Changes in the Japanese Employment System in the Two Lost Decades

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Abstract

This paper re-examines developments in two key elements of the Japanese employment system, seniority-based wages and lifetime employment, using recent microdata from the *Basic Survey on Wage Structure*. In contrast with previous studies, we do find evidence that these practices are eroding. For seniority wages, we find, for example, that the age-wage profile has become flatter in recent years, especially for employees in the middle and final phase of their career. And for lifetime employment, we find a clear downward trend in the share of lifetime employees among younger, university-educated workers from the early 2000s. The findings suggest that a growing share of educated younger workers choose to leave indefinite-contract jobs due to the poor prospects for seniority-based wage progression, while older workers choose to stay in their present job despite stagnating wages, since it is more difficult for them to find alternative employment.

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Introduction

The Japanese employment system has been widely regarded as one important driver of economic growth during the country's high-speed growth era and subsequent decades. It greatly contributed to the productivity and competitiveness of Japanese firms by fostering an environment for long-term investments and by enhancing workers' incentives (see, e.g., Kato and Morishima 2002; Rebick 2005; Moriguchi and Ono 2004). However, the prolonged period of slow growth and repeated recessions following the burst of the bubble economy – what has now become the so-called "Two Lost Decades" – may have transformed the economic structures that were complementary to Japanese labor practices and underpinned their success.

However, to date researchers have discovered little evidence of major changes in the Japanese employment system, or at least the key features of the system, i.e., seniority wages and lifetime employment. In fact, although such practices may be gradually changing in response to changes in the economic and social environment, many have claimed that "core" employees are still covered by these traditional practices. Regarding the seniority wage, previous studies showed that the slope of the age-wage profile had not changed substantially (see, e.g., Hattori and Maeda 2000; Rebick 2001). As for lifetime employment practices, although numerous studies have also been conducted using a variety of measures (see, e.g., Chuma 1998; Kato 2001; Kambayashi and Kato 2009, 2011; Shimizutani and Yokoyama 2009), they all indicate that, even after the mid-1990s, there again was little change in such practices. While the absence of clear signs of change may suggest that the Japanese employment system has been immune to changes in the broader environment surrounding it, another possibility is that previous studies overlooked potential changes, because the period they focused on represents only the beginning of a dynamic long-term transformation. That is to say, most of these studies focused on the 1990s and early 2000s, while structural changes in the employment system may take years to manifest themselves. Yet, it is only since the late 1990s that

pressures have been such that employers started downsizing workforces and laying off employees, as is reflected in the higher unemployment rate in the 2000s.

Against this background, the purpose of the present study is to examine if and how traditional Japanese employment practices, especially seniority wages and lifetime employment, have changed in recent years, especially in the period since the early 2000s. We begin with the construction of a simple theoretical model of the Japanese employment system to review its economic rationale and to consider the effect of the recent changes in socioeconomic conditions on it. The model leads to the prediction that a sustained slowdown in productivity growth and population aging as presently experienced will undermine the stability of the Japanese employment system as an institutional equilibrium.

With the prediction of the theoretical model in mind, we then calculate a variety of measures in our empirical section to examine changes in the two key features of the Japanese employment system – seniority-based wages and lifetime employment – over the period 1989–2008 using annual microdata from the *Basic Survey on Wage Structure* (hereafter, *BSWS*) compiled by the Ministry of Health, Labour and Welfare. As for seniority wages, we examine time variations in: (i) the age-wage profile of male lifetime employees, which are defined as workers that entered a firm immediately after graduation and continued to work in the same firm until the survey date; and (ii) the kernel density wage distribution of lifetime employees by age group. As for lifetime employment, we examine: (i) the share of lifetime employees; and (ii) the five-year job retention rate. As for seniority wages, we examine time variations in: (i) the age-wage profile of male lifetime employees, which are defined as workers that entered a firm immediately after graduation and continued to work in the same firm until the survey date; and (ii) the kernel density wage distribution of lifetime employees by age group. As for lifetime employment, we examine: (i) the share of lifetime employees; and (ii) the five-year job retention rate.

Our analysis on the current state of the Japanese employment system is of relevance to scholars and policy makers alike. First, although theoretical studies on the Japanese employment system frequently highlight the mutual complementarity of its various elements, especially that of seniority wages and lifetime employment (e.g., Itoh 1994; Aoki et al. 1996), most empirical studies actually focus only on a single aspect of the system, i.e., seniority wages or lifetime employment. Our study is the first attempt to examine developments in both of these practices simultaneously, thus taking their complementarity into account. Second, developments in the employment system have potentially significant implications for the prospects of the Japanese economy. If it is indeed the case that the Japanese employment system was a key factor underpinning the performance of Japanese firms, then its erosion would indicate that this may no longer be the case in the present economic and social circumstances. At the same time, the breakdown of the employment system would also have a significant impact on people's lives – an aspect that has received little attention so far. That is to say, without lifetime employment and seniority wages, individual households can no longer base their life plans (as is presumed by the Life-cycle/Permanent Income Hypothesis) on the expectation of a secure job and future salary increases for the head of household.

The Japanese Employment System and the Focus of Our Analysis

Although definitions of the Japanese employment system vary, most studies regard the following three components as key elements: (1) seniority wages, (2) lifetime employment, and (3) enterprise labor unions. Of these three elements, the relevance of labor unions was already in decline during the 1990s, as indicated by the fall in the union participation ratio and their power in wage bargaining (Tsuru 2002). Consequently, our analysis focuses on developments regarding seniority wages and lifetime employment, the elements which until relatively recently appear to have remained intact.

It is important to note, though, that what is labeled the "Japanese employment system"

actually covers only a minority of employees, who are typically male (reflecting Japan's patriarchal society), have a university degree, and work for a large firm (since only large firms tend to be sufficiently stable to credibly promise lifetime employment). Since many firms are trying to replace regular full-time employees on indefinite contracts with other types of workers to provide greater flexibility to cut fixed labor costs in the face of slow economic growth, the percentage of core workers who are actually covered by the practices making up the Japanese employment system is gradually decreasing. This decrease in the share of indefinite-contract workers itself could already be regarded as an erosion of the Japanese employment system. The purpose here, however, is to examine employment practices *among* this core group of indefinite-contract workers traditionally covered by the Japanese employment system.

At this point, it is useful to briefly consider what is meant by lifetime employment. Although definitions provided by scholars differ slightly (see, e.g., Ohkochi 1972, and Aoki et al. 1996), lifetime employment is generally characterized by the following two conditions:

i) lifetime employees are hired immediately after graduation; and

ii) lifetime employees remain in the same firm until the retirement age.

While we adopt the first condition, which we refer to as the "infancy" condition, for our own definition, we moderately relax the second condition (referred to as "loyalty" below) to make our analysis empirically feasible. If we took the second condition literally, given the nature of our repeated cross-sectional dataset, we would not be able to use the observations for young employees, since it is not sure whether they will remain in the same firm until their retirement. Therefore, as mentioned above, we define lifetime employees as workers who were hired by a firm immediately after graduation and continued to work in the same firm until the survey date, not until the mandatory retirement age.

Utilizing our definition of lifetime employees, we examine wage profiles and lifetime

employment patterns for workers until their early 50s. The reason for focusing on workers until their early 50s only is the prevalence of early retirement and/or transfer to other (subsidiary) firms several years before the mandatory retirement age (60 years), especially among employees with a university degree and working for a large firm.[1] These practices mean that it is difficult to properly assess the age-wage relationship and employment continuity of workers close to their retirement. Moreover, the time variation in lifetime employment measures, such as the share of lifetime employees and the job retention rate, for male workers in their late 50s is likely to be directly affected by the extension of the mandatory retirement age by revisions of the "Elderly Employment Stabilization Law," because the actual retirement age of Japanese workers depends greatly on the mandatory retirement age stipulated by the law. To avoid any spurious variation in these measures for workers close to their retirement, we drop observations for workers in their late 50s (i.e., 55 to 59) from our analysis.

A Model of Seniority Wages and Lifetime Employment

Economists have put forward a variety of theories to explain the upward sloping wage profile that characterizes seniority wages and is complemented by lifetime or long-term employment. These theories include the human capital investment model (Becker 1962; Hashimoto 1979; 1981), the agency model, which considers the deferral of wages as a device to mitigate the problem of moral hazard on the part of employees (Lazear 1979; 1981), and models emphasizing the role of employee preference, such as a strong preference for rising consumption throughout one's life (Arai 1984) or an inherent preference for an increasing wage profile (Loewenstein and Sicherman 1991).

Of the different theories, the first two appear to be the most widely accepted among economists. However, intuitively, the agency model does not appear to provide a suitable explanation of the Japanese system, in which the age-wage profiles of highly educated workers

[1] On this point, see, e.g., Ono and Rebick (2003), who observe that "[t]here is long-standing agreement between management and labor in Japan that allows management to move workers around in the company (or even to loan workers to other companies) in return for a guarantee of employment until mandatory retirement age."

and/or workers employed in larger firms are steeper than those of other workers, since there are no reasons to believe that highly educated workers in larger firms are lazier and/or have a stronger incentive to cheat than other workers. In addition, if the steep age-wage profile in Japan is to be explained by the agency model, this would imply that Japanese workers require greater work incentives – and by extension are lazier – than workers elsewhere, which seems unlikely.

Based on these considerations, we here construct a simple theoretical model with firm-specific human capital that is helpful in understanding the economic rationale (and potential vulnerability to changes) of the Japanese employment system. To start with, the model takes the form of a labor contract between a firm and a worker in a single-shot setting, that is, it considers a worker of a certain cohort and two periods only – when the worker is young and when he is old. In the second step, the model is then extended to an overlapping generations version in an infinitely repeated setting.

A Single-Shot Model with Firm-Specific Human Capital Investment

Let us consider a two-period model in which it is assumed that both workers and employers are risk neutral and both capital and labor markets are perfect. Suppose that employment in a given firm entails investment in firm-specific human capital by the employee in the first period. Let q denote the value of the marginal products of a worker (VMP) without any firm-specific human capital investment. For the sake of simplicity, we assume q is constant over the first and second period. If a worker makes firm-specific human capital investments and continues to work in the firm over his working life, q decreases to $q(1-c)$ in the first period and increases to $q(1+r)$ in the second period, where c and r respectively stand for the cost and return of the firm-specific human capital investment. However, if a worker with firm-specific human capital decides to work for a different firm, his VMP drops to q in the second period, since the human capital is firm-specific. We also assume that

workers are indifferent among wage profiles, as long as each profile yields the same present value. Therefore, if their present values are identical, a worker is indifferent between a path which pays him his spot VMP at each point in time and a path which pays him a wage that is initially below his VMP but above his VMP later.

If the firm-specific human capital investment is sufficiently productive to satisfy $r > xc$, where x stands for the reciprocal of the time discount rate, the firm has an incentive to offer an employment contract with seniority wage and long-term employment, as it will profit from the worker's firm-specific human capital under the contract. Consider, for example, the case in which a firm offers a contract with lifetime (2-period) employment and seniority wage, which pays $q(1-a)$ to the worker who made the firm-specific human capital investment in the first period and $q(1+xa)$ in his second period, where a is the parameter determining the slope of the age-wage profile. As the present value of this contract equals that of the spot VMP without the firm-specific human capital investment, i.e., $q+q/x$, the contract will be acceptable for the worker if the lifetime employment commitment by the firm is credible. Moreover, the present value of the profit for the firm under this employment contract will be larger than that under the contract without the firm-specific investment by $q(r-xc)/x$ (>0), as can be verified in the columns under headings (1) and (2) in Table 1, which shows the payoffs for a firm and a worker with/without the firm-specific human capital investment.

Insert Table 1

While the model assumes that firms can credibly commit to providing lifetime employment, workers, on the other hand, may leave their job (in the second stage), for example for personal reasons such as an unexpected deterioration in their or a family member's health, which should be taken into account. Therefore, let Π denote the probability that a worker with firm-specific

human capital will continue to work in the same firm in the second period. It is assumed that workers' decision whether to leave is determined based on economic rationale, so that Π is an increasing function ($\Pi'(a)>0$) of a, the parameter that determines the slope of age-wage profile. Allowing for the possibility of job separation (for personal reasons), the expected lifetime income (ELI) of a worker with firm-specific human capital becomes slightly smaller and can be represented as follows:

$$ELI = \Pi(a) \times (q + q/x) + (1 - \Pi(a)) \times (q(1-a) + q/x) = q + q/x - (1 - \Pi(a))aq \ .$$

To make up for the loss caused by the possibility of job separation, the firm needs to raise the wage payments in the contract with the firm-specific human capital investment. Consider the case when the firm increases the wage payment in the second period by mq. As a result of this adjustment, expected lifetime income now looks as follows:

$$ELI = \Pi(a) \times (q + q(1+m)/x) + (1 - \Pi(a)) \times (q(1-a) + q/x) = q + q/x + \Pi(a)mq/x - (1 - \Pi(a))aq \ .$$

To make this offer just as attractive as the contract without the firm-specific investment, the firm sets $m=((1-\Pi(a))/\Pi(a))ax$.

Given the probability that the worker will remain in the firm in the second period (Π) and the necessary additional payment (m), the expected present value of profits for the firm (EPR) is calculated as follows:

$$\begin{aligned} EPR &= \Pi(a) \times q(r - xc - m)/x + (1 - \Pi(a)) \times (a - c)q \\ &= \Pi(a) \times q(r - xc - \frac{1 - \Pi(a)}{\Pi(a)} ax)/x + (1 - \Pi(a)) \times (a - c)q \\ &= (\Pi(a)r - cx)(q/x). \end{aligned}$$

As q, c, and r are determined by technological factors, and the subjective discount rate (x) is also exogenously given, firms choose the level of a, the slope of the age-wage profile, to maximize profits under the constraint that the required level of expected lifetime income for the worker be maintained. As long as there exists a value a that satisfies the inequality $r > xc/\Pi(a)$, the firm has an

incentive to offer an employment contract with a seniority wage and a long-term employment commitment. Since, as already discussed, Π is an increasing function of a, a profit-maximizing firm has an incentive to set a large a, that is, choose an upward-sloping wage profile, whenever possible.[2] If a is set sufficiently large to satisfy $a>\Pi(a)$ (r/x), both $(a-c)q>0$ and $q(r-xa-m)=q(r-xa/\Pi(a))<0$ hold, meaning that the firm would offer a wage-profile that pays workers less than the spot VMP when they are young and more than the VMP when they are older (see the columns under heading (3) in Table 1 for the payoffs when the possibility of separation is taken into account).

The prediction of the model that the wages of older workers are higher than their spot VMP makes a lot of sense and also provides a rationale for the widespread use of mandatory retirement in Japan. That being said, our argument in this subsection critically depends on our assumption that the firm's commitment to providing lifetime employment and wage increases with seniority is credible. However, in a single-shot setting as we have presented so far, firms cannot make a credible commitment since they have an incentive to breach such a commitment in the second period, as shown below:

- Profit change from a breach of the lifetime employment commitment:

  $(a-c)q+0/x-(\Pi(a)r-cx)(q/x) = (ax-\Pi(a)r)(q/x) > 0$

- Profit change from a breach of the seniority wage commitment:

  $(a-c)q+rq/x-(\Pi(a)r-cx)(q/x) = (ax-\Pi(a)r+r)(q/x) > 0.$

While firms can increase profits by breaching either of the two commitments, firms would be more likely to breach the seniority wage commitment, since the increase in profits in this case is greater. Therefore, in a single-shot setting, firms cannot credibly commit to paying higher wages in the second period, and investment in firm-specific human capital, which would potentially benefit both

[2] It should be noted that in the model presented here, the larger a, the better for the firm. Therefore, even when wages are constrained to be non-negative, the firm would set $a=1$, choosing an extreme seniority wage profile with a zero wage in the first period. To avoid this problem, we would have to extend our model by, for example, introducing liquidity constraints. However, we refrain from doing so here for simplicity.

workers and firms, would not materialize.

Extension of the Model to a Repeated Game

The shortcomings of the single-shot model can be rectified by extending it to an overlapping generations version in a repeated game setting. In a repeated game setting, a breach of commitments by a firm results in a loss of reputation, ruling out the possibility of future contracts involving firm-specific human capital investment. Therefore, firms have an incentive to honor their commitments if the future costs of the reputation loss exceed the spot gain of breaching them.

To make this argument more concrete, let us consider an economy in which people believe that the number of workers (of a certain cohort) in the firm is growing at (n-1)×100 percent, and that workers' productivity is also growing, at a rate of (g-1)×100 percent, from one cohort to the next. The multi-period payoffs (from period t to period t+2) for a labor contract with firm-specific human capital investment are given in Table 2.

Insert Table 2

Panel (a) presents the payoff when the firm honors its commitment, while panel (b) shows the payoff when the firm breaches it. The present values (PVs) of the firm's profits in and after period t are calculated as follows:

- Present value when the commitments are honored:[3]

[3] To calculate the present value, we implicitly assumed that ng is smaller than x.

$$PV_{Honor} = [(a-c)qng + \Pi(a)q(r - xa - m)] + [(a-c)qng + \Pi(a)q(r - xa - m)]\left(\frac{ng}{x}\right)$$
$$+ [(a-c)qng + \Pi(a)q(r - xa - m)]\left(\frac{ng}{x}\right)^2 + \cdots = [(a-c)qng + \Pi(a)q(r - xa - m)]\left(\frac{x}{x-ng}\right)$$
$$= \left[(a-c)qng + \Pi(a)q(r - xa - \frac{1-\Pi(a)}{\Pi(a)}xa)\right]\left(\frac{x}{x-ng}\right) = q[ng(a-c) + \Pi(a)r - ax]\left(\frac{x}{x-ng}\right)$$

- Present value when the commitments are breached:

$$PV_{Breach} = \Pi(a)rq$$

As long as $PV_{Honor} > PV_{Breach}$ holds, the firm has an incentive to honor its commitments, which in turn provides credibility to the contract with seniority wage and lifetime employment. Thus, if these conditions are given, the Japanese employment system can be in a stable equilibrium. However, if the conditions change and $PV_{Breach} > PV_{Honor}$, firms face an incentive to breach their seniority-wage commitment. And if firms do breach existing seniority-wage and lifetime employment commitments, any future commitments will lack credibility and younger workers will no longer accept contracts promising seniority wages and lifetime employment.

In the example above, whether PV_{Honor} is larger or smaller than PV_{Breach} is determined by comparing $q[ng(a-c) + \Pi(a)r - ax]\left(\frac{x}{x-ng}\right)$ and $\Pi(a)rq$. This comparison boils down to a comparison between *ng* and the boundary value $ax/[a-(c-\Pi(a)(r/x))]$. If *ng* is greater than the boundary value, PV_{Honor} exceeds PV_{Breach}; otherwise, PV_{Honor} is smaller than PV_{Breach}. Therefore, assuming for simplicity that the boundary value takes a given number, the sustainability of the Japanese employment system with seniority wages and lifetime employment appears to depend on the level of *ng*. If the economy starts from a situation with a high *ng*, employers' commitment to seniority wages and lifetime employment is credible and the Japanese-style employment system is sustained at an equilibrium that generates firm-specific human capital investment. However, once *ng* falls below the boundary value, the commitment to seniority wages will be breached and the equilibrium with investment in firm-specific human capital will become increasingly unhinged.

Finally, looking at the Japanese economy during the post-war period, while it certainly started with a very high *ng* – rapid labor force and productivity growth – during the high-speed growth era until the mid-1970s, the prolonged period of slow growth following the burst of the bubble has lowered productivity growth (*g*), while the rapid aging of society as well as falling birthrates have created a situation where *n* is very low (even negative). Therefore, our model predicts that the Japanese employment systems is facing a major turning point. In the following section, we empirically examine whether what our model predicts is actually coming true.

Empirical Analysis

Data Sources

In order to examine whether there have been any changes to seniority-based wages and lifetime employment practices, we use micro-level data from the *BSWS* for the period from 1989 to 2008. The survey provides information on both establishments and individuals. Information on establishments includes their 3-digit industrial classification number, the total number of indefinite-contract employees in the firm to which the establishment belongs, and the location. Information on individuals includes not only their wages and bonus payments, but also their age, sex, educational attainment, type of employment, regular/part-time status, length of service in the firm, and actual number of days/hours worked per month. We merged the information on establishments and individuals using the establishment identification number. As mentioned, among the different types of workers, our analysis will focus on male regular indefinite-contract workers.[4]

The *BSWS* covers all areas of Japan and all major industries. Industries were originally classified into approximately 400 very detailed categories. These categories can be reclassified into the 14 major industries of the 2002 Japan Standard Industry Classification. The 14 industries are (1)

[4] Sample statistics of the data used in this paper are reported in Appendix Table 1.

mining; (2) construction; (3) manufacturing; (4) electricity, gas, heat supply, and water; (5) information and communication; (6) transport; (7) wholesale and retail trade; (8) finance and insurance; (9) real estate; (10) eating and drinking places, accommodations; (11) medical, health care and welfare; (12) education, learning support; (13) compound services; and (14) services, n.e.c. The establishments are either (a) establishments with 10 indefinite-contract employees or more, either in the private or public sector, or (b) private establishments with 5-9 indefinite-contract employees. The total number of establishments falling under the *BSWS* criteria was about 1.1 to 1.5 million during the observation period, while the total number of persons employed by these establishments was around 30 to 38 million. The Ministry of Health, Labour, and Welfare, the ministry implementing the *BSWS*, selects establishments in the first stage of a two-stage stratified sampling scheme. In the second stage, each establishment is then asked to randomly choose employees from its payroll records. The number of establishments and of employees sampled per year was about 70,000–80,000 and 1.4 to 1.6 million, respectively.

The way the *BSWS* is compiled was revised in 2005, meriting two comments. First, the way that employees are classified was revised. Until 2004, employees were divided into only two categories, namely indefinite-period contract employees and definite-period contract employees. Since 2005, however, employees have been divided into five categories: (1) regular employees with an indefinite-period contract; (2) regular employees with a definite-period contract; (3) non-regular employees with an indefinite-period contract; (4) non-regular employees with a definite-period contract; and (5) temporary employees. Categories (1) and (3) after 2005 correspond to indefinite-period contract employees before 2004. Thus, we can smoothly connect the data before and after the revision without any significant discrepancy in the definition.

Second, 22 occupations were newly included in the *BSWS*. Of these, 12 occupations were transferred from the *Wage Survey of Outdoor Workers by Occupation* owing to its integration with

the *BSWS*. The other 10 occupations were newly added to cover professional jobs, such as dentists, veterinarians, lawyers, certified public accountants, certified social insurance labor consultants, university lecturers, and so on. In the construction of our sample, we exclude workers in these added occupations to avoid spurious time variations in wage structures and employment.

The *BSWS* has some distinctive advantages for examining changes in Japan's employment practices. First, even after controlling for a variety of employee attributes, such as educational attainment or the size of the firm they work for, the sample size is still sufficiently large. Second, in contrast with other surveys such as the *Employment Status Survey*, which is conducted only every five years but has often been used in previous studies, the *BSWS* is compiled annually. This high frequency allows us to closely follow developments in labor market practices and to identify the timing of potential changes.

That being said, even the *BSWS*, and hence our data set based on it, has some shortcomings. Since establishments sampled in the *BSWS* are randomly selected from the establishments in the *Survey of Firms and Establishments* (*SFE*), which is revised every three to five years, the *BSWS* suffers from large discontinuities between before and after revisions of the *SFE*. In our sample period, such revisions occurred in 1991, 1994, 1996, 1999, 2001, and 2004. To avoid any discontinuities in variables due to the *SFE* revisions, we adjust the original data obtained from the *BSWS* using sampling ratios of individual workers, available from the survey, to obtain the population median-based wage profile. We also compute the population-based kernel density wage distribution, the ratio of lifetime employees, and the retention rate in the same way.

Calculated Measures

To examine recent developments in Japanese employment practices, we compute the following four measures for each year: (1) the age-wage profile; (2) the kernel density wage distribution; (3) the

share of lifetime employees; and (4) the job retention rate.[5] As already explained, we exclude the age group of 55–59 year-olds in order to avoid any potential distortions of wages and employment resulting from early retirement, transfer to subsidiary firms, and the extension of the compulsory retirement age.

Age-Wage Profile

To construct the age-wage profile, which is the most commonly used measure of seniority wages in the literature, we use the median of monthly wages for lifetime employees. Monthly wages here are total monthly contractual cash earnings plus one-twelfth of annual special cash earnings in the previous year. Many previous studies used hourly wages (rather than monthly wages) for the calculation of age-wage profiles because they focus on productivity effects of the Japanese employment system. The reason for using monthly wages here is that this should result in more stable age-wage profiles since monthly wages are unlikely to be significantly affected by fluctuations in hours worked.[6] Further, using monthly wages means that the increase in hourly wages caused by the 1988 and 1994 revisions of the Japanese Labor Standards Law successively reducing the maximum weekly working hours from 48 to 40 does not affect our age-wage profiles. Specifically, we use contractual cash earnings before taxes in the month of June, including overtime payments. This amount is then deflated by the consumer price index for all of Japan (general, excluding imputed rent). Finally, we plot the wage profile using the median values of the monthly wage from 18 (for high school graduates) or 22 (for university graduates) to 54 years of age. The initial wage at 18 or 22 is normalized to 1 to make the variation in the wage slope more visible.

[5] Another potential measure of employment practices, which has been used in numerous other studies, is the average years of tenure. However, this measure does not take into account the "infancy" and "loyalty to single-firm" conditions used for our definition of lifetime employment and is therefore not considered here.

[6] Contracts for indefinite-period workers typically state the monthly wage rather than an hourly wage. Therefore, monthly wages vary little except for some minor fluctuations due to overtime payments. Converting monthly wages to hourly wages (i.e., dividing monthly wage by the hours worked per month) would introduce considerable variation due to fluctuations in the hours worked each month.

Kernel Density Wage Distribution

While the age-wage profile only allows us to examine trends in the median wage, examining the entire wage distribution may allow us to identify changes in higher statistical moments such as the dispersion, skewness, and kurtosis. Therefore, we use the kernel density distribution of monthly wages by age group as our second measure to examine seniority wages. Specifically, we plot the kernel density distributions for the following five age groups against each other: (1) 30–34 year olds; (2) 35–39 year olds; (3) 40–44 year olds; (4) 45–49 year olds; and (5) 50–54 year olds. If the seniority wage system is still intact, we would expect the wage distribution to lie further to the right the older the age group, as wages rise with age and seniority. On the other hand, if the system no longer operates, we would not expect such a clear-cut pattern. In the latter case, even if the seniority wage system is no longer intact, wages may still increase with age to some extent, but the increments between age groups and the distributional pattern are likely to differ from those in the situation where the seniority wage system is intact, reflecting pay schemes in which seniority plays a smaller role and other aspects, such ability or performance, are more important.

Share of Lifetime Employees

As mentioned earlier, lifetime employees here are defined as those who were hired immediately upon graduating from school or university and have continued to work for the same firm until the survey date. This definition satisfies two necessary conditions for lifetime employment: “infancy” and “loyalty” to a single firm. Whether these conditions are satisfied can be determined by examining the difference between workers’ age and their length of service in their firm. University graduates are regarded as a lifetime employees if the difference is 22 or 23. For high school graduates, a difference of 18 indicates that these conditions are satisfied.

The share of lifetime employees in a particular age group *i* at time *t* is calculated by dividing the number of lifetime employees by the total number of workers in the same age group. For presentational reasons, we divide our sample into the following three age groups: (1) 25–34 year olds; (2) 35–44 year olds; and (3) 45–54 year olds.

Job Retention Rate

Our second indicator for the prevalence of lifetime employment is the job retention rate. This is the probability that a worker retains the same job for a certain length of time. This measure has been used in a number of previous studies (e.g., Hall 1982; Hashimoto and Raisian 1985; Chuma 1998; Kato 2001; and Kambayashi and Kato 2009; 2011), which, however, focused on the degree of labor mobility rather than on the prevalence of lifetime employment, since they examined workers with a relatively short length of service, typically 0–4 or 5–10 years.

As our primary interest is in lifetime employment, we apply the concept of the job retention rate to lifetime employees. The job retention rate for lifetime employees is calculated as the ratio of the lifetime employment share in an age category of one survey divided by that in the corresponding higher age category of a later survey. Specifically, we calculate the five-year job retention rates for lifetime employees in seven five-year age groups, that is, 20–24 year olds, 25–29 year olds, 30–34 year olds, 35–39 year olds, 40–44 year olds, 45–49 year olds, and 50–54 year olds, for the four time periods of 1990 to 1995, 1995 to 2000, 2000 to 2005, and 2003 to 2008. We first calculate the share of lifetime employees in each five-year age group for the base years of 1990, 1995, 2000, and 2003. Next, we do the same for each age group in the *BSWS* five years later (1995, 2000, 2005, and 2008). Finally, we divide the share obtained in the first step for one age group by the corresponding value obtained in the second step by the next older age group. For example, the share of lifetime employees in the 20–24 year-old age group in 1990 is divided by that in the 25–29

year-old age group in 1995. The ratio thus obtained is the five-year job retention rate of lifetime employees. Our brief-interval retention rate may help to better identify changes in lifetime employment.

Empirical Findings

This subsection examines the time-series variation in the above-mentioned four measures to see what happened to the Japanese employment system following the burst of the bubble in the early 1990s, especially in the period from the late 1990s up to the present.

Changes in the Wage Profile

We first examine recent developments in the age-wage profile. We divide the sample into the manufacturing sector and the non-manufacturing sector,[7] as the competitive environment in these two sectors has been quite different: while the manufacturing sector has long been subject to fierce international competition, the non-manufacturing sector has been sheltered from competition by regulatory barriers.

We construct separate wage profiles for the two sectors for four different subgroups: (1) university graduates in large firms (defined as firms with more than 1,000 indefinite-contract employees); (2) university graduates in small to medium-sized firms (firms with fewer than 1,000 indefinite-contract employees); (3) high school graduates in large firms; and (4) high school graduates in small to medium-sized firms. The results are presented in Figures 1(a) to 1(d) for the manufacturing sector and 2(a) to 2(d) for the non-manufacturing sector, which depict the age-median wage profiles for three selected two-year intervals, 1989–1990, 1998–1999, and 2007–2008.

[7] The non-manufacturing sector consists of (1) mining; (2) construction; (3) electricity, gas, heat supply, and water; (4) information and communication; (5) transport; (6) wholesale and retail trade; (7) finance and insurance; (8) real estate; (9) eating and drinking places, accommodations; (10) medical, health care and welfare; (11) education, learning support; (12) compound services; and (13) services, n.e.c.

Looking first at the profiles for the first period, 1989–1990, we find that wages increased substantially with age in both sectors, although the slope was steeper in the non-manufacturing than in the manufacturing sector. However, by 1998–1999, the slope had started to flatten somewhat, except for high school graduates in large firms. The relative wage decline was particularly pronounced for middle-aged to older workers, as indicated by the growing divergence between the wage profiles for 1989–1990 and 1998–1999 from the age of around 40 for most subgroups.

Insert Figures 1 and 2

By 2007–2008, the flattening of wage profiles had become even more pronounced. Moreover, differences between the manufacturing and non-manufacturing sector had widened. The wage slope for workers in manufacturing firms slightly declined between 1998–1999 and 2007–2008, regardless of firm size and educational attainment. On the other hand, for 2007–2008, the wage profile in the non-manufacturing sector substantially flattens, or becomes "kinked," around the age of 40. Especially for university graduates, the wage barely increases after the mid-40s, regardless of firm size. And although the wage of high school graduates in the non-manufacturing sector continues to gradually increase with age, the increase in 2007–2008 is fairly small when compared with 1989–1990 and 1998–1999.

It should be noted that the age-wage relationship in the above profiles may also be influenced by cohort factors as well as the age effect. If the cohort factors dominate the relationship, the flattening of the age-wage profile may be only a temporary phenomenon which is specific to certain cohorts. In order to determine the significance of the cohort effect, we plot in Figures 3(a) to 3(d) the cohort-specific age-wage profiles for the non-manufacturing sector. The initial wage for these profiles is not normalized to 1, because the initial wage is not necessarily available for all

cohorts. As can be clearly seen in Figures 3(a) and 3(b), the cohort-specific profiles also gradually flatten for more recent cohorts from around the age of 40. Thus, the flattening of wage profiles does not appear to be due to cohort factors but mainly due to the age effect.

Insert Figure 3

Changes in the Kernel Density Wage Distribution

While our finding of nearly non-increasing wages in the latter half of workers' career appears to suggest that the seniority-wage system is breaking down, it is also possible that the median wage may be affected by certain changes in the distribution of worker quality through labor hoarding and/or employment adjustments following the burst of the bubble. To examine this possibility, Figures 4 and 5 depict the age-group specific kernel density distributions of monthly wages for male university graduates in the non-manufacturing sector, for large and for small to medium-sized firms, respectively. As panels (a) and (b) in Figures 4 and 5 illustrate, in 1989–1990 and 1998–1999, the wage distribution used to shift to the right with age, reflecting pay rises with age and seniority. However, panel (c) for 2007–2008 shows that for the 45–49 and 50–54 age groups, the distribution hardly shifts at all. This minuscule shift as well as the small difference in the shape of the distributions for the 45–49 and 50–54 age groups suggest that the recent decline of the median wage for middle-aged and older workers results not from changes in the distribution of worker quality but from the small increase in wages for the typical employee from middle age onward.

Insert Figures 4 and 5

Changes in the Share of Lifetime Employees

Next, we examine changes in the share of lifetime employees over the past two decades. Figures 6(a) to (d) depict this share for the aforementioned four subgroups in all industries.[8] Among these groups, a clear decline in the lifetime employment rate can be observed for the youngest age group (those aged 25–34) of university graduates working in large firms (see Figure 6(a)). The lifetime employment rate for this group shows a sharp decline of nearly 20 percentage points between the mid-1990s and 2008. On the other hand, Figure 6(b) indicates that in small to medium-sized firms the decline in lifetime employment among the youngest group of university graduates has been more moderate. Figures 6(a) and 6(b) also suggest that the share of lifetime employees in the older age groups has remained largely unchanged during our observation period, with the exception of the oldest (45–54) university graduates group working in large firms (Figure 6(a)), which shows a slightly decreasing trend.

Insert Figure 6

Turning to the lifetime employment ratio for high school graduates, shown in Figures 6(c) and (d), we find no clear trend, except again for the oldest group, i.e., those aged 45–54. The lifetime employment ratio for this oldest group has actually increased. A possible reason for this is the extension of the mandatory retirement age through revisions of the "Elderly Employment Stabilization Law" since the early 1990s. The initial amendment, which was approved in 1994 and enforced in 1998, obliged firms to adopt a mandatory retirement age of 60. In the second revision, the retirement age was raised to 65 in 2004. While the impact of these revisions on the lifetime employment ratio for university graduates was limited since they, as mentioned above, traditionally leave their firm before the mandatory retirement age due to early retirement or temporary transfers,

[8] Because the trend in the lifetime employment ratio differs little between the manufacturing sector and the non-manufacturing sector, we do not report the detailed pattern here. Separate figures for these two sectors are available from the authors upon request.

the revisions had a more visible impact on the lifetime employment ratio for high school graduates because they typically work up to the mandatory retirement age.

The contrast between university and high school graduates, as well as that between large firms and small to medium-sized firms, partially reflects the fact that the Japanese employment system is applied mainly to highly educated male workers in large firms. However, the findings of our analysis suggest that in recent years even for this privileged group of workers traditional Japanese employment practices no longer apply to the same extent as in the past.

Changes in the Job Retention Rate

We now turn to our second measure of lifetime employment, the job retention rate. Table 3 reports the five-year job retention rate for university-educated lifetime employees in large and small to medium-sized firms. Specifically, the table shows that in 1990, 91.5 percent of male indefinite-contract employees aged 20–24 at large firms satisfied the two lifetime employment conditions. However, five years later, in 1995, this was the case for only 65.8 percent of male indefinite-contract employees aged 25–29. Thus, using these figures, the five-year job retention rate for the period 1990 to 1995 is calculated as 65.8/91.5=71.9 percent. The three columns on the right-hand side of the table report the change in the retention rate between two neighboring periods.

Insert Table 3

Examining these figures in detail, we find the following. First, the retention rate for the youngest age group (those aged 20–24) started to decline significantly in the early 1990s. Although this trend can be observed for both large and small to medium-sized firms, it is considerably more pronounced for large firms. Further, for the second and third youngest categories (those aged 25–29

and 30–34), the retention rate also decreased, from the late 1990s and the early 2000s, respectively. These results indicate that young university graduates today are likely to leave indefinite-contract jobs earlier than young graduates did in the past. On the other hand, while the retention rate of middle-aged to older university graduates in large firms temporarily declined between the late 1990s and the early 2000s, this trend did not continue in the most recent period.

Insert Table 4

Next, let us turn to changes in the job retention rate for high school graduates. Table 4 shows that the retention rate for the youngest age group has declined since the late 1990s. In this group, 6.1 percent of employees at large firms and 2.6 percent of employees at small to medium-sized firms left their first jobs between the 1995–2000 period and the 2000–2005 period. Furthermore, in the most recent period, between 2000–2005 and 2003–2008, among the youngest age group, 16.9 percent of employees at large firms and 8.2 percent of employees at small to medium-sized firms left their first job. In the same period, the retention rate of the second youngest group also started to decline. In contrast, the retention rate for age groups of 30 and above remained largely unchanged, with the exception of the large increase in the 1990s and subsequent decrease in the early 2000s in small to medium-sized firms.

Taken together, the results suggest that there has been an erosion of lifetime employment among young workers, both university and high school graduates, although no such trend is found for older workers.

Discussion

Summarizing the findings above, some changes in Japan's employment system appear to have

occurred in recent years. First, older workers, particularly those in the non-manufacturing sector, no longer enjoy the same wage increases as in the past. And second, there is a clear erosion of lifetime employment especially among highly educated young workers. Generally speaking, these findings of our empirical analysis are in line with the predictions of our model of the Japanese employment system. This emphasized the importance of a credible commitment by firms to seniority wages and lifetime employment and suggested that once firms could no longer credibly commit to these practices due to low productivity growth and population aging the Japanese employment system would be undermined.

Let us consider our results – and especially the different findings for younger and older employees – in detail, taking the role of employees' expectations regarding employers' commitment into account. Starting with the erosion of the seniority wage, our model predicts that this would primarily affect older workers, because employers would derive greater benefit from reducing the wages of older employees than breaching their lifetime employment commitment to them once productivity and population growth rates fall below a certain threshold. In practice, older workers often have little choice but to stick with their job because it is difficult for them to find an alternative job without taking a significant pay cut. Therefore, employers are likely to reduce the wage of the elderly rather than to fire them, which is exactly the pattern we found.[9]

On the other hand, the model suggests that the erosion of lifetime employment is expected to begin with young workers. If young employees have doubts regarding the credibility of implicit promises of future wage increases, they are likely to avoid traditional employment relations. Since young workers, especially better educated workers, can find another job more easily than middle-aged or older workers, they are likely to be more sensitive to a(n) (anticipated) decline in their wage. We believe that this is the reason why in our empirical analysis we find that it is

[9] In Japan, strict regulations make it difficult to dismiss employees, increasing employers' costs of laying off workers and encouraging them to reduce employees' wages instead.

especially among the young that lifetime employment relations are on the decrease.

However, the impact on the credibility of firms' commitments is not the only mechanism through which decreasing productivity growth and population aging undermines the Japanese employment system. First, research suggests that the productivity of elderly workers significantly declined in the 1990s and 2000s (see, e.g., Kawaguchi et al. 2006), possibly because such workers may not have been able to keep up with innovations in the field of information and communication technologies. This means that the gap between the labor productivity and the seniority-based wages of middle-aged and older workers may have been growing, which may have exerted downward pressure on the wages of such workers in the latter half of our observation period. Second, the changing age structure of the workforce also matters for the erosion of the seniority wage. In particular, wage costs (=average wage × number of workers) for middle-aged and older workers would have increased disproportionately from the late 1990s as the baby boomer generation (those born between 1947 and 1949, called *dankai* in Japanese) swelled the ranks of the oldest age groups with the highest wages.

Considering the erosion of lifetime employment among younger workers, some other reasons apart from the decline in the predicted seniority wage can be given. These may partly explain our finding that the lifetime employment ratio and the job retention rate started to decline even before wage profiles began to flatten. One potential reason is a decrease in the job-match quality in the labor market for new graduates. Following the burst of the bubble, and especially since the late 1990s, job opportunities for new graduates have deteriorated considerably as firms tried to retain existing workers in order to avoid the sunk costs of firm-specific human capital investments and maintain their reputation for providing employment security. This lack of labor demand for new graduates may have resulted in poor job matching, which in turn may have increased the probability that new graduates leave their employer when the opportunity arises. Yet another possible reason for

the higher job separation among younger workers is legislative changes. Japan's Labor Standards Laws were modified in 1998 to permit fixed-period contracts of three years or less for particular types of jobs. The law was further amended in 2004, extending it to all types of jobs. Until then, the law had obliged firms to choose either indefinite period contracts or definite period contracts of up to one year. The introduction of multi-year definite period contracts may have increased the options for firms as well as workers, resulting in greater inter-firm mobility, particularly among younger workers. In Japan's low-growth economy with considerable uncertainty about the future, firms may have chosen to replace indefinite-contract employees with definite-contract employees in order to increase the flexibility of their human resource management.

Finally, let us consider the differences in wage profile patterns between the manufacturing and the non-manufacturing sector, especially in the 2007–2008 period. Specifically, we found that whereas wages for university graduates in the non-manufacturing sector more or less stagnate once workers reach their mid-40s, wages in the manufacturing sector continue to increase even in later stages of workers' career. We first consider whether the two factors identified in our model as important determinants - productivity and population growth – differ in the two sectors. Figures from the Japan Industrial Productivity (JIP) Database 2010, compiled by the Research Institute of Economy, Trade and Industry (RIETI) of Japan, suggest that the average annual growth rate of total factor productivity (TFP) in the period 1989–2007 was 1.9 percent per year for the manufacturing sector, but only 0.4 percent for the non-manufacturing sector. Looking at the period 2000–2007 only, the difference is even more pronounced, with average annual TFP growth of 3.0 percent in the manufacturing sector and 0.6 percent in the non-manufacturing sector. This difference in productivity growth likely provides at least a partial explanation of the different developments in wage profiles. On the other hand, it is unlikely that changes in the age structure of workers due to population aging play a role in the different wage developments in the manufacturing and the

non-manufacturing sectors, since both are subject to overall demographic trends.

Given the extent of the difference in wage developments between the two sectors, other factors outside the framework of our model probably also play a role. One possible explanation, for example, is increased product market competition in the non-manufacturing sector. At least until the late 1990s, the slope of the wage profile in the non-manufacturing sector – which had enjoyed stronger protection – looked steeper than that in the manufacturing sector, leaving some room for wage cuts for middle-aged and older workers. Deregulation in recent years, especially in the non-manufacturing sector, may have led to greater competition among firms in areas such as finance and insurance, information and communications, and wholesale and retail. With the increase in competition, firms in the non-manufacturing sector were forced to adapt and to improve their managerial efficiency. Again, though, this seems only a partial explanation at best: the changes observed for university graduates in the non-manufacturing sector look a bit too extreme to be the result of competition-induced adjustments only. Hence, further research is required to solve this remaining "puzzle."

Conclusion

The aim of this paper was to examine if and how traditional Japanese employment practices, especially seniority wages and lifetime employment, have changed in recent years, especially in the period since the early 2000s. We started our analysis by presenting a simple theoretical model of the Japanese employment system in order to consider its economic rationale and to predict the way in which the system would erode under changing socioeconomic conditions. On the basis of the predictions of our model, we examined developments in two key components of the Japanese employment system – seniority-based wages and lifetime employment – over the past 20 years using data from the *Basic Survey on Wage Structure*. The findings can be summarized as follows. First,

with regard to seniority-based wages, we examined developments in the age-wage profile for lifetime employees and found a gradual flattening of the wage slope in the 1990s, followed by a "kink" in the wage slope at around age 40 in 2007-2008. Examining, moreover, developments in the wage distribution over time, we found that the shift to the right (higher wages) for older age groups observed in earlier periods had almost disappeared in 2007-2008. Second, in order to examine developments in lifetime employment patterns, we calculated the share of lifetime employees and the five-year job retention rate. While we did not detect a clear trend in the share of lifetime employees among middle-aged and older male indefinite-contract employees, we did find a discernable downward trend in the share for university-educated younger workers from the early 2000s. The job retention rate also declined noticeably in the 2000s for university-educated younger workers.

Overall, the long-term trends of our four measures suggest that the two key elements of the Japanese employment system have recently started to erode simultaneously. It appears that as a result of the flattening of the wage curve in later career stages, younger educated workers have a greater incentive to not commit to the implicit contract underlying the traditional Japanese employment system and a growing proportion are beginning to leave indefinite-contract jobs. On the other hand, many older workers appear to have decided to accept a wage cut – a breach of employers' implicit commitment to seniority-based wages – and stay in their present job because of the lack of alternatives. As a result, the lower job mobility of middle-aged to older workers is likely to have contributed to the disproportionate wage reductions they have had to endure. Thus, given the complementarity of seniority-based wages and lifetime employment, the observed trends overall suggest that the Japanese employment system has started to unravel in recent years.

It should be noted, however, that this assessment is not likely to be shared by everyone. Kambayashi and Kato (2011), for example, found that the job retention rate for core employees –

defined as workers aged 30 to 44 with at least five years of tenure – remained stable during the period 1982–2007. They therefore argue that the burden of employment adjustment during the Lost Decade was shared widely among workers, taking the form of reductions in working hours and wages rather than layoffs. In addition, they suggest that core employees still enjoy a privileged status in Japanese firms. However, while in this sense the Japanese employment system endures, our model and empirical results suggest that although the adjustments described by Kambayashi and Kato (2011) may help the system to survive in the short run, it no longer appears to be sustainable from a long-run perspective. The reason is that the recent wage reduction for core employees is not simply an adjustment of the traditional system to preserve it, but a manifestation of the fact that employers have already been unable to honor their implicit wage commitments to senior workers. This, in turn, means that young new entrants will be reluctant to commit to a seniority-wage system in which they are paid less than their marginal product.

The erosion of the traditional employment system is bound to have a significant impact both on people's lives and on corporate management practices. Although this is an issue that has received little attention in the literature so far, the impact on people's everyday lives is at least as significant as that in the corporate sector. That is, without seniority-based wages and lifetime employment, individual households can no longer plan their lives based on the expectation of a secure job and future salary increases for the head of household. Therefore, considering how the erosion of the Japanese employment system affects the behavior of households (or consumers) is an important topic worthy of further careful study, and we hope to address this in our future work.

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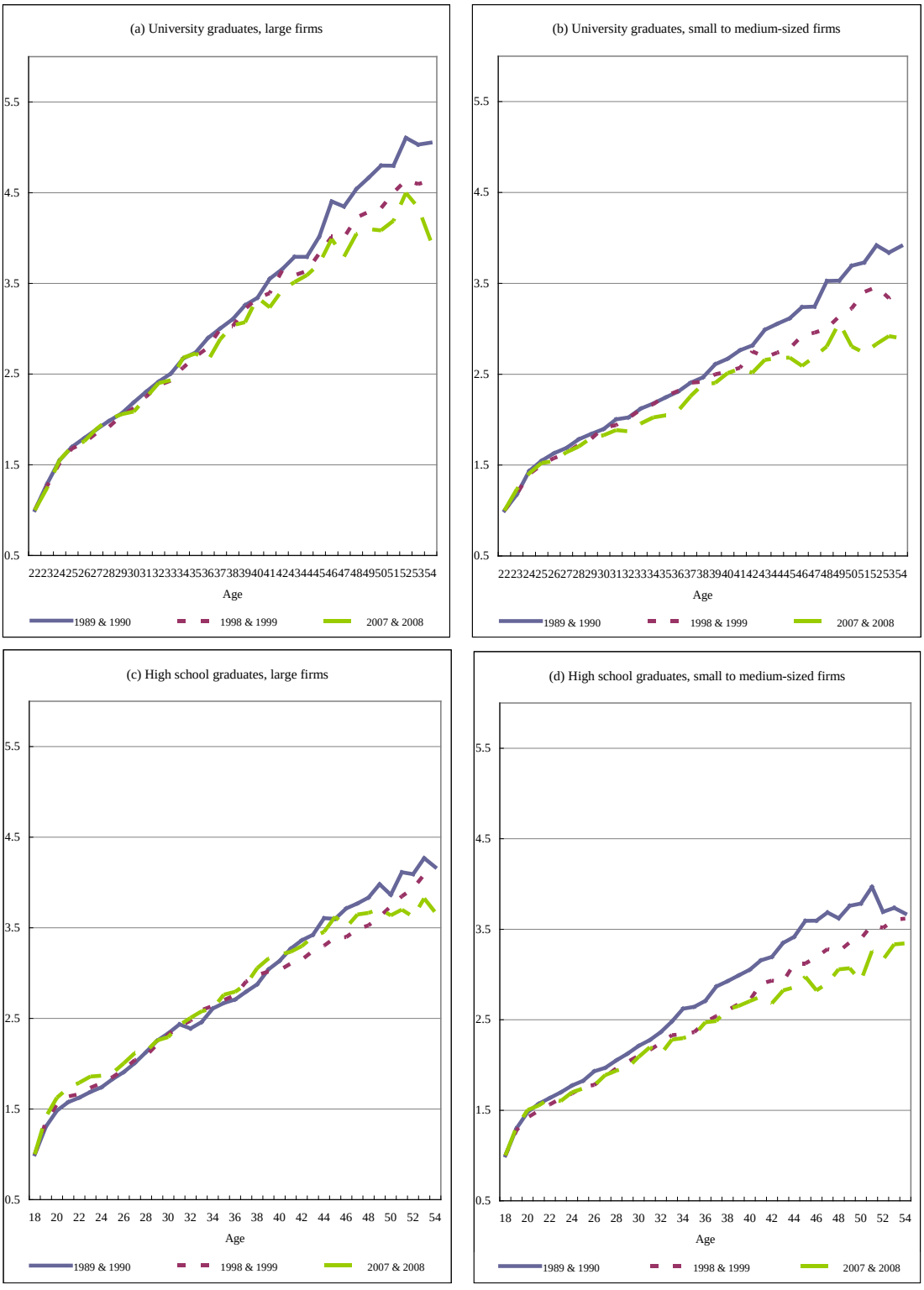
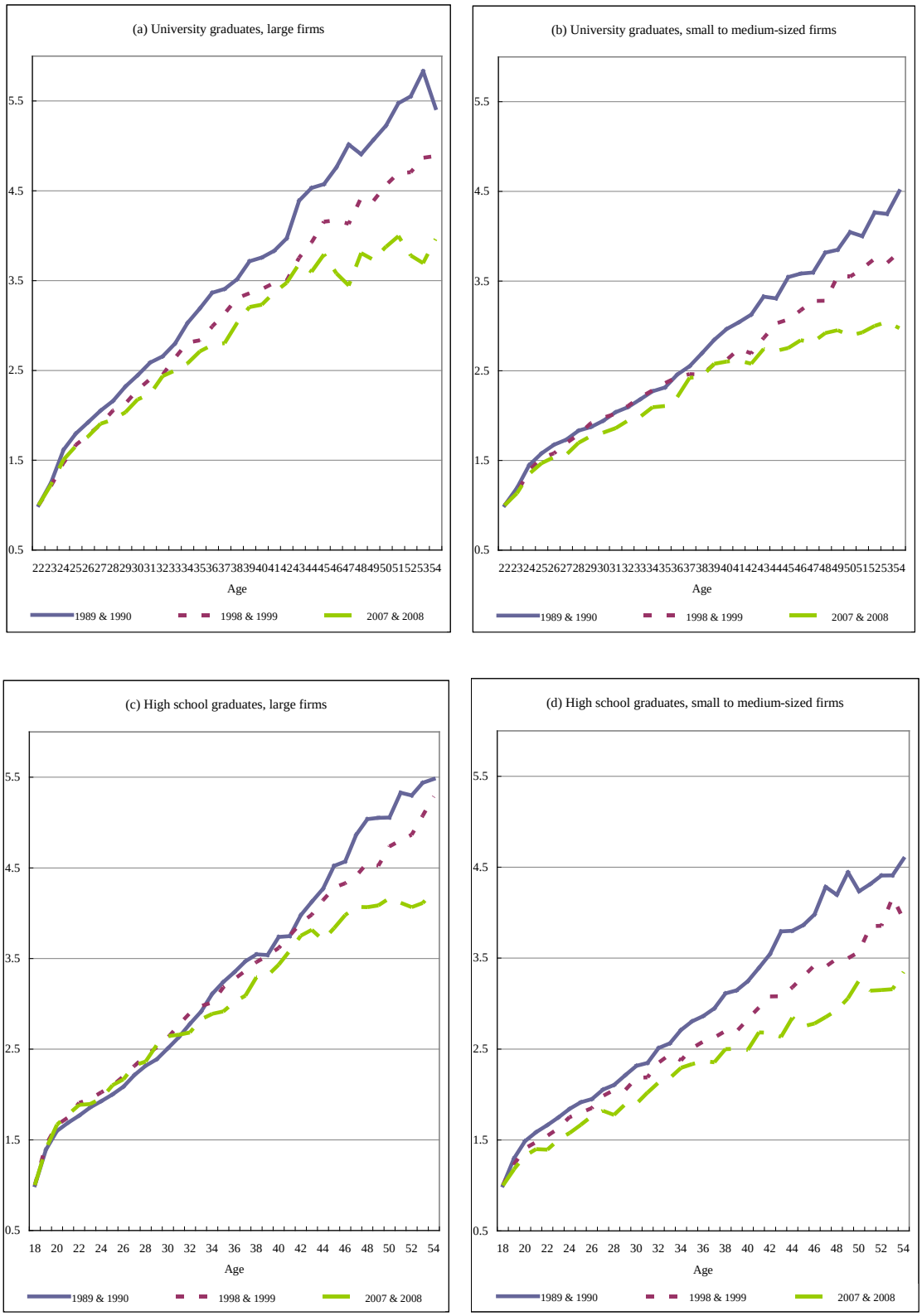
Figure 1. Median monthly wage profile, manufacturing sector



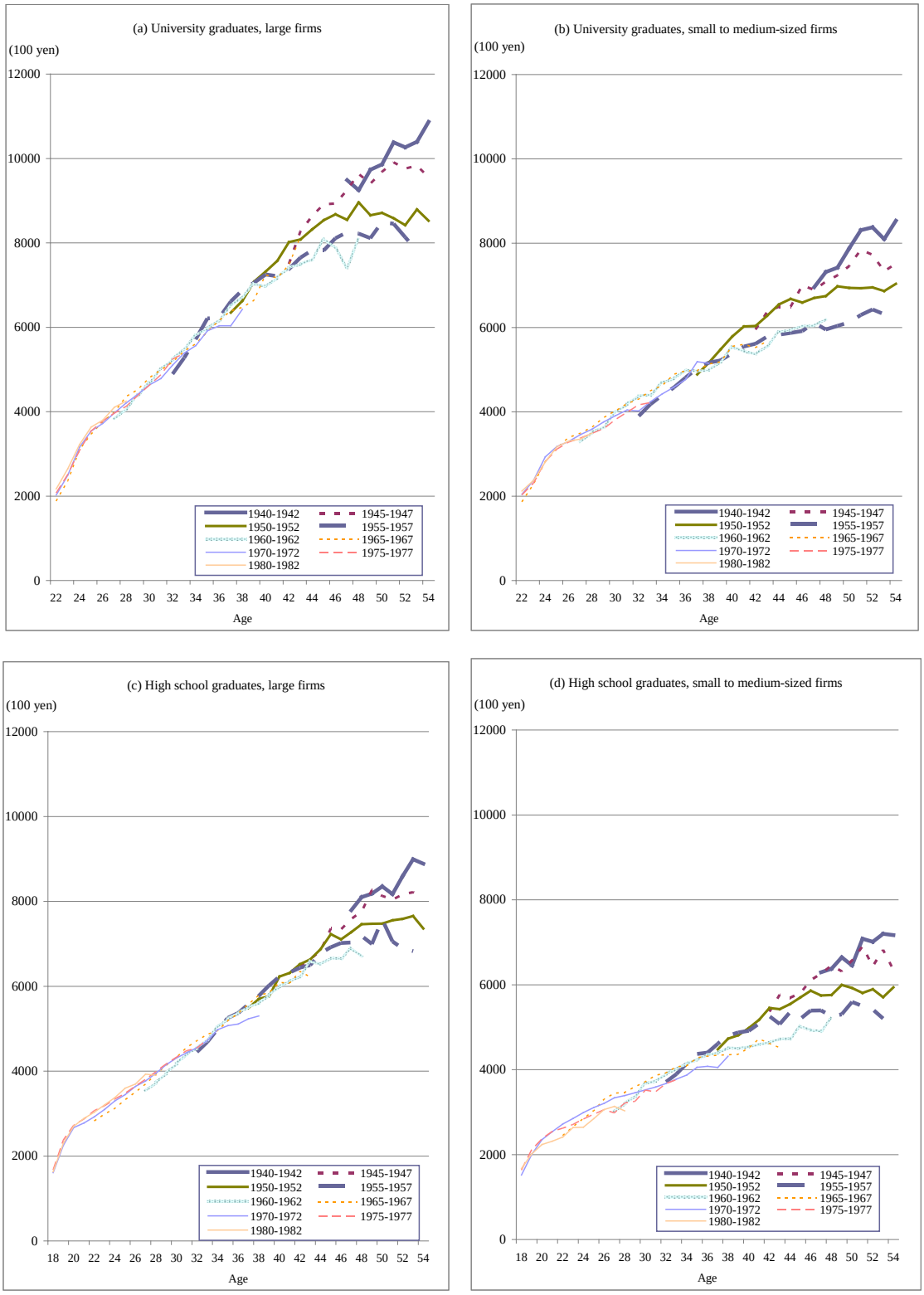
Source: *Basic Survey on Wage Structure* (various issues, 1989-2008).
Notes: The median monthly wage is calculated based on the total amount of monthly contractual cash earnings and one-twelfth of the annual special cash earnings of the previous year. Large firms are firms with 1,000 or more indefinite-contract employees. Small to medium-sized firms are firms with fewer than 1,000 indefinite-contract employees. The median monthly wage is deflated by the consumer price index for Japan (general, excluding imputed rent).

Figure 2. Median monthly wage profile, non-manufacturing sector



Source and notes: See Figure 1.

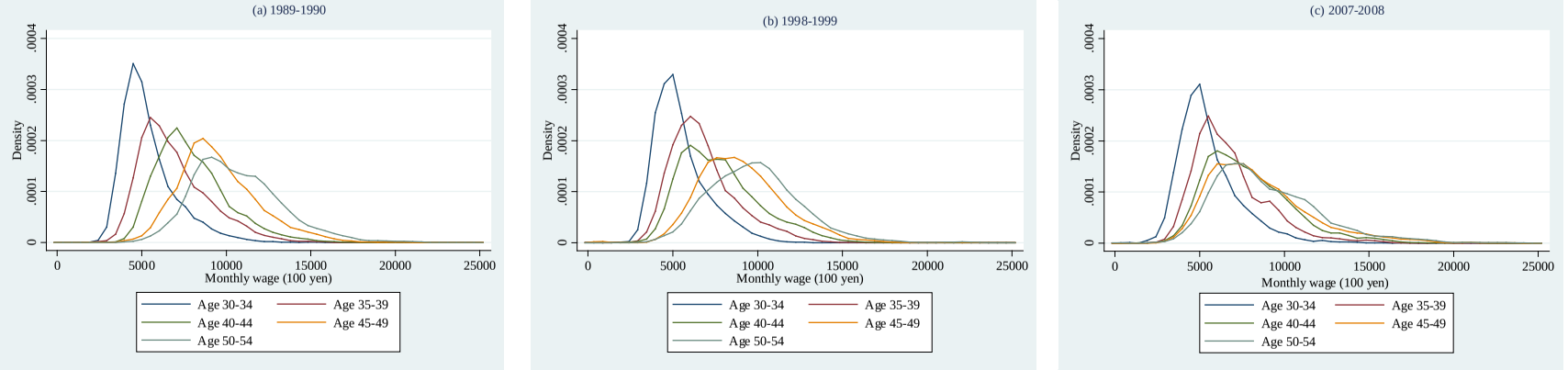
Figure 3. Cohort-specific median monthly wage profile for the non-manufacturing sector

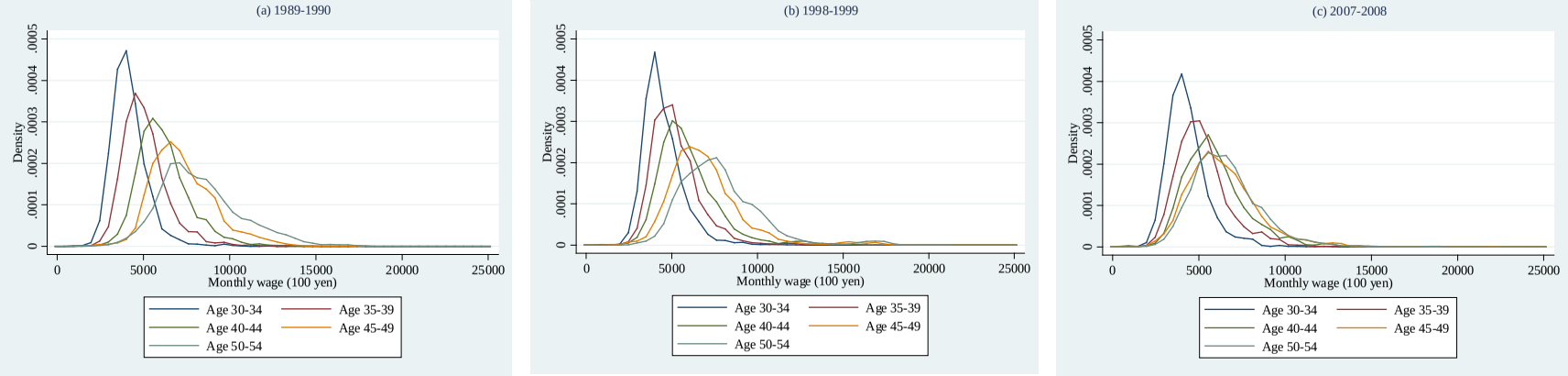


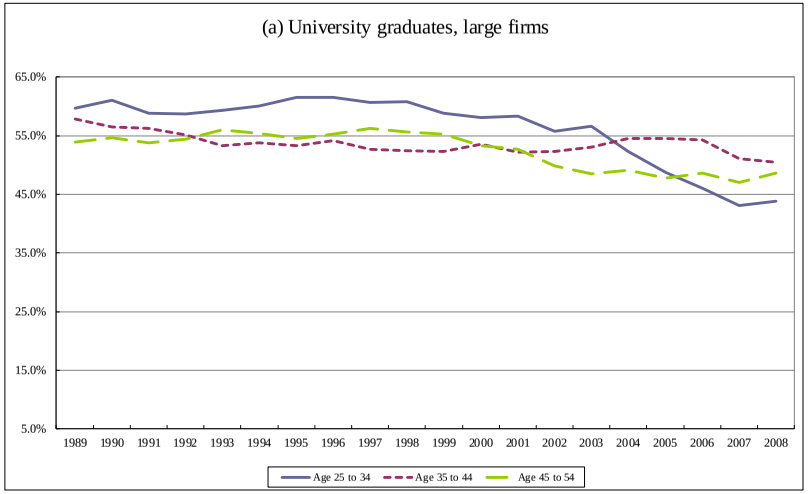
Source: See Figure 1.

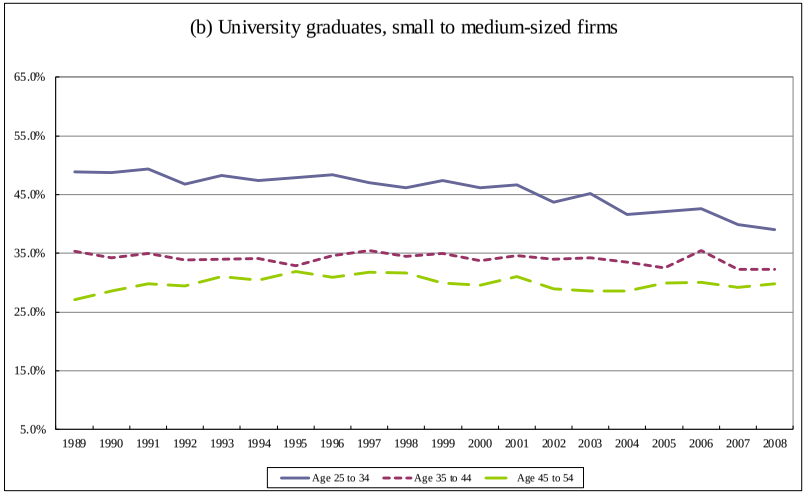
Notes: The cohort-specific wage profile of monthly wages is constructed based on the monthly contractual cash earnings plus one-twelfth of the annual special cash earnings of the previous year, deflated by the CPI. Large firms are firms with 1,000 or more indefinite-contract employees. Small to medium-sized firms are firms with fewer than 1,000 indefinite-contract employees.

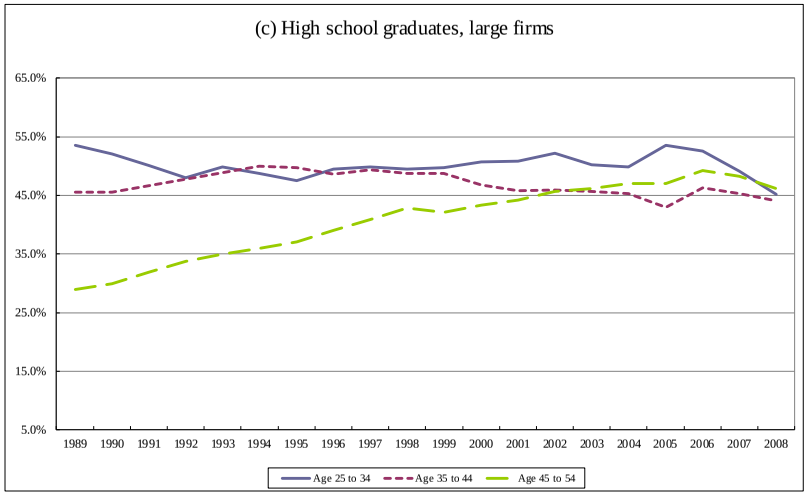
Figure 4. Kernel density distribution of monthly wages for
(male university graduates, non-manufacturi






(a) University graduates, large firms
65.0%
55.0%
45.0%
35.0%
25.0%
15.0%
5.0%
1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008
Age 25 to 34
Age 35 to 44
Age 45 to 54


(b) University graduates, small to medium-sized firms
65.0%
55.0%
45.0%
35.0%
25.0%
15.0%
5.0%
1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008
Age 25 to 34
Age 35 to 44
Age 45 to 54


(c) High school graduates, large firms
65.0%
55.0%
45.0%
35.0%
25.0%
15.0%
5.0%
1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008
Age 25 to 34
Age 35 to 44
Age 45 to 54

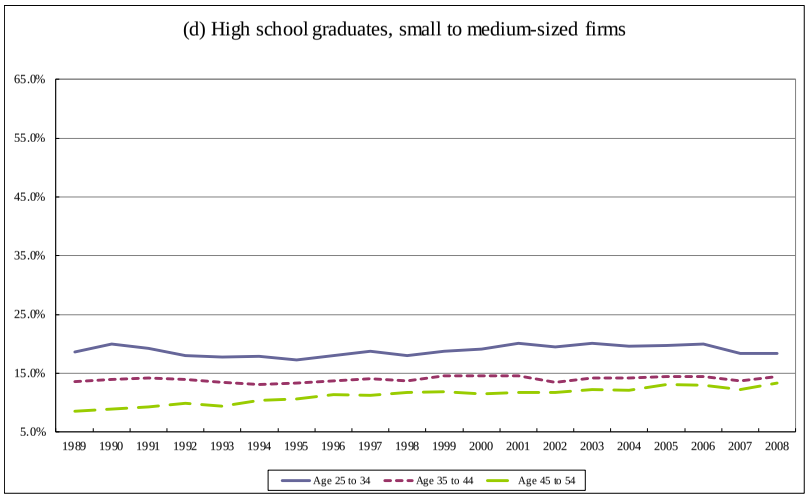

(d) High school graduates, small to medium-sized firms
65.0%
55.0%
45.0%
35.0%
25.0%
15.0%
5.0%
1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008
Age 25 to 34
Age 35 to 44
Age 45 to 54

Table 1. Payoffs with/without firm-specific human capital investment

	(1) Without firm-specific investment			(2) With firm-specific investment (ignoring the possibility of separation)			(3) With firm-specific investment (considering the possibility of separation)		
	VMP	Firm	Worker	VMP	Firm	Worker	VMP	Firm	Worker
First period	q	0	q	$q(1-c)$	$(a-c)q$	$q(1-a)$	$q(1-c)$	$(a-c)q$	$q(1-a)$
Second period	q	0	q	$q(1+r)$	$q(r-xa)$	$q(1+xa)$	$q(1+r)$	$q(r-xa-m)$	$q(1+xa+m)$
Present value	$q+q/x$	0	$q+q/x$	$q(1-c)+q(1+r)/x$	$q(r-xc)/x$	$q+q/x$	$q(1-c)+q(1+r)/x$	$q(r-xc-m)/x$	$q+q(1+m)/x$
Expected present value	$q+q/x$	0	$q+q/x$	$q(1-c)+q(1+r)/x$	$q(r-xc)/x$	$q+q/x$	$q(1-c)+q/x+\Pi(a)r(q/x)$	$(\Pi(a)r-cx)(q/x)$	$q+q/x$

Notes:
- q (>0): Value of marginal product (VMP) of a worker without firm-specific human capital investment.
- c (>0): Cost of firm-specific human capital investment.
- r $(>xc)$: Return to firm-specific human capital investment.
- a: Parameter determining the slope of the age-wage profile.
- x (>1): Reciprocal of time discount rate.
- m (>0): Rate of wage increase that is neccesary to compensate the loss caused by the possibility of job separation.
- $\Pi(\cdot)$: Probability that a worker with firm-specific human capital will continue to work in the same firm in the second period.

Table 2. Multiple period payoffs with firm-specific investment (considering the possibility of separation)

(a) Payoffs when the firm honors its commitment

	Period t			Period $t+1$			Period $t+2$		
	VMP	Firm	Worker	VMP	Firm	Worker	VMP	Firm	Worker
Young cohort	$q(1-c)ng$	$(a-c)qng$	$q(1-a)ng$	$q(1-c)n^2g^2$	$(a-c)qn^2g^2$	$q(1-a)n^2g^2$	$q(1-c)n^3g^3$	$(a-c)qn^3g^3$	$q(1-a)n^3g^3$
Old cohort	$q(1+r)$	$q(r-xa-m)$	$q(1+xa+m)$	$q(1+r)ng$	$q(r-xa-m)ng$	$q(1+xa+m)ng$	$q(1+r)n^2g^2$	$q(r-xa-m)n^2g^2$	$q(1+xa+m)n^2g^2$

(b) Payoffs when the firm breaches its commitment (at the beginning of period t)

	Period t			Period $t+1$			Period $t+2$		
	VMP	Firm	Worker	VMP	Firm	Worker	VMP	Firm	Worker
Young cohort	qng	0	qng	qn^2g^2	0	qn^2g^2	qn^3g^3	0	qn^3g^3
Old cohort	$q(1+r)$	rq	q	qng	0	qng	qn^2g^2	0	qn^2g^2

Notes: q (>0) : Value of marginal product (VMP) of a worker without firm-specific human capital investment.
c (>0) : Cost of firm-specific human capital investment.
r (>xc) : Return to firm-specific human capital investment.
a : Parameter to determining the slope of the age-wage profile.
x (>1) : Reciprocal of time discount rate.
m (>0) : Rate of wage increase that is neccesary to compensate the loss caused by the possibility of job separation.
n : The cohort-to-cohort growth rate in the number of workers in the firm is given by $(n-1)\times 100$.
g : The growth rate of productivity of workers in the firm is given by $(g-1)\times 100$.

Table 3. Five-year job retention rate for university graduates

1990		1995		Five-year job retention rate (A) (i) 1990-1995	1995		2000		Five-year job retention rate (B) (ii) 1995-2000	2000		2005		Five-year job retention rate (C) (iii) 2000-2005	2003		2008		Five-year job retention rate (D) (iv) 2003-2008	(B)-(A) (i)→(ii)	(C)-(B) (ii)→(iii)	(D)-(C) (iii)→(iv)
Lifetime employee share		Lifetime employee share			Lifetime employee share		Lifetime employee share			Lifetime employee share		Lifetime employee share			Lifetime employee share		Lifetime employee share					
Large firms																						
20-24	91.5%	25-29	65.8%	71.9%	20-24	89.9%	25-29	55.9%	62.2%	20-24	88.7%	25-29	50.8%	57.3%	20-24	87.8%	25-29	47.5%	54.0%	-9.7%	-4.9%	-3.3%
25-29	63.3%	30-34	56.2%	88.8%	25-29	65.8%	30-34	59.7%	90.7%	25-29	55.9%	30-34	47.1%	84.2%	25-29	54.2%	30-34	40.3%	74.3%	1.9%	-6.5%	-10.0%
30-34	58.1%	35-39	52.7%	90.7%	30-34	56.2%	35-39	53.3%	94.9%	30-34	59.7%	35-39	57.9%	97.0%	30-34	58.6%	35-39	49.9%	85.2%	4.3%	2.1%	-11.8%
35-39	54.7%	40-44	54.0%	98.7%	35-39	52.7%	40-44	53.9%	102.4%	35-39	53.3%	40-44	50.7%	95.1%	35-39	52.8%	40-44	51.0%	96.6%	3.6%	-7.2%	1.5%
40-44	58.3%	45-49	55.9%	95.8%	40-44	54.0%	45-49	50.7%	93.9%	40-44	53.9%	45-49	48.4%	89.7%	40-44	53.3%	45-49	52.5%	98.4%	-1.9%	-4.2%	8.7%
45-49	57.5%	50-54	52.3%	91.0%	45-49	55.9%	50-54	55.9%	100.0%	45-49	50.7%	50-54	47.0%	92.7%	45-49	47.1%	50-54	43.1%	91.4%	9.1%	-7.3%	-1.4%
Small to medium-sized firms																						
20-24	90.5%	25-29	55.6%	61.4%	20-24	89.7%	25-29	51.2%	57.0%	20-24	89.0%	25-29	48.4%	54.4%	20-24	89.1%	25-29	46.2%	51.9%	-4.4%	-2.6%	-2.5%
25-29	55.7%	30-34	40.7%	73.0%	25-29	55.6%	30-34	39.8%	71.7%	25-29	51.2%	30-34	36.8%	72.0%	25-29	51.7%	30-34	32.6%	63.2%	-1.3%	0.3%	-8.8%
30-34	41.7%	35-39	35.6%	85.4%	30-34	40.7%	35-39	35.4%	87.1%	30-34	39.8%	35-39	34.6%	86.8%	30-34	38.8%	35-39	32.6%	84.1%	1.7%	-0.3%	-2.7%
35-39	34.1%	40-44	29.9%	87.6%	35-39	35.6%	40-44	32.0%	90.0%	35-39	35.4%	40-44	30.4%	85.9%	35-39	35.9%	40-44	31.9%	88.8%	2.4%	-4.1%	3.0%
40-44	34.4%	45-49	32.3%	93.9%	40-44	29.9%	45-49	29.1%	97.6%	40-44	32.0%	45-49	31.6%	98.6%	40-44	32.5%	45-49	32.0%	98.4%	3.6%	1.1%	-0.2%
45-49	31.1%	50-54	31.3%	100.5%	45-49	32.3%	50-54	30.2%	93.7%	45-49	29.1%	50-54	27.8%	95.3%	45-49	29.8%	50-54	27.4%	92.0%	-6.9%	1.6%	-3.4%

employees. Small to medium-sized firms are firms with fewer than 1,000 lifetime contract employees. The three rightmost columns report the change in the retention rate between two neighboring pe

Table 4. Five-year job retention rate for high school graduates

1990	1995	Five-year job retention rate (A)	1995	2000	Five-year job retention rate (B)	2000	2005	Five-year job retention rate (C)	2003	2008	Five-year job retention rate (D)	(B)-(A)	(C)-(B)	(D)-(C)
Lifetime employee share	Lifetime employee share	(i) 1990-1995	Lifetime employee share	Lifetime employee share	(ii) 1995-2000	Lifetime employee share	Lifetime employee share	(iii) 2000-2005	Lifetime employee share	Lifetime employee share	(iv) 2003-2008	(i)→(ii)	(ii)→(iii)	(iii)→(iv)
2a. Large-sized firm														
20-24 60.4%	25-29 47.4%	78.5%	20-24 62.4%	25-29 56.1%	90.1%	20-24 60.7%	25-29 50.9%	84.0%	20-24 63.1%	25-29 42.3%	67.1%	11.5%	-6.1%	-16.9%
25-29 52.4%	30-34 47.6%	90.8%	25-29 47.4%	30-34 44.5%	93.8%	25-29 56.1%	30-34 55.0%	98.0%	25-29 55.0%	30-34 47.0%	85.6%	3.1%	4.1%	-12.4%
30-34 51.7%	35-39 49.7%	96.1%	30-34 47.6%	35-39 45.7%	96.1%	30-34 44.5%	35-39 41.6%	93.4%	30-34 46.7%	35-39 43.9%	94.1%	0.0%	-2.7%	0.7%
35-39 51.7%	40-44 49.8%	96.4%	35-39 49.7%	40-44 48.0%	96.6%	35-39 45.7%	40-44 44.3%	97.0%	35-39 47.5%	40-44 44.2%	93.1%	0.2%	0.4%	-3.9%
40-44 39.7%	45-49 39.5%	99.6%	40-44 49.8%	45-49 50.0%	100.3%	40-44 48.0%	45-49 47.8%	99.5%	40-44 43.9%	45-49 44.5%	101.4%	0.7%	-0.8%	1.8%
45-49 35.0%	50-54 34.1%	97.6%	45-49 39.5%	50-54 37.0%	93.7%	45-49 50.0%	50-54 46.3%	92.7%	45-49 49.3%	50-54 47.9%	97.3%	-3.9%	-1.0%	4.6%
2b. Small- to medium-sized firm														
20-24 35.1%	25-29 19.3%	54.9%	20-24 34.6%	25-29 21.6%	62.5%	20-24 36.1%	25-29 21.6%	59.9%	20-24 37.1%	25-29 19.2%	51.7%	7.6%	-2.6%	-8.2%
25-29 22.0%	30-34 15.1%	68.9%	25-29 19.3%	30-34 16.5%	85.4%	25-29 21.6%	30-34 18.4%	85.1%	25-29 23.6%	30-34 17.8%	75.7%	16.6%	-0.4%	-9.3%
30-34 17.7%	35-39 13.8%	78.1%	30-34 15.1%	35-39 15.4%	101.6%	30-34 16.5%	35-39 14.8%	89.6%	30-34 17.0%	35-39 15.4%	90.7%	23.5%	-12.0%	1.1%
35-39 15.6%	40-44 12.8%	82.1%	35-39 13.8%	40-44 13.8%	99.5%	35-39 15.4%	40-44 14.2%	92.3%	35-39 14.8%	40-44 13.4%	91.1%	17.4%	-7.1%	-1.2%
40-44 12.6%	45-49 11.3%	90.2%	40-44 12.8%	45-49 12.8%	99.9%	40-44 13.8%	45-49 13.1%	95.1%	40-44 13.6%	45-49 13.4%	98.6%	9.8%	-4.8%	3.5%
45-49 10.8%	50-54 9.7%	89.5%	45-49 11.3%	50-54 10.4%	91.7%	45-49 12.8%	50-54 13.1%	102.6%	45-49 13.5%	50-54 13.2%	98.2%	2.2%	10.8%	-4.3%

Appendix Table 1. Sample statistics for the male indefinite-contract employees

Year	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Monthly wage/CPI (100 yen)	4,152.0	4,253.9	4,314.6	4,385.2	4,561.0	4,614.3	4,660.5	4,619.4	4,614.5	4,570.8
	(2,035.5)	(2,076.8)	(2,082.9)	(2,102.7)	(2,230.1)	(2,232.3)	(2,233.9)	(2,166.8)	(2148.0)	(2,154.6)
Age	39.48	39.77	40.01	40.16	39.50	39.56	39.77	40.03	40.27	40.31
	(11.58)	(11.75)	(11.93)	(12.03)	(12.05)	(12.00)	(11.99)	(12.05)	(12.07)	(12.09)
Educational attainment										
Junior high school	0.239	0.229	0.221	0.206	0.161	0.149	0.143	0.142	0.134	0.127
High school	0.520	0.524	0.529	0.533	0.519	0.519	0.518	0.530	0.531	0.526
Junior college	0.037	0.040	0.041	0.044	0.051	0.054	0.058	0.062	0.065	0.070
University	0.204	0.207	0.209	0.216	0.268	0.277	0.281	0.265	0.270	0.277
Firm size (no. of indefinite-contract employees)										
1,000≤	0.315	0.317	0.317	0.329	0.379	0.383	0.370	0.325	0.321	0.324
300≤ & ≤999	0.136	0.139	0.141	0.142	0.163	0.164	0.164	0.165	0.169	0.164
30≤ & ≤299	0.350	0.349	0.346	0.343	0.312	0.306	0.314	0.356	0.358	0.357
5≤ & ≤29	0.200	0.195	0.196	0.186	0.146	0.147	0.151	0.154	0.152	0.155
Observations	762,126	758,632	758,516	759,437	796,410	760,491	800,212	814,247	822,308	803,000

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Monthly wage/CPI (100 yen)	4,553.1	4,583.7	4,639.0	4,605.3	4,567.7	4,513.0	4,564.4	4,593.3	4,590.8	4,495.0
	(2,151.7)	(2145.0)	(2,182.7)	(2,203.5)	(2190.0)	(2,156.5)	(2,287.2)	(2,302.1)	(2,337.1)	(2,281.4)
Age	40.51	40.67	40.88	40.83	41.04	41.16	41.12	41.12	41.08	41.06
	(12.01)	(11.9)	(11.82)	(11.79)	(11.70)	(11.65)	(11.54)	(11.62)	(11.64)	(11.62)
Educational attainment										
Junior high school	0.118	0.111	0.103	0.093	0.085	0.073	0.068	0.063	0.059	0.054
High school	0.523	0.522	0.520	0.517	0.515	0.510	0.486	0.489	0.489	0.502
Junior college	0.072	0.075	0.079	0.083	0.085	0.089	0.087	0.085	0.087	0.088
University	0.287	0.292	0.298	0.307	0.314	0.328	0.360	0.362	0.365	0.356
Firm size (no. of indefinite-contract employees)										
1,000≤	0.319	0.322	0.325	0.320	0.315	0.285	0.278	0.286	0.303	0.316
300≤ & ≤999	0.163	0.163	0.167	0.166	0.167	0.175	0.165	0.163	0.159	0.157
30≤ & ≤299	0.360	0.356	0.351	0.352	0.355	0.405	0.388	0.370	0.368	0.358
5≤ & ≤29	0.157	0.159	0.157	0.162	0.164	0.135	0.169	0.181	0.170	0.169
Observations	792,656	756,490	739,097	722,613	713,736	715,765	567,072	596,717	548,022	554,980