Bank of Japan Working Paper Series

Inter-industry labor reallocation and task distance

Ayako Kondo*
akondo@ynu.ac.jp

Saori Naganuma**
saori.naganuma@boj.or.jp

No.14-E-8
September 2014

Bank of Japan
2-1-1 Nihonbashi-Hongokucho, Chuo-ku, Tokyo 103-0021, Japan

* Faculty of International Social Sciences, Yokohama National University
** Research and Statistics Department, Bank of Japan

Papers in the Bank of Japan Working Paper Series are circulated in order to stimulate discussion and comments. Views expressed are those of authors and do not necessarily reflect those of the Bank.
If you have any comment or question on the working paper series, please contact each author.
When making a copy or reproduction of the content for commercial purposes, please contact the Public Relations Department (post.prd8@boj.or.jp) at the Bank in advance to request permission. When making a copy or reproduction, the source, Bank of Japan Working Paper Series, should explicitly be credited.

Inter-industry labor reallocation and task distance*

Ayako Kondo† and Saori Naganuma‡

September 24, 2014

Abstract

This paper investigates the factors preventing inter-industry labor reallocation by estimating the determinants of inter-industry worker flow and earnings change after a job change. We find that the difference in required tasks is an important reason for reduction in earnings after an inter-industry job change, and the fear of earnings losses may prevent workers from moving to industries requiring a different set of tasks. Also, more workers switch to industries with which their previous industry had larger transactions, although it affects earnings changes only marginally. On the other hand, industry performance does not affect labor inflow or wage changes significantly for inter-industry job changes. Furthermore, earnings loss associated with a move to a distant industry is not necessarily smaller for workers who are relatively more likely to move to a distant industry.

JEL Classification: J62, J21

Keywords: inter-industry labor mobility; task specific human capital

*This research is supported by JSPS KAKENHI Grant Number 23730235 (PI: Ayako Kondo). We are grateful to Kosuke Aoki, Naoko Hara, Ryo Horii, Munechika Katayama, Ryo Kato, Yasusada Murata, Kentaro Nakajima, Soichi Ohta, Shintaro Yamaguchi, and seminar participants at Kyoto Summer Workshop, Bank of Japan, Tohoku University, Policy Modeling Conference 2014, JEA spring meeting 2014, Keio University, and Kansai Labor Workshop for helpful discussions and suggestions. The data for this secondary analysis, "Working Person Survey, Recruit Works Institute," was provided by the Social Science Japan Data Archive, Center for Social Research and Data Archives, Institute of Social Science, The University of Tokyo. Views expressed are those of authors and do not necessarily reflect those of the Bank of Japan.

†Corresponding Author. Faculty of International Social Sciences, Yokohama National University. akondo@ynu.ac.jp.

‡Bank of Japan.

1 Introduction

The Japanese economy has experienced substantial changes in industry structure. Given the increasing trend in unemployment in the recent few decades and the shrinking working-age population, facilitating the reallocation of labor from declining sectors to growing sectors is an important policy goal.[1] However, in reality, there are persistent discrepancies in employment growth, wage growth, and vacancy rates across industries. This paper aims to uncover the factors hindering inter-industry labor reallocation in Japan.

Specifically, we focus on the differences in required tasks as one of the important determinants of inter-industry worker flow and compare their impact with the impacts of other factors such as a proxy for the chances of communication among workers and the productivity of source and destination industries. Then, we examine whether the factors that affect inter-industry worker flow are also relevant to earnings changes associated with inter-industry job changes. The idea behind this is that if some factors specific to a particular industry pair aggravate the earnings losses associated with moves between the two industries, these factors should also decrease the number of workers moving between these industries.

Our analysis relates to the literature on earnings losses associated with job changes and industry-specific human capital. It is widely known that job changers tend to experience earnings losses when they are forced to move to a different industry, as shown by Abe (2005) and Yugami (2005) for Japanese workers and Jacobson, Lalonde and Sullivan (1993) for displaced workers in the United States. Neal (1995) and Parents (2000) argued that such losses are caused by the loss of industry-specific human capital.[2] Furthermore, Poletaev and Robinson (2008) showed that the differences in task portfolios between the previous and current jobs are the major source of earnings losses associated with such inter-industry job changes.[3] We aim to build on these studies by determining the extent to which differences in the required tasks hinder inter-industry labor

[1] Note that "growing" sectors are not necessarily sectors with high labor productivity. As Baumol (1967) pointed out, employment growth in sectors with high labor productivity is often slower than that in less productive sectors, because improved labor productivity is absorbed by a fall in the relative prices of products of the former sectors.

[2] Also, the loss of occupation-specific human capital leads to a substantial earnings loss after a job change to a different occupation (Shaw, 1984; Kambourov and Manovskii 2009). According to Sullivan (2010), both industry-specific and occupation-specific human capital are the key determinants of wages.

[3] Gathmann and Schönberg (2010) and Yamaguchi (2012) also argued that task-specific human capital is an important determinant of wages and earnings.

reallocation.

A methodological innovation of this study is our application of the gravity model, which is widely used in the literature on international trade, to quantify the effects of factors specific to each industry pair and to identify factors that affect flows between one industry and all the other industries in a single framework.[4] With this idea, we begin analyzing the aggregate-level worker flow data sourced from the Labour Force Survey. We find that differences in required tasks are much more important in determining worker flow than the performance of either the source or the destination industry.

Then, we analyze earnings changes by using individual level data from the Working Person Survey. We find that large earnings losses are indeed associated with inter-industry moves that involve large changes in required tasks. However, we also find that the size of the earnings loss is not always systematically related to the characteristics determining the likelihood of moving to a distant industry. Furthermore, industry performance has little impact on earnings after a job change. Although our estimates cannot be interpreted as a causal effect, because we observe earnings changes only for workers who actually switched jobs, the lack of correlation between industry performance and earnings changes may imply that growing industries do not necessarily offer better employment opportunities.

The rest of the paper is organized as follows. The next section describes the empirical model and data. Sections 3 and 4 present the results on worker flow and earnings after job changes. Section 5 explores what types of workers are more willing to move to a distant industry in terms of required tasks. Section 6 concludes.

[4] Cortes and Gallipoli (2014) took a similar approach to analyze mobility across occupations in the United States. We are not aware of any other applications of the gravity model to worker mobility.

2 Data and methodology

2.1 Analysis of worker-flow using the Labour Force Survey

2.1.1 Gravity model of inter-industry worker flow

We borrow the functional form of the gravity equation with country specific components, proposed by Anderson and van Wincoop (2003). Although the theoretical model of international trade on which the gravity model based on is irrelevant to inter-industry worker flow within a country,[5] the functional form of the Anderson–van Wincoop Gravity Equation can capture the following features of inter-industry worker flow: (1) The sizes of inflow to and outflow from each industry are proportional to the size of total employment for the industry, (2) factors specific to a pair of industries affect the mobility cost between the two industries, and (3) some other factors affect outflow from or inflow to a specific industry.[6]

Specifically, the number of workers who moved from industry j to industry k in year t, W_{jkt}, can be modeled as follows:

$$W_{jkt} = \alpha_0 E_{jt}^{\alpha_1} E_{kt}^{\alpha_2} D_{jk}^{\alpha_3} e^{(\theta_{jt}+\eta_{kt}+\lambda_t)} + \varepsilon_{jkt} \tag{1}$$

where E_{jt} is the number of workers employed in industry j, D_{jk} is the mobility cost between industries j and k, and θ_{jt} and η_{kt} represent factors affecting outflow from industry j and inflow to industry k, respectively. λ_t represents macroeconomic factors that affect the total worker flow in year t for all industries. ε_{jkt}, the error term, is assumed to be random and independent from any variables in the model. α_0 is expected to be positive, while α_1 and α_2 are expected to be close to 1, and α_3 is expected to be negative.

Furthermore, D_{jk}, the mobility cost between industries j and k, is decomposed into S_{jk}, the

[5] The original gravity model of international trade assumes that the volume of trade between two countries is proportional to the sizes of the countries' economies (often measured by GDP), and it decreases with the distance between the two countries, which is a proxy for the trade cost. Anderson and van Wincoop (2003) added multilateral resistance, a factor that increases the trade cost of country with any other countries. Note that the multilateral resistance terms in Anderson and van Wincoop (2003) are derived from a general equilibrium framework and are subject to some parameter restrictions, whereas the industry-specific factors in our model are not.

[6] The factors that affect mobility cost can be translated into the "distance" term in the gravity model, while those affecting the utility from working in a specific industry can be modeled just like the multilateral resistance term in the Anderson–van Wincoop model.

difference in the required tasks for industries j and k, and T_{jk}, the chance for industry j's workers to communicate with industry k's workers. Our definitions for these variables appear in the next subsection. D_{jk} can be written as follows:

$$D_{jk} = S_{jk}^{\beta_1} T_{jk}^{\beta_2} \tag{2}$$

β_1 is expected to be positive, and β_2 is expected to be negative.

The factors affecting outflow from industry j in year t are written as the sum of an industry-fixed factor, γ_{0j}, and a factor proportional to the industry performance, p_{jt}.

$$\theta_{jt} = \gamma_{0j} + \gamma_1 p_{jt} \tag{3}$$

Likewise, factors affecting inflow to industry k in year t are written as

$$\eta_{kt} = \delta_{0k} + \delta_1 p_{kt} \tag{4}$$

By substituting (2), (3), and (4) into (1), we get

$$\begin{aligned} W_{jkt} &= \exp(\log \alpha_0 + \alpha_1 \log E_{jt} + \alpha_2 \log E_{kt} + \alpha_3 \beta_1 \log S_{jk} + \alpha_3 \beta_2 \log T_{jk} \\ &\quad + \gamma_{0j} + \gamma_1 p_{jt} + \delta_{0k} + \delta_1 p_{kt} + \lambda_t) + \varepsilon_{jkt} \end{aligned} \tag{5}$$

We follow Silva and Tenreyro (2006) and estimate (5) using the maximum likelihood method, which is mathematically identical to estimating a Poisson regression of W_{jkt} with $\log E_{jt}$, $\log E_{kt}$, $\log S_{jk}$, $\log T_{jk}$, p_{jt}, p_{kt}, and the dummies for the source and destination industries.

2.1.2 Proxies of mobility cost and industry performance

As mentioned above, we model the mobility cost between industries j and k as a compound of the differences in required tasks and chances for communication between each industry's workers. To measure the differences in required tasks, we quantify each task component required by each

industry by taking the weighted average of the occupation-based task indices defined by JILPT (2012). The weight is the employment share of each occupation in total employment of the industry.

Specifically, JILPT(2012) provides a score that is standardized to a mean of 0.0 and a standard deviation of 1.0 for each cell of a matrix of 601 occupations and 30 task components.[7] Each cell represents to what extent task component m is required in occupation o, based on a web survey of 21,033 Japanese workers conducted by the JILPT in 2003-2006.[8]

We calculate the index of task component m for industry j, $\hat{s}_{mj}$, by taking the average of the index of task component m for each occupation weighted by the employment share of each occupation in the total employment of industry j. In order to match it with the matrix of the number of employees in each industry-occupation cell taken from the Employment Status Survey 2007, the original table of 601 occupations is aggregated to a table of 55 occupations by taking simple averages of the index across occupations.

Let s_{mo} denote the index for occupation o and task component m, and let E_{oj} be the number of employees in occupation o and industry j. Then, we calculate the index of task component m for industry j, $\hat{s}_{mj}$, as follows:

$$\hat{s}_{mj} = \sum_{o=1}^{55} \frac{E_{oj}}{\sum_{o=1}^{55} E_{oj}} s_{mo} \tag{6}$$

The difference in the required tasks between industries j and k is measured as the Euclid distance:

$$S_{jk} = \sqrt{\sum_{m=1}^{30} (\hat{s}_{mj} - \hat{s}_{mk})^2} \tag{7}$$

Hereafter we call S_{jk} "task distance."[9]

[7] This is the Japanese version of the Dictionary of Occupational Titles. Applying the same method as Autor, Levy, and Murnane (2003), Ikenaga and Kambayashi (2010) used this matrix to examine the degree of polarization of the Japanese labor market. The Dictionary of Occupational Titles has been used to measure distances in required tasks between jobs and occupations in the U.S. by many studies, including Poltarev and Robinson (2008) and Yamaguchi (2012).

[8] The survey asks about (1) the respondent's current occupation in his/her job, and (2) to what extent each of the 94 skill components is required in his/her job (measured as a value between 1 and 5). We use the aggregated table of 30 skill components published as Table 1 in the Appendix to the JILPT's (2012) survey report.

[9] We assume that the changes in required skills for the moves from industry j to k and vice versa are the same.

The ratio of the total output of industry j sold to industry k is calculated from the Input-Output Table for Japan for 2005.[10] This variable is a proxy of the chances for communication between workers in the two industries. The idea is that, if a worker in industry j has many chances to communicate with workers in industry k, it will help him/her find a job in industry k. Since the communication should be in both directions, we sum up the ratio of the output of the source industry sold to the destination industry and the ratio of the output of the destination industry sold to the source industry. Hereafter, we call this sum, T_{jk}, the "transaction index."

As the proxies of industry performance, p_{jt} and p_{kt}, we test the following four variables: the annual growth rate of total factor productivity (TFP), the industry's average return on assets (ROA), average monthly earnings, and unfilled vacancy rate. We use all four variables rather than choosing any one, because each variable represents a slightly different aspect of the industry's performance. The TFP growth rate reflects the industry's medium-term growth, whereas the ROA captures a shorter term fluctuation. The monthly earnings reflect the attractiveness of the industry from the viewpoint of workers, and the unfilled vacancy rate represents the excess labor demand, that is, the ease of getting a job in the industry. Table A1 in the Appendix describes the data sources and the detailed definitions of these variables.

Note that we run a separate regression for each variable instead of including all of them in one regression for two reasons. First, although these variables reflect different aspects of the industry's performance, they are highly correlated. Thus, including more than one performance variable may lead to a severe multicollinearity problem. Second, practically, the set of industries for which all four variables are available is quite limited.

Since a move from an industry that requires more skills to one that requires less skills may be easier than the reverse move, we try an alternative measure of skill distance, which counts upward and downward moves separately: $\tilde{S}^1_{jk} = \sqrt{\sum_{m=1}^{30}(\hat{s}_{mj} - \hat{s}_{mk})^2 * 1(\hat{s}_{mj} > \hat{s}_{mk})}$, and $\tilde{S}^2_{jk} = \sqrt{\sum_{m=1}^{30}(\hat{s}_{mj} - \hat{s}_{mk})^2 * 1(\hat{s}_{mj} < \hat{s}_{mk})}$, respectively. However, both $\tilde{S}^1_{jk}$ and $\tilde{S}^2_{jk}$ tend to have significantly negative effects on worker flow when one of them is included, and multicollinearity from the strong correlation between $\tilde{S}^1_{jk}$ and $\tilde{S}^2_{jk}$ ($corr(\tilde{S}^1_{jk}, \tilde{S}^2_{jk}) = 0.55$) makes the estimated coefficients unstable and imprecise when both measures are included simultaneously. Thus, we do not use this separate measure.

[10] We used the table with 108 industries. We recoded these 108 industries to consistent coding with each of the Labour Force Survey's 51 industries and the Working Person Survey's 34 industries. The cross-walk table of industry codes (in Japanese) is available upon request.

2.1.3 Worker flow data from the Labour Force Survey

Worker flow data are taken from the Labour Force Survey, which is conducted by the Statistics Bureau of the Ministry of Internal Affairs and Communications. The survey covers all households in Japan. The information on job change is available from the special questionnaire, which is distributed to about 21 thousand people older than 15 every month.

Specifically, we define W_{jkt} as the number of workers employed in industry k in year t who left industry j within a year before the survey. We use 2-digit industry codes (*chubunrui*) with some modifications described in the Appendix.[11] The number of industries in the final dataset is 51, and we calculate W_{jkt} for males and females separately. In order to maintain the exact same industry codes throughout the data period, we limit our data to the years 2003-2008, during which the 11th revision of the Japan Standard Industrial Classification was applied. Thus, the total number of observations is $51 \times 51 \times 2 \times 6 = 31,212$. E_{jt} and E_{kt} are defined as the numbers of workers in the source industry and the destination industry, respectively. Although the Labour Force Survey is conducted monthly, we convert W_{jkt}, E_{jt}, and E_{kt} to annual data by taking the average over 12 months. Then the industry-level variables defined in the previous subsection are merged using the industry and year.

Table 1 shows the summary statistics of worker flow data. Note that 75 percentile of W_{jkt} is 0. That is, more than three in four pairs of industries have no job changers between them in the data. The distribution of the transaction index is also skewed and has a very long tail.

2.2 Analysis of earnings changes and likelihood of move to a distant industry using the Working Person Survey

2.2.1 Earnings changes

After examining the determinants of worker flow, we examine the effect of those variables on earnings changes associated with inter-industry job changes. If a factor decreasing worker flow between two industries actually lowers earnings after job change, the anticipated earnings loss

[11] The worker flow data classified by the 2-digit industry code are not publicly available, and thus, we estimated them using microdata after securing the approval of the Statistics Bureau.

associated with the move may be the main obstacle to worker reallocation. Specifically, we estimate the following equation using the sample of inter-industry job changers:

$$\log I_{ijkt} = \beta_0 + \beta_1 X_{ijkt} + \beta_2 S_{jk} + \beta_3 T_{jk} + \beta_4 p_{jt} + \beta_5 p_{kt} + \xi_j + \zeta_k + \lambda_t + \varepsilon_{ijkt} \tag{8}$$

where I_{ijkt} is individual i's annual earnings after moving from industry j to industry k in year t. X_{ijkt} refers to control variables such as age and its square, education, sex, and log annual earnings before the move. S_{jk}, T_{jk}, p_{jt}, and p_{kt} are the same as defined in the previous subsections, ξ_j and ζ_k are the source and destination industry fixed effects, respectively. λ_t is a year effect, and ε_{ijkt} is a random error term.

Note that the earnings changes after a job change are observable only for those who actually moved. People tend to avoid moving when the earnings loss associated with the job change is large. Our earnings regression (8) does not account for this endogenous selection of job changers, thus β_2 and β_3 cannot be interpreted as the causal effect for the population including those who choose not to move. Nevertheless, if β_2 is significantly negative, it means that people who actually moved to a distant industry experienced a larger earnings loss, and this observed negative impact itself may impede labor reallocation between distant industries by generating the expectation for earnings loss.

We further explore how much of the earnings loss associated with inter-industry job changes is attributable to the differences in the required tasks, using the sample of all job changers including those who moved within an industry. Specifically, we estimate the following equation:

$$\log I_{ijkt} = \beta_0 + \beta_1 1(j \neq k) + \beta_2 \tilde{S}_{it} + \beta_3 T_{jk} + \beta_4 X_{ijkt} + \xi_j + \zeta_k + \lambda_t + \varepsilon_{ijkt} \tag{9}$$

$1(j \neq k)$ is a dummy for the inter-industry move. We explore how the coefficient of this dummy, β_1, changes when we change the controls for task changes, $\tilde{S}_{it}$. We try the following four specifications (1) no control for task distance, (2) control for task distance between source and destination industries (S_{jk} in equation (8), which is 0 for intra-industry changes), (3) control for task distance between current and previous jobs calculated based on the actual occupation, (4) including both

task distance between industries and task distance between actual occupations. Other explanatory variables are the same as equation (8), except that we omit time-variant industry performance p_{jt}, and p_{kt} to avoid running the same regression four times.[12]

2.2.2 Individual characteristics and cost of inter-industry job changes

We further explore who among job changers are relatively more willing to move to an industry requiring tasks different from the current job, and whether they are indeed experiencing smaller earnings losses associated with task distance. We focus on the following three factors: (1) age, (2) educational background, and (3) reason for the job change. Specifically, for each of the three factors, we estimate the following equations:

$$S_{jk} = \beta_0(+\beta_1 female_i) + \sum_{f=1}^{F} \gamma_f 1(a_{it} = A_f) + \varepsilon_{it} \tag{10}$$

$$\log I_{ijkt} = \beta_0 + \beta_1 X_{ijkt} + \sum_{f=1}^{F} \gamma_f 1(a_{it} = A_f) + \delta_0 S_{jk} + \sum_{f=1}^{F} \delta_f 1(a_{it} = A_f) S_{jk} + \varepsilon_{it} \tag{11}$$

where a_{it} is a categorical variable indicating the factor of interest: (1) age at the time of job change (25 or younger, 25-34, 35-44, 45-54, 55-59), (2) education (high school or less, vocational school/junior college/technical college, college or higher), or (3) reason for the job change (involuntary termination, family or health reasons, discontent with the previous job, for a better career). Detailed definitions for these variables are provided in the Appendix. Control variables in X_{ijkt} include log of earnings before a job change and a female dummy.

γ_f represents the effect of a_{it} itself, and δ_f represents how the effect of task distance changes with a_{it}. If workers who are relatively more willing to move to an industry requiring tasks different from the current job are indeed experiencing smaller earnings losses associated with task distance, the signs of γ_f in equation (10) and δ_f in equation (11) should be the same.

There are two reasons why some workers may experience smaller earnings losses than others when they move to a distant industry. The first potential reason is that they may be able to find

[12] We confirmed that inclusion of industry performance variables does not change the results qualitatively. Also, as shown in Table 4, none of the industry performance variables has a statistically significant effect on earnings after a job change.

a job requiring similar tasks even though they move to a distant industry. In other words, task distance between the current and previous jobs based on actual occupations is smaller for them after controlling for task distance between industries. To examine this, we estimate the following equation:

$$\bar{S}_{ijkt} = \beta_0(+\beta_1 female_i) + \sum_{f=1}^{F} \gamma_f 1(a_{it} = A_f) + \delta S_{jk} + \varepsilon_{it} \tag{12}$$

If the workers who experience smaller earnings losses are more likely to find a similar job in a given industry, the signs of δ_f in equation (11) and γ_f in equation (12) should be opposite.

The second potential reason is that the cost of moving to a job requiring different tasks is smaller for these workers. For example, such a cost is smaller for younger workers because they have not accumulated much skills specific to each task yet and thus they do not lose much. To examine this possibility, we estimate the following equation:

$$\log I_{ijkt} = \beta_0 + \beta_1 X_{ijkt} + \sum_{f=1}^{F} \gamma_f 1(a_{it} = A_f) + \delta_0 \bar{S}_{ijkt} + \sum_{f=1}^{F} \delta_f 1(a_{it} = A_f)\bar{S}_{ijkt} + \varepsilon_{it} \tag{13}$$

This equation is basically the same as the equation (11) except that the measure of task distance is based on the actual occupations. We also add controls for task distance between industries and interactions with worker's characteristics to see whether the task distance of actual occupations has a stronger effect than the distance between industries.

2.2.3 Working Person Survey

Data for earnings and individual characteristics of job changers are taken from the Working Person Surveys for 2006, 2008, and 2010, conducted by the Recruit Works Institute. The universe comprises employed people aged 18-59, living in 5 prefectures (4 for the 2010 survey)[13] located in the greater Tokyo metropolitan area. The advantage of using data from the Working Person Survey is that it provides detailed information about current and previous jobs as well as earnings and industry.

[13] The 2006 and 2008 surveys covered Tokyo, Kanagawa, Chiba, Saitama, and Ibaraki. The 2010 survey did not cover Ibaraki.

However, an important drawback is that the year when a worker left the previous employer is not available. Thus, we cannot exclude workers who were out of the labor force for some time before starting their current jobs. This is a problem particularly for women, because many married women withdraw from the labor force when their children are young.

For the analysis of earnings changes and task distance associated with a job change, we limit our sample to those who started to work at the current employer between 2000 and 2010. Table 2 shows the summary statistics.

Since the effects of age and education might be different for males and females, all the analyses are done for the pooled sample of men and women, men only, and women only.

3 Results on worker flow

Table 3 shows the estimated coefficients in equation (5). Panels A-C show the results for the pooled sample of men and women, subsample of men, and subsample of women, respectively. Each column includes different variables for p_{jt} and p_{kt}. As expected, the coefficients of the sizes of the total employment of the destination and source industries are close to 1 in all specifications. Further, log task distance, the measure for the differences in required tasks between the two industries, has a significantly negative impact on worker flow. In contrast, the transaction index has a significantly positive impact on the worker flow between the two industries.

Marginal effects of one standard deviation increase in log task distance and log transaction index are presented at the bottom of Table 3. The marginal effect in each column is evaluated at the mean of the sample used for each regression. The marginal effect of a standard deviation increase in the log task distance ranges from -0.05 to -0.10. This means that a standard deviation increase in task distance leads to about 50-100 fewer inter-industry movers per year (note that W_{jkt} is measured in 1000 persons). Given that 90 percentile of W_{jkt} is 0.69, this is not a trivial impact. Likewise, a standard deviation increase in the log transaction index leads to about 30-50 more inter-industry moves per year. These marginal effects do not vary much across gender.

In contrast, the coefficients on most of the variables for industry performance are statistically insignificant. Among them, the TFP and ROA of the destination industry possess a negative sign,

contrary to the expectation, except for the female sample. Therefore, it is not likely that workers are moving toward industries with improving productivity. The other two variables are related to the labor market, and they seem to be slightly more relevant. The average log earnings of the source industry have a negative effect, and the unfilled vacancy rate of the destination industry has a positive effect and is significant at 10% when both the male and the female subsamples are pooled. This probably implies that workers are hesitant to resign from industries that pay better, and it is easier for them to find a job where excess labor demand is high. Although not statistically significant, the signs are consistent in regressions with subsamples by gender.

4 Results on earnings after an inter-industry job change

Table 4 shows the estimated coefficients in equation (8). Panels A-C show the results for the pooled sample of men and women, subsample of men, and subsample of women, respectively. Each column includes different variables for p_{jt} and p_{kt}.

Log task distance has a statistically significant negative effect on earnings in all specifications. That is, a worker faces loss of earnings when he/she moves to an industry requiring tasks different from those required in the previous job. Thus, it might be the case that an anticipated loss of earnings prevents workers from making job changes. Since the standard deviation of task distance is 2.37 for inter-industry movers, the estimated coefficient implies that a standard deviation increase in the task distance decreases earnings by about 10%. In addition, the difference between males and females is not substantial.

Although the transaction index has a positive effect on earnings after a job change, the coefficients are not always statistically significant. Moreover, the size of the effect is small. Since the standard deviation of the transaction index is 9.5% (i.e., 0.095), the effect of a standard deviation increase in the transaction index increases earnings only by 0.6%. Also, none of the variables for industry performance has statistically significant effects on earnings after a job change. This implies that growing industries do not necessarily offer better salaries.

Table 5 presents the estimated coefficients of a dummy for inter-industry move and task distance measures in equation (9). First, column (1) shows that, without controlling for task distance, inter-

industry movers experience on average 10% larger earnings losses than intra-industry movers. However, column (2) shows that this negative effect becomes insignificant after controlling for task distance between the source and destination industries. In column (3), we control for task distance between current and previous jobs measured using actual occupations instead of task distance between industries. The coefficient of inter-industry move becomes slightly more negative and statistically significant at the 5% level; yet, compared to column (1), the size of the coefficient is much smaller. Furthermore, column (4) shows that, when both task distances between industries and between actual occupations are included, only the distance between actual occupations has a statistically significant negative effect. This implies that only changes in tasks required by the job matter. Columns (5)-(12) confirm the same observations for both males and females, except that the coefficients of the inter-industry move dummy in columns (7) and (11) are not statistically significant.

5 Who are willing to move to industries requiring different task sets?

So far, we have shown that differences in required tasks are one of the major obstacles for inter-industry worker reallocation and that an inter-industry job change associated with a larger change in required tasks leads to a larger decline in earnings after the job change. Combining these two facts suggests that the anticipated earnings loss may deter workers from making inter-industry job changes and hinders smooth reallocation of the labor force from the declining industry to the emerging industry. If so, workers with relatively small earnings losses associated with changes in required tasks may be more willing to move to distant industries. This section investigates this possibility.

Before exploring who is relatively more willing to move to an industry requiring tasks different from the current job, it is necessary to learn who is more likely to change jobs and move across industries. In the Appendix, we examine how the likelihood of job change and inter-industry move are affected by individual characteristics (age and education) and industry performance. To

summarize, we find that women are more likely to change jobs and move across industries than men, and the effect of age is quite different across genders. For men, the probabilities of a job change and an inter-industry move increase with age until they reach 40 and become flat after 40. In contrast, for women, those who were 30-39 years old as of 2000 are the most likely to change jobs and move across industries. On the other hand, the effect of education is similar across genders; basically, more educated workers move less. Lastly, none of the industry performance measures have a statistically significant effect.

To explore who is relatively more willing to move to an industry requiring tasks different from the current job and whether they are indeed experiencing smaller earnings losses, Tables 6a-6c present the estimated coefficients of equations (10) and (11). Each table corresponds to the following three factors: a) age, b) educational background, and c) reason for the job change. All the analyses are done for the pooled sample of men and women, subsample of men, and subsample of women. If the coefficients of factor dummies (e.g. age category) in the first three columns have the same signs as the coefficients of the interaction terms between task distance and these factor dummies, it implies that workers who are more likely to move experience smaller earnings losses after a job change.

Table 6a shows the results for age at the time of the job change. The reference group is 35-44 years old. The first three columns show the effect of age on task distance. The pattern differs for males and females. While young men and men older than 55 are more willing to move to an industry requiring different tasks than prime-aged men, young women are less likely to do so. Interestingly, the effect of age on the task distance among inter-industry job changers is similar to the effect of age on the likelihood of job changes and inter-industry moves described in the Appendix. This implies that people who move more often tend to move to relatively distant industries.

In contrast, the effect of task distance on earnings, shown in the last three columns, does not fit the same pattern as the effect on inter-industry job changes. For both men and women, young workers tend to lose less by moving to a distant industry. This is not surprising because young workers have not invested much on industry- or task-specific human capital and thus do not have

much to lose. Nonetheless, young women are less willing to move across industries, and even if they move, they tend to move to industries requiring a similar set of tasks. Furthermore, old men are more likely to move but lose more by moving to a distant industry. These patterns might reflect the differences in labor demand for each age group; that is, the lack of employment opportunities in industries requiring similar tasks forces old men to move to a distant industry.

Next, Table 6b shows the results for educational background. The reference group is vocational school/junior college/technical college, that is, those with a few years of post-secondary education. For both genders, workers with a high school education or less are more likely to move to a distant industry. This pattern is consistent with that of earnings losses: high school graduates tend to lose less than college graduates.

Lastly, Table 6c shows the results regarding the reason for the job change. The reference group is "discontented with the previous job" and includes people who did not like something about the previous job, such as wages, relationship with colleagues, etc. For both males and females, workers who quit for family or health reasons tend to move to a distant industry. Also, workers who are involuntarily forced to leave the previous job are less likely to move. The effect of task distance on earnings after a job change is not significantly correlated with the reason for quitting.

Given the lack of differences in the effect of task distance, it is natural to think that workers who left for family or health reasons tend to mind less about the disadvantage associated with a job change, perhaps because private reasons would have pressed them to change other working conditions such as hours of work. In addition, we have to keep in mind that we do not have access to data regarding when the respondent left the previous employer. Therefore, we cannot exclude people who left their previous jobs a considerable amount of time ago. This is particularly relevant for workers who quit for family or health reasons, because many of them withdraw from the labor force for several years.

Also, it is worth mentioning that the level of earnings itself varies with the reason for quitting, even with controls for the previous job's earnings. Workers who quit for family or health reasons experience the largest decline in earnings. They earn much less even compared to involuntary job changers who were forced to quit due to dismissal or bankruptcy.

Tables 7a-7c present the estimated coefficients in equation (12). The effects of individual characteristics on task distance between current and previous jobs follow the same pattern as the effects on task distance between industries, except that the older men are much more likely to move to different jobs, and those who quit for a better career tend to move to closer jobs. As shown in columns (2), (4), and (6), the results do not qualitatively change with controls for industry-based task distance. Since the estimated γ_f in Table 7a-c do not possess opposite signs to the estimated δ_f in Table 6a-c, it is not likely that workers experiencing smaller earnings losses associated with a move to a distant industry will find a job requiring similar tasks.

Then, is the cost of moving to a job requiring different tasks smaller for workers who experience smaller earnings losses associated with moving to a distant industry? Tables 8a-8c present the estimated coefficients in equation (13). The coefficients of the interaction terms between task distance and dummies for age and education follow the same pattern as those presented in Tables 6a and 6b, and controls for industry-based task distance does not change the pattern much. Therefore, for age and educational background, it is actually the case that the cost of moving to a job requiring different tasks is smaller for workers who experience smaller earnings losses associated to with a move to a distant industry.

As shown in Table 8c, however, the coefficients of the interaction terms between task distance and dummies for reasons for quitting are somewhat different from those in Table 6c. Although the cost of moving to a distant job is larger for workers who their jobs due to family or health reasons, they are *more* likely to move to a distant job. Also, the cost of moving to a distant job is smaller for workers who quit their previous jobs for better career, while they are less likely to move to a distant job.

Overall, the relationship between the willingness to move to an industry requiring different tasks and the earnings loss caused by the differences in required tasks is not very clear.

6 Concluding remarks

This paper examined the determinants of worker flow by applying the gravity model, using the differences in required tasks and the volume of transaction between two industries as proxies for

distance. The results show that workers tend to move to industries with close relationships in terms of chances for transactions and industries that are similar in terms of required tasks. Industry performance does not play an important role. Further, we found that large earnings losses are associated with inter-industry moves involving large changes in required tasks. However, the size of this loss is not always systematically related to the likelihood of moving to an industry requiring a different set of tasks than the previous job. Again, industry performance has little impact on earnings after a job change.

Encouraging reallocation of labor from declining sectors to growing sectors is an important issue for macroeconomic policies. Our findings of the negligible impact of industry performance imply the lack of spontaneous labor reallocation. Also, the negative effect of task distance on earnings after a job change implies that workers may hesitate to move to industries requiring a different set of tasks for fear of losing the wage premium acquired by task-specific human capital.

A Appendix

A.1 Determinants of job changes

First, we investigate individual characteristics that affect the probability of inter-industry job changes. Since the Working Person Survey is not panel data, it merely conveys whether each worker has experienced a job change or an inter-industry job change during a specific period of time, namely 2000-2010. We investigate how the probability of an inter-industry job change is affected by individual characteristics such as age and education. Specifically, we estimate the following regression:

$$Y_{ij} = \beta_0(+\beta_1 female_i) + \sum_a \gamma_a 1(age2000_i \in agecateg_a) + \sum_e \delta_e 1(educ_i \in educcateg_e) + \xi_j \quad (14)$$

where Y_{ij} takes 1 if individual i has experienced an inter-industry job changes since 2000. $age2000_i$ is the individual i's age as of 2000, and age categories are 5-year intervals beginning from those younger than 15 and counting up to those aged 54-55. We also include dummy variables for

education. The subscript j indicates individual i's industry at the beginning of the period (previous industry if i has changed his/her job since 2000, and current industry otherwise) and ξ_j represents industry fixed effects.

For this analysis, the sample includes all individuals who started work prior to 2000. The dependent variables are defined as follows. The indicator for job change takes 1 if the worker started the current job between 2000-2010 and has resigned from a job at least once (i.e., the current job is not the first job) and 0 otherwise. The indicator for inter-industry job change takes 1 if the indicator for job change takes 1 and if the industries of the current and previous jobs are different. The industry at the beginning of the period is defined as the industry of the previous job for those who have changed their jobs since 2000 and that of the current job for the others. Table A2 of the Appendix show the summary statistics.

Table A3 shows estimated coefficients on the female dummy, dummies for age categories as of 2000, and education dummies in equation (14). The dependent variables are a dummy for having changed a job between 2000 and the survey year ("Job change") and a dummy for having moved across industries between 2000 and the survey year ("Inter-ind. move"). All the regressions include dummies for the industry at the beginning of the period, namely the industry of the previous job for those who have changed their jobs since 2000 and that of the current job for the others.

There are substantial differences between men and women. First, women are more likely to change jobs and move across industries than men. Also, the effect of age is quite different. Younger men (less than 40) are more likely to change jobs and move across industries, except for the youngest group, many of whom were still in school in 2000 and thus had spent shorter time periods in the labor force at the time of the survey. For men older than 40 as of 2000, the probabilities of job change and inter-industry move are mostly the same as those for the reference group, except for the positive coefficients on ages 45-49. These positive coefficients may reflect involuntary resignations due to downsizing, but the size of the coefficients is not very large. In contrast, women who were 30-39 years old as of 2000 are the most likely to change jobs and move across industries. This is probably because many women resign from full-time jobs after the birth of the first child and return to the labor force after their child starts kindergarten or elementary

school. Note that the Working Person Survey does not provide information on when the worker quit the previous job; thus, the timing of the "job change" in our data is actually the timing when the worker started her current job.

The effect of education is similar across genders. College graduates are much less likely to change jobs and move across industries than high school graduates, the reference group. Those who went to vocational school after finishing high school also tend to stay in the same job, probably because they are more likely to have a specialist job. The effect of junior college is significantly negative only for women, but this insignificance for men is likely to be due to the small number of men who go to junior college.

In addition, Table A4a and A4b show the effects of industry performance and age categories on separation and hiring rates using data taken from the publicly available tables of the Employment Trend Survey. Basically, industry performance does not affect separation or hiring rates much. This is consistent with the insignificant effect of industry performance on worker flow presented in Table 3. Note that the effects of age do not look similar to those presented in Table A3 because of the differences in the definitions of the dependent variables. “Separation” in the Employment Trend Survey includes those who permanently withdraw from the labor force, and “hiring” includes those who got a job for the first time. However, the job changers in the Working Person Survey include only those who resigned from a job and started a new job sometime between 2000 and 2010.

A.2 Industry and Occupation Coding

The Labour Force Survey for 2003-2008 used the 11th revision of the Japan Standard Industrial Classification. The original 2-digit classification includes 96 industries. We make the following modifications in order to merge the variables taken from other data sources.

1. The following variables are deleted because they are not covered in the other data sources: Agriculture; Forestry; Fishery; Aquaculture; Postal services (except otherwise classified); Cooperative associations (not elsewhere classified); Professional services (not elsewhere classified), Political, business and cultural organizations; Religion; Miscellaneous services; For-

eign governments and international agencies in Japan; National government services; and Local government services.

2. Manufacture of textile mill products, except apparel and other finished products made from fabrics and similar materials and Manufacture of apparel and other finished products made from fabrics and similar materials are combined into Manufacture of textile including apparel.

3. Manufacture of general machinery and Manufacture of precision instruments and machinery are combined into Manufacture of general machinery.

4. Road passenger transport and Road freight transport are combined into Road transport.

5. Five separate categories of retail trade are combined into a single category Retail trade.

6. General eating and drinking places and Spree eating and drinking places are combined into Eating and drinking place.

7. Medical and other health services and Public health and hygiene are combined into Medical and health care.

8. School education and Miscellaneous education, learning support are combined into Education.

9. Automobile maintenance services and Machine, etc. repair services (except otherwise classified) are combined into Maintenance and repair services.

These modifications reduce the number of remaining industries from 96 to 51.

Industry coding in the Working Person Survey is different from that in the Japan Standard Industrial Classification. There are 66 industries in the original data, but in order to make the coding consistent with the other data taken from government surveys, we need to merge some industries into a larger category. Consequently, the analysis sample includes 34 industries.

We also make modifications to the industry coding of data sources for the explanatory variables. In addition, the occupation coding of the Employment Status Survey is also modified so that it can be merged with the task data taken from JILPT (2012).

A.3 Reasons for job change

The original questionnaire asked the respondent to pick the most important reason for a job change from 22 options including "Others." We dropped job changers who answered "Others" and divided the remaining 21 options into 4 categories as follows:

"Involuntary termination": (1) mandatory retirement, (2) expiration of employment contract, (3) bankruptcy or dismissal for downsizing.

"Family or health reason": (4) marriage, (5) childbirth, (6) to focus on childcare, (7) family caregiving, (8) injury or disease.

"Discontent with the previous job": (9) not satisfied with wages, (10) not satisfied with evaluation, (11) bad working conditions (hours and days of work, location, etc.), (12) too physically demanding, (13) too mentally demanding, (14) can't utilize ability and expertise, (15) do not feel I am "growing" in my job , (17) anxiety for the company's future, (18) discontent with recent job transfer (including both intra-firm relocation and transfer to affiliated companies), (19) frustrated by colleagues.

"For a better career": (16) got an offer of a better job, (20) to study for further education or to acquire a license, (21) to start one's own business.

References

Abe, Masahiro (2005) "Tenshokugo no Chingin Henka to Sangyo Tokushuteki Skill no Sonshitsu," in *Nihon Keizai no Kankyo Henka to Rodo Shijo*, Toyokeizai (in Japanese).

Anderson, James and Eric van Wincoop (2003) "Gravity with Gravitas: A Solution to the Border Puzzle," American Economic Review, 93, 170- 192.

Baumol, William J. (1967) "Macroeconomics of Unbalanced Growth: The Anatomy of Urban Crisis," American Economic Review, 57 (3), 425-426.

Cortes, Guido Matias and Giovanni Gallipoli (2014) "The Costs of Occupational Mobility: An Aggregate Analysis," mimeo.

Gathmann, Christina and Uta Schönberg (2010) "How General Is Human Capital? A Task-Based Approach," Journal of Labor Economics, 28 (1), 1-49.

Ikenaga, Hanae and Ryo Kambayashi (2010) "Long-term Trends in the Polarization of the Japanese Labor Market: The Increase of Non-routine Task Input and Its Valuation in the Labor Market," PIE Discussion Paper No. 462, Hitotsubashi University. (in Japanese)

JILPT (2012) "The Studies on Occupational Structure – Numerical Analyses of Occupations and An Analysis of Occupational Mobility –," JILPT Research Report No. 146, Japan Institute for Labour Policy and Training (in Japanese).

Jacobson, Louis, Robert Lalonde and Daniel Sullivan (1993) "Earnings Losses of Displaced Workers," American Economic Review, 83(4), 685-709.

Kambourov, Gueorgui and Inourii Manovskii (2009) "Occupational Specificity and Human Capital," International Economic Review, 50 (1), 63-115.

Neal, Derek (1995) "Industry Specific Human Capital: Evidence from Displaced Workers," Journal of Labor Economics, 13, 653-677.

Parent, Daniel (2000) "Industry-Specific Capital and the Wage Profile: Evidence from the National Longitudinal Survey of Youth and the Panel Study of Income Dynamics," Journal of Labor Economics, 18 (2), 306-323.

Poletaev, Maxim and Chris Robinson, (2008) "Human Capital Specificity: Evidence from the Dictionary of Occupational Titles and Displaced Worker Surveys," Journal of Labor Economics, 26 (3), 387-420.

Shaw, Kathryn L. (1984) "A Formulation of the Earnings Function Using the Concept of Occupational Investment," Journal of Human Resources, 19 (3), 319-340.

Silva, J. M. C. Santos and Silvana Tenreyro (2006) "The Log of Gravity," The Review of Economics and Statistics, 88 (4), 641-658.

Sullivan, Paul (2010) "Empirical evidence on occupation and industry specific human capital," Labour Economics, 17, 567-580.

Yamaguchi, Shintaro (2012) "Tasks and Heterogeneous Human Capital," Journal of Labor Economics, 30 (1), 1-53.

Yugami, Kazufumi (2005) "Tenshoku to Chingin Henka: Shitsugyosha data niyoru Bunseki," JILPT Discussion Paper 05-004 (in Japanese).

Table 1. Summary statistics of Worker-flow data

	mean	sd	p50	p75	p90	N
Worker flow (1000 persons)	0.43	3.55	0.00	0.00	0.69	31,212
Total employment of destination industry	459.2	774.2	179.9	436.4	1128.6	31,212
Total employment of source industry	459.2	774.2	179.9	436.4	1128.6	31,212
Task distance	2.13	1.02	2.25	2.85	3.38	31,212
Transaction index	3.8%	10.2%	1.0%	2.9%	8.8%	31,212
TFP growth rate of destination industry	0.43%	3.47%	0.35%	1.86%	4.63%	28,764
TFP growth rate of source industry	0.43%	3.47%	0.35%	1.86%	4.63%	28,764
ROA of destination industry	4.30	2.74	3.98	5.59	6.79	27,930
ROA of source industry	4.30	2.74	3.98	5.59	6.79	27,930
log average monthly earnings of destination industry	341.6	61.5	335.8	375.2	426.6	27,744
log average monthly earnings of source industry	341.6	61.5	335.8	375.2	426.6	27,744
Unfilled vacancy rate of destination industry	1.1%	1.1%	0.8%	1.3%	1.9%	22,440
Unfilled vacancy rate of source industry	1.1%	1.1%	0.8%	1.3%	1.9%	22,440

Note: Unit of the observation is a cell by source industry, destination industry, sex, and year (2003-2008). Thus, N should be equal to (number of industries for which the variable is available)^2*2*6.

Table 2. Summary statistics of Working Person Survey

	All job changers			Inter-industry movers only		
	All	Male	Female	All	Male	Female
Sample size	7,667	3,681	3,986	4,505	1,976	2,529
Annual earnings after job change (10k yen)	291.94	405.46	187.11	261.31	368.92	167.08
log of annual earnings after job change	5.36	5.81	4.93	5.26	5.74	4.83
Annual earnings before job change (10k yen)	335.05	442.55	235.78	304.61	399.55	220.96
log of annual earnings before job change	5.54	5.89	5.21	5.45	5.79	5.15
Education						
Jr. High School	3.3%	4.6%	2.1%	4.0%	5.4%	2.8%
High school	32.0%	29.3%	34.4%	37.6%	34.3%	40.5%
Vocational college (1-3yr)	17.3%	15.7%	18.7%	14.6%	13.0%	16.0%
Junior college (2yr; AA equivalent)	11.1%	1.3%	20.2%	11.4%	1.4%	20.0%
Kosen (Tech college; AA equivalent)	1.5%	2.7%	0.4%	1.4%	2.8%	0.3%
College (4year)	32.0%	41.8%	22.8%	29.2%	40.3%	19.7%
Graduate school	2.8%	4.6%	1.3%	1.8%	2.9%	0.9%
Year of job change	2005.5	2005.4	2005.6	2002.0	2000.7	2003.2
Age at the time of job change	35.48	34.62	36.27	34.19	31.99	36.09
Reason of quit						
Involuntary termination	15.8%	18.4%	13.3%	12.3%	14.4%	10.5%
Family or health reason	19.5%	3.3%	34.5%	24.7%	4.0%	42.8%
Discontent with the previous job	51.9%	61.8%	42.6%	49.9%	63.9%	37.7%
For a better career	12.9%	16.4%	9.6%	13.1%	17.7%	9.1%
Task distance between the destination and source industries	1.33	1.18	1.47	2.37	2.28	2.45
Transaction index	28.5%	25.0%	31.8%	9.5%	9.6%	9.4%

TFP growth rate of destination industry	0.06%	0.03%	0.08%	0.06%	0.07%	0.05%
TFP growth rate of source industry	0.04%	0.02%	0.06%	0.08%	0.10%	0.07%
ROA of destination industry	3.67%	3.69%	3.66%	3.53%	3.59%	3.48%
ROA of source industry	3.74%	3.67%	3.81%	3.60%	3.47%	3.69%
Log average monthly earnings of destination industry	5.78	5.81	5.76	5.77	5.79	5.75
Log average monthly earnings of source industry	5.79	5.81	5.77	5.77	5.78	5.77
Unfilled vacancy rate of destination industry	0.91%	0.90%	0.91%	1.00%	0.95%	1.04%
Unfilled vacancy rate of source industry	0.91%	0.91%	0.90%	1.00%	0.99%	1.01%
Task distance between current and previous jobs (measured based on occupation)	2.74	2.53	2.91	3.92	4.06	3.81

Table 3 Determinants of inter-industry worker flow

A. All

	(1)	(2)	(3)	(4)
log total employment	0.925***	0.889***	0.885***	0.896***
of destination industry	[0.034]	[0.037]	[0.030]	[0.037]
log total employment	0.867***	0.851***	0.868***	0.857***
of source industry	[0.033]	[0.031]	[0.027]	[0.035]
log task distance	-0.417***	-0.533***	-0.443***	-0.453***
	[0.023]	[0.029]	[0.022]	[0.026]
Log transaction index	0.116***	0.065***	0.082***	0.117***
	[0.013]	[0.012]	[0.011]	[0.014]
TFP growth rate	-0.091			
of destination industry	[0.499]			
TFP growth rate	0.688			
of source industry	[0.513]			
ROA		-0.037		
of destination industry *100		[0.044]		
ROA		-0.022		
of source industry *100		[0.018]		
log average earnings			0.408	
of destination industry			[0.471]	
log average earnings			-0.979*	
of source industry			[0.538]	
Unfilled vacancy rate				4.216*
of destination industry				[2.222]
Unfilled vacancy rate				0.070
of source industry				[2.415]
Observations	25,752	20,520	23,928	18,740
Marginal effects of a SD change of:				
Log task distance	-0.053	-0.100	-0.098	-0.069
Log transaction index	0.040	0.032	0.050	0.047

Note: Coefficients of Poisson regressions. See the text for details. The number of observation is smaller than that in Table 1 because observations with 0 or negative values for the transaction index or task distance are dropped in order to take log of them. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table 3 Determinants of inter-industry worker flow

B. Male

	(1)	(2)	(3)	(4)
log total employment	1.102***	0.960***	0.994***	0.903***
of destination industry	[0.220]	[0.325]	[0.293]	[0.274]
log total employment	0.729***	1.397***	1.214***	0.874***
of source industry	[0.257]	[0.329]	[0.253]	[0.313]
log task distance	-0.477***	-0.565***	-0.484***	-0.481***
	[0.031]	[0.042]	[0.030]	[0.035]
log transaction index	0.126***	0.080***	0.089***	0.121***
	[0.016]	[0.019]	[0.015]	[0.017]
TFP growth rate	-1.042			
of destination industry	[0.663]			
TFP growth rate	0.497			
of source industry	[0.654]			
ROA		-0.072		
of destination industry *100		[0.067]		
ROA		-0.023		
of source industry *100		[0.027]		
log average earnings			0.918	
of destination industry			[0.647]	
log average earnings			-1.057	
of source industry			[0.727]	
Unfilled vacancy rate				4.844
of destination industry				[2.959]
Unfilled vacancy rate				-0.923
of source industry				[3.367]
Observations	12,876	10,260	11,964	9,370
Marginal effects of a SD change of:				
Log task distance	-0.071	-0.108	-0.112	-0.083
Log transaction index	0.051	0.040	0.057	0.055

Note: Coefficients of Poisson regressions. See the text for details. The number of observation is smaller than that in Table 1 because observations with 0 or negative values for the transaction index or task distance are dropped in order to take log of them. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table 3 Determinants of inter-industry worker flow

C. Female

	(1)	(2)	(3)	(4)
log total employment	1.246***	0.917***	0.973***	1.053***
of destination industry	[0.254]	[0.249]	[0.224]	[0.315]
log total employment	0.608**	0.845***	0.850***	0.135
of source industry	[0.278]	[0.313]	[0.207]	[0.334]
log task distance	-0.344***	-0.489***	-0.364***	-0.412***
	[0.036]	[0.042]	[0.035]	[0.040]
log transaction index	0.080***	0.038**	0.064***	0.089***
	[0.019]	[0.015]	[0.014]	[0.021]
TFP growth rate	0.940			
of destination industry	[0.767]			
TFP growth rate	0.905			
of source industry	[0.758]			
ROA		0.010		
of destination industry *100		[0.027]		
ROA		-0.012		
of source industry *100		[0.022]		
log average earnings			0.015	
of destination industry			[0.639]	
log average earnings			-0.754	
of source industry			[0.677]	
Unfilled vacancy rate				3.510
of destination industry				[3.284]
Unfilled vacancy rate				0.633
of source industry				[3.355]
Observations	12,336	9,820	11,444	8,950
Marginal effects of a SD change of:				
Log task distance	-0.039	-0.095	-0.081	-0.059
Log transaction index	0.022	0.018	0.036	0.031

Note: Coefficients of Poisson regressions. See the text for details. The number of observation is smaller than that in Table 1 because observations with 0 or negative values for the transaction index or task distance are dropped in order to take log of them. Also, all industry pairs with mining are dropped because so few women leave or enter the mining industry that poisson regression including mining does not converge on STATA. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table 4 Determinants of earnings after inter-industry job change

A. All

	(1)	(2)	(3)	(4)
Task distance between the	-0.044***	-0.046***	-0.049***	-0.043***
source & destination industries	[0.007]	[0.007]	[0.007]	[0.007]
Transaction index	0.066**	0.052*	0.052	0.051*
	[0.030]	[0.029]	[0.032]	[0.030]
TFP growth rate	-0.030			
of destination industry	[0.290]			
TFP growth rate	-0.223			
of source industry	[0.294]			
ROA		0.003		
of destination industry *100		[0.005]		
ROA		-0.002		
of source industry *100		[0.004]		
log average earnings			0.384	
of destination industry			[0.355]	
log average earnings			0.317	
of source industry			[0.348]	
Unfilled vacancy rate				0.009
of destination industry *100				[0.012]
Unfilled vacancy rate				-0.001
of source industry *100				[0.013]
Observations	6,862	7,618	6,792	7,186
R-squared	0.626	0.626	0.621	0.631

Note: Linear regression of log annual earnings after job change. Control variables omitted from the table include the female dummy, age and squared age, log earnings of the previous job, dummy variables for year of obtaining the current job, year of the survey, industry of current and previous jobs, and education. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table 4 Changes in earnings after inter-industry job change (continued)

B. Male

	(1)	(2)	(3)	(4)
Task distance between the	-0.029***	-0.031***	-0.036***	-0.032***
source & destination industries	[0.007]	[0.007]	[0.008]	[0.007]
IO index	0.058*	0.042	0.047	0.032
	[0.034]	[0.034]	[0.038]	[0.034]
TFP growth rate	0.028			
of destination industry	[0.312]			
TFP growth rate	-0.386			
of source industry	[0.340]			
ROA		-0.006		
of destination industry *100		[0.007]		
ROA		0.008		
of source industry *100		[0.005]		
log average earnings			0.207	
of destination industry			[0.384]	
log average earnings			0.210	
of source industry			[0.380]	
Unfilled vacancy rate				-0.014
of destination industry *100				[0.012]
Unfilled vacancy rate				0.018
of source industry *100				[0.012]
Observations	3,330	3,669	3,203	3,540
R-squared	0.645	0.665	0.660	0.668

Note: Linear regression of log annual earnings after job change. Control variables omitted from the table include age and squared age, log earnings of the previous job, dummy variables for year of obtaining the current job, year of the survey, industry of current and previous jobs, and education. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table 4 Changes in earnings after inter-industry job change (continued)

C. Female

	(1)	(2)	(3)	(4)
Task distance between the	-0.040***	-0.043***	-0.045***	-0.035***
source & destination industries	[0.012]	[0.012]	[0.012]	[0.013]
Transaction index	0.098**	0.083*	0.079	0.093**
	[0.047]	[0.046]	[0.048]	[0.047]
TFP growth rate	-0.243			
of destination industry	[0.455]			
TFP growth rate	-0.148			
of source industry	[0.431]			
ROA		0.008		
of destination industry *100		[0.006]		
ROA		-0.006		
of source industry *100		[0.006]		
log average earnings			0.751	
of destination industry			[0.554]	
log average earnings			0.416	
of source industry			[0.553]	
Unfilled vacancy rate				0.034
of destination industry *100				[0.021]
Unfilled vacancy rate				-0.013
of source industry *100				[0.024]
Observations	3,532	3,949	3,589	3,646
R-squared	0.447	0.45	0.454	0.456

Note: Linear regression of log annual earnings after job change. Control variables omitted from the table include age and squared age, log earnings of the previous job, dummy variables for year of obtaining the current job, year of the survey, industry of current and previous jobs, and education. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table 5 Changes in earnings after job changes, including intra-industry moves, and differences in required tasks before and after the job change

	All			
	(1)	(2)	(3)	(4)
Inter-industry move (dummy)	-0.100***	-0.019	-0.036**	-0.012
	[0.015]	[0.031]	[0.018]	[0.034]
Task distance between the		-0.039***		-0.012
source & destination industries		[0.013]		[0.014]
Task distance between current and			-0.022***	-0.022***
previous jobs (based on occupations)			[0.003]	[0.003]
Transaction index between the	0.075***	0.051*	0.085***	0.077**
source & destination industries	[0.028]	[0.029]	[0.031]	[0.032]
Observations	7,667	7,667	5,971	5,971
R-squared	0.627	0.627	0.63	0.63
	Male			
	(5)	(6)	(7)	(8)
Inter-industry move (dummy)	-0.072***	-0.020	-0.021	-0.005
	[0.018]	[0.034]	[0.023]	[0.039]
Task distance between the		-0.024*		-0.008
source & destination industries		[0.013]		[0.014]
Task distance between current and			-0.016***	-0.016***
previous jobs (based on occupations)			[0.003]	[0.003]
Transaction index between the	0.048	0.04	0.061	0.058
source & destination industries	[0.035]	[0.035]	[0.039]	[0.038]
Observations	3,681	3,681	2,729	2,729
R-squared	0.666	0.666	0.7	0.7
	Female			
	(9)	(10)	(11)	(12)
Inter-industry move (dummy)	-0.089***	-0.015	-0.023	-0.038
	[0.025]	[0.052]	[0.028]	[0.057]
Task distance between the		-0.036		0.008
source & destination industries		[0.024]		[0.026]
Task distance between current and			-0.024***	-0.024***
previous jobs (based on occupations)			[0.004]	[0.004]
Transaction index between the	0.112***	0.084*	0.120***	0.127**
source & destination industries	[0.041]	[0.046]	[0.045]	[0.051]
Observations	3,986	3,986	3,242	3,242
R-squared	0.45	0.45	0.46	0.46

Note: Linear regression of log annual earnings after job change. Control variables omitted from the table include age and squared age, log earnings of the previous job, dummy variables for year of obtaining the current job, year of the survey, industry of current and previous jobs, and education. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively. The sample sizes of columns (3), (4), (7), (8), (11) and (12) are smaller than the other columns because some of the occupation codes in the Working Person Survey do not fit to any occupation in JILPT (2012) and thus we were unable to calculate task distance based on actual occupations for them.

Table 6a Task distance between the source and destination industries and earnings change; by age at the time of getting the current job (reference: 35-44 years old)

	Y=Task distance bet S&D industries			Y=log(earnings)		
	All	Male	Female	All	Male	Female
Age: 25 or younger	0.079*	0.408***	-0.211***	-0.002	-0.082**	0.168***
	[0.046]	[0.066]	[0.064]	[0.028]	[0.036]	[0.044]
Age: 25-34	-0.044	0.125**	-0.165***	0.051**	-0.002	0.166***
	[0.035]	[0.052]	[0.048]	[0.021]	[0.021]	[0.038]
Age: 45-54	-0.064	-0.038	-0.078	-0.029	-0.087***	-0.002
	[0.043]	[0.067]	[0.056]	[0.027]	[0.029]	[0.045]
Age 55-59	0.028	0.190*	-0.085	-0.166***	-0.341***	0.054
	[0.077]	[0.106]	[0.114]	[0.049]	[0.061]	[0.076]
Task distance between the				-0.090***	-0.036***	-0.098***
source & destination industries				[0.010]	[0.011]	[0.015]
Task distance*				0.084***	0.030	0.096***
Age: 25 or younger				[0.015]	[0.019]	[0.022]
Task distance*				0.039***	0.000	0.03
Age: 25-34				[0.012]	[0.013]	[0.019]
Task distance*				0.011	-0.058***	0.033
Age: 45-54				[0.016]	[0.020]	[0.023]
Task distance*				-0.011	-0.063	-0.036
Age 55-59				[0.030]	[0.042]	[0.042]
Observations	9,278	4,297	4,981	8,563	4,017	4,546
R-squared	0.018	0.011	0.003	0.598	0.64	0.39

Note: Variables omitted from the table: male dummy (all) in task distance regressions and male dummy (all) and log earnings of the previous jobs in earnings regressions. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table 6b Task distance between the source and destination industries and earnings change; by education (reference: vocational school, jr college and technical college)

	Y=Task distance bet S&D industries			Y=log(earnings)		
	All	Male	Female	All	Male	Female
High School or less	0.164***	0.138**	0.184***	-0.042**	0.012	-0.086***
	[0.034]	[0.057]	[0.043]	[0.021]	[0.023]	[0.033]
College (4year)	0.009	0.026	-0.023	0.089***	0.094***	0.112***
or more	[0.037]	[0.055]	[0.052]	[0.022]	[0.023]	[0.038]
Task distance between the				-0.065***	-0.017	-0.084***
source & destination industries				[0.009]	[0.012]	[0.012]
Task distance*				0.020*	-0.025	0.041**
High School or less				[0.012]	[0.015]	[0.017]
Task distance*				-0.013	-0.037**	-0.023
College (4year) or more				[0.013]	[0.013]	[0.014]
Observations	9,278	4,297	4,981	8,563	4,017	4,546
R-squared	0.02	0.002	0.005	0.592	0.623	0.372

Note: Variables omitted from the table: male dummy (all) in task distance regressions and male dummy (all) and log earnings of the previous jobs in earnings regressions. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table 6c Task distance between the source and destination industries and earnings change; by the reasons why the respondent quit the previous job (reference: discontent with the previous job)

	Y=Task distance bet S&D industries			Y=log(earnings)		
	All	Male	Female	All	Male	Female
Involuntary quits	-0.095**	-0.129**	-0.052	-0.099***	-0.134***	-0.064*
	[0.041]	[0.055]	[0.063]	[0.021]	[0.025]	[0.036]
Family or health reason	0.317***	0.256**	0.330***	-0.518***	-0.297***	-0.547***
	[0.040]	[0.117]	[0.045]	[0.032]	[0.078]	[0.036]
For a better career	-0.068	-0.057	-0.087	0.067***	0.073***	0.047
	[0.045]	[0.058]	[0.071]	[0.020]	[0.022]	[0.039]
Task distance between the				-0.041***	-0.033***	-0.049***
source & destination industries				[0.006]	[0.007]	[0.009]
Task distance*				-0.01	-0.024	0
Involuntary termination				[0.013]	[0.017]	[0.020]
Task distance*				-0.018	-0.023	-0.009
Family or health reason				[0.015]	[0.044]	[0.017]
Task distance*				0.003	-0.009	0.022
For a better career				[0.012]	[0.014]	[0.021]
Observations	8,829	4,102	4,727	8,147	3,835	4,312
R-squared	0.027	0.003	0.016	0.636	0.627	0.463

Note: Variables omitted from the table: male dummy (all) in task distance regressions and male dummy (all) and log earnings of the previous jobs in earnings regressions. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table 7a Determinants of task distance between current and previous jobs (based on occupation); by age at the time of getting the current job (reference: 35-44 years old)

Y=task distance between current and previous jobs

	All	All	Male	Male	Female	Female
Age: 25 or younger	0.335***	0.193**	1.193***	0.633***	-0.314**	-0.207
	[0.104]	[0.095]	[0.158]	[0.146]	[0.136]	[0.128]
Age: 25-34	-0.067	-0.074	0.365***	0.163	-0.301***	-0.230**
	[0.080]	[0.075]	[0.127]	[0.115]	[0.103]	[0.099]
Age: 45-54	0.038	0.100	0.413**	0.357**	-0.157	-0.044
	[0.100]	[0.095]	[0.174]	[0.160]	[0.121]	[0.118]
Age 55-59	-0.091	-0.063	0.563**	0.357	-0.526**	-0.392*
	[0.181]	[0.176]	[0.279]	[0.269]	[0.234]	[0.230]
Task distance between the		1.039***		1.147***		0.947***
source & destination industries		[0.022]		[0.034]		[0.028]
Observations	8,152	7,276	3,503	3,198	4,649	4,078
R-squared	0.005	0.239	0.016	0.28	0.003	0.207

Note: Variables omitted from the table: male dummy (all). *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table 7b Determinants of task distance between current and previous jobs (based on occupation); by education (reference: vocational school, jr college and technical college)

Y=task distance between current and previous jobs

	All	All	Male	Male	Female	Female
High School or less	0.322***	0.106	0.225	0.004	0.351***	0.143
	[0.078]	[0.071]	[0.140]	[0.119]	[0.093]	[0.089]
College (4year)	-0.129	-0.127	-0.350***	-0.375***	0.064	0.11
or more	[0.085]	[0.080]	[0.135]	[0.119]	[0.113]	[0.111]
Task distance between the		1.036***		1.156***		0.948***
source & destination industries		[0.022]		[0.033]		[0.028]
Observations	8,152	7,276	3,503	3,198	4,649	4,078
R-squared	0.007	0.239	0.008	0.279	0.003	0.206

Note: Variables omitted from the table: male dummy (all). *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table 7c Determinants of task distance between current and previous jobs (based on occupation); by the reasons why the respondent quit the previous job (reference: discontent with the previous job)

Y=task distance between current and previous jobs

	All	All	Male	Male	Female	Female
Involuntary termination	-0.134	-0.046	-0.081	0.033	-0.191	-0.123
	[0.097]	[0.093]	[0.139]	[0.128]	[0.134]	[0.136]
Family or health reason	0.542***	0.211**	0.883***	0.530**	0.497***	0.195**
	[0.089]	[0.084]	[0.288]	[0.259]	[0.096]	[0.092]
For a better career	-0.218**	-0.153	-0.245*	-0.202*	-0.179	-0.076
	[0.102]	[0.094]	[0.138]	[0.121]	[0.153]	[0.150]
Task distance between the		1.036***		1.156***		0.946***
source & destination industries		[0.022]		[0.034]		[0.029]
Observations	7,727	6,926	3,332	3,057	4,395	3,869
R-squared	0.01	0.24	0.005	0.275	0.01	0.21

Note: Variables omitted from the table: male dummy (all). *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table 8a Earnings change due to differences in required tasks between current and previous jobs; by age at the time of getting the current job (reference: 35-44 years old)

	All	All	Male	Male	Female	Female
Task distance between current and	-0.042***	-0.029***	-0.017***	-0.012*	-0.048***	-0.036***
previous jobs (based on occupations)	[0.005]	[0.006]	[0.005]	[0.007]	[0.007]	[0.008]
Task distance bet jobs *	0.035***	0.020**	0.016*	0.012	0.045***	0.029**
Age: 25 or younger	[0.008]	[0.009]	[0.009]	[0.011]	[0.011]	[0.012]
Task distance bet jobs *	0.011*	0.009	-0.004	-0.003	0.008	0.012
Age: 25-34	[0.006]	[0.007]	[0.006]	[0.008]	[0.010]	[0.011]
Task distance bet jobs *	0	-0.008	-0.030***	-0.025**	0.01	-0.001
Age: 45-54	[0.008]	[0.009]	[0.009]	[0.011]	[0.011]	[0.012]
Task distance bet jobs *	0	0.005	-0.049**	-0.044*	0.036	0.061**
Age 55-59	[0.016]	[0.018]	[0.021]	[0.023]	[0.022]	[0.026]
Task distance between the		-0.065***		-0.029*		-0.066***
source & destination industries		[0.013]		[0.015]		[0.018]
Task distance bet. industries*		0.074***		0.028		0.077***
Age: 25 or younger		[0.019]		[0.027]		[0.024]
Task distance bet. industries *		0.034**		0.015		0.017
Age: 25-34		[0.016]		[0.018]		[0.023]
Task distance bet. industries *		0.021		-0.026		0.029
Age: 45-54		[0.020]		[0.025]		[0.026]
Task distance bet. industries *		0.019		0.012		-0.041
Age 55-59		[0.037]		[0.054]		[0.050]
Observations	7,522	6,722	3,269	2,991	4,253	3,731
R-squared	0.587	0.599	0.662	0.666	0.391	0.401

Note: Variables omitted from the table: log earnings of the previous jobs, dummies for age categories, male dummy (all). *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table 8b Earnings change due to differences in required tasks between current and previous jobs; by education (reference: vocational school, jr college and technical college)

	All	All	Male	Male	Female	Female
Task distance between current and	-0.038***	-0.032***	-0.016***	-0.019***	-0.048***	-0.041***
previous jobs (based on occupations)	[0.005]	[0.006]	[0.005]	[0.007]	[0.006]	[0.007]
Task distance bet jobs *	0.017***	0.022***	0.001	0.012	0.024***	0.029***
High School or less	[0.006]	[0.007]	[0.007]	[0.009]	[0.009]	[0.010]
Task distance bet jobs *	0	0.002	-0.018***	-0.008	0.004	0.007
College (4year) or more	[0.006]	[0.007]	[0.007]	[0.008]	[0.010]	[0.012]
Task distance between the		-0.032***		0.009		-0.045***
source & destination industries		[0.012]		[0.015]		[0.015]
Task distance bet. industries *		-0.002		-0.038*		0.011
High School or less		[0.015]		[0.021]		[0.020]
Task distance bet. industries *		-0.01		-0.036**		-0.02
College (4year) or more		[0.015]		[0.018]		[0.024]
Observations	7,522	6,722	3,269	2,991	4,253	3,731
R-squared	0.585	0.595	0.648	0.653	0.38	0.387

Note: Variables omitted from the table: log earnings of the previous jobs, dummies for high school and college education, male dummy (all). *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table 8c Earnings change due to differences in required tasks between current and previous jobs; by the reasons why the respondent quit the previous job (reference: discontent with the previous job)

	All	All	Male	Male	Female	Female
Task distance between current and	-0.023***	-0.019***	-0.018***	-0.014***	-0.028***	-0.025***
previous jobs (based on occupations)	[0.003]	[0.003]	[0.003]	[0.004]	[0.005]	[0.006]
Task distance bet jobs *	-0.005	-0.003	-0.011	-0.009	0.001	0.001
Involuntary termination	[0.006]	[0.007]	[0.007]	[0.009]	[0.010]	[0.011]
Task distance bet jobs *	-0.015**	-0.008	-0.046**	-0.052**	-0.009	0.000
Family or health reason	[0.008]	[0.009]	[0.019]	[0.024]	[0.009]	[0.010]
Task distance bet jobs *	0.007	0.008	-0.003	0.000	0.024**	0.023**
For a better career	[0.006]	[0.007]	[0.007]	[0.009]	[0.010]	[0.011]
Task distance between the		-0.023***		-0.016*		-0.027**
source & destination industries		[0.007]		[0.010]		[0.011]
Task distance bet. industries*		-0.005		-0.006		-0.008
Involuntary termination		[0.014]		[0.021]		[0.021]
Task distance bet. industries *		-0.004		0.05		-0.001
Family or health reason		[0.018]		[0.059]		[0.021]
Task distance bet. industries *		-0.001		-0.002		0.000
For a better career		[0.015]		[0.018]		[0.023]
Observations	7,122	6,395	3,105	2,857	4,017	3,538
R-squared	0.633	0.641	0.65	0.655	0.474	0.477

Note: Variables omitted from the table: log earnings of the previous jobs, dummies for reasons of quits, male dummy (all).

*, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Appendix Table A1 Sources and definitions of variables for industry performance

Variable	Definition	Data source	Method of aggregation across industries
TFP growth rate	Annual growth rate of the industry's TFP.	JIP database, RIETI. http://www.rieti.go.jp/en/database/JIP2012/index.html. 4 growth accounting > 19 TFP growth rate by sector.	Simple average.
ROA	Current profit divided by total asset.	Financial Statements Statistics of Corporations by Industry (hojinkigyotokei), Ministry of Finance.	Sum of profits divided by sum of asset.
Average monthly earnings	Average monthly earnings of the industry, including overtime pay but excluding bonus.	Basic Survey of Wage Structure, Ministry of Welfare, Labor, and Health.	Average weighted by the number of employees of each industry.
Unfilled vacancy rate	The number of "Unfilled vacancies (mijusoku kyujin)" divided by the number of employees.	Survey of Employment Trend, Ministry of Welfare, Labor, and Health.	Sum of unfilled vacancy divided by sum of employees.

Appendix Table A2 Summary statistics of Sample from Working Person Survey used in Table A3 (including those who did not change jobs)

	All			Job changers only		
	All	Male	Female	All	Male	Female
Sample size	21,639	12,668	8,971	7,667	3,681	3,986
Earnings as of survey	429.6	559.3	242.7	333.1	463.2	210.7
Age in 2000	30.4	30.7	30.0	30.0	29.2	30.6
Education						
Jr. High School	3.26%	3.72%	2.61%	3.3%	4.59%	2.11%
High school	30.32%	27.8%	33.86%	31.98%	29.34%	34.42%
Vocational college (1-3yr)	14.15%	12.09%	17.05%	17.26%	15.65%	18.74%
Junior college (2yr; AA equivalent)	8.26%	1.02%	18.48%	11.13%	1.28%	20.22%
Kosen (Tech college; AA equivalent)	1.55%	2.41%	0.33%	1.54%	2.74%	0.43%
College (4year)	38.44%	47.27%	25.97%	31.96%	41.84%	22.83%
Graduate school	4.03%	5.7%	1.68%	2.84%	4.56%	1.25%
Job changers	35.4%	29.1%	44.4%	-	-	-

Appendix Table A3 Determinants of job changes and inter-industry move

	All		Male		Female	
Dept. var	Job change	Inter-ind. Move	Job change	Inter-ind. move	Job change	Inter-ind. move
Female	0.184***	0.190***				
	[0.007]	[0.007]				
ageU15	-0.239***	-0.139***	-0.078***	0.005	-0.429***	-0.307***
(as of 2000)	[0.015]	[0.014]	[0.019]	[0.017]	[0.022]	[0.022]
age15_19	-0.014	0.001	0.126***	0.116***	-0.195***	-0.152***
(as of 2000)	[0.013]	[0.012]	[0.016]	[0.014]	[0.019]	[0.020]
age20_24	0.122***	0.071***	0.219***	0.155***	-0.019	-0.052**
(as of 2000)	[0.012]	[0.012]	[0.016]	[0.014]	[0.019]	[0.020]
age25_29	0.089***	0.046***	0.169***	0.101***	-0.027	-0.034*
(as of 2000)	[0.012]	[0.011]	[0.015]	[0.013]	[0.019]	[0.020]
age30_34	0.048***	0.024**	0.073***	0.032***	0.019	0.022
(as of 2000)	[0.012]	[0.011]	[0.015]	[0.012]	[0.019]	[0.021]
age40_44	-0.033**	-0.022*	-0.002	-0.007	-0.087***	-0.051**
(as of 2000)	[0.013]	[0.012]	[0.016]	[0.013]	[0.021]	[0.022]
age45_49	-0.041***	-0.035***	0.058***	0.039***	-0.185***	-0.142***
(as of 2000)	[0.013]	[0.012]	[0.016]	[0.013]	[0.021]	[0.021]
age50_54	-0.110***	-0.089***	0.027	0.016	-0.311***	-0.243***
(as of 2000)	[0.019]	[0.016]	[0.023]	[0.019]	[0.031]	[0.029]
Junior HS	0.073***	0.005	0.090***	0.028	0.052*	-0.013
	[0.019]	[0.018]	[0.024]	[0.022]	[0.030]	[0.033]
Vocational	-0.018*	-0.041***	-0.001	-0.026**	-0.031**	-0.052***
(after HS)	[0.011]	[0.010]	[0.015]	[0.013]	[0.015]	[0.016]
Jr college	-0.016	0.003	0.02	0.027	-0.043***	-0.028*
	[0.013]	[0.013]	[0.041]	[0.038]	[0.014]	[0.015]
Tech college	-0.022	-0.031	-0.003	0.007	0.036	-0.091
	[0.027]	[0.024]	[0.029]	[0.025]	[0.083]	[0.084]
College	-0.158***	-0.109***	-0.124***	-0.070***	-0.177***	-0.145***
	[0.008]	[0.008]	[0.010]	[0.009]	[0.014]	[0.014]
Grad school	-0.209***	-0.162***	-0.175***	-0.128***	-0.259***	-0.201***
	[0.017]	[0.014]	[0.019]	[0.015]	[0.041]	[0.038]
Observations	21,639	21,639	12,668	12,668	8,971	8,971
R-squared	0.158	0.109	0.111	0.067	0.135	0.102

Note: Linear regressions with controls for initial industry dummies. Standard errors are in brackets. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively. Reference group for education is high school.

Appendix Table A4a Determinants of separation and hiring rates (Male)

	Separation rate				Hiring rate			
Age 15-19	14.515***	14.114***	15.099***	15.631***	68.820***	68.517***	74.049***	73.311***
	[1.283]	[1.275]	[1.222]	[1.156]	[1.364]	[1.352]	[1.708]	[1.641]
Age 20-24	11.301***	11.223***	11.296***	11.332***	28.234***	28.910***	29.743***	29.731***
	[1.277]	[1.269]	[1.216]	[1.151]	[1.357]	[1.345]	[1.700]	[1.634]
Age 25-29	6.255***	6.488***	6.390***	6.325***	8.070***	8.583***	8.938***	8.541***
	[1.277]	[1.269]	[1.216]	[1.151]	[1.357]	[1.345]	[1.700]	[1.634]
Age 30-34	2.709**	2.841**	2.823**	2.482**	2.708**	2.788**	2.814*	2.815*
	[1.277]	[1.269]	[1.216]	[1.151]	[1.357]	[1.345]	[1.700]	[1.634]
Age 40-44	-0.72	-0.872	-0.838	-1.043	-1.142	-1.386	-1.35	-1.355
	[1.277]	[1.269]	[1.216]	[1.151]	[1.357]	[1.345]	[1.700]	[1.634]
Age 45-49	-0.523	-0.719	-0.791	-0.947	-1.606	-1.791	-1.803	-1.77
	[1.277]	[1.269]	[1.216]	[1.151]	[1.357]	[1.345]	[1.700]	[1.634]
Age 50-54	-0.143	-0.374	-0.534	-0.568	-2.491*	-2.782**	-2.494	-2.452
	[1.277]	[1.269]	[1.216]	[1.151]	[1.357]	[1.345]	[1.700]	[1.634]
Age 55-59	0.944	0.667	0.692	0.899	-2.125	-2.315*	-2.131	-1.827
	[1.277]	[1.269]	[1.216]	[1.151]	[1.357]	[1.345]	[1.700]	[1.634]
TFP	4.922				16.124			
	[13.203]				[14.037]			
ROA		-0.339				0.536*		
		[0.283]				[0.300]		
Log average earnings			25.440*				22.099	
			[15.424]				[21.549]	
Unfilled vacancy rate				0.123				1.15
				[0.572]				[0.812]
Observations	1,482	1,482	1,527	1,743	1,482	1,482	1,527	1,743
R-squared	0.29	0.292	0.309	0.325	0.778	0.782	0.714	0.701

Note: Data for separation and hiring rates are taken from Employment Trend Surveys 2004-2008. Linear regressions with controls for industry dummies and year dummies. Standard errors are in brackets. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Appendix Table A4b Determinants of separation and hiring rates (Female)

	Separation rate				Hiring rate			
Age 15-19	7.107***	7.439***	7.575***	7.822***	66.429***	63.559***	63.437***	65.444***
	[1.325]	[1.308]	[1.200]	[1.198]	[1.815]	[1.513]	[1.443]	[1.626]
Age 20-24	8.817***	9.166***	8.919***	8.945***	17.224***	17.350***	17.492***	18.149***
	[1.302]	[1.288]	[1.190]	[1.180]	[1.784]	[1.490]	[1.431]	[1.602]
Age 25-29	9.095***	9.211***	9.247***	9.253***	3.439*	3.350**	3.526**	3.806**
	[1.302]	[1.288]	[1.190]	[1.180]	[1.784]	[1.490]	[1.431]	[1.602]
Age 30-34	2.589**	2.606**	2.720**	2.945**	0.369	0.618	0.991	0.473
	[1.302]	[1.288]	[1.190]	[1.180]	[1.784]	[1.490]	[1.431]	[1.602]
Age 40-44	-3.170**	-3.168**	-2.845**	-2.918**	-3.883**	-3.899***	-4.104***	-3.381**
	[1.302]	[1.288]	[1.190]	[1.180]	[1.784]	[1.490]	[1.431]	[1.602]
Age 45-49	-3.881***	-3.839***	-4.538***	-4.049***	-7.339***	-7.185***	-6.737***	-7.044***
	[1.302]	[1.288]	[1.190]	[1.180]	[1.784]	[1.490]	[1.431]	[1.602]
Age 50-54	-5.252***	-5.120***	-4.774***	-5.017***	-10.860***	-10.661***	-10.033***	-10.150***
	[1.302]	[1.288]	[1.190]	[1.180]	[1.784]	[1.490]	[1.431]	[1.602]
Age 55-59	-5.263***	-5.065***	-4.816***	-4.897***	-12.436***	-12.151***	-11.667***	-11.479***
	[1.302]	[1.288]	[1.190]	[1.180]	[1.784]	[1.490]	[1.431]	[1.602]
TFP	9.954				-3.781			
	[13.514]				[18.512]			
ROA		-0.152				-0.101		
		[0.289]				[0.335]		
Log average earnings			-15.743				-14.235	
			[15.093]				[18.147]	
Unfilled vacancy rate				-0.316				-0.855
				[0.584]				[0.793]
Observations	1,475	1,476	1,525	1,736	1,475	1,476	1,525	1,736
R-squared	0.307	0.314	0.333	0.339	0.677	0.737	0.747	0.686

Note: Data for separation and hiring rates are taken from Employment Trend Surveys 2004-2008. Linear regressions with controls for industry dummies and year dummies. Standard errors are in brackets. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.