# Does downsizing take a toll on retained staff? An analysis of increased working hours during recessions using Japanese micro data

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**Abstract**

Using several kinds of micro data from household, employee, and retrospective surveys, this paper examines the increase in the working hours of regular male employees in Japan during the recession of the early 2000s. The most important finding of this paper is that working hours consistently tended to be longer among regular male employees in firms with major employee adjustments. The results suggest that the existence of abundant fixed duties necessary to maintain the internal specifics of an organization primarily accounted for the increase in working hours during the recession in Japan.

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Employees' working hours usually fluctuate with the workload. Moreover, employees generally work longer hours in periods of boom than during recession. However, the exact opposite phenomenon has been observed in some countries after the most recent serious recession occurred in 2008. For example, a survey of more than 300 companies in the United States and Canada found that nearly two-thirds of employers asked their workers to put in more hours than normal after the global financial crisis of 2008 began (The Towers Watson [2011]). Another report indicates that over a third of those surveyed in the UK reported an increase in unpaid overtime because of the recession (Callcredit [2009]).

A similar phenomenon was also observed over a decade ago in Japan. The average working hours of regular male employees increased between the late 1990s and the early 2000s, when Japan's economy underwent a recession. According to the *iLibrary* of the Organization for Economic Cooperation and Development (OECD), there has been a decline in Japan's average annual working hours over the past decades. While the OECD data include part-time workers, the unusual fact that working hours of Japanese full-time regular employees have increased between the late 1990s and the early 2000s, under prolonged recession, has gone unnoticed. To the best of our knowledge, this is the first analysis of the counter-cyclical phenomenon of an increase in working hours even under severe recession. Our hypothesis is that recent changes in Japanese employment practice are responsible for this phenomenon, as discussed below.

Long-term employment and seniority-based wage payments are well-known characteristics of Japanese firms. One theoretical explanation for this is that it enables the accumulation of firm-specific human capital (Hashimoto and Raisian 1985, Mincer and Higuchi 1988). The other explanation is that rapid technological innovation and shortage of skilled workers created internal labor markets during the rapid growth era of the 1960s (Koike 1988). Both these theories predict that labor-hoarding behavior in order to save large amount of investment costs may be prevalent among Japanese firms during recessions.

An important feature of Japan's lifetime employment system is the two-tier structure of a typical firm. In order to protect regular employees from recessions, Japanese firms hire fixed-term contract or part-time workers as a buffer for contingencies. Therefore, a typical practice in Japanese firms is to reduce non-regular workers during a recession by denying contract renewal, while hoarding regular workers as much as possible. This practice is also prevalent owing to the strict employment protection legislation for regular employees in Japan. In such an environment, firms invest considerable resources towards the accumulation of job-related skills for regular

employees, while the corresponding investment for non-regular employees remains small. Substantial training costs coupled with significant hiring and firing costs are responsible for Japanese firms avoiding a reduction in the number of regular employees, and their attempting to cut personnel costs by reducing the working hours of incumbent employees during an economic recession. Such a labor-hoarding practice is rational under the assumption that the negative shock is temporary or minor. On the other hand, when the negative shock is expected to be persistent and substantial, even firms with a propensity to hoard labor are compelled to reduce the number of regular employees by freezing hiring and accelerating dismissals. As a result, if the firm has certain fixed activities conducted almost independently of production, the workload on every remaining employee may increase in spite of the recession. Consequently, the smaller number of regular employees who are retained after the company has downsized may need to work longer hours.

Furthermore, since the end of the 1990s, an increasing number of Japanese firms have introduced measures to reduce employment through payment of extra retirement allowances. Certain studies have emphasized that the Japanese wage system has been in transition since the end of the 1990s (for example, Genda 1998, Rebick 2005, Ono 2010). They suggested that the labor cost has become more flexible in Japanese firms as seniority, such as age and tenure, no longer play dominant roles in determining wages, and that these firms are more likely to pay wages based on the short-term performances of individual workers. The increasing possibilities of dismissal along with the transitions in the payment system during this period may have induced workers to work longer hours.

In addition, since the late 1990s, a large number of non-regular workers are being employed as a more effective method to secure flexibilities in wage and employment. During the 1990s, Japanese firms changed the proportion of regular and non-regular workers by increasing the ratio of the latter in order to prepare for the uncertainties of the impending downturn. According to *Labour Force Survey*, the proportion of non-regular workers was 16.4 percent in 1985, but grew rapidly to 20.9 percent in 1995, 32.6 percent in 2005, and 34.3 percent in 2010. The ratio of non-regular workers almost doubled during the prolonged recession and non-regular employees replaced regular ones in numerous jobs. Thus, the increase in the number of new non-regular employees such as temporary agency workers may increase the job burden and working hours of regular workers who oversee these non-regular workers in terms of managing teams and adjusting team production.

## Overview

In this section, we describe the manner in which the working hours for regular male employees have changed since the early 1990s owing to the prolonged recession (Japan's so-called "lost decade").

Japan's employment system is characterized by long-term employment that begins immediately after the completion of education and lasts until the age of mandatory retirement is attained.[1] The consequences of this so-called "lifetime" employment system are long job tenure and high job retention rates for prime-aged male workers. A *seishain*, or regular employee, works full-time on an employment contract that does not specify the date of termination, which effectively implies that the employee will continue to work for that firm until the mandatory retirement.[2]

Figure 1 presents the series for the average weekly number of working hours of prime-aged (25–49) regular male employees and the male unemployment rate from 1986 to 2007. Both series have been adapted from *Special Survey of the Labour Force Survey* and data obtained from the special questionnaire of *Labour Force Survey*.[3] Both surveys are conducted by the Statistics Bureau, Ministry of Internal Affairs and Communications, Japan. It is evident from Figure 1 that the working hours of prime-age regular male employees declined rapidly towards the end of the 1980s and up to the early 1990s. This reflects a reduction of the (straight-hour) workweek from 48 hours to 40 hours, as mandated by the 1988 amendment to the Labor Standards Act, and the effect of the economic recession that occurred in the early 1990s. After the decline in the early 1990s, the number of working hours remained around 48 hours per week until 1997. However, after 1998 when the recession worsened, this number rose and almost equaled the number of working hours during the economic boom at the end of the 1980s. In other words, working hours per week grew from 47.7 hours in 1998 to 50.2 hours in

[1] Although this sounds contrary to popular belief, Kato (2001) emphasized the enduring nature of the lifetime employment practice in Japan using pre-1997 data. Further, Kambayashi and Kato (2011) also found that the job stability of regular employees did not fall in particular during the first five years of Japan's lost decade. However, they did suggest that the job stability of regular employees eventually fell, albeit slightly, towards the end of the 1990s up to early 2000. Therefore, further data is necessary to test whether the traditional Japanese employment system has undergone a complete transformation in response to prolonged recessions.

[2] On certain occasions, even if an employee satisfies this condition, he/she is not considered as a "regular" employee. Thus, numerous surveys, including the *Labour Force Survey*, directly ask what the respondent is called by the employer in order to clearly classify regular and non-regular workers.

[3] Unless noted otherwise, all analyses using *the Labour Force Survey* from this point forward are based on calculations using weights provided by the Statistics Bureau, Ministry of Internal Affairs and Communications, Japan.

2004, which is close to the level recorded in 1988 (51.1 hours).[4] Coupled with the domestic recession that began in the early 1990s, the Asian financial crisis of 1998 (which hit all of Asia, including Japan), further dampened the economy. At this time, the Bank of Japan had introduced a zero-interest rate policy to prevent the economy from falling into further recession. However, the recession deepened after 1998 until the early 2000s, with the unemployment rate rising to an unprecedented level during this period, as shown in Figure 1.

Further, Figure 2 presents the divergence in working hours among certain groups of regular male employee groups for 1988 and 2004, two specific years in which the working hours peaked. Although the average number of working hours was about the same for both 1988 and 2004, several other different features are evident from Figure 2. First, in 1988, employees in their 20s worked the longest hours among all age groups; the younger the employee, the longer he worked. However, in 2004, employees in their 30s worked the longest hours. Moreover, employees in their 40s, who used to work for a relatively lesser number of hours in the 1980s, began working longer hours, enough to equal those of workers in their 20s. Second, in 1988, highly educated employees worked a lesser number of hours than less-educated ones. However, in 2004, there was an increase in the working hours of highly educated employees. Lastly, white-collar employees worked for a greater number of hours than their blue-collar counterparts did in 1988, with this tendency increasing in 2004.

Two aspects may be emphasized from these observations. First, the working hours changed counter-cyclically from the end of the 1990s to the early 2000s. This may be regarded as a rather unique phenomenon, particularly since the typical practice adopted in Japanese firms during previous recessions was to reduce working hours as much as possible in order to protect employees from dismissal;[5] therefore, working hours had changed pro-cyclically in the past. Second, during this period there was a change in the characteristics of male employees who worked relatively longer hours. The employees whose working hours increased during this period were in their 30s, highly educated, and white-collar workers. What has led to these changes during this

[4] Although not shown in the figure, even after controlling for demographic and compositional changes that occurred during the two decades (such as the rising proportion of elderly persons, lower fertility rates, increasing number of years in education, and decline in marriage rate), the series presented in the figure remains almost the same. Using a rich time-use survey, Kuroda (2010) reported a similar trend for full-time Japanese workers.

[5] Some studies have explored the speed of employment and adjustment of working hours for Japan and other countries using both aggregate and industry-level data (for example, Tachibanaki 1987, Hashimoto and Raisian 1988, Abraham and Houseman 1989). A large number of these studies suggest that the adjustment of employment is significantly slower in Japan than in other countries.

period? In order to investigate the reasons for this increase in working hours or counter-cyclicality, we introduce four possible mechanisms in the next section.

## Underlying Mechanisms

### *Adjustment of Labor*

In this section, several hypotheses are presented in order to explain why working hours of prime-age regular male employees tended to be longer during the recession. As already indicated, until Japan underwent the long recession in the 1990s, the employment adjustment in Japanese firms was characterized by "labor hoarding," where during recession, there was a gradual adjustment in the number of employees accompanied by a sharp decrease in working hours.

This phenomenon can be explained naturally by noting that Japanese firms have to incur high costs of adjustment with a change in the number of employees. The most important contributor to these costs is the investment in firm-specific human capital. It not only entails a large training cost after hiring employees but also makes it difficult for firms to reduce the number of their employees during recessions, since they have to implicitly assure long-term employment to their employees (in order to support such an employment policy at Japanese firms, several Japanese labor case laws also place high priority on maintaining employment levels in firms.)

In order to make our hypotheses clearer, we briefly discuss a typical dynamic model of labor demand and its implications for the joint determination of employment and working hours.[6] It is assumed that a firm exists forever and it maximizes the present value of expected profit. The firm faces uncertainty regarding the product price $z$ in the future. While it is aware of the current price, it only knows the distribution of the future price.

Let the production function depend only on labor. Therefore, the production level at time $t$ can be expressed by

$$y_t = f(h_t, N_t), \qquad (1)$$

where $h_t$ denotes the number of working hours, and $N_t$, the number of workers ($F_1 > 0$, $F_2 > 0$).

There are two sources of labor cost: one is the wage paid to the workers and the other is the cost of labor adjustment. It is assumed that the wage rate is a function of

[6] See Hamermesh (1993, section 6.6) for more details about the properties of dynamic labor demand models for both hours and employment adjustment.

the number of working hours, which is a natural assumption if we consider overtime premiums. More fundamental is the assumption concerning the employment adjustment costs mentioned above. Let $C(N_t - N_{t-1})$ be such adjustment costs. On the other hand, no such adjustment costs exist for the working hours, and thus, the firm can optimally determine its working hours after observing the realized value of the current product price. Now, the firm's problem is to maximize its expected discounted cash flows, such that

$$\mathrm{Max}_{h_t, N_t} E_t \left\{ \sum_{i=0}^{\infty} \left( \frac{1}{1+r} \right)^i \left( z_t f(h_t, N_t) - w_t(h_t) h_t N_t - C(N_t - N_{t-1}) \right) \right\}, \qquad (2)$$

where *r* is the firm's discount rate.

Though we do not solve this model explicitly, its qualitative implications are well known (see Hamermesh 1993), the most important being that employment adjustment costs decrease employment variability. Another property of the model is that while a temporal fluctuation in the product price does not change the level of employment very much, it changes the working hours by quite an extent, because firms can change working hours without incurring adjustment costs. This seems to accord well with the labor-hoarding behavior of the Japanese firms observed during recessions before the 1990s.

On the other hand, the model implies that a permanent change in the product price brings about a large change in employment. For example, when firms perceive decreases in the current as well as future prices (the price distribution shifts to the left), they are forced to lay off a large number of workers. In other words, employment will be reduced sharply if a negative shock is expected in the long run. This seems to explain the employment reduction witnessed during the prolonged recession of the 1990s. Unfortunately, however, the model predicts that the working hours would also be reduced, contrary to the experience between the late 1990s and the early 2000s. Several hypotheses are presented below to explain this phenomenon.

***The fixed-duty effect***

One possibility is that if certain activities in a firm are conducted independently of the production level, the working hours of each retained employee will increase as a result of the large-scale reduction in the total number of employees.

Let us now assume that employees are not only engaged in ordinary production activities, but also in activities that are not prone to change due to

modifications in demand for their products or services. The existence of such fixed duties may be easily understood if the actual operations of a firm are considered. For example, "internal control" jobs (such as accounting, planning, and human resources), and production-related activities in the factory (such as overhauling and repair of machinery) are necessary for the operation of a firm, and are largely independent of the demand level. Therefore, in the following discussion, we assume the existence of such "fixed" duties independent of the production level, and that these duties always require *D* number of hours to be invested by all employees. A typical production function in this case is written as follows.

$$\begin{aligned} y_t = f(h_t, N_t) \geq 0 \quad \text{if} \quad h_t^d N_t \geq D \quad \text{and} \\ y_t = 0 \qquad \text{if} \quad h_t^d N_t < D, \end{aligned} \tag{3}$$

where $h_t^d$ is the average working hours per worker for such duties in period *t*. The average total number of working hours is represented by $\hat{h}_t = h_t + h_t^d$.

If there is a fall in the expected and actual price, the number of workers will decrease and the working hours utilized for production will also decrease. On the other hand, the working hours for the fixed duties per worker will increase depending on the overall reduction in the number of workers. It should be noted that if the reduction in both price and the number of workers due to recession is significantly large, then the increase in the working hours for fixed duties may overtake the decrease in the working hours caused due to reduction in production. As a result, it is possible that there is an overall increase in the working hours.

***The worker-replacement effect***

Our next explanation for the increased working hours of regular male employees comes from the rapid increase in the number of non-regular workers during the prolonged recession. If regular and non-regular employees are not perfect substitutes for one another, the increase in the number of non-skilled workers at the workplace may shift the burden of fulfilling fixed duties and supervision to the regular retained employees. If this is the case, the greater the ratio of non-regular employees at the workplace, the greater the burden that shifts onto the regular employees; this increases their working hours.

This concept can easily be introduced into the production function with fixed duties (3). Let *M* be the number of non-regular workers working fixed hours and assume

that firms do not incur adjustment costs when they make changes to the number of non-regular workers. Then, the production function becomes $y_t = f(h_t, M_t, N_t)$, where *N* represents the number of regular workers. Further, we assume that regular workers have to supervise non-regular workers, and that the total hours necessary for the fulfillment of fixed duties are given by

$$D = D(M), \quad D' > 0. \qquad (4)$$

Then, the ratio of this value to the number of regular workers yields the number of hours spent in the management of non-regular workers per regular worker.

On the basis of this production technology, it may be indicated that when Japanese firms face an unstable economic shock, they restrain and increase the number of regular and non-regular workers, respectively. However, in return, this may increase the total working hours spent in team management, and coupled with the likely reduction in the number of regular workers, prolong the working hours of regular workers.

***The dismissal-threat effect***

Although retaining regular workers was the typical practice adopted by Japanese firms, the Japanese labor market underwent an unprecedented and huge employment adjustment pressure due to the large and persistent negative economic shocks that occurred in the late 1990s. Under such an environment, certain firms were compelled to reduce the number of regular employees. The dismissal-threat effect describes the phenomenon whereby the greater possibility of dismissal in such an economic scenario induced workers to work longer hours in order to avoid being laid off. This may be particularly true for white-collar workers, who typically work long hours in an attempt to prove to their employers that they are rather hardworking and thus must not be dismissed.

Suppose that there exits asymmetric information about productivity or performance level between employers and employees. While workers know the precise level of their productivity, employers only know the value that contains the measurement error. This typically happens when the workers work in a team or a project evaluation requires a long time for the firm to ascertain each worker's actual contribution to it. Further, suppose that both parties know that long working hours can raise the workers' observed performance levels. If the firm uses such observed performance levels as an important criterion for layoff, workers are induced to work

longer hours simply to influence the firm's evaluation of their individual productivity.[7]

***The wage-incentive effect***

Our final hypothesis is centered on the concept that larger earnings inequality would induce workers to work longer, since the extra working hours would imply greater wages if there is a large inequality in earnings among workers. The original concept has been given by Bell and Freeman (2001), who found that the large differences in the working hours between the United States and Germany can be explained by earnings inequality. They indicate that since inequality is much larger in the United States, U.S. workers are more likely to work longer hours to seek higher wages (see also Kuhn and Lozano [2008]). They argued that this result is consistent with tournament models, in which a larger wage spread (net return from winning the promotion tournament) induces greater effort to become a winner.[8] Since greater effort tends to entail working longer hours, a positive relationship appears between wage inequality and working hours.

Introduction of a performance-based pay system can also explain the positive relationship between working hours and earnings dispersion. During the late 1990s, inequality in earnings expanded particularly among highly educated male employees in Japan.[9] This may have been induced by the introduction of the performance-based pay system, which was widespread in Japan during this period. Since the performance-based pay system is a wage system, whereby the wage is paid on the basis of the short-term explicit performance of the worker, the marginal benefit from making a greater effort is likely to increase if such a system is introduced.[10] Therefore, employees tend to work longer hours in order to achieve better production performance.

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[7] This explanation is rather close in spirit to the one discussed in Landers, Rebitzer, and Taylor (1996), which argued that large law firms use the number of hours worked as an indicator of associates' propensity to work hard. Their paper indicates that reliance upon the number of working hours as an indicator of performance leads to a rat-race equilibrium, in which associates are forced to work long hours.

[8] Among others, Lazear and Rosen (1981) and Rosen (1986) made early contributions to the literature regarding the tournament model. Since then, a number of papers have been published in order to test the validity of its implications. For instance, more recently, DeVaro (2006) used a sample of skilled workers from a cross section of establishments in four metropolitan areas of the United States to show that workers are motivated by large wage spreads.

[9] Kambayashi, Kawaguchi, and Yokoyama (2008) reported that the wage variance among Japanese males expanded after 1997, and found that this expansion can mostly be explained by an increase in variance within groups.

[10] Lazear (2000) found that introducing a piece-rate incentive raised worker productivity and increased the standard deviation in their wages. Lemieux, MacLeod, and Parent (2009) showed that the growing incidence of performance- pay explains much of the variance of men's wages in the United States between the late 1970s and the early 1990s.

## Empirical Examination

### *Analysis using Labour Force Survey data*

We employ three data sources to examine the above hypotheses for increasing working hours during recessions.[11] The first is *Special Survey of the Labour Force Survey* and the special questionnaire of *Labour Force Survey*. *Special Survey of the Labour Force Survey* has been conducted annually every February from the early 1980s until 2001, with each year's sample comprising approximately 90,000 individuals over the age of 15 in randomly selected households. In 2002, the annual *Special Survey* was replaced with the monthly *Labour Force Survey* that incorporated a special questionnaire with a sample size of 23,000 individuals each month. Both surveys are cross sectional, and include the same questions pertaining to annual earnings, detailed employment status, employer characteristics, and basic demographic characteristics, thereby making both surveys inter-related.[12] We limit our samples to prime-age (25–49 years old) regular male employees work for private firms.

We estimate the following nested reduced form model that incorporates the four possible explanations (mentioned in the previous section) for the increase in the number of working hours during the severe recession.

$$\ln h_{i,t} = \sum_j X_{ij,t}\alpha_{j,t} + \sum_k Y_{ik,t}\beta_{k,t} + \sum_l m_{l,t}\gamma_{l,t} + u_{i,t} \quad , \qquad (5)$$

where $\ln h_i$ is log weekly number of working hours of individual $i$, $X_{ij}$ represents the possible factors $j$ ($j$ = 1, 2, 3, 4) that describe the four effects described in the previous section, $Y_{ik}$ represents the observed individual characteristics, $m_l$ represents other control variables, $u_i$ is an error term, and subscript $t$ represents time. Each variable is explained in the following manner. $\alpha$, $\beta$, $\gamma$ are parameters to be estimated.

The coefficients of interest are $\alpha_1$ through $\alpha_4$, which measure the relevance of the four effects. First, for the *fixed-duty effect*, we include the rate of change in the total number of workers (both regular and non-regular employees, including males and females). The total number of workers was grouped by industry and firm size.[13] Thereafter, we calculated the rate of change by subtracting the number of employees

[11] Basic statistics of the three data sets used in this paper are available upon request.

[12] In order to avoid the seasonality bias, we realize the importance of using samples from the month of February only. However, due to the lack of an adequate sample size, we were forced to include data from the *Labour Force Surveys* conducted from January to March.

[13] The industries are classified as "construction," "manufacturing," "transport and postal activities," "wholesale and retail trade," "finance, insurance, and real estate," and "other service industries." Firm sizes are 500 and over, 30–499, and less than 30 employees.

five years previously from the current number of employees in the same group. The rate of change in the number of employees reflects the magnitude of labor adjustment that occurred during the period under study.

Second, for the *worker-replacement effect*, we calculate the number of non-regular workers grouped by industry and firm size, and divide it by the total number of employees in the same group. This non-regular worker ratio is incorporated as a proxy for the magnitude of worker replacement. To capture the effect of the rapid increase in the worker replacement ratio, we also subtract the non-regular worker ratio from the ratio calculated five years ago for the same group and include the rate of change in the estimation.

Third, for the *dismissal-threat effect*, we calculate the possibility of dismissal in the following manner. First, we group the number of regular male employees $N_g$ ($g$ denotes group) by firm size, 5-year age group, and education.[14] Then, we subtract $N_g$ from the number of male employees present five years ago for the same cohort group $g$ in order to calculate the dismissal rate for each group, $(N_{g,t-5} - N_{g,t})/ N_{g,t-5} \times 100$. The higher the dismissal rate, the higher the possibility of the corresponding group to be dismissed from employment.[15]

Fourth, for the *wage-incentive effect*, the data does not allow us to directly identify whether each individual is hired in a firm using the performance-based pay system. Instead, following Bell and Freeman (2001), we examine the effect by incorporating a divergence of wages in the estimation equation. Specifically, we use data from the *Basic Survey on Wage Structure* conducted by the Ministry of Health, Labour, and Welfare of Japan, which is the most trusted official survey on wages in Japan.[16] From this survey, we employ the "decile dispersion coefficient (= [9th decile − 1st decile]/2 × Median)" as a proxy for wage variation, grouped by firm sizes, five-year age group, and education.[17]

As to individual characteristics, we include age, age-squared, education

[14] Educational qualifications are classified as one of the following: high school diploma or less, junior or technical college (2-year) diplomas, and university diploma or higher.

[15] The variable for the dismissal threat effect cannot be distinguished by industry because of data limitation. And since the change in the number of regular workers also includes factors such as inflows to and outflows of non-regular workers, the self-employed, and the out-of-labor force, this variable is not necessarily the best proxy of dismissal rate. The two supplementary analyses that follow will test this hypothesis more directly.

[16] These data are collected annually from establishments with 10 or more regular employees. The survey incorporates a sample size of almost 80,000 establishments.

[17] Firm sizes are 1,000 and over, 100–999, and 10–99 employees. Since the *Basic Survey on Wage Structure* does not include wage information on firms with less than 10 employees, we use information from firms with 10–99 employees as an approximation. Age groups are classified as 25–29, 30–34, 35–39, 40–44, and 45–49 years.

dummies, firm size dummies, industry dummies, occupation dummies, marital status dummy (married = 1), child dummy (having a child under six = 1), working spouse dummy (working spouse = 1), residential prefecture dummies, and cohort dummies. Further, with regard to control variables, we incorporate the regional male unemployment rate grouped by 10 regional blocks in order to control for the differences in demand by region.[18] In addition, we include monthly scheduled cash earnings (amount of contractual cash earnings, not including overtime allowance) from the *Basic Survey on Wage Structure* categorized by industry, firm size, age, and education. Further, the monthly scheduled cash earnings are converted to the log scale in real terms using information from the *Consumer Price Index* at the prefecture level.[19]

We add a variable to control for the difference in the age structure of the regular employees. This is done by calculating the ratio of the number of regular employees in a certain age group to that of employees who are five years younger: $N_{A-1,t} / N_{A,t}$, where $N_{A,t}$ is the number of regular employees in age group $A$ in period $t$. If the ratio is equal to one, it implies that the number of regular employees who are five years younger is the same as the number of employees in the selected age group. If the ratio exceeds or is less than 1, it implies that the number of younger employees is greater or lesser than the number of employees in the selected age group, respectively.

Using the above variables, we estimate equation (5) for the following three periods: (a) 1998–1999, (b) 2002–2004, and (c) 2006–2007.[20] The economic recession in Japan first deepened in 1998 and 1999. In 2002–2004, both average number of working hours and unemployment rate peaked after 1998. Mild economic recovery was experienced in 2006 and 2007, before the global financial crisis hit the economy again in 2008.

We first estimate the weighted least squares (WLS) for each period using sampling weights provided by the Statistical Bureau. We limit our samples to those

[18] The 10 regional blocks are Hokkaido, Tohoku, Southern Kanto, Northern Kanto and Koshin, Hokuriku, Toukai, Kinki, Chugoku, Shikoku, and Kyusyu.

[19] As the monthly cash earning is determined on the basis of the statutory work week, it is independent of the actual working hours. We use this variable in order to avoid the negative correlation that may occur when the hourly wage is calculated as the individual's annual income divided by annual work hours (= weekly hours worked multiplied by 52 weeks). However, when we use the instrumented hourly wage calculated from this hourly wage, we obtain similar results.

[20] While the left-hand side of our estimation is the number of weekly hours worked by individual employees, each of the explanatory variables we incorporated as possible factors to test the above effects have been calculated using aggregated data. There is no simultaneous bias for estimation as we assume that employees decide their individual working hours given the aggregate working conditions they encounter. Mean work hours per week and standard deviations (in parenthesis) are 48.36 (11.31) in 1998-1999, 50.61 (12.52) in 2002-2004, and 50.38 (12.02) in 2006-2007. Summary statistics for the explanatory variables are available on request.

employees who work for over 40 hours per week.[21] In addition, we also estimate the Tobit model (censored below 40 hours) using sampling weights. The estimation results are presented in Table 1 (WLS) and Table 2 (Tobit model). It is evident that both tables present similar results. [22]

For the fixed-duty effect, *changes in the number of workers* has a significantly negative sign for 2002–2004 (both in Tables 1 and 2), suggesting that this effect was present during this period. Working hours peaked implying that the huge reduction in the number of employees due to prolonged recession resulted in an increase in the working hours of retained regular employees.

Further, the results reveal that the worker-replacement effect also held during the prolonged recession. Specifically, the *ratio of non-regular workers* has a significantly positive trend for 1998–1999 and 2002–2004. Furthermore, the rapid increase in the *ratio of non-regular workers* also caused an increase in working hours during 2002–2004.

As to the dismissal-threat effect, the *probability of dismissal* is significantly positive for 1998–1999, although for 2002–2004 and 2006–2007, this probability is insignificant. This implies that this effect was only present at the beginning of the severe recession.

Regarding the wage incentive effect, our estimation results reveal that *wage variation* is statistically significant in all periods, thereby implying that the performance-based pay system, which was widespread in Japan during these periods, may have pressurized employees to work for longer hours.

Further, Table 3 presents the results of the probit model estimation, in which the variable in the left-hand side takes 1 if an employee works for over 60 hours per week and 0 otherwise. In other words, Table 3 indicates which of the four effects is most relevant for employees who worked for extremely long hours. It is evident from Table 3 that the fixed-duty and worker-replacement effects are the two main factors that drove employees to work rather long hours during this period.

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[21] In Japan, there is a government policy measure to provide subsidies to a firm that undergoes a severe downturn in business in order to protect regular workers' employment. All the employees hired by firms that receive such subsidies must either take one day off per month or curtail work hours to below the legal workweek (40 hours per week). Note, however, that even when we include samples of those working for 40 hours or less, our overall estimation results do not change.

[22] In order to consider the possible autocorrelation between unmeasured error terms, for example, we should use block bootstrapping to cluster standard errors by sector because even the ordinary clustered estimator may overestimate the standard errors. The reexamination by block bootstrapping estimation remains for future efforts.

***Analysis using employee survey data***

The examination in the previous section confirms the fact that the downsizing of Japanese firms may increase the working hours of remaining staff. We have seen that when a fixed amount of duties need to be performed in a workplace with a smaller number of employees, each of them is charged with additional tasks, so that they are forced to increase their working hours. This is true even in the recessions of the early 2000s.

Our previous analysis using data from the *Labour Force Survey* also throws light on another significant point. We proposed four hypotheses, each accounting for the changes in employment and wages in individual workplaces. However, as part of any rigorous examination of increasing working hours, it is important that we also consider changes at the firm level. While the *Labour Force Survey* includes questions about the industries and firm sizes where respondents work, it does not contain detailed information about the work situation at these firms and workplaces. Consequently, we use indirect aggregate variables grouped by industry and firm size as proxies for the proposed hypotheses. This involves the assumption that the hypothesized effects work equally for employees in the same industry and at firms of the same size. It is also advisable to capture changes in tasks performed at the individual level for each of the sampled employees in order to measure the fixed-duty effect.

The *Labour Force Survey* has a strong advantage over other surveys in terms of data volume and quality, in that it is a large survey conducted every month by the government. However, it cannot clarify micro-level changes at the firm or workplace level. Therefore, it is necessary to demonstrate the robustness of our hypotheses using alternative data that directly assess changes in employees' actual tasks at individual workplaces.

Hence, we now reexamine the hypotheses using micro data from an employee survey instead. We use data from the *Surveys on Work Motivation and Employment Management*, which were conducted in January 2004 by the Japan Institute for Labor Policy and Training (JILPT). The institute is the Japanese government think tank for labor policy issues. The survey targets workers at private firms with 100 employees or more. 7,828 persons replied.

This employee survey contains many questions on changes in working conditions at individual workplaces between 2001 and 2003. Among them, we focus on whether the employees had increased their regular working hours during the past three years. In addition, the survey also asked if they needed to take charge of additional tasks or cover a wider range of tasks than before. In the following analysis, we use the replies

to these questions as dependent variables and examine the factors affecting the related changes at the workplace level. We additionally employ a dependent variable that takes 1 if an employee worked over 60 hours per week in December 2003 and 0 otherwise, in order to allow a comparison with the results in Table 3.

Similar to the procedure used with the *Labour Force Survey* data, we limit our sample to regular full-time male employees between 25 and 49 years. We further limit the sample to those who worked at the same firms between 2001 and 2003 in order to examine changes at these firms during this time. 63.9 percent of the respondents replied that the tasks for which they had voluntarily taken responsibility had increased in that three-year period, and 74.5 percent felt that they had been required to enlarge the range of their tasks during this time. On the other hand, the increase in working hours was limited to 30.2 percent, meaning that some employees responded to heavier work burdens by increasing their work intensity within the same working hour time frame rather than putting in extra hours.

Nevertheless, there is no doubt that the increase in the number and range of individual tasks at these workplaces resulted in increasing working hours for many employees; 42.3 percent of the employees who were made to increase their task burden also increased their working hours, while just 8.7 percent increased working hours among those whose duties decreased or did not change. It is therefore crucial to specify the reasons for enlarged task burdens in order to clarify the reasons for increased working hours.

As control variables in the probit estimation model, we use the dummy variables of age, education, firm size, industry, occupation, marital status, spouse works, children, and annual income (similar to our earlier estimation using data from the *Labour Force Survey*). Regarding variables to reflect the effects described before, we introduce the following dummy variables to represent changes in circumstances in the workplace between 2001 and 2003: “experience of a large employment cut,” “change in wage variation,” and “change in the risk of future dismissal.” The variable for “experience of a large employment cut” represents the source of the fixed-duty effect, while “wage variation” and “change in the risk of future dismissal” are proxies for the wage-incentive and the future-dismissal effect, respectively. 40.6 percent responded that their employer underwent large restructuring, 31.5 percent had experienced an increase in wage variation, and 56.7 percent had perceived a rise in the risk of future dismissal during this period. Since this data does not contain information on the number of non-regular workers, we limit our analysis to test these three effects. We test the worker-replacement effect in the third analysis as seen below.

Table 4 shows the main results of the probit estimation, which establishes the economic significance of the fixed-duty effect. The marginal effects of the experience of a large employment cut are significantly positive for all the dependent variables. The employees who continued working at firms experiencing large employment cuts increased their own task burden and work range, while also increasing their working hours during the same period. It can be suggested that these increases in task burdens and working hours are closely related, and that heavier task burdens also boosted the probability of an employee working 60 hours or more per week. These results are consistent with the fixed-duty effect. Therefore, the main results of the *Labour Force Survey* are supported by the estimation using the alternative employee survey, namely, that the fixed-duty effect played a crucial role in increasing working hours in the early 2000s.

On the other hand, Table 4 shows that the wage incentive had no effect on working hours. The dummy for wage variation was indeed significantly positive for the increase in the number and range of tasks. However, it was not significant for the increase in working hours and the probability of working 60 hours or more per week. This implies that while the introduction of a meritocratic wage system did not always promote an increase in working hours, it did burden employees with more tasks. Therefore, the new wage system might instead make employees perform more effectively within the limited working timeframe.

The dummy for change in the likelihood of future dismissal was not significant for any dependent variables. While the actual decline in employment forced an increase in working hours because of labor shortages at the workplace, the threat of dismissal in the future had little effect on motivation to work longer hours.

Table 5 summarizes the estimated results for the effect of increasing working hours by occupation. The independent variables remained the same as those in Table 4, except for the occupation dummies. This shows that the experience of a large employment cut had a significant positive effect on increasing working hours for most occupations. Only “other occupations,” a category that mainly consists of production workers, showed an insignificant result. Time schedules are rigidly fixed for production workers at factories, so that neither firms nor employees have the freedom or flexibility to change work hours in this environment. As overtime work necessarily requires extra payment, it is probable that firms hesitated to increase working hours for blue-collar employees.

In contrast, for white-collar employees such as managers, professionals, clerks, and sales and service workers, the experience of a large employment cut had a

significantly positive influence on increasing working hours during this period. Unlike production workers, it is quite possible for white-collar workers to rearrange their working hours. Moreover, it is well known that open-ended and (sometimes) ambiguous job descriptions are features unique to the internal (white-collar) labor market in Japan. This practice enables Japanese employees to develop multiple skills through frequent job rotations through different kinds of jobs (Koike 1988). Thus, the flexibility of job arrangements in the Japanese white-collar labor market caused changes in tasks for white-collar employees, generating longer working hours even in the recession of the early 2000s. This means that the fixed-duty effect can also be observed among most white-collar employees.

***Analysis using retrospective survey data***

We also conducted a retrospective survey via the web to supplement the above two analyses. Similar to the above two surveys, we limit our target to regular full-time white-collar male employees aged between 25 and 49 years in 2002. 5,010 persons replied and the respondent rate was 74.7%. The survey was conducted in January 2012.

In this retrospective survey, we collect various details concerning changes in working conditions at the individual level from 1999 to 2002. We also focus on whether the employees' working hours as well as the number of tasks increased during those three years. In the analysis, we use the replies to these questions as dependent variables and examine the factors affecting the related changes at the workplace level. Specifically, we employ the ordered probit estimation, where dependent variables are either the changes in the number of tasks or the number of hours worked between 1999 and 2002. Both ordinal variables contain five choices: "significantly increased," "fairly increased," "did not change," "fairly decreased," and "significantly decreased."[23] In order to compare these results with those of Tables 3 and 4, we conduct a probit estimation in which a dependent variable takes 1 if an employee usually worked over 60 hours per week in 2002 and 0 otherwise.

Similar to the previous analysis, we focus on the information representing changes in circumstances at the workplace between 1999 through 2002 as the main explanatory variables: "experience of a large employment cut," "change in wage variation," and "change in the risk of future dismissal." 44.0 percent responded that

[23] Since this is a retrospective survey, we also include a "don't remember" response. The number of people who responded "don't remember" was not very large—3.6 percent for "the number of tasks" and 5.8 percent for "the number of hours worked." We exclude these samples from our analyses. For the explanatory variables, however, we do not omit this information and instead, utilize it as "don't remember" dummies in the regression.

their employer underwent large restructuring, 31.8 percent had experienced an increase in wage variation, and 21.1 percent had perceived a rise in the risk of future dismissal. The variable "experience of a large employment cut" represents the source of the fixed-duty effect, while the other two variables are proxies for the wage-incentive and the dismissal-threat effect, respectively.

We use age, dummy variables for years of education, marital status, child, occupation, firm size, industry, ratio of non-regular workers at the workplace, white-collar exempted, job title, hourly wage rate (instrumented), composition of age structure at the workplace, and firm's profit in 2002, as the other control variables in both estimation models. For estimating the hourly wage rate obtained by annual incomes divided by annual work hours, we used answers from the question "the closest description of the task you performed in 2002" as the instrument variable. Specifically, as done by Autor, Levy, and Murnane (2003), we asked respondents to choose from seven categories: "non-routine analytical tasks," "non-routine interactive tasks," "routine cognitive tasks," "routine manual tasks," "non-routine manual tasks," "other," and "don't remember."

Table 6 shows the main results of the ordered probit and probit estimation, and clearly establishes the economic significance of the fixed-duty effect. The coefficients of "experience of a large employment cut" are significantly positive for regressions (1) to (4), which mirrors the results of the previous analysis, that is, employees who experienced large employment cuts increased their own task burden and working hours during this period. It can be said that these results are quite consistent with the fixed-duty effect. On the other hand, Table 6 shows that the wage variation had significant effects on both the task burden and the working hours, which is not completely consistent with the results obtained in Table 4. Therefore, the incentive effect on effort expended and hours worked in the merit system that was widely adopted during this period require further analysis. The dummy for changes in future dismissal likelihood did not show significant results for the analysis of number of hours worked. As discussed in the previous section, the threat of dismissal in the future had little effect on motivation to work longer hours during this period.

Table 7 shows the main results of the ordered probit estimation, by further limiting the sample to those who worked at the same workplace from 1999 through 2002 (i.e., those who did not experience job rotation during the period), in order to examine the effect of changes in employee composition at the workplace level over these three years. Almost all the coefficients of the results in (1) and (2) show significantly positive signs for workplaces that increased the number of regular workers.

The interpretation is straightforward: Workplaces that hired more regular workers despite this recessionary period must have experienced significant increase in workloads, and therefore the task burden and working hours for each worker also increased.

However, some significant results were also obtained for those workplaces that laid off regular workers. Regressions (3) and (4) show the results for employees who worked in firms with a large employment cut and those without, respectively. As expected, the results differ significantly. Employees at a workplace where regular workers decreased presumably because of a large employment cut conducted by the firm, reported increased work hours, whereas those in the same environment, except for the large retrenchment, did not report increased work hours during the same period. The regression result (3) may be interpreted as the effect of worker replacement during this period. As noted previously, if regular and non-regular employees are not perfect substitutes, the increase in the ratio of non-skilled workers at the workplace may have shifted the burden of fulfilling fixed duties and supervision to the retained regular employees. The regression result confirms this; the increase in the ratio of non-regular employees at the workplace that experienced a large employment cut shifted the fixed duties to regular employees, and therefore, increased their number of working hours.

In Table 8, we split our samples into (1) those who engaged in the same tasks as non-regular workers, and (2) those who engaged in different tasks from non-regular workers, in order to further investigate these hypotheses. The variable of "experience of a large employment cut" shows a significantly positive result only for those respondents who engaged in tasks different from those of non-regular workers at that time. This emphasizes that relevance of the worker-replacement effect presumably combined with the fixed duty effect.

Lastly, in Table 8, we split our samples into four categories, (3) to (6), by using the answers obtained by asking each respondent the relation between their workload and business cycles. Specifically, we asked respondents to choose from the following four categories: "my task became very busy during booms," "my task became very busy during busts," "my task had no relation with business cycles," "my task became busy when any kind of shock occurred."

The variable of "experience of a large employment cut," which was always significant in previous regressions, shows no significant signs for respondents whose tasks were naturally busy during booms or busts (regressions (3) and (4)). However, significant results are obtained for those respondents whose tasks were not related to business cycles (regressions (5) and (6)). Therefore, we may interpret this result as follows: Tasks for which the workload does not necessarily change with business cycles

are a typical feature of fixed duties independent of production. Therefore, all the results obtained so far confirm that the fixed-duty effect played a crucial role in increasing the working hours of regular Japanese male employees in the early 2000s.

## Discussion and Conclusion

This paper addressed the confounding issue of why the working hours of regular Japanese male employees increased in spite of the serious recession between the late 1990s and the early 2000s. It has long been said that a typical feature of Japanese firms under recession is labor hoarding, which implies the maintenance of a certain level of employment in firms, to the extent possible. In economic downturns of the past, such a practice was common particularly when a negative shock was considered temporary and firms reduced employees' working hours in order to reduce personnel costs. However, when the shock is predicted to be persistent and substantial, even firms with a developed internal labor market and accumulated firm-specific skills can reduce employment. Our empirical examination using several micro data sources consistently revealed that there was an increase in the working hours of employees in firms that greatly reduced the number of regular employees, since the retained employees were required to fulfill fixed duties necessary for the internal maintenance of the organization.

Furthermore, we also found two other reasons to partly explain the increase in the number of working hours during the recession. The Japanese system of wages and employment practices has been in transition since the 1990s. The seniority-based wage rule has weakened, and an increasing number of firms are employing the performance-based system, thereby enlarging the wage disparity as compared to that in the past. This paper indicated that the working hours of regular male employees tended to increase in firms with a steady increase in wage variance on the basis of performance. In addition, the number of non-regular employees has increased rapidly in Japan as well as in other developed countries. We also found an increase in the working hours of regular Japanese male employees in firms that increased the ratio of non-regular workers.

In conclusion, one significant aspect of these results stands out. The effect of the transitions in wage and employment practices in Japan may not be continuous but transient, as these transitions only occurred in the beginning of the 2000s. For example, the effect of increasing non-regular workers on the increase in working hours of regular employees disappeared in the latter half of the 2000s, as is evident from the results of

our paper. According to Genda, Kuroda, and Ohta (2010), the ratio of regular employees working extremely long hours (over 60 hours per week) has decreased since 2005, with this phenomenon being particularly prevalent among employees in the service and production industries. This is because non-regular employees, such as temporary agency workers sourced through employment agencies, were rapidly introduced in these occupations.[24] It is our casual observation that in the period of economic recovery after 2005, firms chose to increase the number of such non-regular workers as a buffer for unexpected contingencies rather than asking regular workers to work overtime. Further studies will be required to examine the long-term effect of increasing the number of non-regular workers on regular workers' working condition.

[24] Until 2004, law (*Act for Securing the Proper Operation of Worker Dispatching Undertakings and Improved Working Conditions for Dispatched Workers*) prohibited Japanese manufacturing factories from using temporary (employment agency-hired) production workers. Following its deregulation, factories were permitted to employ such temporary agency workers, leading to a rapid increase in the proportion of such workers in the industry.

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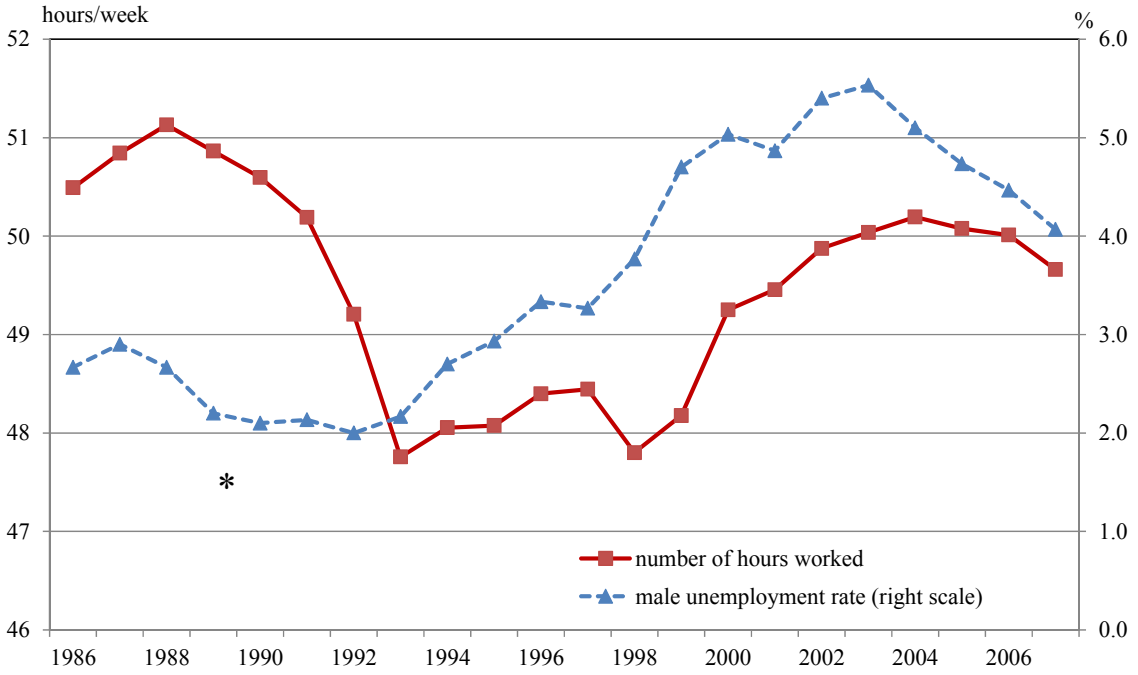
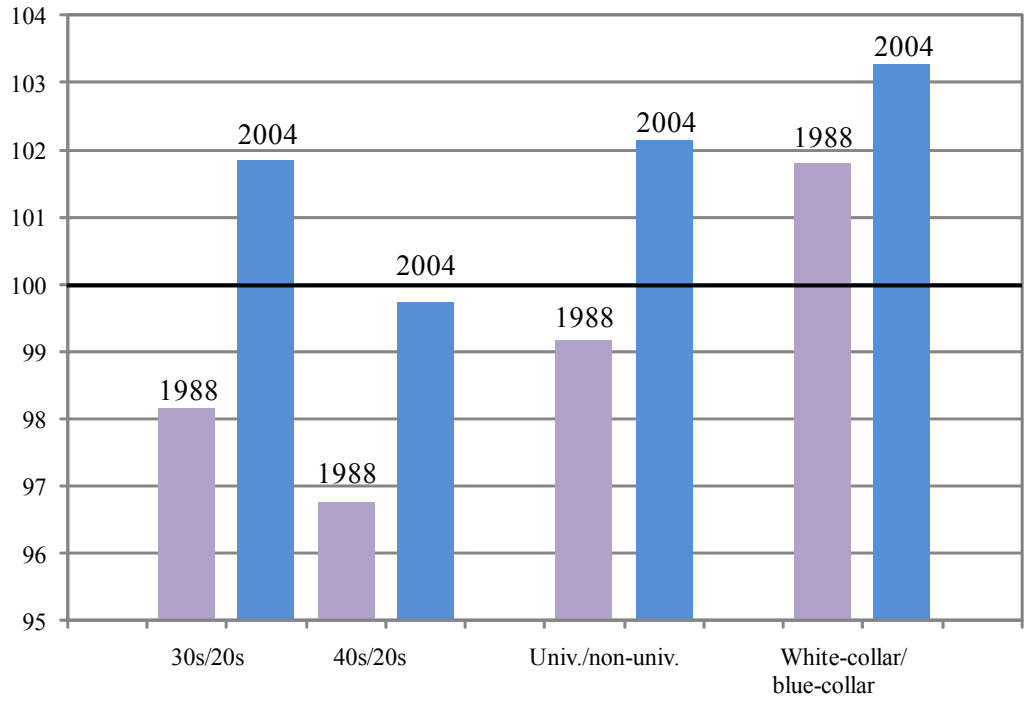
**Figure 1. Average weekly working hours of prime-age regular male employees and the male unemployment rate in Japan**




Sources: The *Special Survey of the Labour Force Survey* (1986–2001) and data obtained from the special questionnaire of *the Labour Force Survey* (2002–2007).

Notes: Prime-age regular male employees exclude self-employed, part-time, and non-regular employees, and students. The unemployment rate is the national average for male employees. The * indicates the actual number of working hours in 1989, as reported in the source documents. The large drop in working hours in this year was due to the *taiso-no-rei* (the ritual of the Showa emperor's demise), which took place during the last week of February 1989, when numerous Japanese workers took a day off to offer condolences. Since this was a special occasion, we conducted a linear interpolation for the actual number of working hours in 1989 using data from 1988 and 1990 in this figure.

**Figure 2. Divergence in working hours among different groups of regular male employees**




Notes: "30s/20s" and "40s/20s" indicate the average number of working hours of male employees in their 30s and 40s respectively, when the average number of working hours of male employees in their 20s equals 100. "Univ./non-univ." indicates the average number of working hours of male university graduates when the average number of working hours of male non-university graduates equals 100. "White-collar/blue-collar" indicates the average number of working hours of white-collar male workers when the average number of working hours of blue-collar male workers equals 100. Further, "White-collar" includes male professional and technical workers, managers and officials, clerical and related workers, and sales workers. "Blue-collar" includes male protective service workers, workers in transportation and communication, production process workers, and laborers.

## Table 1. Estimation results using the weighted least squares method

| | Dependent variable: log weekly number of working hours | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1998–1999 | | | 2002–2004 | | | 2006–2007 | | |
| Age | 0.0023 | (0.0065) | | 0.0114 | (0.0076) | | 0.0144 | (0.0116) | |
| Age^2 | -0.0001 | (0.0001) | | -0.0001 | (0.0001) | | -0.0001 | (0.0001) | |
| Educational background | | | | | | | | | |
| (base = high school and junior high diploma) | | | | | | | | | |
| junior or technical college (2–year) diploma | 0.0249 | (0.0064) | *** | 0.0186 | (0.0067) | *** | 0.0237 | (0.0076) | *** |
| university diploma or more | 0.0220 | (0.0064) | *** | 0.0366 | (0.0071) | *** | 0.0217 | (0.0088) | ** |
| Firm size (base = less than 30) | | | | | | | | | |
| 30 to 499 employees | 0.0124 | (0.0103) | | 0.0363 | (0.0103) | *** | 0.0051 | (0.0088) | |
| 500 employees and over | 0.0023 | (0.0149) | | -0.0108 | (0.0149) | | 0.0009 | (0.0117) | |
| Industry (base = construction) | | | | | | | | | |
| Manufacturing | -0.0523 | (0.0119) | *** | -0.0645 | (0.0086) | *** | -0.0525 | (0.0091) | *** |
| Transport and postal activites | -0.0261 | (0.0193) | | 0.0711 | (0.0287) | ** | -0.0483 | (0.0197) | ** |
| Wholesale and retail trade | -0.0212 | (0.0196) | | -0.0297 | (0.0189) | | -0.0053 | (0.0214) | |
| Finance, insurance, and real estate | -0.0067 | (0.0146) | | -0.0240 | (0.0148) | | -0.0405 | (0.0151) | *** |
| Other service industries | -0.0582 | (0.0112) | *** | -0.0793 | (0.0145) | *** | -0.0491 | (0.0199) | ** |
| Occupation (base = clerical) | | | | | | | | | |
| Professional and technical workers | 0.0291 | (0.0072) | *** | 0.0335 | (0.0072) | *** | 0.0256 | (0.0089) | *** |
| Managers and officials | 0.0746 | (0.0167) | *** | 0.0358 | (0.0200) | * | 0.0523 | (0.0182) | *** |
| Sales workers | 0.0492 | (0.0062) | *** | 0.0479 | (0.0068) | *** | 0.0456 | (0.0084) | *** |
| Protective service workers | 0.0750 | (0.0108) | *** | 0.0826 | (0.0110) | *** | 0.0447 | (0.0148) | *** |
| Workers in transport and communication | 0.0719 | (0.0110) | *** | 0.0966 | (0.0109) | *** | 0.0980 | (0.0153) | *** |
| Production process workers | 0.0038 | (0.0059) | | -0.0021 | (0.0069) | | -0.0038 | (0.0083) | |
| Laborers | 0.0339 | (0.0093) | *** | 0.0382 | (0.0110) | *** | 0.0412 | (0.0132) | *** |
| Other control variables | | | | | | | | | |
| Marital status (married = 1) | 0.0287 | (0.0054) | *** | 0.0350 | (0.0059) | *** | 0.0313 | (0.0076) | *** |
| Child (less than 6 years old = 1) | 0.0168 | (0.0052) | *** | 0.0114 | (0.0057) | ** | 0.0243 | (0.0070) | *** |
| Spouse works (work = 1) | 0.0020 | (0.0045) | | -0.0003 | (0.0049) | | -0.0100 | (0.0065) | |
| Log real monthly wage | -0.0352 | (0.0256) | | -0.0697 | (0.0277) | ** | -0.0540 | (0.0279) | * |
| Regional unemployment rate | 0.0043 | (0.0032) | | -0.0005 | (0.0052) | | -0.0205 | (0.0113) | * |
| Composition of age structure | -0.0179 | (0.0136) | | -0.0064 | (0.0147) | | -0.0365 | (0.0140) | *** |
| Possible factors | | | | | | | | | |
| Changes in the no. of workers (× 100) | -0.0101 | (0.0427) | | -0.3784 | (0.0847) | *** | 0.0192 | (0.0611) | |
| Ratio of non-regular workers (× 100) | 0.1336 | (0.0644) | ** | 0.2948 | (0.0761) | *** | -0.0128 | (0.0659) | |
| Changes in the ratio of non-regular workers (× 100) | -0.0204 | (0.0338) | | 0.0697 | (0.0354) | ** | -0.0679 | (0.0389) | * |
| Wage variation | 0.1238 | (0.0607) | ** | 0.2078 | (0.0659) | *** | 0.1248 | (0.0729) | * |
| Probability of dismissal (× 100) | 0.0404 | (0.0163) | ** | -0.0057 | (0.0083) | | -0.0028 | (0.0103) | |
| Constant | 3.8216 | (0.1172) | *** | 3.5913 | (0.1377) | *** | 3.7464 | (0.2122) | *** |
| Prefecture and cohort dummies | yes | | | yes | | | yes | | |
| Sample sizes | 21,943 | | | 21,396 | | | 12,549 | | |
| Adjusted R2 | 0.0446 | | | 0.0495 | | | 0.0421 | | |

Notes: Values within parentheses denote standard errors. ***, **, and * denote statistical significance at the 1, 5, and 10 percent levels respectively. The same values apply to the following tables as well.

## Table 2. Estimation results from the Tobit model

| | Dependent variable: log weekly number of working hours | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Possible factors | 1998–1999 | | | 2002–2004 | | | 2006–2007 | | |
| Changes in the number of workers (× 100) | -0.0234 | (0.0363) | | -0.4087 | (0.0762) | *** | 0.0461 | (0.0576) | |
| Ratio of non-regular workers (× 100) | 0.1714 | (0.0693) | ** | 0.3306 | (0.0717) | *** | -0.0408 | (0.0652) | |
| Changes in the ratio of non-regular workers (× 100) | -0.0246 | (0.0336) | | 0.0863 | (0.0321) | *** | -0.0666 | (0.0388) | * |
| Wage variation | 0.1332 | (0.0627) | ** | 0.2380 | (0.0603) | *** | 0.1558 | (0.0714) | ** |
| Probability of dismissal (× 100) | 0.0380 | (0.0146) | *** | -0.0048 | (0.0078) | | -0.0012 | (0.0090) | |
| Sample sizes | 21,943 | | | 21,396 | | | 12,549 | | |
| Pseudo R2 | 0.0819 | | | 0.0975 | | | 0.0942 | | |
| Log likelihood | -7551.6 | | | -6586.3 | | | -3477.7 | | |

Notes: For this estimation, we use the same control variables as those for Table 1.

## Table 3. Estimation results from the probit model

| | Dependent variable: the probability of working for 60 hours or more per week | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Possible factors | 1998–1999 | | | 2002–2004 | | | 2006–2007 | | |
| Changes in the number of workers (× 100) | -0.0786 | (0.0411) | * | -0.5753 | (0.1147) | *** | -0.1111 | (0.0801) | |
| Ratio of non-regular workers (× 100) | 0.1852 | (0.0804) | ** | 0.5384 | (0.1123) | *** | 0.0258 | (0.0978) | |
| Changes in the ratio of non-regular workers (× 100) | 0.0145 | (0.0390) | | 0.1159 | (0.0461) | ** | -0.0239 | (0.0553) | |
| Wage variation | -0.0527 | (0.0707) | | 0.0104 | (0.0933) | | 0.0999 | (0.0994) | |
| Probability of dismissal (× 100) | -0.0026 | (0.0165) | | -0.0042 | (0.0115) | | -0.0139 | (0.0132) | |
| Sample sizes | 21,943 | | | 21,396 | | | 12,549 | | |
| Pseudo R2 | 0.0450 | | | 0.0418 | | | 0.0445 | | |
| Log likelihood | -6580.2 | | | -8713.9 | | | -4787.8 | | |

Notes: For this estimation, we use the same control variables as those for Table 2. The left-hand side variable takes 1 if an employee works for over 60 hours per week and 0 otherwise. The figures represent marginal effects.

**Table 4. Estimated results using the employee survey conducted in 2004**

| Changes at workplaces from 2001 to 2003 | Dependent variables: Changes from 2001 to 2003 — Extent of increase in the number of the respondent's tasks | | Extent of increase in the range of the respondent's tasks | | The increase in working hours | | The probability of working for 60 hours or more per week | |
|---|---|---|---|---|---|---|---|---|
| Experience of a large employment cut | 0.0500 | (0.0204) ** | 0.0465 | (0.0181) ** | 0.0914 | (0.0196) *** | 0.0645 | (0.0152) *** |
| Wage variation (base = no change) | | | | | | | | |
| increased | 0.0455 | (0.0223) ** | 0.0382 | (0.0198) * | 0.0186 | (0.0215) | 0.0196 | (0.0167) |
| decreased | 0.0841 | (0.0437) * | 0.0606 | (0.0376) | -0.0007 | (0.0454) | 0.0004 | (0.0354) |
| Risk of future dismissal (base = no change) | | | | | | | | |
| felt strongly | 0.0256 | (0.0216) | 0.0055 | (0.0193) | 0.0265 | (0.0203) | 0.0151 | (0.0155) |
| felt weakly | 0.0597 | (0.0405) | 0.0739 | (0.0337) ** | -0.0328 | (0.0395) | 0.0103 | (0.0328) |
| Sample sizes | 2,447 | | 2,446 | | 2,448 | | 2,337 | |
| Pseudo R2 | 0.0373 | | 0.0470 | | 0.0247 | | 0.0819 | |

Notes: The numbers denote the marginal effect of the probit estimation. Numbers within parentheses denote standard errors. As other explanatory variables, the dummy variables for age, education, firm sizes, industries, occupations, marital status, spouse works, children, and annual income, are included. The reference group for wage variation and risk of future dismissal is “unchanged.”

**Table 5. Estimated results of changes in workplaces with longer working hours by occupation**

| | Dependent variable: increase in working hours from 2001 to 2003 | | | | | |
|---|---|---|---|---|---|---|
| Changes at workplaces from 2001 to 2003 | Higher management employees | Lower management employees | Professinal employees | Clerks | Sales and service employees | Other occupational workers |
| Experience of a large employment cut | 0.0996 (0.0394) ** | 0.1111 (0.0356) *** | 0.1215 (0.0414) *** | 0.0793 (0.0336) ** | 0.1618 (0.0749) ** | 0.1270 (0.1045) |
| Wage variation (base = no change) | | | | | | |
| increased | 0.0093 (0.0419) | 0.0359 (0.0387) | 0.0564 (0.0467) | -0.0071 (0.0372) | 0.0966 (0.0791) | -0.1319 (0.1072) |
| decreased | 0.0717 (0.0968) | -0.0064 (0.0817) | -0.0951 (0.0842) | -0.0043 (0.0805) | -0.1612 (0.1833) | 0.1099 (0.1737) |
| Risk of future dismissal (base = no change) | | | | | | |
| felt strongly | 0.0427 (0.0417) | 0.0343 (0.0372) | -0.0007 (0.0438) | 0.0330 (0.349) | 0.0422 (0.0760) | -0.0177 (0.1177) |
| felt weakly | -0.1091 (0.0706) | 0.1740 (0.0998) * | -0.1411 (0.0813) | 0.0689 (0.0725) | -0.2883 (0.0903) * | -0.0067 (0.1981) |
| Sample sizes | 633 | 752 | 597 | 819 | 241 | 137 |
| Pseudo R2 | 0.0541 | 0.0531 | 0.0652 | 0.0417 | 0.1443 | 0.2004 |

Notes: The numbers denote the marginal effect of the probit estimation. Numbers within parentheses denote standard errors. Other independent variables and reference groups are the same as in Table 4, except occupation dummies. Higher managerial workers include the *yakuin* (executives), the *bucho* (directors), and the *kacho* (section managers), while lower managerial workers include the *kakaricho* (subsection chiefs).

**Table 6. Estimation results from the web survey**

| Regression type | (1) Ordered probit | | | (2) Ordered probit | | | (3) Probit | | | (4) Ordered probit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Changes at workplaces from 1999 to 2002 | Dependent variables | | | | | | | | | | | |
| | The number of the respondent's tasks | | | Number of working hours | | | Worked more than 60 hours per week | | | Number of working hours | | |
| Experience of a large employment cut | 0.1008 | (0.0380) | *** | 0.0827 | (0.0393) | ** | 0.0598 | (0.0180) | *** | 0.0972 | (0.0424) | ** |
| Wage variation (base = no change) | | | | | | | | | | | | |
| increased siginificantly | 0.3943 | (0.0813) | *** | 0.3301 | (0.0815) | *** | 0.1074 | (0.0412) | *** | 0.3683 | (0.0898) | *** |
| increased fairly | 0.1864 | (0.0412) | *** | 0.2456 | (0.0425) | *** | 0.0820 | (0.0202) | *** | 0.2615 | (0.0459) | *** |
| decreased fairly | 0.0058 | (0.1145) | | -0.0089 | (0.1207) | | 0.0777 | (0.0626) | | 0.1575 | (0.1406) | |
| decreased significantly | -0.0100 | (0.1947) | | -0.1264 | (0.2023) | | -0.0950 | (0.0927) | | -0.3177 | (0.2300) | |
| don't remember | -0.0420 | (0.0629) | | -0.0457 | (0.0671) | | -0.0124 | (0.0305) | | -0.0521 | (0.0744) | |
| Risk of future dismissal (base = no change) | | | | | | | | | | | | |
| felt strongly | 0.0741 | (0.0901) | | 0.0951 | (0.0904) | | -0.0203 | (0.0417) | | 0.0948 | (0.0988) | |
| felt weakly | 0.0846 | (0.0505) | * | -0.0192 | (0.0525) | | -0.0120 | (0.0243) | | -0.0071 | (0.0571) | |
| did not feel at all | 0.1582 | (0.0398) | *** | 0.0409 | (0.0416) | | 0.0084 | (0.0196) | | 0.0597 | (0.0458) | |
| don't remember | 0.0381 | (0.0978) | | 0.1143 | (0.1111) | | 0.0045 | (0.0462) | | 0.1636 | (0.1229) | |
| cutpoint1 | 2.4727 | (4.4497) | | 3.1043 | (4.6661) | | | | | 4.3593 | (5.2386) | |
| cutpoint2 | 3.1689 | (4.4494) | | 4.1095 | (4.6651) | | | | | 5.3425 | (5.2378) | |
| cutpoint3 | 4.6844 | (4.4493) | | 6.1057 | (4.6653) | | | | | 7.3548 | (5.2381) | |
| cutpoint4 | 5.8128 | (4.4496) | | 7.2193 | (4.6659) | | | | | 8.4914 | (5.2387) | |
| Sample sizes | 4,289 | | | 4,221 | | | 3,657 | | | 3,524 | | |
| Pseudo R2 | 0.0540 | | | 0.0517 | | | 0.0805 | | | 0.0577 | | |
| Log likelihood | -5052.6 | | | -4266.1 | | | -2183.8 | | | -3542.2 | | |

Notes: Values given in parentheses denote standard errors. The same control variables (age, years of education, spouse dummy, child dummy, occupation dummies, firm size dummies, industry dummies, ratio of non-regular workers at workplaces, exempt dummy, title dummies, the hourly wage rate (instrumented), composition of employee age structure at the workplace, and firm's profit in 2002) are used in each estimation. (1), (2), and (4) are results of the ordered probit model. (3) is the result of the probit estimation, where the left-hand side variable takes 1 if an employee works for over 60 hours per week and 0 otherwise. The numbers represent marginal effects. In (4), we limit samples to those respondents who worked under a five-day work week.

**Table 7. Estimation results from the web survey using information from workplaces**

| | Samples limited to those who did not experience job rotation from 1999 to 2002 | | | |
|---|---|---|---|---|
| | | | Firm undertooked a large employment cut | Firm did not undertake a large employment cut |
| Regression type | (1) Ordered probit | (2) Ordered probit | (3) Ordered probit | (4) Ordered probit |
| | Dependent variables | | | |
| Changes at workplaces from 1999 to 2002 | The number of the respondent's tasks | Number of working hours | Number of working hours | Number of working hours |
| Change in employee composition at the workplace (base = no change) | | | | |
| regular (increased) and nonregular (increased) | 0.3534 (0.0847) *** | 0.3322 (0.0879) *** | 0.4259 (0.1322) *** | 0.2419 (0.1213) ** |
| regular (increased) and nonregular (no change) | 0.2487 (0.0833) *** | 0.2324 (0.0879) *** | 0.0679 (0.1428) | 0.3312 (0.1151) *** |
| regular (increased) and nonregular (decreased) | 0.9579 (0.2718) *** | -0.0479 (0.2817) | -0.6425 (0.4338) | 0.5111 (0.3813) |
| regular (no change) and nonregular (increased) | 0.5866 (0.1043) *** | 0.3564 (0.1075) *** | 0.3194 (0.1552) ** | 0.4491 (0.1547) *** |
| regular (no change) and nonregular (decreased) | 0.1896 (0.1257) | 0.1084 (0.1313) | 0.1052 (0.1925) | 0.0414 (0.1849) |
| regular (decreased) and nonregular (increased) | 0.4758 (0.1009) | 0.3907 (0.1058) *** | 0.3844 (0.1338) *** | 0.2798 (0.1862) |
| regular (decreased) and nonregular (no change) | 0.2090 (0.0729) *** | 0.204 (0.0769) *** | 0.2062 (0.1017) ** | 0.0441 (0.1279) |
| regular (decreased) and nonregular (decreased) | 0.1959 (0.0865) ** | 0.0295 (0.0904) | -0.1257 (0.1196) | 0.1154 (0.1493) |
| cutpoint1 | 2.7238 (5.2757) | 8.0252 (5.6255) | 12.1814 (9.1990) | 3.3533 (7.4328) |
| cutpoint2 | 3.3412 (5.2753) | 9.0706 (5.6241) | 13.2786 (9.1955) | 4.4247 (7.4314) |
| cutpoint3 | 4.9764 (5.2751) | 11.2626 (5.6250) ** | 15.2325 (9.1966) * | 6.8662 (7.4329) |
| cutpoint4 | 6.1354 (5.2756) | 12.459 (5.6259) ** | 16.4717 (9.1988) * | 8.0939 (7.4332) |
| Sample sizes | 3,053 | 3,000 | 1,244 | 1,756 |
| Pseudo R2 | 0.0540 | 0.0627 | 0.0707 | 0.0825 |
| Log likelihood | -3500.0 | -2794.4 | -1269.4 | -1452.2 |

Notes: Values given in parentheses denote standard errors. The same control variables (age, years of education, spouse dummy, child dummy, occupation dummies, firm size dummies, industry dummies, ratio of non-regular workers at workplaces, exempt dummy, title dummies, the hourly wage rate (instrumented), composition of employee age structure at the workplace, and firm's profit in 2002) are used in each estimation.

**Table 8. Estimation results from the web survey using information on tasks conducted by workers and business cycles**

| | Whether the respondent's tasks are the same as those of non-regular workers | | The connection between respondent's tasks and business cycles | | | |
|---|---|---|---|---|---|---|
| | Conducting same tasks | Not conducting same tasks | Increases during booms | Increases during busts | No relation with business cycles | Increases when any kind of shocks occur |
| Regression type | (1) Ordered probit | (2) Ordered probit | (3) Ordered probit | (4) Ordered probit | (5) Ordered probit | (6) Ordered probit |
| Changes at workplaces from 1999 to 2002 | Dependent variables | | | | | |
| | the number of working hours | the number of working hours | the number of working hours | the number of working hours | the number of working hours | the number of working hours |
| Experience of a large employment cut | 0.0638 (0.1270) | 0.1361 (0.0546) ** | 0.0056 (0.0741) | 0.3085 (0.1984) | 0.2384 (0.0946) ** | 0.2911 (0.1395) ** |
| Wage variation (base = no change) | | | | | | |
| increased siginificantly | 0.5181 (0.2684) * | 0.2622 (0.1179) ** | 0.1826 (0.1565) | 0.5515 (0.3621) | 0.3942 (0.2183) * | 0.5321 (0.3016) * |
| increased fairly | 0.3359 (0.1395) ** | 0.2657 (0.0593) *** | 0.2156 (0.0813) *** | 0.1477 (0.1922) | 0.3856 (0.1062) *** | 0.4153 (0.1477) *** |
| decreased fairly | -0.2828 (0.3917) | 0.0049 (0.1634) | 0.0487 (0.2344) | -0.6875 (0.4084) * | 0.1563 (0.3165) | -0.4322 (0.4046) |
| decreased significantly | -0.2597 (0.4391) | -0.0314 (0.3478) | -0.3805 (0.3372) | -0.2197 (0.7819) | 0.9195 (0.5962) | -0.3751 (1.3884) |
| don't remember | -0.1200 (0.2239) | 0.0008 (0.0906) | -0.1963 (0.1235) | 1.2432 (0.5066) ** | 0.1342 (0.1626) | -0.0710 (0.2250) |
| Risk of future dismissal (base = no change) | | | | | | |
| felt strongly | -0.1691 (0.2622) | 0.2937 (0.1380) ** | 0.3091 (0.1657) * | 0.5209 (0.4339) | 0.1683 (0.2756) | -0.1800 (0.3747) |
| felt weakly | -0.329 (0.1665) ** | 0.0982 (0.0736) | 0.1754 (0.1000) * | -0.2596 (0.2300) | 0.0075 (0.1311) | 0.0923 (0.1891) |
| did not feel at all | -0.1525 (0.1341) | 0.0507 (0.0560) | 0.0427 (0.0762) | 0.6037 (0.2337) *** | 0.0462 (0.0982) | 0.0072 (0.1424) |
| don't remember | -0.1405 (0.4264) | 0.1103 (0.1545) | -0.1946 (0.2194) | 1.3026 (0.8101) | 0.0801 (0.2943) | 0.5017 (0.3310) |
| cutpoint1 | -5.1682 (14.3965) | 9.5004 (6.4084) | -5.9461 (8.6096) | 34.0757 (24.4906) | 10.7952 (11.1971) | -0.8732 (16.5838) |
| cutpoint2 | -4.2009 (14.3919) | 10.5767 (6.4073) * | -4.9670 (8.6081) | 36.0166 (24.5017) | 12.1758 (11.1898) | 0.4045 (16.5747) |
| cutpoint3 | -1.8003 (14.3898) | 12.7849 (6.4087) ** | -2.7388 (8.6066) | 37.6420 (24.5104) | 14.7779 (11.1920) | 2.7771 (16.5741) |
| cutpoint4 | -0.5522 (14.3919) | 14.0037 (6.4095) ** | -1.4108 (8.6073) | | 15.9534 (11.1938) | 4.0627 (16.5761) |
| Sample sizes | 505 | 2,414 | 1,356 | 241 | 885 | 454 |
| Pseudo R2 | 0.135 | 0.0694 | 0.0977 | 0.205 | 0.0986 | 0.137 |
| Log likelihood | -445.8 | -2225.7 | -1230.2 | -221.1 | -705.6 | -403.7 |

Notes: Values given in parentheses denote standard errors. We use the same control variables as those noted for Table 7 in each estimation.