' wage growth rates

(a) Overall (b) Internal labor market class (c) External labor market class

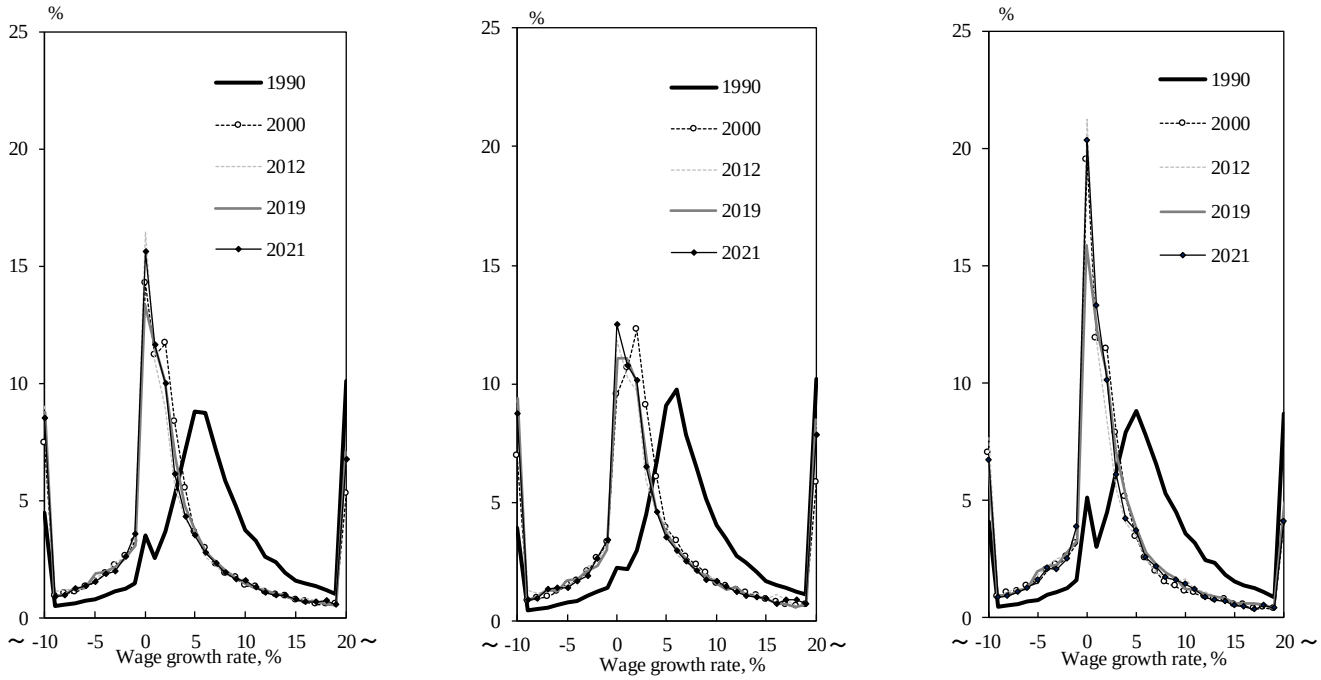
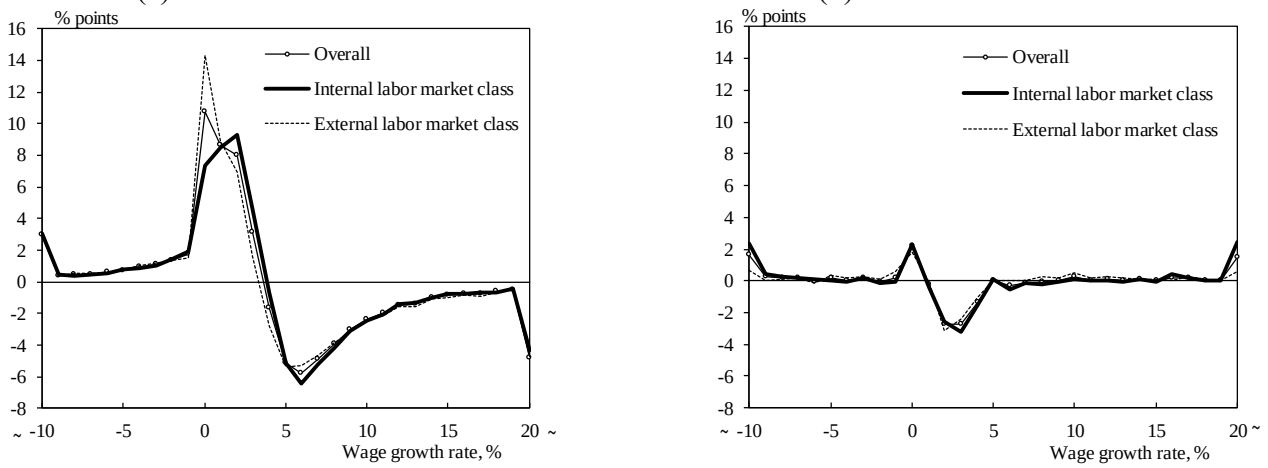


Figure 11. Changes in distributions of individual full-time workers' wage growth rates

(a) From 1990 to 2000 (b) From 2000 to 2012



(c) From 2012 to 2019 (d) From 2019 to 2021

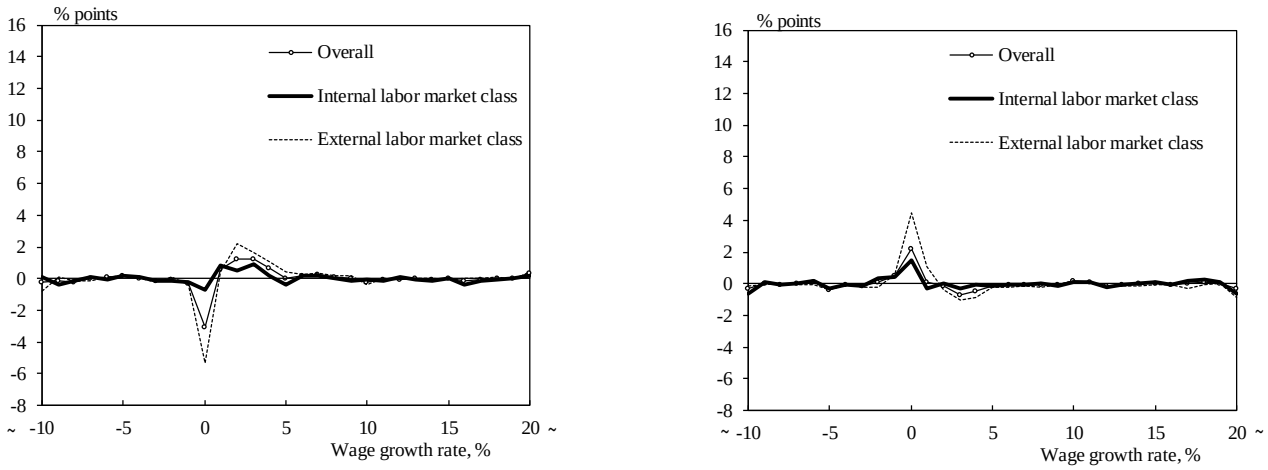
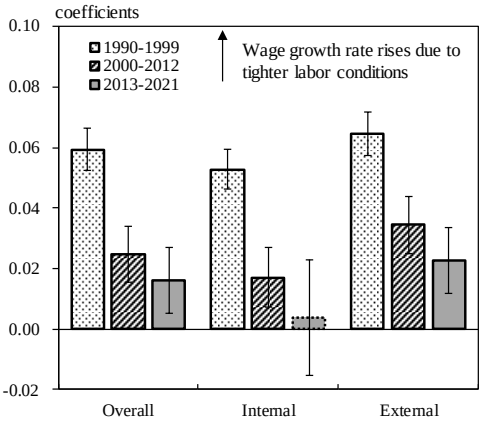
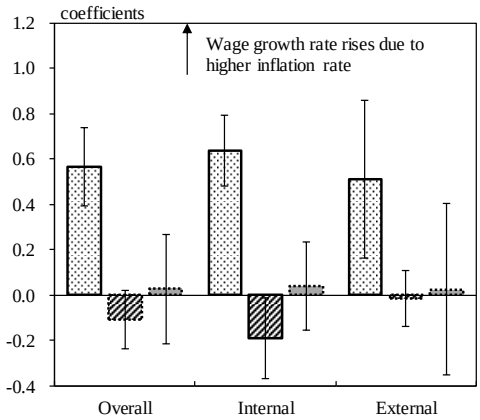


Figure 12. Estimated coefficients in equation (3)

(a) Employment conditions DI



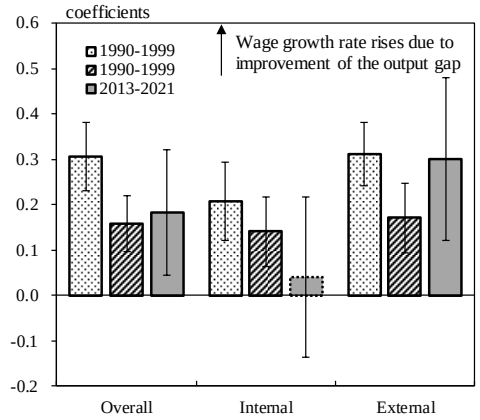
(b) Previous-year CPI inflation



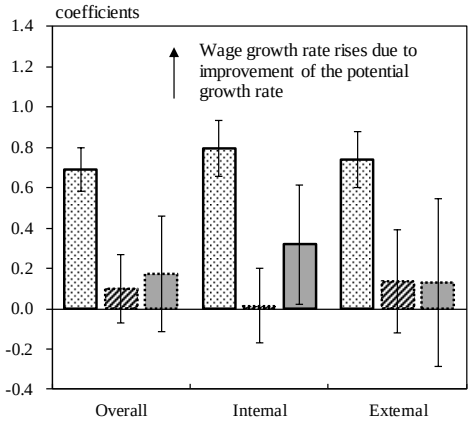
Notes: The dotted lines indicate that coefficients are not statistically significant at 10 percent. The bands represent 90 percent confidence intervals.

Figure 13. Estimated coefficients in equation (4)

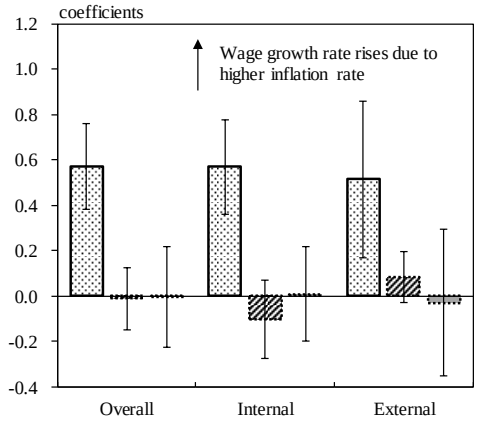
(a) Output gap



(b) Potential growth



(c) Previous-year CPI inflation



Notes: The dotted lines indicate that coefficients are not statistically significant at 10 percent. The bands represent 90 percent confidence intervals.

Table A.1. Detailed estimation results for equation (3)

	Dependents: Monthly scheduled cash earnings (y/y chg.)								
	Sample period: 1990-1999			Sample period: 2000-2012			Sample period: 2013-2021		
	Internal	Indeterminate	External	Internal	Indeterminate	External	Internal	Indeterminate	External
Employment conditions DI (inverse)	0.053***	0.062***	0.062***	0.013*	0.028***	0.034***	0.008	0.014	0.022**
	(0.004)	(0.005)	(0.004)	(0.007)	(0.007)	(0.008)	(0.012)	(0.015)	(0.008)
CPI inflation rate in previous year	0.578***	0.502**	0.618***	-0.177	-0.082	-0.016	-0.026	0.018	0.039
(y/y chg.)	(0.088)	(0.236)	(0.178)	(0.125)	(0.089)	(0.103)	(0.181)	(0.161)	(0.241)
Control variables									
Firm's margin	0.005	0.026	0.003	-0.014*	-0.002	-0.001	-0.031*	0.015	0.004
	(0.007)	(0.021)	(0.016)	(0.007)	(0.008)	(0.006)	(0.018)	(0.013)	(0.016)
Years of service	-0.103***	-0.145***	-0.228***	-0.057***	-0.099***	-0.188***	-0.099***	-0.093***	-0.124***
	(0.015)	(0.024)	(0.032)	(0.011)	(0.027)	(0.020)	(0.022)	(0.025)	(0.023)
Years of service (squared)	-0.000	0.002**	0.004***	-0.001***	0.000	0.003***	0.000	-0.000	0.002***
	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)
Aged 60 or above	-2.625***	-1.689***	-2.555***	-2.612***	-1.111*	-2.187***	-2.709***	-1.375***	-2.246***
	(0.402)	(0.309)	(0.389)	(0.443)	(0.619)	(0.163)	(0.303)	(0.468)	(0.338)
Female	-0.709***	-0.248	0.379**	-0.681***	0.019	0.066	-0.443***	-0.152	-0.022
	(0.136)	(0.229)	(0.155)	(0.096)	(0.199)	(0.111)	(0.111)	(0.179)	(0.136)
Senior High school graduates	0.972***	0.871***	0.451***	0.356	0.631***	0.310**	0.941**	0.461	0.116
	(0.084)	(0.128)	(0.151)	(0.218)	(0.094)	(0.109)	(0.333)	(0.489)	(0.544)
Junior college etc. graduates	1.413***	1.222***	0.775***	0.450*	0.814***	0.353***	0.906	0.239	0.200
	(0.081)	(0.168)	(0.158)	(0.260)	(0.188)	(0.103)	(0.529)	(0.433)	(0.553)
University etc. graduates	1.455***	1.041***	1.759	0.963***	0.759***	-0.178	1.598***	0.359	0.084
	(0.104)	(0.121)	(1.148)	(0.275)	(0.202)	(0.178)	(0.388)	(0.597)	(0.470)
Scheduled working hours (y/y chg.)	0.035***	0.080***	0.241***	0.056***	0.070***	0.252***	0.050***	0.064***	0.197***
	(0.005)	(0.022)	(0.053)	(0.007)	(0.005)	(0.028)	(0.007)	(0.009)	(0.016)
Constant	5.321***	4.615***	4.078***	3.397***	2.866***	2.933***	2.652***	3.881***	3.056***
	(0.223)	(0.514)	(0.692)	(0.411)	(0.245)	(0.270)	(0.676)	(0.570)	(0.710)
Observations	469,571	207,391	327,890	434,643	287,275	470,939	134,033	131,963	208,444

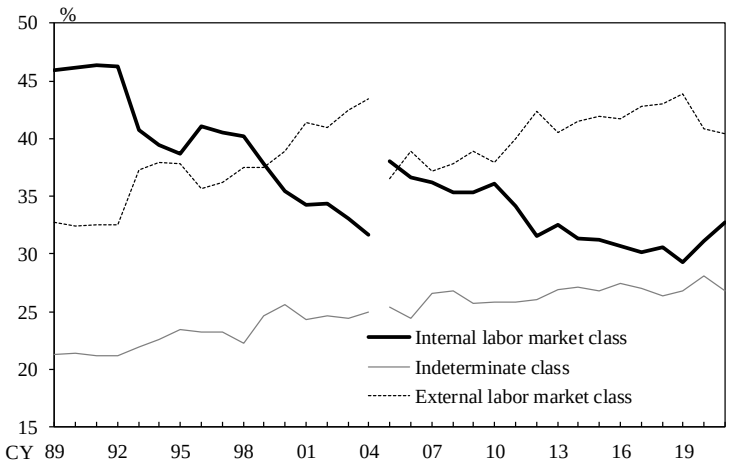
Notes: ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively. Standard errors (robust for clustering by industry and firm size) are in parentheses. The coefficients on industry and firm size dummies are omitted from the table. The label "Junior college etc. graduates" represents junior college, upper secondary specialized training school, or professional training college graduates, while "University etc. graduates" represents university or graduate school graduates.

Table A.2. Detailed estimation results for equation (4)

	Dependents: Monthly scheduled cash earnings (y/y chg.)								
	Sample period: 1990-1999			Sample period: 2000-2012			Sample period: 2013-2021		
	Internal	Indeterminate	External	Internal	Indeterminate	External	Internal	Indeterminate	External
Output gap	0.183***	0.185***	0.263***	0.098*	0.164***	0.169***	0.097	0.154	0.300**
	(0.057)	(0.040)	(0.045)	(0.052)	(0.049)	(0.056)	(0.122)	(0.126)	(0.122)
Potential growth rate	0.874***	0.993***	0.795***	0.048	-0.036	0.129	0.493**	0.043	0.057
	(0.096)	(0.088)	(0.092)	(0.113)	(0.199)	(0.159)	(0.184)	(0.157)	(0.255)
CPI inflation rate in previous year	0.487***	0.416	0.571***	-0.111	0.009	0.077	-0.081	-0.001	-0.012
(y/y chg.)	(0.111)	(0.239)	(0.185)	(0.111)	(0.094)	(0.083)	(0.184)	(0.157)	(0.233)
Control variables									
Firm's margin	-0.001	0.016	-0.000	-0.015**	-0.008	-0.013*	-0.018	0.022*	0.016
	(0.005)	(0.013)	(0.013)	(0.006)	(0.006)	(0.007)	(0.019)	(0.013)	(0.016)
Years of service	-0.104***	-0.144***	-0.227***	-0.058***	-0.099***	-0.187***	-0.100***	-0.094***	-0.124***
	(0.015)	(0.024)	(0.031)	(0.011)	(0.027)	(0.020)	(0.022)	(0.025)	(0.023)
Years of service (squared)	-0.000	0.002**	0.004***	-0.001***	0.001	0.003***	0.000	0.000	0.002***
	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)
Aged 60 or above	-2.621***	-1.683***	-2.563***	-2.608***	-1.119*	-2.166***	-2.727***	-1.387***	-2.225***
	(0.391)	(0.304)	(0.390)	(0.441)	(0.613)	(0.158)	(0.289)	(0.459)	(0.338)
Female	-0.726***	-0.250	0.376**	-0.678***	-0.006	0.054	-0.450***	-0.140	-0.015
	(0.136)	(0.242)	(0.153)	(0.095)	(0.197)	(0.112)	(0.105)	(0.169)	(0.135)
Senior High school graduates	0.984***	0.884***	0.437***	0.421**	0.676***	0.351***	1.027***	0.478	0.120
	(0.083)	(0.128)	(0.147)	(0.185)	(0.089)	(0.112)	(0.338)	(0.480)	(0.541)
Junior college etc. graduates	1.446***	1.280***	0.759***	0.527**	0.883***	0.388***	0.989*	0.264	0.226
	(0.090)	(0.161)	(0.154)	(0.231)	(0.195)	(0.106)	(0.530)	(0.430)	(0.559)
University etc. graduates	1.482***	1.062***	1.766	1.048***	0.841***	-0.131	1.690***	0.378	0.114
	(0.101)	(0.119)	(1.140)	(0.239)	(0.219)	(0.182)	(0.386)	(0.583)	(0.475)
Scheduled working hours (y/y chg.)	0.034***	0.080***	0.241***	0.056***	0.070***	0.252***	0.051***	0.065***	0.199***
	(0.005)	(0.022)	(0.053)	(0.007)	(0.005)	(0.028)	(0.007)	(0.009)	(0.017)
Constant	3.205***	2.531***	2.583***	3.307***	2.732***	2.543***	2.714***	4.311***	3.884***
	(0.268)	(0.300)	(0.492)	(0.345)	(0.221)	(0.286)	(0.579)	(0.565)	(0.749)
Observations	469,571	207,391	327,890	434,643	287,275	470,939	134,033	131,963	208,444

Notes: ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively. Standard errors (robust for clustering by industry and firm size) are in parentheses. The coefficients on industry and firm size dummies are omitted from the table. The label "Junior college etc. graduates" represents junior college, upper secondary specialized training school, or professional training college graduates, while "University etc. graduates" represents university or graduate school graduates.

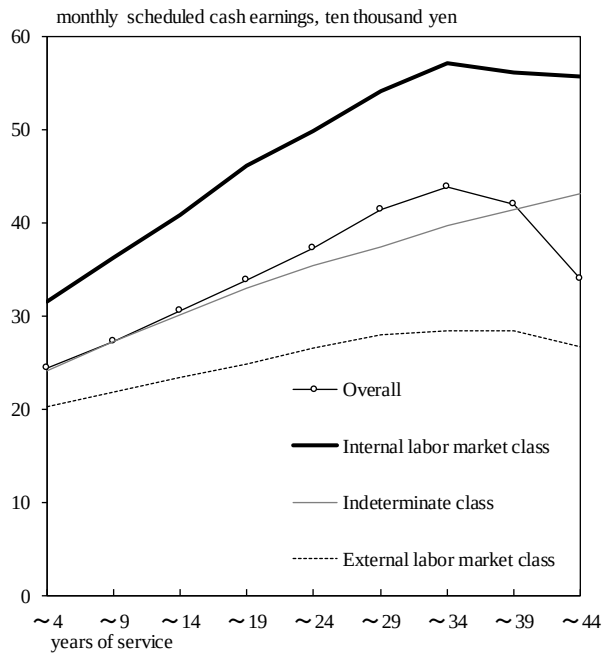
Figure A.1. Proportion of full-time workers in each labor market class



Note: A discontinuity arises between 2004 and 2005 due to changes in questionnaire.

Figure A.2. Wage curves for each labor market class: averages over 2017–2021

(a) Years of service based



(b) Age based

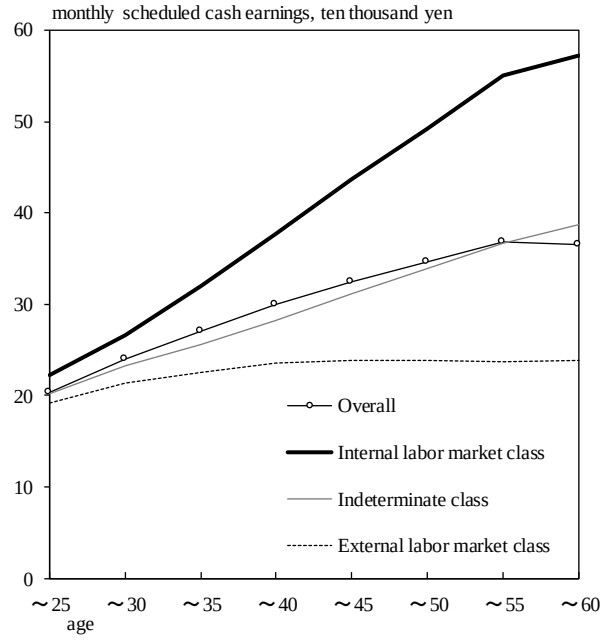
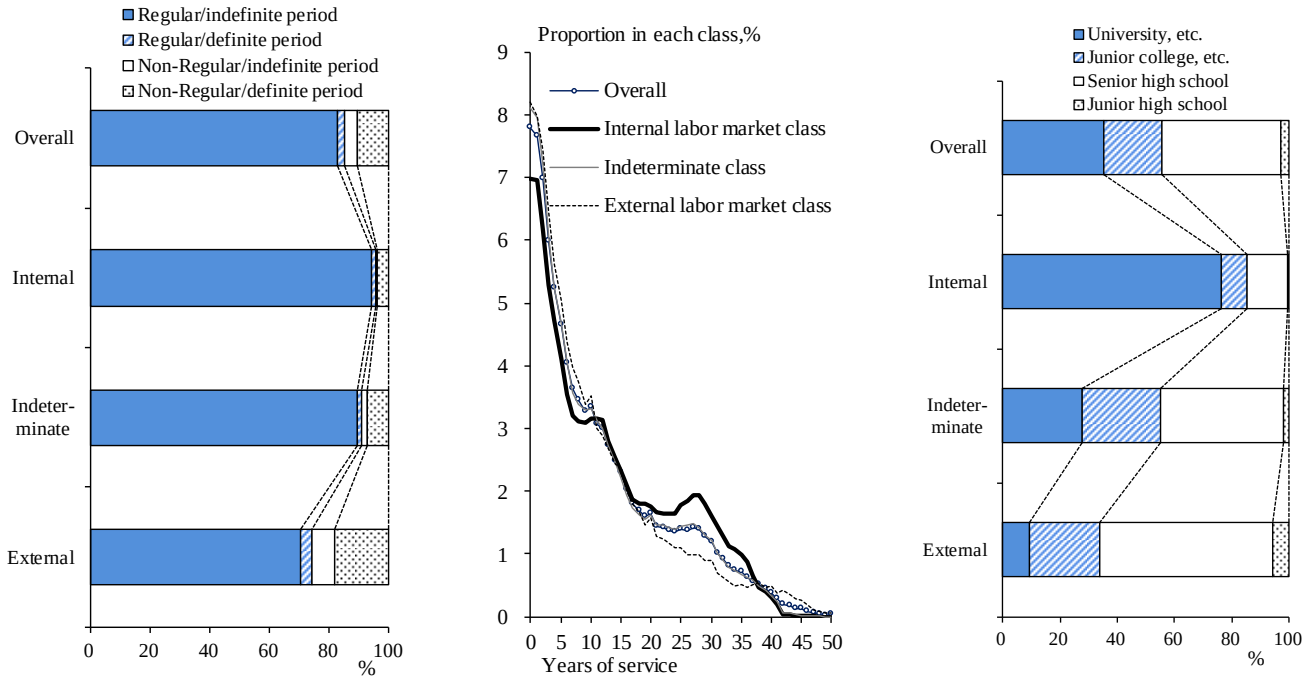


Figure A.3. Composition of labor market classes by full-time workers' type: 2017–2021

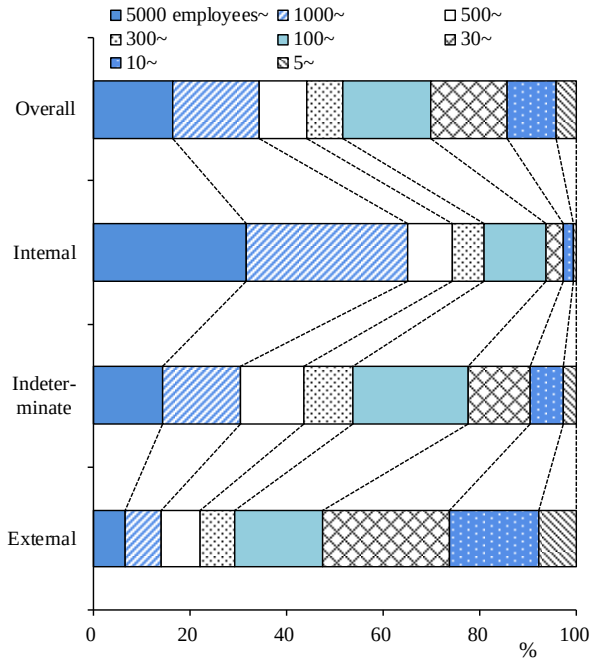
(a) Type of employment (b) Years of service (c) Educational background



Note: In panel (c), "University etc. " represents university or graduate school graduates, while "Junior college etc. " represents junior college, upper secondary specialized training school, or professional training college graduates.

Figure A.4. Composition of labor market classes by firms' type: 2017–2021

(a) Number of firms' employees (b) Industry



Industry	Proportion of workers in each class			
	Overall	Internal	Indeterminate	External
Manufacturing	24.0	23.1	27.2	22.6
Construction	6.9	5.3	5.9	8.8
Electricity, gas, heat supply and water	0.8	1.6	0.7	0.2
Wholesale and retail trade	14.5	17.2	14.2	12.8
Services	53.8	52.9	52.0	55.6
Medical, healthcare and welfare	16.7	9.4	15.8	22.7
Amusement, accommodations, eating and drinking	4.0	2.8	4.0	4.8
Transport and postal	7.7	5.9	8.4	8.5
Finance and insurance, professional and technical	7.9	12.8	6.7	5.1
Information and communications	4.2	7.5	4.4	1.6
Others	13.4	14.5	12.8	12.9
Overall	100.0	100.0	100.0	100.0

Figure A.5. Distributions of individual full-time workers' wage growth rates

(a) Internal labor market class (b) Indeterminate class (c) External labor market class

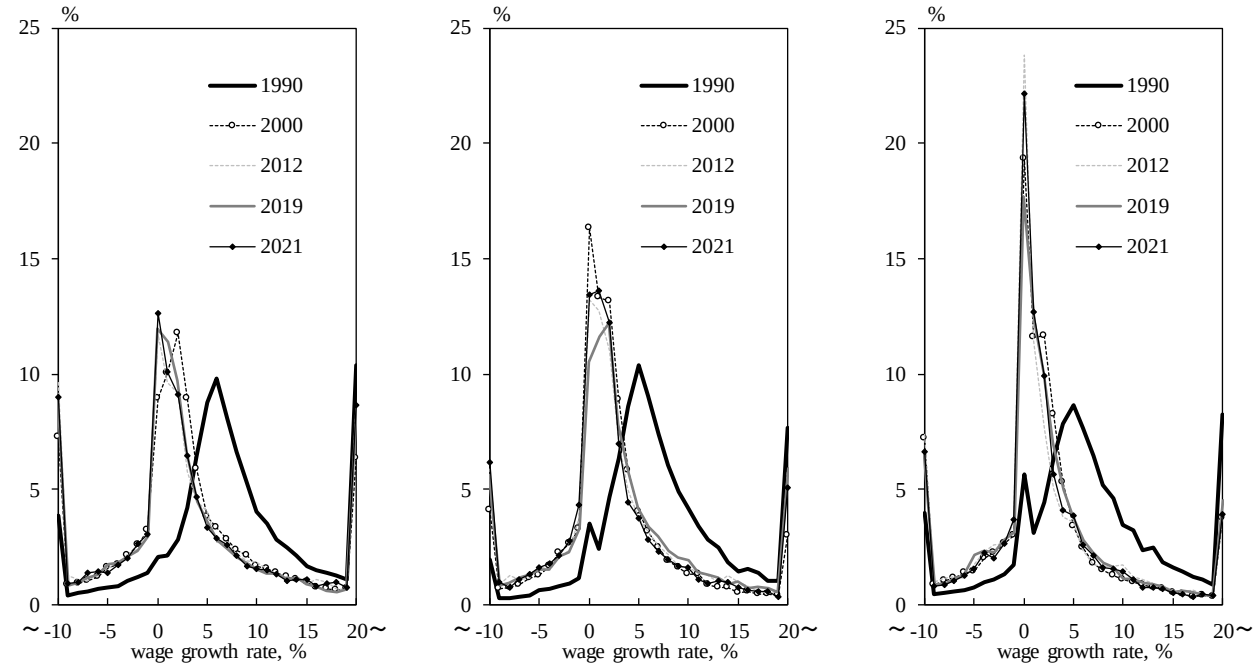
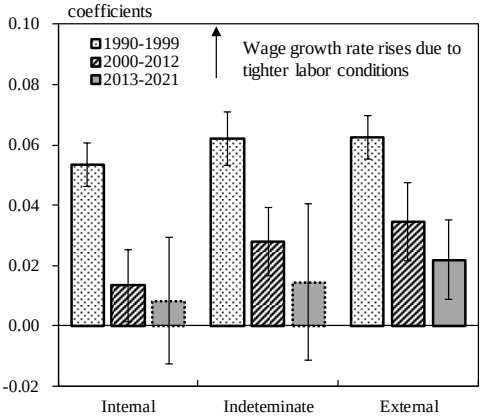
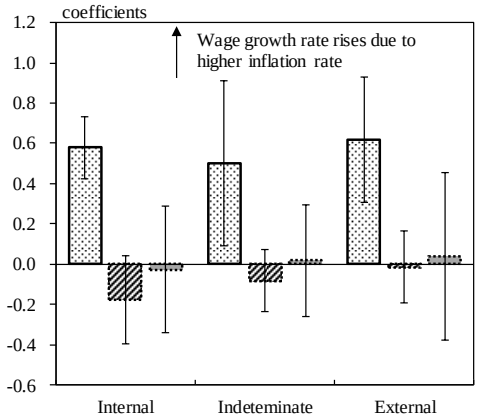


Figure A.6. Estimated coefficients in equation (3)

(a) Employment conditions DI



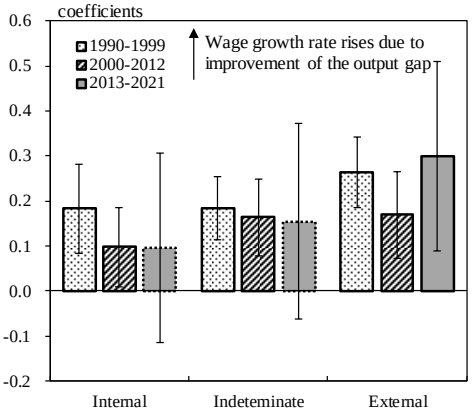
(b) Previous-year CPI inflation



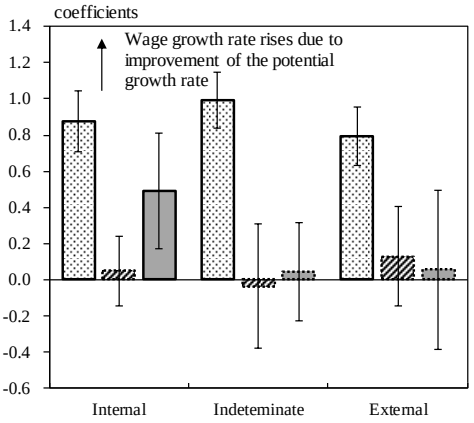
Notes: The dotted lines indicate that coefficients are not statistically significant at 10 percent. The bands represent 90 percent confidence intervals.

Figure A.7. Estimated coefficients in equation (4)

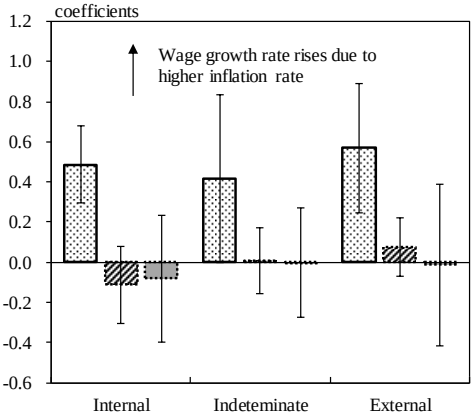
(a) Output gap



(b) Potential growth

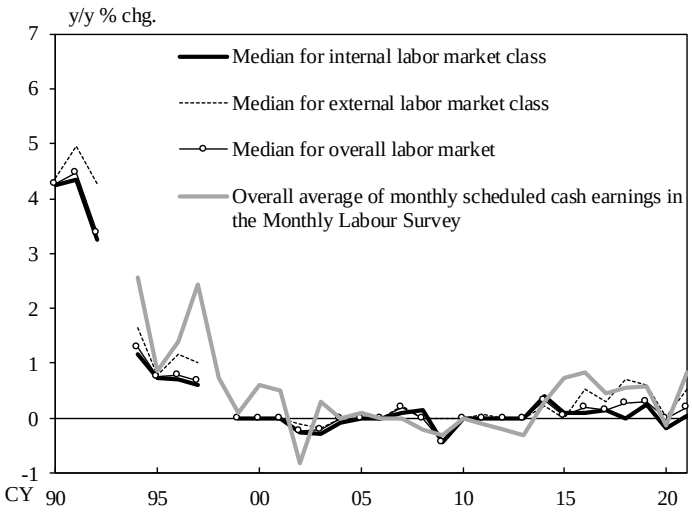


(c) Previous-year CPI inflation



Notes: The dotted lines indicate that coefficients are not statistically significant at 10 percent. The bands represent 90 percent confidence intervals.

Figure B.1. Wage growth rates of full-time workers without seniority-related wage increases



Notes: Figures are those for June of the current year. Figures from the Monthly Labour Survey from 2016:Q1 onward are based on continuing observations following sample revisions.
Source: Ministry of Health, Labour and Welfare.