difficult." The flexibility of 7 factors related to the working environment is also asked by a four-grade system such as "very flexible," "flexible," "not very flexible," and "not flexible at all."

Using these variables, I create a "principal components score" across firms, which is extracted from "principal components" for measuring the accessibility of measures and the flexibility of the workplace environment based on a principal component analysis. The principal component analysis would be valuable to expose the fundamental structure of the data in a way that best explains the variance in the data. The benefit of this method is to assign a continuous "principal component score" to each respondent by summing up numerous correlated variables into a smaller number of uncorrelated variables. Therefore, use of "principal component scores" which summarize the accessibility to various work-life balance measures and the flexibility of working environments may avoid a statistical bias caused by "multicollinearity" when we put these possibly correlated explanatory variables separately into a single regression. Here, the larger scores mean the better accessibility to various measures and a more flexible working environment as a whole.

Table 1: Basic Statistics

	Continue to be hired by the same employer (N=140)			
	Total (N=140)	Not being reinstated after 1st childbirth (N=45) Censored	Being reinstated after 1st childbirth (N=95) Failed	
	Mean (S.D.)	Mean (S.D.)	Mean (S.D.)	
1. Censoring and duration variables				
Censoring dummy for reinstatement after 1st childbirth (=1)	0.679	0.000	1.000	
	(0.469)	(0.000)	(0.000)	
Months after 1st childbirth (months)	34.957	84.533	11.474	a/
	(48.113)	(58.562)	(9.152)	
2. Household characteristics				
Mother's age at 1st childbirth	28.964	28.244	29.305	
	(3.599)	(3.076)	(3.790)	
Father's age at 1st childbirth	30.757	30.578	30.842	
	(4.692)	(3.368)	(5.217)	
Mother's educational attainment (college graduate=1)	0.564	0.489	0.600	
	(0.498)	(0.506)	(0.492)	
Father's educational atteinment (college graduate=1)	0.571	0.667	0.526	
	(0.497)	(0.477)	(0.502)	
Informal support for child care (=1)	0.614	0.489	0.674	b/
	(0.489)	(0.506)	(0.471)	
1st child's health status at birth (birthweight<2500g=1)	0.121	0.222	0.074	b/
	(0.328)	(0.420)	(0.263)	
2nd childbirth before reinstatement after 1st childbirth (=1)	0.221	0.622	0.032	a/
	(0.417)	(0.490)	(0.176)	
3. Mothers' status in the labor market at the time of one-year before 1st childbirth				
Full-time worker (=1)	0.343	0.089	0.463	a/
	(0.476)	(0.288)	(0.501)	
Profession or skilled worker (=1)	0.129	0.000	0.189	a/
	(0.336)	(0.000)	(0.394)	
Clerical worker (=1)	0.186	0.089	0.232	b/
	(0.390)	(0.288)	(0.424)	
Other (=1)	0.686	0.911	0.579	a/
	(0.466)	(0.288)	(0.496)	
Annual income (yen)	3,443,214	3,014,667	3,646,211	b/
	(1,369,208)	(1,449,661)	(1,288,004)	
Logarithum value of annual income	14.949	14.748	15.044	a/
	(0.512)	(0.678)	(0.380)	
4. Macro-based characteristics of local areas at the survey				
Rate of waiting-list child for day-care center in the local area (%)	0.910	1.444	0.657	a/
	(1.349)	(1.845)	(0.947)	

Source: Calculated by the author, based on the "Survey for Working Environment and Fertility" conducted by Central Research Service Inc (Chuo Chosa Sha) in 2007.
Note: a/, b/, and c/ refer to a significance level of 1, 5, and 10 percent, respectively, for differences between means of two categories within (1) reinstatement after 1st childbirth ("Not being reinstated after 1st childbirth" and "Being reinstated after 1st childbirth"); and (2) Continuity of 1st job after school graduation ("Change jobs" and "Continue to be hired by the same employer ").
Note: Unfortunately, the survey did not ask father's status in labor market at the time of one-year before the first childbirth.

Table 2: Work-life balance measures and workplace flexibility on mother's job

Variables	Continue to be hired by the same employer (N=140)	Not being reinstated after 1st childbirth (N=45)	Being reinstated after 1st childbirth (N=95)	
	Mean (S.D.)	Censored Mean (S.D.)	Failed Mean (S.D.)	
1. Comprehensive measurements				
Principal components score for accessibilty	0.605	0.084	0.852	a/
	(1.043)	(1.093)	(0.926)	
Principal components score for flexibility at mother's working place	0.516	0.244	0.645	a/
	(0.859)	(0.808)	(0.857)	
2. Presence (=1)				
Annual paid leave by half a day	0.743	0.511	0.853	a/
	(0.439)	(0.506)	(0.356)	
Shortening of working hours	0.736	0.489	0.853	a/
	(0.443)	(0.506)	(0.356)	
Limitation on late-night work	0.679	0.511	0.758	a/
	(0.469)	(0.506)	(0.431)	
Limitation on overtime work	0.379	0.111	0.505	a/
	(0.487)	(0.318)	(0.503)	
Child care leave system more generous than the legal definition	0.557	0.356	0.653	a/
	(0.499)	(0.484)	(0.479)	
Nursing care leave system more generous than the legal definition	0.279	0.022	0.400	a/
	(0.450)	(0.149)	(0.492)	
Flexible time of starting and ending work	0.429	0.200	0.537	a/
	(0.497)	(0.405)	(0.501)	
Financial support for day-care center	0.114	0.067	0.137	
	(0.319)	(0.252)	(0.346)	
Telecommuting	0.300	0.244	0.326	
	(0.460)	(0.435)	(0.471)	
Area-specific working system	0.129	0.089	0.147	
	(0.336)	(0.288)	(0.356)	
Reemployment	0.193	0.067	0.253	a/
	(0.396)	(0.252)	(0.437)	
Sick/injured child care leave	0.257	0.022	0.368	a/
	(0.439)	(0.149)	(0.485)	
3. Accessibility (very easy to use or easy to use=1)				
Annual paid leave by half a day	0.850	0.667	0.937	a/
	(0.358)	(0.477)	(0.245)	
Shortening of working hours	0.321	0.200	0.379	b/
	(0.469)	(0.405)	(0.488)	
Limitation on late-night work	0.229	0.200	0.242	
	(0.421)	(0.405)	(0.431)	
Limitation on overtime work	0.093	0.067	0.105	
	(0.291)	(0.252)	(0.309)	
Child care leave system more generous than the legal definition	0.714	0.711	0.716	
	(0.453)	(0.458)	(0.453)	
Nursing care leave system more generous than the legal definition	0.207	0.133	0.242	
	(0.407)	(0.344)	(0.431)	
Flexible time of staring and ending work on weekdays	0.236	0.133	0.284	b/
	(0.426)	(0.344)	(0.453)	
Financial support for day-care center	0.064	0.067	0.063	
	(0.246)	(0.252)	(0.245)	
Telecommuting	0.600	0.667	0.568	
	(0.492)	(0.477)	(0.498)	
Area-specific working system	0.257	0.111	0.326	a/
	(0.439)	(0.318)	(0.471)	
Reemployment	0.257	0.111	0.326	a/
	(0.439)	(0.318)	(0.471)	
Sick/injured child care leave	0.157	0.022	0.221	a/
	(0.365)	(0.149)	(0.417)	
4. Flexibility (very flexible or flexible=1)				
Workloads	0.500	0.511	0.495	
	(0.502)	(0.506)	(0.503)	
Tasks	0.371	0.400	0.358	
	(0.485)	(0.495)	(0.482)	
Deadline or time of delivery	0.307	0.222	0.347	
	(0.463)	(0.420)	(0.479)	
Schedule for meeting and conference	0.150	0.067	0.189	c/
	(0.358)	(0.252)	(0.394)	
Time of staring work on weekdays	0.314	0.178	0.379	b/
	(0.466)	(0.387)	(0.488)	
Time of ending work on weekdays	0.507	0.400	0.558	c/
	(0.502)	(0.495)	(0.499)	
Annual paid leave	0.829	0.756	0.863	
	(0.378)	(0.435)	(0.346)	

Source: Calculated by the author, based on the "Survey for Working Environment and Fertility" conducted by Central Research Service Inc (Chuo Chosa Sha) in 2007.
Note: The data are limited to those who have at least one child and continue to be hired by the same employer after school graduation. Since the survey asked questions related only to respondents' current working place, the author has to clarify those who worked in the same firm as now when they had a first baby, in order to examine effects of various systems on the timing of being reinstated after 1st child birth.
Note: The survey asked the presence and accessibility of 12 types of systems for balancing work and family lives; and the flexibility of 7 factors related to working environment at current respondent's workplace, shown in Table 2. As regards the presence, the survey asked whether each of 12 systems is available for employees. For the accessibility, the respondents are questioned how easy to use it (such as "very easy", "easy", "cannot be said either", "not very easy", and "very difficult") when a system is available. The flexibility of 7 factors related to working environment is asked ("very flexible", "flexible", "not very flexible", and "not flexible at all"). Using these variables, the author creates a couple of "principal components score" across firms, which is extracted "principal components" for measuring the accessibility of systems and the flexibility of workplace environment based on principal component analysis.
Note: In this study, the presence of accessibility of these systems and the flexibility of working environment at current father's working place are ignored, because they are not statistically significant for further duration analyses.
Note: a/, b/, and c/ refer to a significance level of 1, 5, and 10 percent, respectively, for differences between means of two categoris; "Not being reinstated after 1st childbirth" and "Being reinstated after 1st childbirth".

Table 2 shows the basic statistics. For the comprehensive measurements, both principal components scores are significantly less in the right-censored group than the failure group for the accessibility (0.08 versus 0.85) and the flexibility (0.24 versus 0.65). Indeed, female workers who are reinstated in the labor market after the first childbirth are likely to benefit from the presence and accessibility of each system and the flexibility of the working environment. In sum, as far as the basic statistics show, various support from employers would have positive impact on female reinstatement after the first childbirth.

5. Results

5.1 Kaplan-Meier survival and Nelson-Aalen cumulative hazard estimates

While the basic statistics give us a clue to the effects of various characteristics on the probability of females to come back to work, the Kaplan-Meier survival and the Nelson-Aalen cumulative hazard estimates focus on the timing when female workers exit to the labor market after the first childbirth. Figure 2-Figure 4 show plots of the Kaplan-Meier survival and the Nelson-Aalen cumulative hazard estimates for 72 months after the first childbirth, by major respondents' characteristics of which means differ significantly between right-censored and failed samples in Table 1. In all figures, survival ratios tend to decrease and thus hazard estimates are inclined to increase largely at the time of two months (eight weeks) and one year after the first childbirth for certain types of female respondents. This shows that female respondents are most likely to be reinstated into the labor market just after eight-week maternity-leaves or one-year child care leaves, which are the time periods provided by the law. After 12 months, both survival and hazard curves are inclined to stay steady, which implies that female workers who have not been reinstated into the labor market within one year after the first childbirth are less likely to come back to work eventually.

The first group of figures (Figure 2-1-a-Figure 2-2-b) regards the relation of survival ratios and cumulative hazard estimates with major household characteristics, such as the presence of informal support for child care and birthweight. In regards to household characteristics, the timing of coming back to work would be much earlier for females with informal support for child care (Figure 2-1-a and Figure 2-1-b); and whose first baby's birthweight is 2500g or heavier (Figure 2-2-a and Figure 2-2-b), correspondingly compared to those without informal support, and who have a low-weight baby.

The second group of figures (Figure 3-1-a-Figure 3-3-b) shows the relation of survival ratios and cumulative hazard estimates with the mother's status in the labor market one-year before the first childbirth, such as employment status (full-time versus part-time workers), type of job (profession or skilled worker, clerical worker, and other), and quartile income level. As the basic statistics show, these figures imply that females who face high opportunity costs, such as full-time work (Figure 3-1-a and Figure 3-1-b), profession or skilled work (Figure 3-2-a and Figure 3-2-b), and high-income employees (Figure 3-3-a and Figure 3-3-b), are likely to exit to the labor market earlier than those with low opportunity costs. Remarkably, survival ratios are decreasing and so hazards estimates are increasing almost proportionally to quartile income levels.

Finally, the fifth group of figures (Figure 4-1-a-Figure 4-2-b) indicates how the accessibility of work-life balance measures provided by employers and the flexibility of the working environment on a mother's job affects survival ratios and hazard estimates. Figure 4-1-a and Figure 4-1-b show survival ratios and hazard estimates by principal component scores for the accessibility less than the median (-0.602), -0.602, and larger. Also, Figure 4-2-a and Figure 4-2-b show the principal component scores for flexibility less than the median (0.521), 0.521, and larger. Female employees who have better access to measures and who work in relatively flexible working environments are likely to exit to the labor market early after the first childbirth. The following sections adjust for all these characteristics at the same time within a single regression.

5.2 Effects of the accessibility to work-life balance measures and workplace flexibility

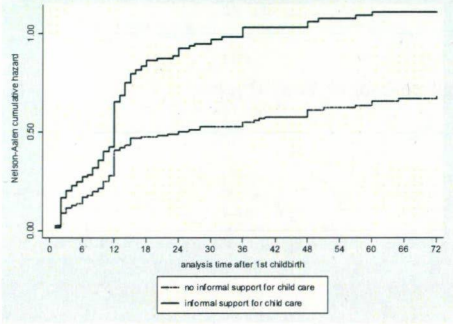
In this section, I introduce the accessibility to work-life balance measures and the flexibility of the working environment into the duration analyses. Table 3 shows the results based on semi- parametric and parametric regression analyses for 140 extracted samples. Due to the restricted number of samples, I apply a bootstrapping estimation to calculate standard errors in the following regressions with 50 replication times. The first column of Table 3

indicates explanatory variables ($\overline{X}_j$) to expose the timing of female workers to come back to work after the first childbirth. Observing hazard ratios as results of the semi-parametric Cox-proportional hazards estimates, parametric hazard estimates with weibull, exponential and weibull-gamma distributions are shown from the second through the fifth columns. A hazard estimate of more than one is interpreted as a higher probability of female workers to come back to work and thus a shorter duration of being on child care leave after the first childbirth. On the other hand, a hazard estimate of less than one shows a less likelihood to exit to the labor market and longer duration of being on leave after the first childbirth.

Figure 2: Kaplan-Meier survival estimates and Nelson-Aalen cumulative hazard estimates by household characteristics (N=140; Failure=95)

Nelson-Aalen cumulative hazard estimates

Figure2-1-b: by informal support for child care



Kaplan-Meier survival estimates

Figure2-1-a: by Informal support for child care

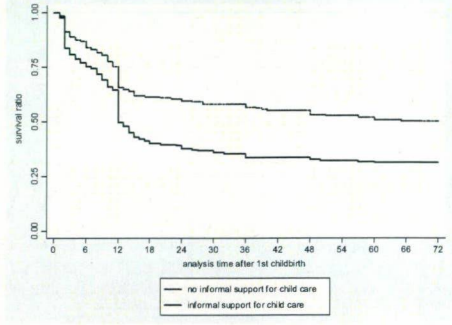


Figure2-2-b: by 1st child's birthweight

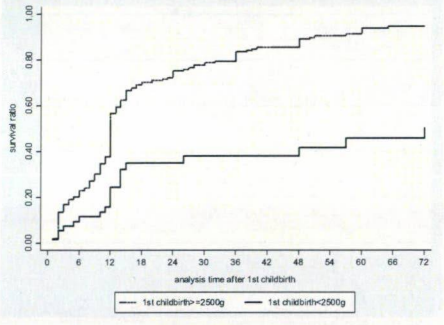
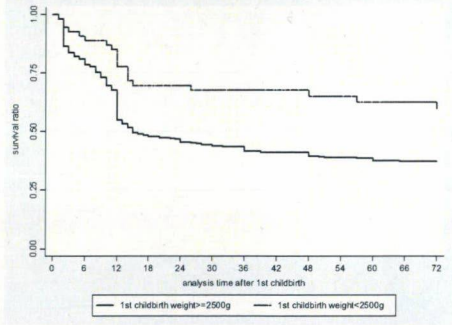


Figure2-2-a: by 1st child's birthweight



In regards to household characteristics, the mother's age at the time of the first childbirth would increase the probability of a mother to come back to work and thus remain on leave in long time periods. On the other hand, a low-weight baby would decrease the probability of mothers to exit to the labor market and so he or she is likely to prolong the duration to be on child care leave. They are robust variables, regardless of type of regression. The parametric models show that a father's educational attainment and the presence of informal child care have reversed impacts on the reinstatement of mothers. Higher educated fathers are likely to remain mothers out of the labor market for long time periods, while the presence of informal child care is likely to raise the probability of mothers to exit to the labor market within short time periods. Approaches other than weibull implies that a father's age at the time of the first childbirth and the second childbirth continuously to the first baby before reinstatement would decrease the probability of mothers to exit to the labor market and so these characteristics are likely to prolong the duration of mothers to be on child care leave. The educational attainments of mothers do not seem to have significant impacts on their own reinstatement into the labor market after the first childbirth. The father's educational attainment and age might also be interpreted as proxy variables for their income status. Also, the presence of informal care would decrease the costs of child care.

Figure 3: Kaplan-Meier survival estimates and Nelson-Aalen cumulative hazard estimates by mothers' status in the labor market at the time of one-year before the first childbirth (N=140; Failure=95)

Kaplan-Meier survival estimates

Figure3-1-a: by employment status

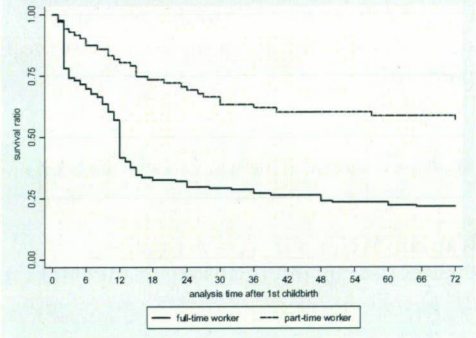


Figure3-2-a: by type of job

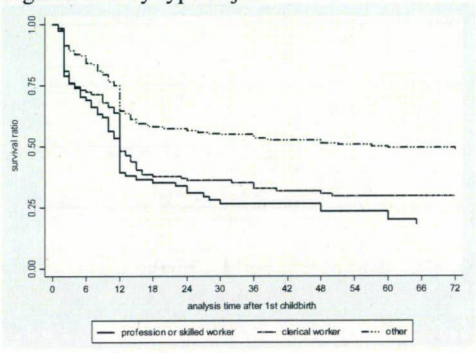
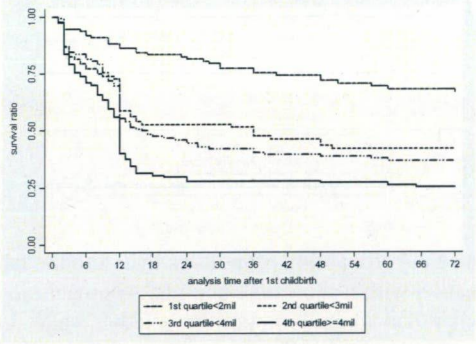


Figure3-3-a: by quartile income level one year



Nelson-Aalen cumulative hazard estimates

Figure3-1-b: by employment status

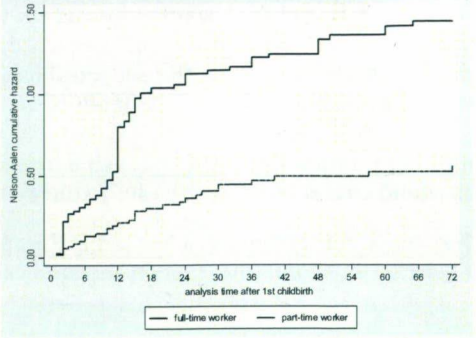


Figure3-2-b: by type of job

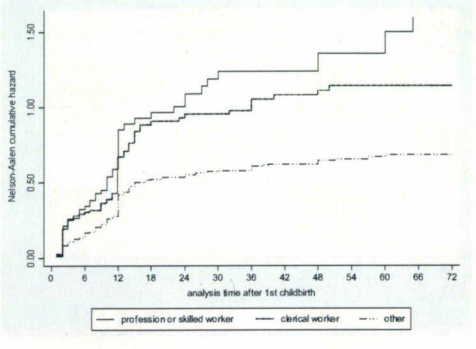
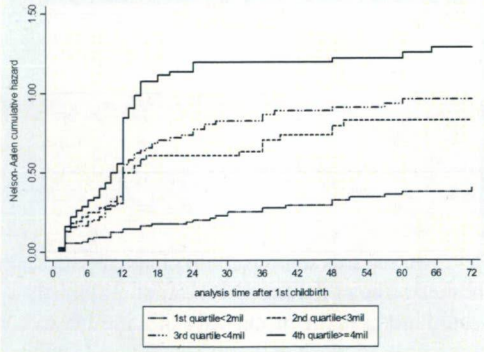


Figure3-3-b: by quartile income level one year



Related to the status of mothers in the labor market one-year before the first childbirth, profession/skilled workers or clerical workers with higher income would motivate mothers to be reinstated into the labor market and thus shorten the time period of being on leave after the first childbirth in some parametric approaches. Especially in the weibull-gamma model, these variables have the strongest positive impacts on the probability of reinstatement. However, the results are inconsistent across the type of regression.

For the accessibility of work-life balance measures and workplace flexibility, principal component scores for accessibility has a significant positive impact on female reinstatement in parametric approaches, while the effects of principal components score for flexibility are consistently negative but statistically insignificant. Therefore, a female employee who accesses work-life balance measures easily is likely to come back to work within short periods of time after the first childbirth, after adjusting for the effects of opportunity costs.

Figure 4: Kaplan-Meier survival estimates and Nelson-Aalen cumulative hazard estimates by the accessibility of work-and-balance systems and the flexibility of working environment (N=140; Failure=95)

Kaplan-Meier survival estimates

Figure4-1-a: by the accessibility

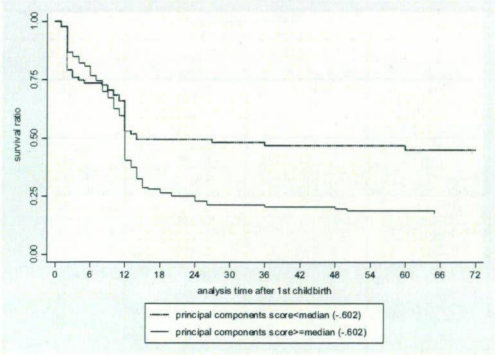
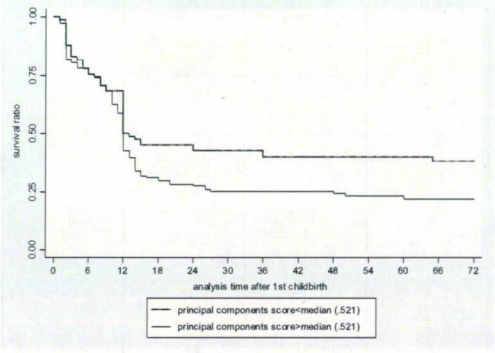


Figure4-2-a: by the flexibility



Nelson-Aalen cumulative hazard estimates

Figure4-1-b: by the accessibility

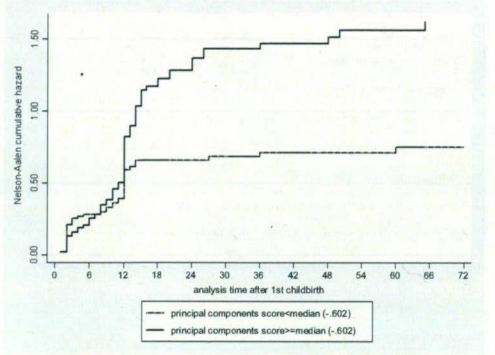
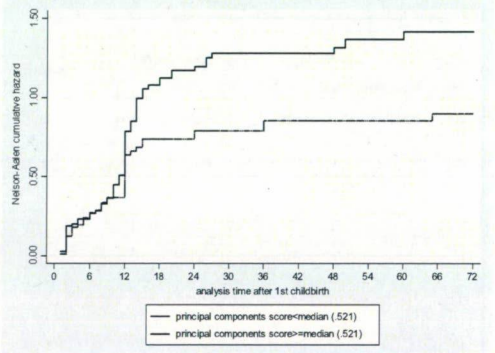


Figure4-2-b: by the flexibility



The results are also controlled by 17 year dummy variables from 1991 through 2007, implying the timing of the first childbirth, which I did not show in the Table. Overall, regardless of the type of regression, those who had their first babies after the Family Care Leave Act was enacted in 1991 are significantly less likely to exit to the labor market and so prolong the duration to be on child care leave. This era after 1991 has overlapped with the so-called "lost decade" after the burst of the economic bubble in Japan. The economic recession might have both negative and positive effects on the timing of females to be reinstated into the labor market after a certain time period of child care leave and the direction of effects depend on the stability of the female's career. In a economic recession, a female worker who quit a job before childbirth would remain unemployed for long time periods since she simply could not find a job or she was less likely to find a job with favorable working conditions. On the other hand, a stable female worker who has been hired by the same employer before and after the childbirth is likely to come back to work immediately after the childbirth because the long duration of being on child care leave would be a risk to their job in the tight labor market. However, focusing on stable female workers in this study, I obtained completely opposite results to what I expected. Because the Japanese government has been revising family-related systems and adopting work-life balance measures from the 1990s through to the early 2000s (e.g., the extension and amendment of the Family Care Leave Act in 1995 and 2005, reduction of firms' responsibility of employees' pension insurance fee and health insurance in 2000 and 2001, respectively), the negative impacts of year dummies after 1991 could imply that the improvement of the accessibility to child care and sick/injured child care leave have a much stronger impact on a stable female worker's reinstatement than the pressure by the tight labor market. In that sense, the hazard estimates of year dummy variables after 1991 could be even underestimated.

Table 3: Effects of various determinants including work-life balance measures and workplace flexibility on timing of mothers to be reinstated into the labor market after the 1st childbirth (Number of subjects=140; Number of failures=95)

Independent variable	Cox-proportional	Parametric hazard estimates with weibull distribution	exponential distribution	weibull-gamma distribution
	Observed Hazard Ratio (Boot strap S.E)			
1. Household characteristics				
Mother's age at 1st childbirth	1.072	1.107	1.087 c/	1.112 c/
	(0.060)	(0.081)	(0.050)	(0.063)
Father's age at 1st childbirth	0.910 c/	0.900 b/	0.917 b/	0.881 a/
	(0.047)	(0.047)	(0.033)	(0.039)
Mother's educational attainment (college graduate=1)	1.687	1.963 c/	1.673	1.806
	(0.622)	(0.791)	(0.587)	(0.675)
Father's educational atteinment (college graduate=1)	0.486 b/	0.487	0.559 c/	0.457 b/
	(0.162)	(0.223)	(0.167)	(0.171)
Infomal support for child care (=1)	1.314	1.639	1.471 c/	1.456
	(0.410)	(0.568)	(0.341)	(0.478)
1st child's health status at birth (birthweight<2500g=1)	0.333	0.203	0.289	0.274 b/
	(2.298)	(0.251)	(0.235)	(0.159)
2nd childbirth before reinstatement after 1st childbirth (=1)	0.044	0.017	0.028	0.006 a/
	(0.595)	(0.076)	(0.083)	(0.006)
2. Mothers' status in the labor market at the time of one-year before 1st childbirth				
Full-time worker (=1)	0.665	0.707	0.743	0.599
	(0.303)	(0.397)	(0.284)	(0.345)
Profession or skilled worker (=1)	3.707 b/	4.054 b/	3.235 b/	4.665 b/
	(1.986)	(2.552)	(1.615)	(2.942)
Clerical worker (=1)	2.811 c/	3.050 c/	2.504 b/	3.647 b/
	(1.574)	(1.824)	(1.164)	(2.321)
Logarithum value of annual income	2.539 a/	3.023 b/	2.509 a/	3.607 a/
	(0.757)	(1.354)	(0.859)	(1.453)
3. Stability of carrier				
Father: Continue to be hired by the same employer after graduation (=1)	0.858	1.040	1.039	1.053
	(0.277)	(0.375)	(0.283)	(0.399)
4. Timing of childbirth and macro-based characteristics of local areas				
Timing of 1st childbirth after the Family Care Leave Act activated in 1991	0.281 b/	0.487	0.536	0.246 b/
	(0.173)	(0.356)	(0.308)	(0.158)
Rate of waiting-list child for day-care center in the local area (%)	0.885	0.882	0.871	0.800
	(0.118)	(0.117)	(0.080)	(0.116)
Urban dummy (population of municipal area>=0.3million=1)	0.901	0.932	0.928	0.835
	(0.322)	(0.350)	(0.209)	(0.288)
5. The accessibility and the flexibility				
Principal components score for accessibility	1.267	1.411	1.344 b/	1.382 b/
	(0.220)	(0.312)	(0.167)	(0.225)
Principal components score for flexibility at mother's working place	0.794	0.802	0.865	0.978
	(0.175)	(0.164)	(0.157)	(0.219)
$\ln \sigma$	-	0.237 b/	-	0.503 a/
	(-)	(0.114)	(-)	(0.157)
$\sigma\ (=1/\alpha)$	-	1.268	-	1.654
	(-)	(0.144)	(-)	(0.259)
$1/\sigma\ (=\alpha)$	-	0.789	-	0.605
	(-)	(0.090)	(-)	(0.095)
θ				0.624
				(0.372)
Wald chi-square	66.060	47.240	55.490	132.480
Log likelihood	-359.142	-150.498	-154.191	-149.823

Source: Calculated by the author, based on the "Survey for Working Environment and Fertility" conducted by Central Research Service Inc (Chuo Chosa Sha) in 2007.

Note: The data are limited to those who have at least one child and continue to be hired by the same employer after school graduation. Since the survey asked questions related only to respondents' current working place, I have to clarify those who worked in the same firm as now when they had a first baby, in order to examine effects of various systems on the timing of being reinstated into labor market after the first childbirth.

Note: In this study, the presence of accessibility of these systems and the flexibility of working environment at current father's working place are ignored, because they are not statistically significant for further duration analyses.

Note: a/, b/, and c/ refer to a significance level of 1, 5, and 10 percent, respectively.

Note: Likelihood-ratio test of theta=0: chibar2(01) = 1.35 Prob>=chibar2 = 0.123

Finally, in regards to the effect of heterogeneity in the model, the weibull -gamma estimation shows that the p-value for the likelihood-ratio test becomes 0.255. Therefore, we cannot reject the zero hypothesis of $H_0 : \theta = 0$ so that the assumption of the homogeneous baseline hazard across individuals may be justified. After correcting standard errors, effects of opportunity costs remain strongly positive on the probability of reinstatement for female stable workers who have been hired by the same employers after school graduation. Further, the effects of accessibility to work-life balance measures become positive.

6. Conclusions and discussions

Using the micro-based data on married union members and their spouses, this study evaluates the effects of work-life balance measures and workplace flexibility on a female worker's choice and timing of being reinstated into the labor market after the first childbirth. In this section, I would like to review major results in this study with the discussion about the limitations and some policy implications.

The plots of Kaplan-Meier survival and the Nelson-Aalen cumulative hazard estimates show a basic characteristic in the female labor market after the first childbirth, such that those who have not come back to work within one year have been facing a high risk of never being reinstated into the labor market, regardless of various factors.

In the weibull-gamma model setting for correcting standard errors, the results show that opportunity costs such as profession/skilled or clerical work with high annual income would motivate a female worker to be reinstated into the labor market within short time periods after the first childbirth. If the significant effects of opportunity costs are reliable results, the growth in the rates of female workers with low opportunity costs (such as non-regular status with low life-time income) in younger age groups will have a reversed negative impact on the bottom of the M-shaped distribution of the female workforce in the next decades.

However, as I previously mentioned, due to the limitations of the data, this study includes married couples of which at least one person belongs to the labor union and thus, are probably working in a better environment than non-labor union couples. Further, for investigating policy effects, out of these labor-union couples, I extract couples with female spouses having a stable career and who may enjoy even better working conditions than unstable employees. This implies that including only female employees who could take advantage of better working conditions will lead to a "selection bias problem" to overestimate the effects of opportunity costs. Aside from the size of effects, however, the lower opportunity costs for younger female workers still could be a serious issue in order to be complemented with the lack of workforce caused by a drastic change in the population structure by an increase in female labor supply.

For a stable female employee who has continued to be hired by the same employer after school graduation, adjusting for the opportunity costs, and the accessibility of work-life balance measures as a whole remains a significant positive impact on the probability to come back to work and thus would shorten the length of being on leave after the first childbirth in parametric model settings. However, including only stable female employees working in better environments would probably underestimate the effects of the measures because I choose only female workers who have strong wills to continue to work even after the first childbirth, regardless of the accessibility of various measures. Also, I have to note another crucial limitation of this study, such that work-life balance measures can be identified at the survey period rather than at the timing of first childbirth. Due to the public pressure on firms to extend family-care and work-life balance measures in the last decade, the systems were most likely to be changed between the early 1990s and the time of survey. So, I just can interpret the work-life balance measures in the year of 2007 as a proxy of the tolerance and liberal attitudes of firms to family care.

Since the direct child care costs are not identified for the first child in individual households, I rather control for the presence of informal child care and rate of waiting-lists to the quota of children for day care centers in a female worker's residential municipal area. In the results, the presence of informal care would decrease the costs of child care and increase the probability of mothers to exit to the labor market within short periods. While an increase in the rate of waiting-list children for day care centers in a local area robustly has a significant negative effect on female reinstatement for entire labor-union couples, the direction and size of the effects are almost the same for female stable employees, and becomes statistically insignificant. Suppose that female employees with stable careers can take advantage of child care measures. They may stay at home with infant babies who are less than 3 years old, of which demand and supply for child care provided by day care centers are most likely to be mismatched. Therefore, a choice of reinstatement by a stable female worker would not be affected by the rate of waiting-list children in local areas. In that sense, this result may also be affected by the "selection bias," which underestimates the effect of public child care resources provided by day care centers. Besides, I use the waiting-list children for day care centers in 2007 because I cannot specify the data at the timing of the first childbirth which I should have used. Thus, the results should also be very carefully interpreted.

Since the data used in this study suffer from serious selection bias, the results should never be generalized and the policy implications are quite restricted. Further research should be to re-examine the hypothesis using the nation-wide random sampling data source. Under such conditions, the results show that:

(1) female workers, who have not come back to work within one year after the first childbirth, would face a high risk of never being reinstated into the labor market; (2) a decrease in child care costs due to the presence of informal care and an increase in opportunity costs such as profession/skilled or clerical work with high annual income would motivate a female worker to be reinstated into the labor market within short time periods after the first childbirth; and (3) adjusting for the opportunity costs, the accessibility of work-life balance measures still remains a significant positive impact on the probability of a stable female employee to come back to work, thus shortening the length of being on leave.

Notes

(Note 1) "The Special Survey of the Labour Force Survey" and "Labour Force Survey" show that the percentages of female regular and non-regular employees in age groups of 15-24 and 25-34 are approximately 62% versus 37%, and 70% versus 29% in 1998, which has become about 50% versus 50%, and 59% versus 41% respectively, in 2008 (Statistics Bureau, 2008).

(Note 2) In this study, I use "Survey for Working Environment and Fertility" which is described in the latter section. For example, as work-life balance policies, the survey asked the presence and accessibility of 12 types of policies such as annual paid leave by half a day, shortening of working hours, limitation on late-night work, limitation on overtime work, child care leave systems and nursing care leave systems more generous than the legal definition, flexible times of starting and ending work, day care center financial support, telecommuting, area-specific working systems, reemployment, and sick/injured child care leave.

(Note 3) The law is officially called "Act on the Welfare of Workers Who Take Care of Children or Other Family Members Including Child Care and Family Care Leave.".Article 1 shows that the purposes of this Act are to promote the welfare of workers, etc. who take care of children or other family members and to contribute to the development of the economy and society.These purposes will be accomplished by helping balance such persons' work life and family life by means of continuing employment and promoting re-employment of said workers, etc. through such steps as establishing a system for Child Care Leave, Family Care Leave, and Sick/Injured Child Care Leave, prescribing measures to be taken by employers concerning working hours, etc. with the view to facilitating the care of children and other family members, and taking measures to support said workers, etc ("Japanese Law Transition" webpage: http://www.japaneselawtranslation.go.jp/law/detail/?ft=2&re=01&dn=1&yo=&kn[]=%E3%81%84&x=10&y=16&ky=&page=3).

(Note 4) JSD was established on July 2001, which consists of 194,000 workers (Women-59%, Men-41%, and Part-time workers-35%) in 137 enterprise-wide unions in distributive, service, and allied industries, as of April 2007 (JSD webpage, http://www.jsd-union.org/). UIZ was founded in September 2002 and the number of members is approximately one million (Women-53%, Men-47%, and Part-time workers-44%) in about 2,500 affiliated unions as of September 2008 (UZI webpage, http://www.uizensen.or.jp/).

(Note 5) It includes "de facto marriage" which is a married, but not registered couple.

(Note 6) The survey was also conducted on 1,514 unmarried union members (a response rate of 53.9% out of 2,810).However, this study excludes them because there are too few single-parent households and the information on either parent who does not currently live with children is missing, such as age, educational attainment, and status in the labor market, which is necessary for regression analyses in this study. Further, the survey was carried out on 52 current employers (a response rate of 65% out of 80) of the union members, asking questions regarding working environments in detail, e.g., the number of employees by sex, age and full-time or part-time status, the presence and accessibility of various systems for balancing work and family lives, wage structure by sex and educational attainment, and personnel affairs and welfare systems. The regression results adjusting for these characteristics of each firm are not shown in this paper, because none of these are statistically significant. Yet, the results can be requested to the author.

(Note 7) The survey asked only female respondents employment status, type of job, and income one-year before the first childbirth.

(Note 8) Unfortunately, the survey did not ask fathers' statuses in labor market one-year before the first childbirth.

(Note 9) Accurately, the rate of waiting-list children for day care centers should be treated

as an endogeneous variable in functions of the female labor supply due to the interactive causality. However, in this study, this variable is considered to be exogenous under a strong assumption such that people do not migrate before and after the first childbirth.

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IS MINIMUM WAGE AN EFFECTIVE ANTI-POVERTY POLICY IN JAPAN?

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Abstract. This paper considers whether the minimum wage is a well-targeted antipoverty policy by examining the backgrounds of minimum-wage workers. Whether raising the minimum wage reduces employment for unskilled workers is also investigated. An examination of micro data from a large-scale government household survey, the Employment Structure Survey (*Shugyo Kozo Kihon Chosa*), reveals that approximately half of minimum-wage workers belong to households with annual incomes of more than 5 million yen as a non-head of household. A regression analysis indicates that an increase in the minimum wage moderately reduces the employment of male teenagers and middle-aged married women, while it encourages the employment of high-school age youth.

1. INTRODUCTION

The media have recently been drawing the public's attention to poverty issues in Japan. Indeed, in 1999 approximately 8% of households were below the poverty threshold, which is the government criterion for eligibility for livelihood assistance (Komamura (2003).[1] The new minimum-wage legislation enacted in November 2007 requires the government to consider the level of livelihood assistance when determining the minimum wage. The passage of this new legislation paved the way for increasing the minimum wage.

Economists have long discussed whether raising the minimum wage is an effective policy option for alleviating poverty and have tended to take a negative attitude toward it, regarding it as a variation of price intervention. This discussion dates back to the early 20th century,[2] and to the classical work of Stigler (1946), who viewed the minimum wage as an ineffective antipoverty policy because minimum-wage workers do not necessarily belong to poor households, and because it can reduce the employment of unskilled workers. Whether minimum-wage workers belong to poor households continued to be evaluated by Card and Krueger (1995), Burkhauser *et al.* (1996) and Neumark and Wascher (2008), who concluded that in the USA a non-negligible fraction of minimum-wage workers belong to non-poor households. The minimum wage's negative impact on employment has been widely studied in the USA, and the

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[1] Komamura (2003) estimates that among households presumably eligible for livelihood assistance, only 18.5% actually received the assistance.

[2] See Neumark and Wascher (2008) for the history of economic thought on the minimum wage.

evidence is reviewed in Brown *et al.* (1983), Card and Krueger (1995), Kennan (1995), Brown (1999) and Neumark and Wascher (2008). Although the influential book by Card and Krueger (1995) changed the way economists think about the minimum wage's role in a labour market that is not perfectly competitive, as evidenced by Manning (2003), economists' general attitude toward the minimum wage continues to be sceptical because of its negative impact on employment and its potential to reduce opportunities for skill formation (see Neumark and Wascher 2008).

In spite of intense interest in the role of the minimum wage in Japan, not much is known about minimum-wage workers and whether raising the minimum wage would decrease employment. Abe and Tanaka (2007), Abe and Tamada (2008) and Kambayashi *et al.* (2009) consistently point out that the minimum wage has a significant impact on the wage distribution, particularly on part-time workers in rural areas. These findings might give the impression that raising the minimum wage is an effective antipoverty policy; however, Tachibanaki and Urakawa (2007) report that a large portion of minimum-wage workers are not household heads and belong to wealthier households than many non-minimum-wage workers, based on Japan's General Social Survey, 2000–2002, with an annual sample size of around 1000.

Evidence regarding the effect of the minimum wage on employment is still mixed. Kawaguchi (2009) do not find systematic evidence of employment loss caused by an increase in the real value of minimum wage based on time-series data covering 1983–2006. Exploiting regional variation in the real value of the minimum wage, Tachibanaki and Urakawa (2007) do not find evidence of employment loss caused by a high minimum wage based on prefecture-level, cross-sectional household data from 2002, whereas Yugami (2005) find a positive correlation between the unemployment rate and the minimum wage based on prefecture-level census data from 2000. Ariga (2007) found that a higher prefectural minimum wage increased the wages of high-school graduates and suppressed new job openings for them based on prefecture-level, cross-sectional data from the Employment Service Bureau of the Ministry of Labor and Health. None of the above studies exploit prefecture-level panel data to estimate the effect of the minimum wage on employment, allowing for prefecture unobserved heterogeneity. However, an unobserved macro shock could be correlated with the time-series change of the minimum wage, or regional, unobserved heterogeneity could be correlated with the level of the regional minimum wage. Therefore, controlling for both an unobserved macro shock and unobserved, prefecture heterogeneity using prefecture-level panel data is indispensable. Kambayashi *et al.* (2009) explore 1997–2002 prefecture-level panel data and using a fixed-effects estimation find that a higher real value of the minimum wage reduces employment for women between the ages of 31 and 59 years[3].

[3] Using another approach, Kawaguchi and Yamada (2007) analyse a panel of individuals and find that those low-wage workers who are directly affected by minimum-wage hikes are more likely to lose their jobs after minimum-wage hikes, allowing for individual fixed effects.

The purpose of the present paper is to examine the backgrounds of minimum-wage workers and the minimum wage's effect on employment, as well as schooling decisions, based on micro data from the Employment Status Survey (ESS) between 1982 and 2002. The analysis reveals that approximately 4–10% of male workers and 22–41% of female workers were employed at the minimum wage in 2002, while the corresponding numbers were approximately 3–6% for men and 22–36% for women in 1982. An examination of minimum-wage workers' backgrounds reveals that approximately half of them belong to households with an annual income of more than 5 million yen as a non-head of household.

The variation in the fraction of workers affected by a minimum-wage hike resulting from the heterogeneity of wage distributions across prefectures is exploited to evaluate the effect of a minimum-wage increase on employment across prefectures. The estimation results indicate that a minimum-wage hike decreases employment among male teenagers and middle-aged married women. Its magnitude is small for male teenagers, but moderate for middle-aged married women. An analysis of schooling and employment choices among high-school age teenagers indicates that an increase in the real minimum-wage level encourages youths to work and induces them to drop out of high school. The findings show that higher minimum wages reduce the employment rate of teenage youth while encouraging employment of high-school age youth. The combination of these two factors implies that the minimum-wage hike negatively affects high-school graduates' labour market prospects.

This paper is organized as follows. Section 2 introduces the institutional background of the minimum-wage system. Section 3 explains the data and the time-series trend of the minimum wage. Section 4 examines the background of minimum-wage workers and considers whether a minimum-wage hike helps poor households. Section 5 evaluates the minimum wage's effect on employment. Section 6 reports the minimum wage's effect on the choices of 16 and 17-year olds. The final section concludes.

2. INSTITUTIONAL BACKGROUND

The minimum wage in Japan became statutory in 1959. There are two distinct minimum wage systems: a regional minimum wage set by prefectures that applies to all workers, and an industry minimum wage that is applied on top of the regional minimum wage to workers in specific industries in specific prefectures. This paper focuses only on the regional minimum wage because the industrial minimum wage does not have extensive coverage and is gradually being abolished,[4] and because the specific industries that the industrial minimum wages are defined for cannot be exactly matched to the industry codes in the data.

[4] The report by *Saitei Chingin no Arikata Kenkyukai* (minimum wage study group) of the Ministry of Health, Labor and Welfare (2005) included a recommendation for the revision of the industrial minimum wage, including the possibility of its abolishment. In the fiscal year 2000, 4.5 million workers were covered by the industry minimum wage, whereas 52 million workers were covered by the regional minimum wage according to a press release by the Ministry of Labor and Welfare on 25 January 2001.

The regional minimum wages are determined by the following process. First, a national council on minimum wages, which consists of members representing the public interest (retired bureaucrats and academics), employers and employees (union leaders), provides 'criteria' (*meyasu*) for minimum-wage increases for four distinct regional blocks that include all 47 prefectures divided roughly by wage level. Second, local minimum wage councils deliberate and decide on their own minimum-wage levels, but the criteria suggested by the national council have a significant influence on the local councils' final decisions. In the national council's negotiations, the opinions of representatives of the public interest are extremely important because there are always conflicts between the representatives of employees and employers that make it very difficult to reach a unanimous agreement on minimum-wage increase amounts. In this situation, the opinions of council members representing the public interest are respected as a means of reaching an agreement. The council members' opinions tend to be strongly affected by a rate of average wage increase that is based on a government establishment survey implemented for the purpose of minimum-wage determination.[5]

3. MINIMUM WAGE VARIABLES AND DATA

This study utilizes the ESS (*Shugyo Kozo Kihon Chosa*) from the years 1982, 1987, 1992, 1997 and 2002. The ESS is conducted every 5 years on household members age 15 years or older from a sample of approximately 440 000 households that is representative of the complete population. The survey collects information on household members and each member's labour force status on 1 October of each survey year. The file contains approximately 1 million individuals, with equal numbers of men and women, for each year the survey is conducted.

Two variables are defined to express the value of minimum wages in relation to wage distributions in regional labour markets: the fraction of minimum-wage workers (FMW) and the Kaiz index. FMW is defined as the percentage of workers earning the minimum wage or less out of all employed workers.

Information regarding the minimum wage by prefecture is obtained from the Pandect of Minimum Wage Determination (*Saitei Chingin Kettei Yoran*). Although the minimum wage is basically provided as an hourly rate,[6] the survey only records individuals' annual earnings in ranges. To compare annual earnings with the minimum wage, we calculate *minimum wage annual income*, which is defined as the annual earnings of an individual if he or she works at the minimum wage all year, as the product of minimum wage by weekly work hours

[5] The survey is the *Chingin Kettei Joukyo Chosa* (Survey of Current Wage Determination) by the Ministry of Health and Labor. This survey takes place every June and samples approximately 10 000 establishments in manufacturing, wholesale and retail, restaurant, and service industries that hire no more than 30 employees.

[6] Until 2002, the minimum wage was also defined using the daily wage as well as hourly wage, but this practice was abolished after 2002.

and the annual number of workdays divided by 5.[7] Because annual workdays and weekly work hours are also reported in ranges, we construct two different ranges of minimum-wage earnings by assigning a maximum and minimum value to one range bracket for workdays and one range bracket for weekly work hours.[8] The actual minimum-wage earnings should lie between the two different minimum-wage earnings levels used here. The annual earnings, also reported in ranges, are defined as the minimum value of a range bracket.[9] A minimum-wage worker is defined as a worker earning less than the minimum-wage earnings. FMW is defined as the number of minimum-wage workers divided by the number of employed workers. The FMW using the maximum and minimum values of workdays and work hours are called the fraction-of-minimum-wage-workers minimum (FMW, min) and the fraction-of-minimum-wage-workers maximum (FMW, max), respectively. In the above process, workers working fewer than 200 days in a year on irregular work schedules, which consist of approximately 12% of the sample, are dropped because the survey does not record their work hours and workdays. This data limitation might underestimate FMW if those workers working limited days without a regular work schedule are more likely to receive minimum wages than the workers working on regular schedules. Self-employed workers and family workers are also excluded from the sample because they are not covered by the minimum wage law.

The Kaiz index is defined as the minimum wage divided by the average wage at an hourly rate. The average hourly wage is determined from prefecture-level data from the Basic Survey on Wage Structure because the hourly wage can be precisely calculated from monthly hours of work and earnings based on payroll records.[10] We calculate the average wage at an hourly rate as the scheduled monthly wage divided by the scheduled monthly hours of work. Although both FMW and Kaiz variables measure the value of the minimum wage as it relates to wage distributions, the two measures exploit different information: FMW

[7] 5 is the number of week-days.

[8] The ranges of annual workdays are: fewer than 50, 50–99, 100–149, 150–199, 200–249, and 250 and above for all survey years. The ranges of work hours are: less than 15, 15–21, 22–34, 35–42, 43–48, 49–59, and 60 and above for 1987; less than 15, 15–21, 22–34, 35–42, 43–45, 46–48, 49–59, and 60 and above for 1992; less than 15, 15–21, 22–34, 35–42, 43–48, 49–59, and 60 and above for 1997; less than 15, 15–19, 20–21, 22–34, 35–42, 43–48, 49–59, and 60 and above for 2002. For the lowest and highest bracket ranges of annual workdays, 0 and 260 days are assigned, respectively. For the lowest and highest bracket ranges of weekly work hours, 0 and 80 are assigned, respectively.

[9] The annual income ranges denominated by thousand yen are: less than 500, 500–990, 1000–1490, 1500–1990, 2000–2490, 2500–2990, 3000–3990, 4000–4990, 5000–5990, 6000–6990, 7000–7990, 8000–8990, 9000–9900, 10 000–14 900, and 15 000 or above for year 2002. The ranges for 1992 and 1997 are: less than 500, 500–990, 1000–1490, 1500–1990, 2000–2490, 2500–2990, 3000–3990, 4000–4990, 5000–6990, 7000–9900, 10 000–14 900, and 15 000 or above. The ranges for 1987 and 1982 are: less than 500, 500–990, 1000–1490, 1500–1990, 2000–2490, 2500–2990, 3000–3990, 4000–4990, 5000–6990, 7000–9900, and 10 000 or above. To compare annual income each year, this study integrates income ranges of 5 years with that of 1982.

[10] The Japanese Government conducts the Basic Survey on Wage Structure annually. This survey includes observations randomly chosen from almost all regions and industries, except agriculture, in Japan. The establishments in the sample, which are randomly chosen in proportion to the size of prefectures, have 10 or more employees in both private and public sectors, or belong to private firms with 5 to 9 employees. Employees are also randomly selected from among the establishments included in this survey. This study uses prefecture-level data disclosed by the Japanese Government.

exploits information from the lower part of the wage distribution relative to the minimum wage, whereas the Kaiz index captures the mean of the wage distribution relative to the minimum wage. Therefore, it is possible for the Kaiz index to be low even if the FMW is high when the wage distribution has a fat right tail.

4. CHARACTERISTICS OF MINIMUM-WAGE WORKERS

Table 1 reports the breakdown of minimum-wage workers by education, sex and age categories. The FMW among junior-high and high-school graduates is higher than that among college graduates. Both younger and older workers are more likely to be minimum-wage workers. It is also notable that the FMW increased in all categories from 1982 to 2002. Table 2 indicates the FMW and the Kaiz index by prefectures. Both the FMW and the Kaiz tend to be high in rural areas. Figure 1(a) and (b) show the histograms of annual earnings normalized by the minimum value, defined as: (annual earnings – the minimum value of

Table 1. Fraction of minimum wage workers by education, sex and age categories

Year	1982		2002	
FMW	FMW minimum	FMW maximum	FMW minimum	FMW maximum
Education (%)				
Junior high school	14.92	24.37	18.47	33.47
High school	9.17	16.79	13.48	26.20
Junior college	7.09	13.57	11.56	23.93
College	1.78	3.94	3.06	7.39
Sex (%)				
Male	2.80	6.48	4.42	10.48
15–19	26.47	44.31	38.95	61.78
20–24	7.86	20.36	14.93	33.98
25–29	2.40	6.91	4.69	14.58
30–39	0.91	2.56	2.07	6.23
40–49	0.70	2.06	1.39	3.93
50–59	1.46	3.66	1.84	4.61
60–	9.18	16.59	9.52	19.64
Female	22.22	36.16	22.11	40.74
15–19	27.74	43.84	48.86	71.02
20–24	13.59	26.10	20.78	41.56
25–29	14.79	25.22	13.38	29.23
30–39	24.51	39.09	19.80	36.33
40–49	24.70	40.34	22.52	42.02
50–59	24.22	37.93	22.52	41.72
60–	37.45	51.85	33.94	54.21

The fraction of minimum-wage workers (FMW) is defined as the number of minimum-wage workers among all employed workers. **Minimum-wage worker is defined if imputed minimum-wage annual earnings are above reported annual earnings.** Imputed minimum-wage annual earnings are calculated in two ways: one based on the minimum values of workdays and work hours, and the other based on the maximum values of workdays and work hours. The minimum-wage worker defined by the former method is the minimum number of minimum-wage workers and the latter method is the maximum number of minimum-wage workers. Therefore, the resulting fraction of minimum-wage workers has its bound ranging from FMW minimum to FMW maximum.

Table 2. Percent of workers earning less than the minimum wage and the Kaiz index

Year	1982			2002			Year	1982			2002		
Minimum wage variable	FMW minimum	FMW maximum	Kaiz	FMW minimum	FMW maximum	Kaiz	Minimum wage variable	FMW minimum	FMW maximum	Kaiz	FMW minimum	FMW maximum	Kaiz
Hokkaido	9.6	15.4	0.38	15.0	26.0	0.40	Shiga	8.4	14.7	0.35	9.8	20.5	0.36
Aomori	12.7	21.8	0.43	14.6	26.9	0.44	Kyoto	8.4	14.4	0.35	12.8	24.9	0.37
Iwate	13.2	22.9	0.42	13.7	25.4	0.44	Osaka	7.7	16.3	0.33	12.2	24.9	0.35
Miyagi	9.1	16.1	0.37	11.4	21.6	0.37	Hyogo	7.5	13.8	0.33	11.6	22.9	0.36
Akita	14.3	23.3	0.45	14.0	26.2	0.43	Nara	7.6	12.4	0.35	9.8	20.0	0.36
Yamagata	12.0	21.3	0.44	11.4	22.0	0.42	Wakayama	9.6	16.0	0.35	13.0	24.8	0.39
Fukushima	10.7	19.3	0.40	11.2	21.9	0.39	Tottori	10.4	18.4	0.44	10.3	20.0	0.41
Ibaraki	7.4	13.9	0.37	9.3	20.5	0.36	Shimane	12.7	20.3	0.42	10.2	20.4	0.42
Tochigi	9.1	16.4	0.37	11.7	23.4	0.37	Okayama	10.7	16.3	0.37	12.0	21.0	0.38
Gunma	9.9	17.1	0.38	12.0	23.9	0.38	Hiroshima	8.0	14.7	0.35	11.8	22.6	0.36
Saitama	7.1	13.0	0.35	10.8	22.5	0.37	Yamaguchi	9.8	16.3	0.36	12.5	23.2	0.40
Chiba	7.1	12.8	0.34	9.3	20.3	0.35	Tokushima	12.4	20.2	0.40	11.0	20.8	0.38
Tokyo	8.3	16.0	0.32	8.8	19.5	0.31	Kagawa	9.4	15.9	0.37	10.2	20.1	0.39
Kanagawa	6.7	13.6	0.32	9.2	19.9	0.35	Ehime	12.2	20.6	0.38	12.5	22.9	0.38
Niigata	10.2	19.2	0.42	11.2	21.2	0.42	Kochi	11.3	19.6	0.40	11.9	22.2	0.40
Toyama	9.8	15.9	0.38	9.8	19.4	0.40	Fukuoka	9.6	17.4	0.35	13.6	26.4	0.38
Ishikawa	10.4	17.4	0.39	11.0	23.4	0.40	Saga	11.5	20.0	0.42	13.0	24.8	0.42
Fukui	9.0	15.9	0.40	10.0	20.7	0.39	Nagasaki	11.1	18.9	0.38	14.1	25.8	0.41
Yamanashi	8.2	15.0	0.40	9.9	21.0	0.37	Kumamoto	12.5	22.3	0.41	15.0	28.0	0.41
Nagano	9.5	16.2	0.39	10.1	21.5	0.39	Oita	10.5	18.2	0.39	13.7	25.5	0.40
Gifu	9.5	17.7	0.40	13.5	25.4	0.41	Miyazaki	14.2	24.1	0.43	15.2	28.1	0.43
Shizuoka	9.2	15.4	0.37	10.9	23.6	0.39	Kagoshima	12.6	22.2	0.42	13.7	25.9	0.41
Aichi	8.9	15.3	0.35	11.4	22.6	0.36	Okinawa	14.0	23.5	0.36	19.2	33.6	0.44
Mie	10.7	17.5	0.37	12.9	24.6	0.37							

The fraction of minimum-wage workers (FMW) is defined as the number of minimum-wage workers among all employed workers. Minimum-wage worker is defined if imputed minimum-wage annual earnings are above reported annual earnings. Imputed minimum-wage annual earnings are calculated in two ways: one based on the minimum values of workdays and work hours, and the other based on the maximum values of workdays and work hours. The minimum-wage worker defined by the former method is the minimum number of minimum-wage workers and the latter method is the maximum number of minimum-wage workers. Therefore, the resulting fraction of minimum-wage workers has its bound ranging from FMW minimum to FMW maximum.

The Kaiz index is defined as a minimum wage divided by the average wage of 25–59 years old male workers.