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Abstract

This study employs a large-scale dataset to examine major theoretical factors affecting job creation and destruction in Japan. The new measurement first provides information for both job creation and job destruction pertaining to individual Japanese firms, enabling empirical work at the firm level, which was impossible in previous studies. Different from a comparative study conducted with German data, our study results indicate that wages and job productivity significantly affect job creation and destruction in Japan; namely, an increase in wages significantly decreases firms' job creation and increases their job destruction, whereas an increase in productivity significantly increases firms' job creation and reduces job destruction. Moreover, although a larger number of *seishain* workers, i.e., workers who are granted lifetime employment rights in Japan, helps decrease job destruction, they also decrease job creation, and the negative effect on job creation outweighs the positive effect on job destruction.

Keywords: Job creation, Job destruction, Wages, Job productivity, Hiring cost
JEL classification: J20, J23, J30

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1. Introduction

Labor market dynamics are marked by the creation of new jobs and the destruction of old jobs at the firm level. Wages and job productivity are important determinants in labor economic theories to determine the volume of job creation and destruction (Mortensen & Pissarides, 1994). However, labor market regulations impede empirical studies on the effects of wages and job productivity. Lack of data on firm-level job creation and destruction has hindered research efforts in Japan. This study contributes to the literature in the Japanese context by using a large-scale dataset of job flows to examine major theoretical factors affecting job creation and destruction.

Using firm-level data from Germany, Moser, Dieter, and Beatrice (2010) found that firms' job creation negatively responds to larger average wage costs, while it is not affected by shocks on the firms' productivity, such as sales growth; job destruction was not significantly affected by either wage costs or productivity shocks. They explained that Germany's labor market regulations induce employment smoothing. Therefore, theoretical factors, such as wages and productivity, that determine job creation and destruction are probably inactive in some economies.

These effects are not clear in the Japanese context. Several researchers have made descriptive analyses of gross job creation and destruction (Ando & Kimura, 2015; Fukao & Kwon, 2011; Higuchi & Shimpo, 1999; Kodama & Inui, 2015; Tachibanaki & Morikawa, 1999; Teruyama & Genda, 2002). Gross job creation was calculated by summing up the entire net employment increase in the expanding firms, and gross job destruction was calculated by summing up the entire net employment decrease in the shrinking firms. These studies provided important evidence regarding job creation and destruction at a macro level.

This study differs from previous studies in that a new dataset that enables estimation of job creation and destruction at the firm level in Japan is used. Usually, in an individual firm, the creation of new jobs and the destruction of old jobs occur simultaneously, and the dataset was used to capture both these phenomena.

Furthermore, at the firm level, net employment change of an individual firm, which is the difference between its job creation and destruction, has been examined in some previous studies (Kodama & Inui, 2015; Fukao & Kwon, 2011; Genda, 2004). This study is different because the effects on job creation and destruction differ from that on the net employment growth. For instance, a positive effect on net employment growth could be due to several possibilities: a small negative effect on job creation and large negative effect on job destruction, a large positive effect on job creation and small positive effect on job destruction, a positive effect on job creation and no effect on job destruction, among others. In the U.S. context, Klein, Schuh, and Triest (2003) found that job reallocations, which are the sum of the jobs created and destroyed, are significantly affected by trends of real exchange rate, while net employment was not. Furthermore, "cyclical real exchange rates significantly affect net employment through job destruction only" (Klein, Schuh, & Triest, 2003, p. 239). In the Japanese context, Tachibanaki and Morikawa (1999) conducted an industry-level econometric analysis on gross job creation and job destruction and found that business regulations significantly decreased gross job creation, destruction, and reallocation rates; however, the net employment rate of change remained unaffected. Thus, an insignificant effect on net employment change does not indicate zero effects on employment because the effects on job creation and job destruction are probably hidden.

Moreover, job creation and destruction, which occur simultaneously in the same firm, are larger than the net employment changes of the firm. As discussed by Moser et al. (2010), an increase in the number of employees in the marketing division may compensate for a reduction in the number

of employees in the export plant in case of a real appreciation. Therefore, the estimation of gross job creation and destruction, which uses an aggregation of net employment increases or decreases, "would understate the true magnitude of job reallocation by not indicating any job creation or destruction, although it actually took place" (Cahuc & Zylberberg, 2004, p. 506). Lagarde, Maurin, and Torelli (1995) found that job reallocations within firms represent almost half of all job reallocations in France (Cahuc & Zylberberg, 2004). Therefore, the magnitude of job reallocation within firms probably represents job creation and destruction of considerable magnitude.

Different from the measurement of gross job creation and destruction in previous studies, the estimation and data in this study includes within-firm job reallocations at the division level. For a particular firm, job creation is defined as the total employment growth of all expanding divisions, and job destruction is defined as the total employment decreases of all shrinking divisions. Therefore, within-firm job reallocations are counted at the division level. In addition, it provides data on both job creation and destruction for each observation of Japanese firms, which enables firm-level analysis of econometric models.

The theoretical background of this study is based on basic models of search theory, introduced by Pissarides (2000), which suggest that the optimal number of jobs created increase with increase in job productivity, while this optimal number decreases with increasing wage and hiring costs. Further, job destruction is based on the ideas of endogenous job destruction, which considers that firms destroy jobs below the threshold idiosyncratic productivities (Pissarides, 2000). The model suggests that lower general productivity and higher wages lead to a higher rate of job destruction. However, as found by Moser et al. (2010), in the real economy, those effects may be inhibited because of regulations. Thus, examinations based on actual data are necessary.

Furthermore, the rate of *seishain* workers, i.e., the rate of workers who are granted lifetime employment rights due to a Japanese employment tradition, to total employment, is introduced to the model. In determining job creation, it is used as a proxy for the variable of hiring cost. A larger rate of *seishain* workers refers to higher hiring costs, because firms are much more careful in their search and selection of *seishain* workers than of non-*seishain* workers, because once hired, firms are almost unable to fire *seishain* workers due to firing regulations. In determining job destruction, although hiring cost do not work, the rate of *seishain* workers is introduced to control the effect of firing regulations.

The remainder of the study is organized as follows. Section 2 provides a brief literature review. Section 3 describes the model that forms the theoretical background of the empirical study. The data are presented in Section 4. Section 5 reports the estimation results and Section 6 concludes.

2. Literature Review

Previous studies have focused on *gross* job creation and job destruction in Japan, which are the aggregation of net employment increases and decreases, respectively. They aggregated firms by the difference in their characteristics, such as subsectors and difference sizes. Descriptive statistics rather than econometric models were used for their analysis. For instance, Kodama and Inui (2015) compared the gross job creation and destruction rates in multinational-enterprise group and domestic-company group, finding that the former is higher than that of the latter. Fukao and Kwon (2011) found that the *gross* job creation and destruction rate is higher in younger- than in older-firm group. Further, Ando and Kimura (2015) classified firms based on their ability to be divisible into subsets of three dimensions: first, is the subsector of firms (for example, manufacturing firms), second, is whether a firm is small or large, and third is further sub-divided as follows: (1)

multinationals expanding their foreign operations, (2) multinationals not expanding their foreign operations, and (3) local firms. Ando and Kimura further examined different characteristics of gross job creation and destruction among those groups based on the descriptive statistics.

Further, econometric analysis in those previous studies concentrated on determinants of net employment growth of firms, which is the difference between job creation and destruction. For instance, Kodama and Inui (2015) found that net reductions in domestic employment mainly arise from firms without overseas subsidiary companies and non-expanding multinational enterprises, while domestic employment increases when the number of overseas subsidiaries increases. Tachibanaki and Morikawa (2000) found that "plants with higher wages tend to have a lower employment reduction rate;" in particular, "if wages are restrained by 1%, the number of employees will increase by 0.05% to 0.21%." (Tachibanaki & Morikawa, 2000, p. 2)

Those studies provide important evidence for determinants of net employment changes. However, few studies have examined firm-level determinants of job creation and destruction, which are different from determinants of net employment changes as discussed in the previous section. The reason is that the measurement in gross terms was not able to provide individual firm-level creation and destruction data because when considering an individual firm, their data become a single net employment change of the firm.

As a result, building on the extant literature, this study employs a new measurement and data, to examine firm-level job creation and destruction in Japan.

3. Model

The model employed in this study assumes that a firm simultaneously creates new jobs and destroys old jobs. The firm creates jobs to maximize the expected returns from new jobs and destroys jobs associated with productivities that are below a reservation level.

3.1 Job creation

Based on the studies by Pissarides (2000), job creation by a firm is determined as follows. First, the rate at which vacancies are filled, q, is defined as follows:

$$q = H/V \tag{1}$$

where H is the total number of new hires by a firm[1] and V is the total number of job vacancies. It is assumed that the total number of new hires, H, is determined by the number of vacant jobs in the firm, V, and the number of job seekers in the labor market, S, in the form of an increasing function that is concave and homogeneous of degree 1 as follows:

$$q = \frac{H(S,V)}{V} = H\left(\frac{S}{V}, 1\right) \equiv q\left(\frac{S}{V}\right). \tag{2}$$

In the stationary state, the present discounted value of expected profit from a job vacancy, Z, is obtained as follows:

[1] Job–worker matches that do not lead to new hires are ignored.

$$Z = \frac{1}{1+r}[-pc + qJ + (1-q)Z] \tag{3}$$

where *pc* is the hiring cost when the job is created, for example, advertising cost, and is determined by the job's hiring cost index, *c*, and increases with the job's productivity, *p*. The job's productivity is defined by the output of the job. The interest rate is represented by *r*.

Next, the present discounted value of expected profit from an occupied job, *J*, is obtained as follows:

$$J = \frac{1}{1+r}[p - w + (1-\lambda)J] \tag{4}$$

where *w* is the wage of the job and λ is the probability that an external shock destroys the job.

According to Pissarides (2000), in equilibrium, all profitable opportunities from new jobs are exploited, which leads to zero expected value from the vacant jobs, that is, $V = 0$. This implies the following equation:

$$J = \frac{pc}{q} \tag{5}$$

Using equations (3), (4), and (5), the job creation condition is obtained as follows:

$$p - w - \frac{(r+\lambda)pc}{q(S/V)} = 0 \tag{6}$$

Equation (6) shows that the number of jobs created by a firm, *V*, increases with the productivity of a job, *p*, and the number of job seekers in the labor market, *S*, and decreases with the wage level of a job, *w*, and the hiring cost of a job, *c*.

3.2 Job destruction

According to Pissarides (2000), firms destroy jobs whose expected value, *J*, is below zero. We assume that the idiosyncratic productivity of each job is *px*, where *p* is the average productivity of all jobs in the firm and *x* is the index of idiosyncratic productivity for each job. Furthermore, *J(px)* is assumed to be a continuous function of productivity *px*, so that the job destruction rule, $J(px) < 0$, satisfies the following equation with respect to *R*, which is the reservation productivity:

$$J(pR) = 0 \tag{7}$$

This indicates that firms destroy jobs once their idiosyncratic productivities fall below the reservation productivity, *pR*.

Unlike the study by Pissarides (2000), this study assumes that an adverse shock, λ, completely destroys jobs that are hit by the shock. Furthermore, it assumes exogenous wages. Moreover, decreases in idiosyncratic productivities are not caused by adverse shocks; instead, they occur at a given rate. Every year, the rate of jobs whose productivity falls below *R* is τ, which is defined as

follows:

$$\tau = \frac{R}{\hat{p}} \tag{8}$$

where $\hat{p}$ is the highest productivity of all jobs in the firm.

Based on the assumptions and earlier discussions, the present discounted value of expected profit from an occupied job is as follows:

$$rJ(px) = px - w - \lambda J(px) \tag{9}$$

Substituting *x* with *R*, Equation (9) becomes

$$rJ(pR) = pR - w - \lambda J(pR) \tag{10}$$

Substituting Equation (10) with Equation (7), we obtain the following equation:

$$R = \frac{w}{p} \tag{11}$$

This indicates that reservation productivity decreases when the average productivity of all jobs in the firm increases, and reservation productivity increases when the average wage in the firm increases.

Because higher reservation productivity indicates that more jobs should be destroyed, this study finds that higher average productivity of jobs in the firm decreases job destruction, while a higher level of wages increases job destruction. This is shown by substituting Equation (11) into Equation (8), which leads to the following equation:

$$\tau = \frac{w}{p\hat{p}} \tag{12}$$

In Equation (12), because τ is the proportion of jobs whose productivity falls below *R*, it equals the ratio of jobs destroyed by the firm. Consequently, the rate of job destruction increases with wage level and decreases with the average productivity of jobs in the firm.

4. Data

The panel data in this study are constructed from the Basic Survey of Japanese Business Structure and Activities (BSBJSA), an annual survey conducted by Ministry of Economy, Trade and Industry. The survey covers medium and large firms in Japan; small firms that employ 50 workers or more with 30,000,000 yen or more worth of capital are also included. The response rate is over 80% with around 30,000 firms completing the questionnaire each year. The study's time series spans across 1995–2014; data beyond 2014 were not available during the research process. Surveyed firms are secondary- or tertiary-industry firms; there is a very small number of primary -industry firms (below 1% of all sample), the sample of which is deleted in this study.

Note that unlike the *Survey on Employment Trends*, which is an official employment survey conducted by the Ministry of Health, Labour and Welfare, the BSBJSA survey includes detailed information on firms' activities and performance, which enables the analysis of firm-level determinants of job creation and job destruction.

4.1 Calculations of firm-level job creation and destruction

Unlike previous measurements of gross job creation and destruction, based on net changes in employment at the firm level, this study measures at the division level. The strength of the new measurement is that, for instance, if a firm creates some jobs in one division and simultaneously destroys some jobs in another division, the real numbers of job creation and destruction are captured.

First, the magnitude of job creation in firm *i* in year *t* is defined as the sum of all the increased jobs in divisions that expand or open in firm *i* in year *t*, represented as follows (the number of divisions in firm *i* is *d*):

$$JC_{i,t} = \sum_{d=1}^{S} \Delta N_{i,d,t}^{C} \tag{13}$$

where

$$\Delta N_{i,d,t}^{C} = N_{i,d,t} - N_{i,d,t-1} \tag{14}$$

conditioned on

$$N_{i,d,t} - N_{i,d,t-1} > 0 \tag{15}$$

In Equations (13)–(15), *S* is the number of divisions in firm *i* and $N_{i,d,t}$ is the number of workers employed in division *d* in firm *i* in year *t*.

The magnitude of job destruction in firm *i* in year *t* is defined as the sum of all lost jobs in divisions that diminish or close in firm *i* in year *t*, represented as follows (the number of divisions in firm i is d):

$$JD_{i,t} = \sum_{d=1}^{S} \Delta N_{i,d,t}^{D} \tag{16}$$

where

$$\Delta N_{i,d,t}^{D} = -(N_{i,d,t} - N_{i,d,t-1}) \tag{17}$$

conditioned on

$$N_{i,d,t} - N_{i,d,t-1} < 0 \tag{18}$$

Note that in a firm, the number of jobs is assumed to be equal to the number of employed workers. There may be some jobs that have not hired workers, i.e., job advertisements looking for workers; those vacant jobs are ignored in this study.

The rate of job creation in firm *i* in year *t*, $JCR_{i,t}$, is defined in the following manner, similarly to Davis et.al. (1996) (p. 189):

$$JCR_{i,t} = \frac{JC_{i,t}}{0.5(N_{i,t} + N_{i,t-1})} \tag{19}$$

where $N_{i,t}$ is the number of workers employed in firm i in year *t*.

The rate of job destruction in firm *i* in year *t*, $JDR_{i,t}$, is defined as follows:

$$JDR_{i,t} = \frac{JD_{i,t}}{0.5(N_{i,t} + N_{i,t-1})} \tag{20}$$

Firms that were newly set up and shut down are excluded by the measurements. Indeed, some job creation and destruction can be attributed to the setting up and shutting down of firms. However, this is not within the scope of the objectives of this study because such instances are quite different from job creation and destruction in existing firms.

Furthermore, the branch firms or plants of firms are considered similar to divisions, which are classified into other firms such as research, service, and manufacturing.

4.2 Data of other variables

The data of other variables are obtained as follows. Because of the assumption that the number of jobs equals the number of employed workers, wage is the average wage across all workers in the firm, and job productivity is the average output of all employment in the firm. Furthermore, job seekers are the number of job seekers in job agencies (*syokugyou anntei jyo* in Japanese), and interest rate is the annual interest rate reported by the Bank of Japan (BOJ). Table 1 reports the descriptive statistics.

5. Estimation

5.1 Estimation equation and method

Job creation and destruction using Japanese firm-level data are estimated based on the theoretical model described in Section 3.

First, job creation is estimated as follows:

$$job\_creation_{it} = \alpha_1 productivity_{i,t-1} + \alpha_2 wage_{it} + \alpha_3 seishain_{it} + \alpha_4 job\_seekers_t + \alpha_5 interest\_rate_t + \alpha_6 control\_variables_{it}^{jc} + \varepsilon_{it}^{jc} \tag{21}$$

Here $job\_creation_{it}$ refers to jobs created in firm *i* in year *t*. In the real economy, firms require time to observe and to calculate total productivity; therefore, we choose data from the previous year for productivity, $product_{i,t-1}$. Furthermore, $wage_{it}$ is the average wage in firm i in year *t*, $seishain_{it}$ is an index of hiring cost in firm i in year *t*, $job\_seekers_t$ is the number of job seekers in year *t*, $interest\_rate_t$ is the interest rate in year *t*, and ε_{it}^{jc} is the error terms of job creation equation for firm i in year t.

The term $control\_variables_{it}$ is a group of control variables, including whether the firm belongs to the manufacturing industry, the rate of foreign capital, profit per job, capital per job, the number of divisions, and the average size of divisions. In addition, because of unpredictability, adverse shocks that destroy created jobs are not included in the estimation equation.

The estimation equation of job destruction is as follows:

$$job\_destruction_{it} = \beta_1 productivity_{i,t-1} + \beta_2 wage_{it} + \beta_3 seishain_{it}$$

$$+\beta_4 other\_control\_variables_{it}^{jd} + \varepsilon_{it}^{jd} \quad (22)$$

where $job\_destruction_{it}$ is the destroyed jobs in firm *i* in year *t*. $seishain_{it}$is introduced to control the effect of restrictions on firing *seishain* workers. Similar to job creation, $other\_control\_variables_{it}$ includes whether the firm belongs to the manufacturing industry, the rate of foreign capital, profit per job, capital per job, the number of divisions, and the average size of divisions.

Panel analysis is used for estimation, with cross sections of around 30,000 firms each year and a time series of 1995–2014. Hausman tests found that the random-effects estimations are rejected. In addition, the Wald F-test indicates that pooled-data models are rejected. Hence, fixed-effects estimation was adopted in this study.

5.2 Estimation results

Before reporting the major results of the study, this section first examines the effects on net employment changes in comparison with previous studies. Then, the section provides the major estimation results of the model, including effects on job creation and destruction. The size of effects is also discussed in this section.

5.2.1 Effects on net employment changes

Table 2 reports the results of estimation on net employment changes. The first and third columns are fixed-effect models of net employment growth number (NEC number) and net employment growth rate (NEC rate), respectively; for comparison, results of random-effect models are reported in the second and fourth columns. It is indicated that wages have a negative impact, while productivity has a positive impact on net employment changes.

The results of the effects on net employment growth provide perspectives on the relationships between wages and productivity and employment changes. However, the effects on firm-level job creation and destruction cannot be identified with the above results. Consider the example of the positive effect of productivity on net employment growth, there are many possibilities on effects of productivity on job creation and destruction, all of which lead to a positive effect of productivity on net employment growth: a positive effect on job creation and no effect on job destruction, a small negative effect on job creation and a large negative effect on job destruction (and other possibilities). A single analysis of net employment changes is inadequate to identify those effects.

Similar problems arise in the estimate of *seishain* workers. A significant negative effect of *seishain* workers on employment changes, as seen in Table 2, is inexplicable because it is contrary to the fact that the employment of *seishain* workers is protected by firing regulations. The real reasons for this negative effect are inconclusive without distinguishing its effects between job creation and destruction.

5.2.2 Estimation results of job creation and destruction

Tables 3–6 show the major results of this study. Tables 3 and 5 report the estimated results on the number of job creations and destructions, respectively. Tables 4 and 6 report the estimated results on the rate of newly created and newly destroyed jobs to total employment (%), respectively. Furthermore, JC3 in Table 3, JCR3 in Table 4, JD3 in Table 5, and JDR3 in Table 6 are the main results of the fixed-effect estimations. For comparison, the results of random effect models are also

reported, which are JC4, JCR4, JD4, and JDR4. Finally, JC5, JCR5, JD5, and JDR5 report the comparison results of pooled data models.

Tables 3 and 4 present the findings on job creations. First, the estimated coefficients of wages are negative and highly significant in all methods of estimation of job creation, which indicate that higher wages have negative effects on firms' job creation. As indicated in the theoretical model, a higher level of wages reduces the expected value from an occupied job, leading to less job creation by firms. Second, productivity exhibits significantly positive estimates in all models of job creation, which indicates that productivity increases firms' job creation. Contrary to wages, higher productivity contributes to the job's expected value so that firms create more jobs if productivity increases.

Further, the rate of *seishain* workers exhibits a significantly negative estimated coefficient, indicating that hiring more *seishain* workers could inhibit job creation by firms in Japan. The reason is that more *seishain* workers indicate higher hiring costs, which reduce the expected value from a vacant job, as shown in our theoretical model. Finally, JC3 and JCR3, the main study results of fixed-effect estimations, controlling for probable effects other than theoretical variables, indicate that more job seekers in the labor market could lead to more job creations by a firm, which is also consistent with our theoretical model.

Moreover, the results of the control variables show that firms with a higher ratio of foreign capital could create fewer jobs and both profits and capital contribute to firms' job creation.

Finally, Tables 5 and 6 present the estimation results for job destruction. First, wage has a significantly positive estimated coefficient, which indicates that higher wages could lead to higher jobs destruction. The theoretical model in this study indicates that higher wages lead to higher reservation productivity; thus, more jobs fall below the reservation productivity and are therefore destroyed. Second, the estimated coefficients of productivity are significantly negative, indicating a negative effect of productivity on job destruction. This is also consistent with the theoretical model in this study, which showed that fewer jobs are destroyed if average productivity increases.

In the control variables of job destruction estimation, this study found that the proportion of *seishain* workers is associated with a significant negative coefficient, as the fixed-effect estimation of JDR2 and JDR3 show. It is indicated that fewer jobs are lost in firms with a higher proportion of *seishain* workers because the regulations make it difficult for firms to fire *seishain* workers. Reminding that a higher proportion of *seishain* workers also reduces firms' job creation, as discussed earlier, the proportion of *seishain* workers could be a measure of the rigidity of the employment dynamics of the firm, in which firms with more *seishain* workers has a low level of employment dynamics.

Other control variables in the job destruction estimation show that higher profit and higher capital could reduce job destructions. Finally, firms with a higher rate of foreign capital are associated with a lower job destruction rate.

5.3 Discussion on size of effects

The sizes of the effects discussed earlier differ between job creation and destruction. These magnitudes are analyzed using the main study results of fixed-effect estimations, including all the theoretical and control variables, which are JC3 in Table 3 and JD3 in Table 5. Note that random-effect models of JC4, JCR4, JD4, and JDR4 and pooled data models of JC5, JCR5, JD5, and JDR5 are rejected by Hausman test and Wald F-test, respectively.

First, although more number of *seishain* workers help decrease job destruction, they also decrease job creation, and the negative effect on job creation is much larger than the positive effect on job

destruction. As Tables 3 and 5 show, the effect of *seishain* workers is −21.69 in JC3 and −3.12 in JD3. It is indicated that the shortcoming of the *seishain* system, whereby job creation is inhibited, is much larger than its contribution toward decreasing job destruction. In fact, in recent years, there has been ongoing debate on the limitations of this system in Japanese society vis-à-vis growing inequality, reducing female employment, and inhibiting labor mobility (Kawaguchi, 2015). This study provides new empirical evidence on another shortcoming, that is, its effect in terms of reducing job creation and total employment.

Furthermore, in the theory of job creation and destruction as proposed by Pissarides (2000), the role of productivity is as important as that of wages. However, this empirical study based on yearly creation and destruction of jobs shows that wages have a larger effect than productivity, probably because in the short-to-medium run of annual changes, when there is an increase in wages, Japanese firms immediately adjust job creation and destruction; while in case of a decrease in productivity, Japanese firms may prioritize other methods such as job training and improvement in management before moving to adjustment by job creation and destruction. In fact, other theories state that in the short run, capital is fixed, and labor demand depends only "on the real wage and the market power of the firm," while in the long run, it is possible that "the level of production is taken as given, and we will look for the optimal combinations of capital and labor" (Cahuc & Zylberberg p. 173, 176). Consequently, in the short run, the effect of wages on labor demand could be larger than other possible effects.

In addition, it is apparent that the negative effect of wages on job creation is smaller than its positive effect on job destruction. As the estimations JC3 and JD3 show, which includes all theoretical and control variables and uses the fixed effects estimation of our model, the size of the negative effect of wages on job creation is 3.01 and the size of the positive effect of wages on job destruction is 6.59. The possible reason could be the seniority payment system in Japan (*neikojyoretsu* in Japanese), wherein wages of new workers are much lower than their productivities, while the wages of senior workers are much higher, even higher than their productivities[2] (Kawaguchi et al. 2006, Kodama and Kazuhiko, 2012). Therefore, when the general wage level increases, it is preferable for firms to reduce the number of senior workers whose wage levels are higher than their productivities, than to reduce the number of new hires whose wage levels are lower than their productivities.

Finally, the positive effect of job productivity on job creation (0.20) is slightly larger than its negative effect on job destruction (0.15). Therefore, when productivity decreases, Japanese firms reduce job creation and increase job destruction, with the former's magnitude being a little higher. The reason could be that firms have more incentives to reduce new hires than remove current employees because the productivity of current or senior workers is generally higher than new hires.

6. Conclusions

The new measurement of division-level data in this study in Japan has enabled a firm-level econometric analysis of job creation and destruction. The study results not only support theoretical models but also provide strong empirical evidence on the effects on job creation and destruction in Japan.

In line with labor economic theory, two major factors in job creation and destruction were

[2] The seniority payment was considered consistent with the Lazear (1979) theory of incentive contract in literatures.

examined: wages and job productivity. The results are different from the German study by Moser et al. (2010), which found insignificant effects of productivity on job creation and destruction as well as insignificant effects of wage on job destruction but significant effects of wage on job creation. The empirical results of this study, using data from Japan, are consistent with theories relevant to the two factors. In specific, Japanese firms' behavior regarding job creation and destruction reacts significantly to wages and productivity: an increase in wages significantly decreases firms' job creation and increases their job destruction, whereas an increase in productivity significantly increases firms' job creation and reduces job destruction, It is suggested that, compared to German firms, Japanese firms find it easier to choose optimal behavior regarding job creation and destruction in reaction to changes in productivity and wages.

In the analysis of *seishain* workers, i.e., workers who are granted lifetime employment rights in Japan, the results imply that the level of job creation is lower in firms with a higher rate of *seishain* workers, because hiring a *seishain* worker costs more than hiring a non-*seishain* worker. Furthermore, due to regulations on firing of *seishain* workers in Japan, it was found that a higher proportion of *seishain* workers reduces job destructions. However, comparing the size of those two effects, this study found that the effect on job creation is much larger than that on job destruction, implying that for employment of *seishain* workers, its inhibition of job creations is larger than its reduction of job destruction.

In terms of policy implications, this study indicates that with respect to wage protection and firing restrictions, polices should be framed carefully. Even if they apparently benefit currently employed workers, these policies probably also inhibit job creation and, thus, are harmful to the labor market.

Appendix 1
Employment of divisions in BSBJSA

In the data of BSBJSA, employment of each firm is reported at the division level, such as the research and planning division, R&D division, and so on. Furthermore, for the firms with branches, those branch firms are divided into manufacturing firms, commerce firms, service firms, and so on, which are treated similar to divisions in this study. Table A1 reports the related summary statistics.

Table A1 Summary statistics of employment in BSBJSA

	Observations	Mean	Standard Deviation	Minimum	Maximum
Divisions of research and planning	536873	5.06	32.92	0	5508
Divisions of information	536873	2.92	22.41	0	4156
Divisions of R&D	536873	8.37	100.23	0	15400
Divisions of international business	536873	1.17	14.55	0	4144
Divisions of HR, accounting, general affairs, and other management	536873	25.25	114.16	0	13200
Divisions of manufacturing, mining, electricity, or gas	536873	41.23	138.12	0	10880
Divisions of commerce	536873	23.99	104.83	0	32153
Divisions of other production activities	536873	25.40	155.06	0	22279
Branch firms of manufacturing, mining, electricity, or gas	536873	89.37	777.49	0	59467
Branch firms of commerce	536873	115.60	899.55	0	128347

Table A1 Summary statistics of employment in BSBJSA (continued)

	Obs.	Mean	Sta Dev.	Mini.	Maxi.
Branch firms of restaurants	536873	23.32	658.10	0	152721
Branch firms of service	536873	19.73	344.99	0	52367
Branch firms of research	536873	6.83	124.59	0	14988
Branch firms of information	536873	7.73	149.55	0	33864
Branch firms of warehouse, transportation, or delivery	536873	3.96	88.48	0	53280
Branch firms of others	536873	11.67	241.33	0	74586
Branch firms overseas	536873	1.03	37.58	0	19912
Assignment employment	536873	9.67	136.78	0	15586

Appendix 2 Several characteristics of firm-level job creation and destruction in Japan

First, Table A2 reports the time variation of average job creation rate, job destruction rate, net employment change rate, and within-firm job reallocation rate. It is indicated that job creation and destruction rates were high in the 1990s but reduced in the 2000s. Further, during the recession of 2008–2010, the job creation rate decreased persistently, while the general relationship of job creation and destruction with the business cycle was not systematic when looking at the whole period, which is different from the U.S. study of Davis et al. (1996). Indeed, to the best of our knowledge, a systematic relationship between Japanese job flows and business cycle was not reported in any previous studies that followed the method of Davis et al. (1996) when using Japanese data. Further, because our calculation of job creation and destruction is different from that of Davis et al. (1996), as discussed earlier, the “cyclicality”, which was found by Davis et al. (1996), is not observed in this Japanese study.

Further in Table A2, values in parentheses are rates of job creation and destruction caused by opening and closing divisions, respectively, which are around 1/3 to 1/2 of total job creation and destruction, respectively.

Table A2. Annual Results: average job creation rate, job destruction rate, net employment change rate, and within-firm job reallocation rate

	Job Creation rate	Job Destruction rate	Net employment change rate	Within-firm job reallocation rate
1996	21.41	21.98	−0.67	17.55
	(12.96)	(10.94)		
1997	17.80	17.71	−0.03	13.92
	(9.87)	(8.70)		
1998	23.92	24.57	−0.77	20.39
	(13.75)	(17.82)		
1999	20.46	22.00	−2.17	16.90
	(15.04)	(11.32)		
2000	13.27	14.58	−1.40	9.81
	(6.30)	(5.82)		
2001	15.05	15.91	−0.94	11.25
	(7.93)	(6.56)		
2002	12.57	14.35	−1.84	8.76
	(5.50)	(5.36)		
2003	11.44	12.57	−1.20	7.61
	(4.54)	(4.39)		
2004	12.74	12.78	−0.10	8.53
	(5.43)	(5.00)		
2005	13.89	13.62	0.21	9.60
	(6.64)	(6.26)		
2006	14.15	13.22	0.87	9.56
	(6.63)	(6.36)		
2007	15.54	14.09	1.40	10.77
	(7.56)	(7.64)		
2008	14.57	13.13	1.37	9.78
	(7.02)	(6.46)		
2009	13.98	14.20	−0.27	9.73
	(6.81)	(6.80)		
2010	12.78	13.74	−1.02	9.00
	(6.01)	(5.86)		
2011	12.27	12.12	0.09	8.40
	(5.59)	(5.35)		

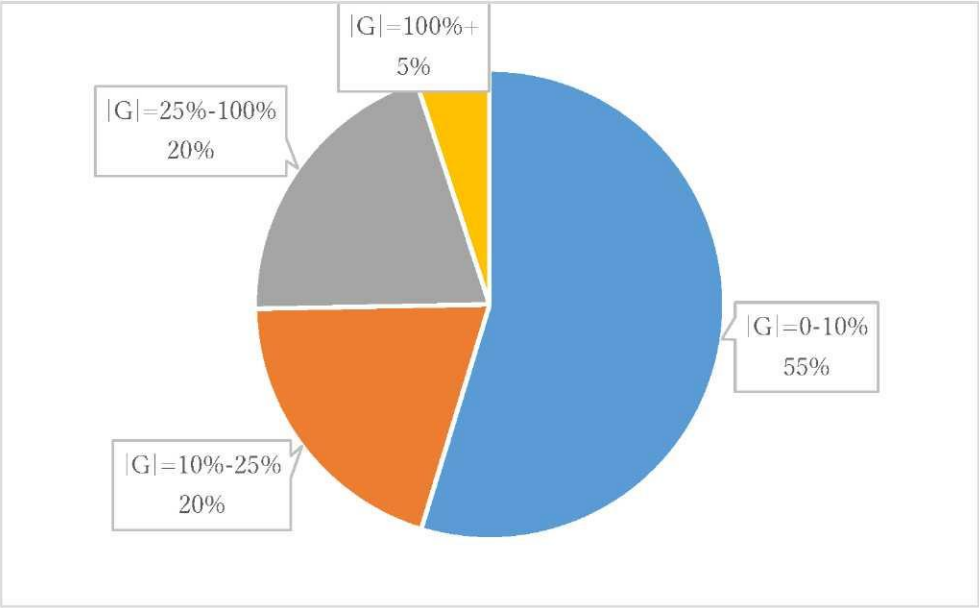
2012	12.23	12.29	−0.11	8.67
	(5.67)	(5.57)		
2013	12.16	12.08	0.02	8.53
	(5.66)	(5.62)		
2014	11.70	11.02	0.62	7.83
	(5.00)	(4.91)		

Notes:
(1) Values in parentheses are rates of job creation and destruction caused by opening and closing divisions, respectively.
(2) Within-firm reallocation is the lower bound of job creation and job destruction for each firm.

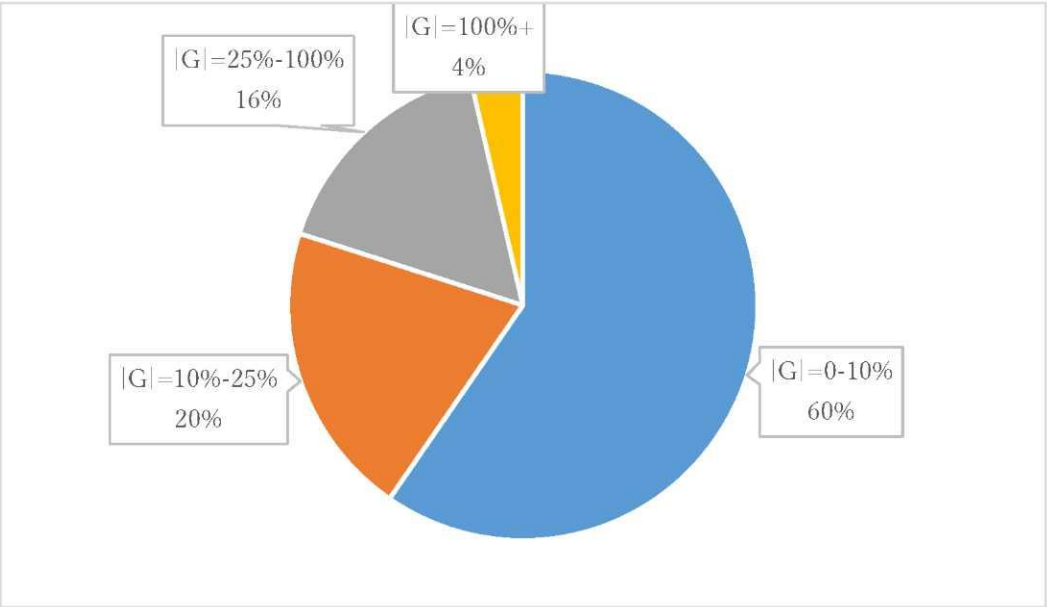
Moreover, we examine the distribution of job creation and destruction by employment growth (Davis et.al 1996 pp.26-31), the results of which are reported in Figure A1. It is indicated that over half of job creation and destruction in existing firms occurs at firms that experience employment changes that were below 10%.

Figure A1 Distribution of job creation and destruction by employment growth

(1) Distribution of job creation by employment growth



(2) Distribution of job destruction by employment growth



Further, persistence rates of job creation and destruction are reported in Table A3. Following Davis et.al (1996), the one/two-year persistence of job creation is the percentage of newly created jobs that remain filled within one/two years; the one/two-year persistence of job destruction is the percentage of newly destroyed jobs that do not reappear within one/two years. The calculation method follows Davis et al. 1996 (pp. 22, fifth paragraph), but distinguishes jobs in different divisions, which was not done by Davis et al. (1996). Similarly, as the fact of gross job creation and destruction of U.S. manufacturing firms that was found by Davis et.al 1996 (pp.24), it is indicated that job destruction is more likely to persist for one or two years, compared to job creation.

Table A3 Average persistence rates of job creation and destruction (%)

	Job creation		Job destruction	
	one year	two years	one year	two years
1996	0.61	0.29	0.76	0.50
1997	0.50	0.29	0.73	0.53
1998	0.42	0.25	0.57	0.34
1999	0.73	0.52	0.83	0.62
2000	0.55	0.34	0.76	0.57
2001	0.59	0.38	0.78	0.57
2002	0.61	0.38	0.77	0.55
2003	0.61	0.38	0.75	0.52
2004	0.61	0.40	0.73	0.49
2005	0.63	0.41	0.71	0.46
2006	0.63	0.43	0.71	0.46
2007	0.65	0.42	0.70	0.43
2008	0.62	0.40	0.72	0.47
2009	0.61	0.40	0.74	0.52
2010	0.63	0.40	0.74	0.51
2011	0.63	0.41	0.74	0.50
2012	0.62	0.41	0.73	0.48
2013	0.64		0.71	

Appendix 3
Results on employment of *seishain* workers

Regarding the employment of the group of *seishain* workers, because of lack of data at the division level, the estimates of their job creation and destruction are not available. We only examine net employment changes.

In Table A4, the first and second columns are estimates for the employment change of *seishain* workers, and the third and fourth columns are for the rate of employment change. It is indicated that productivity significantly positively impacts employment changes of *seishain* workers, and wages significantly negatively impact it. Those are consistent with the result of net employment changes of *seishain* and non-*seishain* workers.

Table A4 Regression results on net employment changes of *seishain* workers (S_NEC)

	S_NEC1 (number)	S_NEC2 (number)	S_NEC rate 1(%)	S_NEC rate 2(%)
productivity	0.07	0.04	0.02	0.02
	[5.14]***	[2.42]**	[11.66]***	[6.81]***
wage	-4.83	-5.03	-1.49	-1.62
	[-9.03]***	[-9.22]***	[-21.28]***	[-22.64]***
job seekers	-12.24	-10.83	-9.67	-9.20
	[-5.00]***	[-4.34]***	[-30.07]***	[-28.23]***
interest rate	240.80	246.28	151.69	153.39
	[69.01]***	[69.17]***	[331.09]***	[329.65]***
total employment	46.90	50.89	-0.13	-0.03
	[35.33]***	[36.53]***	[-0.73]	[-0.14]
division number	2.80	2.56	2.32	2.34
	[5.06]***	[4.54]***	[31.85]***	[31.75]***
division size	-103.45	-99.70	1.09	1.19
	[-19.73]***	[-18.46]***	[1.58]	[1.69]*
manufacturing		-6.39		-3.09
		[-1.72]*		[-6.36]***
foreign capital rate		-30.27		-6.98
		[-3.19]***		[-5.62]***
profit		2.26		0.46
		[10.44]***		[16.17]***
capital		0.31		0.10
		[6.44]***		[16.43]***
_cons	-46.76	-52.59	-25.40	-26.54
	[-6.27]***	[-6.72]***	[-25.94]***	[-25.96]***
R-squared	0.05	0.06	0.29	0.29
N	369273	360697	369271	360695

Note: * p < 0.1, ** p < 0.05, *** p < 0.01

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Table 1. Descriptive statistics

Variable	Obs.	Mean	Sta. Dev.	Min.	Max.
job creation (number)	433942	55.27	410.96	0	126237
job destruction (number)	433942	51.83	355.67	0	99996
net employment change (number)	433942	3.18	387.53	-99691	126132
job creation rate(%)	433942	14.01	21.78	0.00	196.07
job destruction rate(%)	433942	14.12	21.29	0.00	195.02
net employment change rate(%)	433942	-0.18	15.22	-194.92	195.60
productivity (million yen)	558655	46.90	110.04	0.01	13440.51
wage (million yen)	462370	4.05	2.16	0.0007	612.82
seishain rate	558655	0.34	0.43	0	1
job seekers (million person)	558655	2.37	0.25	1.97	2.81
interest rate	558655	0.36	0.19	0.10	0.75
manufacturing firm	558655	0.48	0.50	0	1
foreign capital rate	554651	0.02	0.11	0	1
profit per job (million yen)	558371	1.27	9.48	-289.03	3648.91
capital per job (million yen)	547978	11.10	36.63	0.0002	12582.34
total employment(thousand person)	536594	0.42	1.74	0.05	153.41
division number	536594	4.72	2.07	1	17
division size(thousand person)	536594	0.09	0.35	0.0049	60.84

Table 2 Regression results on net employment changes (NEC)

	NEC number	NEC number	NEC rate	NEC rate
	Model	Comparison	Model	Comparison
productivity	0.35	0.05	0.04	0.01
	[15.41]***	[5.51]***	[50.73]***	[36.26]***
wage	-10.07	-10.27	-3.43	-1.99
	[-13.83]***	[-25.81]***	[-129.48]***	[-109.59]***
seishain workers	-9.32	0.91	-3.38	-1.08
	[-4.39]***	[0.52]	[-43.76]***	[-16.14]***
job seekers	-0.60	-5.86	-1.25	-1.87
	[-0.17]	[-1.73]*	[-9.99]***	[-15.65]***
interest rate	5.28	4.73	3.41	1.61
	[1.03]	[0.96]	[18.28]***	[9.15]***
manufacturing	-2.20	1.15	0.70	-0.11
	[-0.44]	[0.78]	[3.87]***	[-1.38]
foreign capital rate	-95.37	-58.06	-0.58	2.09
	[-7.54]***	[-8.56]***	[-1.27]	[6.87]***
profit	2.45	2.04	0.29	0.32
	[8.50]***	[9.79]***	[27.43]***	[37.78]***
capital	0.84	-0.03	0.07	0.02
	[13.57]***	[-0.98]	[30.42]***	[14.40]***
total employment	407.95	43.18	1.65	0.30
	[223.49]***	[55.67]***	[24.85]***	[7.42]***
division number	-5.65	-4.11	0.60	0.40
	[-7.53]***	[-11.24]***	[21.89]***	[22.15]***
division size	-171.19	3.16	3.48	1.38
	[-23.62]***	[0.84]	[13.19]***	[7.81]***
Cons.	-117.75	54.14	9.77	8.96
	[-11.14]***	[5.85]***	[25.43]***	[26.76]***
R-squared	0.035	0.0378	0.025	0.0318
N	341443	341443	341443	341443

Notes: the dependent variables are defined as follows: $NEC_{it} = JC_{it} - JD_{it}$, $NEC\_rate_{it} = JCR_{it} - JDR_{it}$ * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3 Estimation results of job creation (number)

	JC1	JC2	JC3	JC4	JC5
	Model	Model	Model	Comparison	Comparison
productivity	0.16	0.22	0.20	0.03	0.02
	[9.32]***	[11.06]***	[9.37]***	[3.14]***	[2.22]**
wage	-3.26	-2.83	-3.01	-5.97	-5.68
	[-4.86]***	[-4.25]***	[-4.43]***	[-14.16]***	[-15.22]***
seishain workers	-20.47	-21.36	-21.69	-16.58	-16.07
	[-10.43]***	[-10.96]***	[-10.96]***	[-9.85]***	[-9.76]***
job_seekers	5.46	6.10	5.88	2.07	1.87
	[1.72]*	[1.94]*	[1.84]*	[0.67]	[0.59]
interest_rate	33.20	35.61	36.28	33.24	34.07
	[7.01]***	[7.58]***	[7.59]***	[7.30]***	[7.36]***
total employment	230.93	248.78	249.27	108.20	90.25
	[138.75]***	[147.62]***	[146.56]***	[123.11]***	[124.15]***
division number	0.46	-0.31	-0.31	-1.52	-0.08
	[0.66]	[-0.45]	[-0.45]	[-3.74]***	[-0.22]
division size	180.14	164.49	164.76	101.93	140.43
	[26.97]***	[24.59]***	[24.39]***	[25.27]***	[39.86]***
manufacturing		-3.66	-3.72	-13.01	-13.88
		[-0.80]	[-0.80]	[-7.66]***	[-10.05]***
foreign capital rate		-121.30	-123.09	-42.25	-22.83
		[-10.48]***	[-10.44]***	[-5.98]***	[-3.59]***
profit			0.76	0.97	1.13
			[2.82]***	[4.70]***	[5.78]***
capital			0.49	-0.06	-0.09
			[8.54]***	[-1.91]*	[-3.59]***
Constant	-76.46	-79.78	-84.70	28.63	24.00
	[-8.05]***	[-8.26]***	[-8.60]***	[3.34]***	[2.77]***
R-squared	0.22	0.23	0.23	0.23	0.23
N	349418	347435	341443	341443	341443

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4 Estimation results of job creation rate (%)

	JCR1	JCR2	JCR3	JCR4	JCR5
	Model	Model	Model	Comparison	Comparison
productivity	0.02	0.03	0.03	0.01	0.01
	[25.17]***	[29.60]***	[25.97]***	[18.64]***	[13.08]***
wage	-1.47	-1.49	-1.49	-1.09	-0.70
	[-40.85]***	[-40.89]***	[-40.84]***	[-40.02]***	[-33.86]***
seishain workers	-6.15	-6.21	-6.21	-5.15	-4.16
	[-58.18]***	[-58.47]***	[-58.30]***	[-54.04]***	[-45.36]***
job seekers	0.54	0.59	0.51	-0.01	-0.29
	[3.14]***	[3.43]***	[2.98]***	[-0.06]	[-1.62]
interest rate	11.40	11.46	11.48	10.75	10.70
	[44.69]***	[44.73]***	[44.62]***	[43.95]***	[41.50]***
division number	-0.25	-0.30	-0.30	-0.34	-0.34
	[-6.86]***	[-7.86]***	[-7.89]***	[-12.41]***	[-17.94]***
division size	2.89	1.66	1.64	0.87	0.68
	[10.58]***	[4.56]***	[4.50]***	[3.26]***	[3.44]***
manufacturing		0.59	0.65	-2.56	-2.91
		[2.35]**	[2.61]***	[-20.18]***	[-37.79]***
foreign capital rate		-2.06	-1.96	1.09	2.48
		[-3.27]***	[-3.09]***	[2.39]**	[7.00]***
total employment		0.55	0.57	-0.02	-0.17
		[6.00]***	[6.27]***	[-0.40]	[-4.18]***
profit			0.08	0.11	0.13
			[5.64]***	[9.35]***	[11.95]***
capital			0.04	0.01	0.00
			[14.12]***	[5.20]***	[-0.57]
Cons.	17.48	16.85	16.54	20.28	18.46
	[34.20]***	[31.99]***	[31.20]***	[43.13]***	[38.22]***
R-squared	0.02	0.01	0.01	0.02	0.02
N	349418	347435	341443	341443	341443

Note: * p < 0.1, ** p < 0.05, *** p < 0.01

Table 5 Estimation results of job destruction (number)

	JD1	JD2	JD3	JD4	JD5
	Model	Model	Model	Comparison	Comparison
productivity	-0.13	-0.18	-0.15	-0.05	-0.03
	[-9.22]***	[-10.62]***	[-8.22]***	[-5.31]***	[-4.76]***
wage	6.53	6.33	6.59	5.72	3.94
	[11.52]***	[11.10]***	[11.37]***	[14.69]***	[12.15]***
total employment	-140.53	-150.18	-150.19	22.42	45.93
	[-99.86]***	[-104.01]***	[-103.11]***	[26.71]***	[71.91]***
division number	4.63	4.91	4.97	5.31	3.64
	[7.89]***	[8.45]***	[8.42]***	[13.93]***	[12.23]***
division size	292.64	300.87	301.01	182.74	133.52
	[52.65]***	[53.77]***	[53.32]***	[48.69]***	[43.22]***
seishain workers		-3.43	-3.12	-6.97	-8.30
		[-2.20]**	[-1.97]**	[-4.90]***	[-6.02]***
manufacturing		-1.88	-1.74	-16.71	-14.66
		[-0.49]	[-0.45]	[-10.25]***	[-12.23]***
foreign capital rate		-37.98	-38.64	19.36	29.28
		[-3.89]***	[-3.89]***	[2.97]***	[5.25]***
profit			-1.54	-0.91	-0.80
			[-6.82]***	[-4.99]***	[-4.75]***
capital			-0.34	-0.06	-0.06
			[-6.84]***	[-2.21]**	[-2.64]***
Cons.	45.91	51.68	54.74	-9.39	-2.80
	[11.96]***	[11.97]***	[12.40]***	[-3.81]***	[-1.47]
R-squared	0.09	0.09	0.09	0.12	0.12
N	369273	366731	360697	360697	360697

Note: * p < 0.1, ** p < 0.05, *** p < 0.01

Table 6 Estimation results of job destruction rate (%)

	JDR1	JDR2	JDR3	JDR4	JDR5
	Model	Model	Model	Comparison	Comparison
productivity	-0.01	-0.02	-0.01	-0.01	-0.003
	[-14.44]***	[-14.81]***	[-10.63]***	[-9.59]***	[-7.01]***
wage	2.07	1.97	1.98	1.22	0.63
	[59.98]***	[55.90]***	[55.80]***	[45.85]***	[31.15]***
division number	-1.04	-0.94	-0.94	-0.84	-0.65
	[-29.24]***	[-25.92]***	[-25.77]***	[-31.30]***	[-35.03]***
division size	-4.49	-1.89	-1.83	-0.63	-0.72
	[-16.91]***	[-5.33]***	[-5.19]***	[-2.43]**	[-3.77]***
seishain workers		-1.65	-1.64	-2.50	-3.22
		[-17.15]***	[-16.93]***	[-28.53]***	[-37.63]***
manufacturing		0.01	0.08	-2.41	-2.56
		[0.05]	[0.32]	[-19.36]***	[-34.15]***
foreign capital rate		-1.33	-1.38	-1.13	0.23
		[-2.16]**	[-2.24]**	[-2.54]**	[0.67]
total employment		-1.05	-1.06	-0.46	-0.20
		[-11.83]***	[-11.88]***	[-7.54]***	[-5.14]***
profit			-0.20	-0.21	-0.19
			[-14.34]***	[-17.32]***	[-18.14]***
capital			-0.03	-0.02	-0.01
			[-8.47]***	[-8.10]***	[-5.60]***
Cons.	11.98	12.90	13.14	17.69	17.99
	[50.89]***	[47.85]***	[48.20]***	[98.60]***	[151.33]***
R-squared	0.005	0.01	0.01	0.01	0.02
N	349418	347435	341443	341443	341443

Note: * p < 0.1, ** p < 0.05, *** p < 0.01