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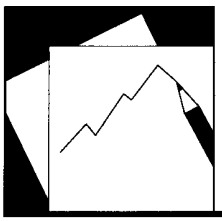

IMF Working Paper

Is Labor Market Mismatch a Big Deal in Japan?

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Is Labor Market Mismatch a Big Deal in Japan?

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Abstract

Despite its low unemployment rate, the recent shift in the Japanese Beveridge curve indicates increased labor mismatch. This paper quantifies the age, employment-type (full or part-time), and occupational mismatch in the Japanese labor market following Sahin and others (2013). Between April 2000 and April 2013, the age mismatch has steadily declined while the occupational and employmenttype mismatch has shown a countercyclical pattern, showing a sharp increase during the global financial crisis. Occupational mismatch accounted for approximtely 20-40 percent of the recent rise in the unemployment rate in Japan. The magnitude was comparable to that of the U.K. and the U.S.

JEL Classification Numbers: E24, J23, J63, J64

Keywords: mismatch, vacancies, unemployment, Japanese labor market

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[1] Department of Economics, The University of Chicago. This paper was prepared during my summer internship at the Asia and Pacific Department, IMF in 2013. I am indebted to Dennis Botman, Stephan Danninger, Raphael Lam, and Ikuo Saito for their suggestions and support for this research project. I would also like to thank participants in a seminar held at the International Monetary Fund for their helpful comments.

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I. Introduction

The unemployment rate in Japan has been low but steadily increased in the last three decades. The 10-year average unemployment rate rose from 2.5 percent in the 1980s, to 3 percent in the 1990s, and to 4.7 percent in the 2000s (Figure 1). Nonetheless, among advanced economies, the Japanese unemployment rate has historically been low (Figure 1). It stayed well below 4 percent prior to the 1997 recession in Japan and has risen modestly by 1.2 percent to around 5 percent since then-even through the 2008 global financial crisis. The corresponding unemployment rates in the U.K. and in the U.S. have increased by 4.7 percent and 2.1 percent, respectively, between 2006 and 2009. This low unemployment rate is sometimes cited as reflecting a sound labor market in Japan (e.g lifetime employment and job security).[1]

Since the late 1990s, however, the Beveridge curve in Japan has shifted outward, suggesting a potential increase in labor market mismatch (Figure 2). The Beveridge curve describes the relationship between the job vacancy rate and the unemployment rate. Business cycles are shown as movement along the Beveridge curve. Recessions are usually times of high unemployment rates and low vacancy rates while economic booms are those of high vacancy rates and a low unemployment. An outward shift of the Beveridge curve suggests an increased mismatch that is, unemployed workers are not matched to existing job vacancies owing to skill and other mismatches.

The goal of this paper is to systematically measure mismatches in the Japanese labor market. First, we calculate the mismatch across age groups, occupation, and employment-type (full time versus part time) in Japan and track the evolution of their severity for the period between April 2000 and April 2013 by applying the methodology developed by Sahin et al. (2013).[2] Second, we measure how much the types of mismatch have contributed to the rise in the Japanese unemployment rate during the global financial crisis.

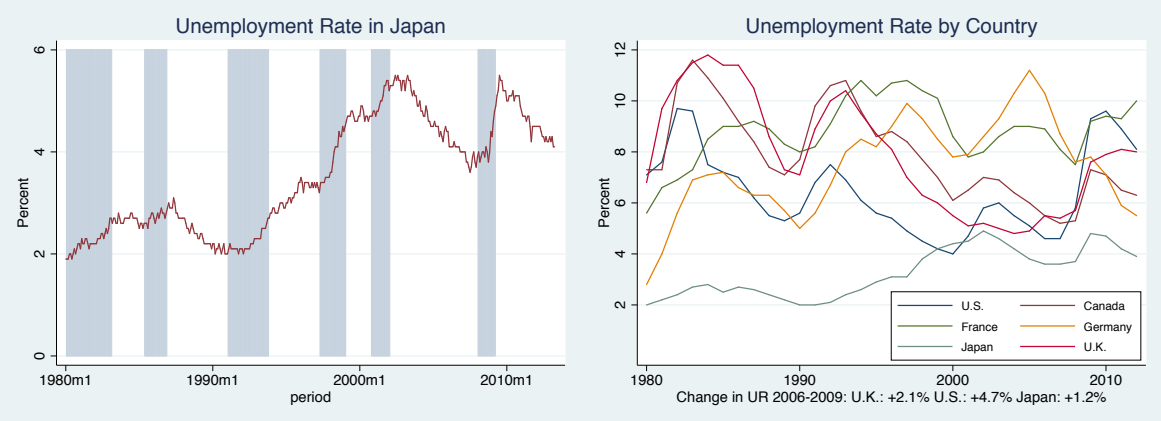
Empirical estimates suggest that the age mismatch has steadily declined, while both the occupational and employment-type mismatch show a countercyclical pattern. For instance, the occupational mismatch increased sharply by about 1.5 to 2-fold during the 2008 global financial crisis and has stayed relatively high since then. The occupational mismatch accounted for a significant portion (20-40 percent) of the recent rise in the unemployment rate, and its magnitude is comparable to that of the U.K. (Patterson et al. 2013) and the U.S. (Sahin et al. 2013).

The analytical results are generally robust but are subject to a few limitations. The analysis accounts for heterogeneity in matching efficiency across markets (e.g., different occupations) but assumes homogeneity in productivities and job separation rates across submarkets due to data limitations. While such simplifications may affect

[1]For instance, Steinberg and Nakane (2011) argue that the smaller increase in the unemployment rate in Japan during recessions relative to other countries can be partially explained by more flexible wage payments; an employment subsidy program; and a corporate governance structure that prioritizes workers' rights over those of shareholders'.

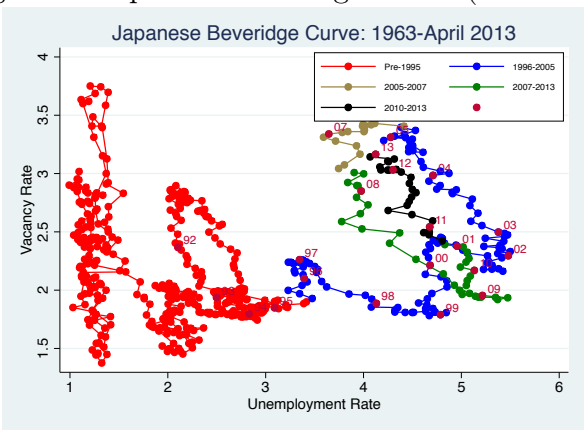
[2]While mismatch measures between male and female workers, regular and nonregular workers, and prefectures (geography) are also of interest, the limitations on hiring data in these categories prevented us from conducting the analysis.

Figure 1: Unemployment Rates



Sources: Ministry of Internal Affairs and Communications in Japan (MIAC) and Organization of Economic Corporation and Development (OECD)

Figure 2: Japanese Beveridge Curve (1963-2013)



Sources: Vacancies are obtained from the Ministry of Labour, Health and Welfare (MLHW). The labor force data (unemployed counts, employed counts, and unemployment rates) are obtained from the Ministry of Internal Affairs and Communications (MIAC).

our results, the U.S. evidence in Sahin et al. (2013) shows that effects of differences in these assumptions are rather small.[3]

In light of the empirical results, policy measures to address occupational mismatch could build on existing training programs and matching process. Structural reforms to further promote the flexibility in the labor market in Japan could add job mobility across occupations over the long term. Although this paper does not provide definitive policy recommendations, the government policies targeted at reducing occupational mismatch could lower the recent increase in the unemployment rate and potentially raise the economy's growth potentials.

This paper is organized as follows. Section II reviews existing literature, and Section

[3]For instance, the endogenous vacancy tends to magnify the contribution of mismatch to the rise in the unemployment rate than the exogenous case, but the difference in magnitudes is small. See Sahin et al. (2013) for more details.

III describes the data. Section IV explains the empirical strategy to measure mismatch in the Japanese labor market and how that contributes to the rise in the unemployment rate. Section V presents the empirical results, and Section VI concludes and discusses potential policy measures.

II. Literature

The present paper is related to the literature that investigates labor mismatch in Japan. Ito et al. (2009), for instance, studied the Japanese Beveridge curve and suggest that mismatches have increased over time in Japan. However, they did not quantify the level of mismatch and the dimensions in which such mismatch increased. Other studies (e.g., Higuchi et al., 2012) have measured a mismatch index given by the sum of the absolute distance of vacancy and unemployment share across different markets. Sato et al. (2006), for instance, use this conventional mismatch index and find that in major metropolitan prefectures, there exist excess vacancies particularly in technical and specialized occupations, causing higher mismatch. Their cross-sectional regression analysis show that mismatch is not significantly higher in the prefectures with higher unemployment rates. However, their mismatch index could be misleading as matching efficiencies in different markets are assumed to be homogenous. A higher vacancy-unemployment ratio, for instance, does not necessarily result in more matches.[4] Furthermore, this mismatch index cannot be converted to the implied loss in the unemployment rates. The present paper takes into account differences in matching efficiencies and quantifies mismatches in the Japanese labor market and can shed some lights on the views that have been suggested by these previous studies.[5]

There are several papers that quantified various dimensions of mismatch and their contributions to the changes in the unemployment rates. Sahin et al. (2013) developed a methodology to measure mismatch in various dimensions as the deviations of observed labor market outcomes from the socially efficient outcomes. For the U.S., Sahin et al. (2013) find that the occupational mismatch contributed to at most 1/3 of the rise in the unemployment rate during the Great Recession in the U.S. labor market and that the occupational mismatch is more severe than the geographical mismatch. Patterson et al. (2013) apply the same methodology to the U.K. and find that the contribution of occupational mismatch to the rise in the unemployment rate during the 2008 recession is comparable to that of the U.S. Occupational mismatch in the U.K. accounted for 1/4-1/3 of the recent rise in the unemployment rate.

III. Data

This paper uses aggregate data on the unemployment rate and the job separation rate and group level data on unemployment, vacancies, and hires. We obtain the aggregate unemployment rate from the Ministry of Internal Affairs and Communications (MIAC) in Japan and the job separation rate from *the Monthly Labour Survey* by the Ministry of Health, Labour and Welfare (MHLW). Group level data on unemployment, vacancies, and hires in Japan are obtained from *Employment Referrals for General Workers*, a survey conducted by MHLW at the public employment securities offices. The

[4] See Appendix A2 for more discussions.

[5] In Appendix A5, we compare the conventional mismatch index with our preferred mismatch indices.

Table 1: Japan: Monthly Average and Shares (Percent) of Hires, Unemployment, and Vacancies: April 2000-April 2013

		Hires	Unemployed	Vacancies
Total (Monthly Average) (level)		151,998	2,324,788	1,643,031
Age	**15-24 years old**	17.3	12.6	22.1
	25-34 years old	29.2	27.7	27.0
	35-44 years old	21.7	19.0	21.1
	45-54 years old	16.9	17.4	14.6
	55-64 years old	13.4	20.6	10.9
	65 years old and over	1.6	2.7	4.3
Employment Type	**Full-Time**	68.3	62.3	54.2
	Part-Time	31.7	37.7	45.8
Occupation	**Production processing**	34.1	31.8	26.7
	Clerks	19.2	29.0	10.6
	Professionals/Engineers	16.3	13.4	23.2
	Sales	10.5	12.7	15.5
	Services	10.2	7.2	15.0
	Transportation,information, communications	5.9	4.1	5.4
	Defense	2.5	0.8	2.9
	Agricultural,forestry, fishery	1.0	0.5	0.5
	Managers	0.2	0.4	0.2

Source: Ministry of Health Labour, and Welfare; and author's calculations.

data contain disaggregate information on hires, vacancies, and unemployment counts by different occupational categories, age groups, and full-time and part-time workers.[6]

The occupational classification has changed several times in Japan, and it is therefore challenging to make a consistent measure of mismatch index for a long period of time. Therefore, we use data at nine disaggregated occupation levels based on the classification revision in 1999; the data cover the period between April 2000 to April 2013. As a robustness check, we repeat the analysis based on a more disaggregated level of 65 occupational categories. In calculating age mismatch, we use six 10 year-age brackets: 15-24, 25-34, 35-44, 45-54, 55-64, and 65 years old and over. The age data cover the period from January 1996 to April 2013. The data on full-time versus part-time workers date back to January 1972 (Appendix A1). Availability of the disaggregate labor market data limit the analysis to the period from April 2000 to April 2013.

Table 1 summarizes the data used in this paper: the average monthly number of hires, unemployed, and vacancies and each group's shares between April 2000 and April 2013. On average, there are 2.3 million unemployed workers and 1.6 million vacancies in a month, resulting in about 0.15 million monthly hires. Percentage shares by age groups show that the share of hires is greater than their respective share of unemployment for younger age groups (15-24, 25-34, 35-44 years old) than for older

[6]See Appendix A1 for the detailed information on the data.

age groups (45-54, 55-64, and 65 years and older). This implies that while there are relatively more older unemployed workers who are searching for jobs, their younger counterparts tend to be hired disproportionately. Shares by employment type show that full-time workers are disproportionately hired more than part-time workers. In particular, while 62.3 percent of unemployed workers are looking for full-time positions, 68.3 percent of the hirings are for full-time workers. Lastly, some occupation types have disproportionately higher shares of hires relative to their corresponding shares of unemployed workers (production processing occupations, professionals and engineers, services, transportation, information and communications, defense, and agricultural, forestry, and fishery) than others (clerks, sales, and managers). Nonetheless, the shares reported in Table 1 are the average values between April 2000 and April 2013 and do not indicate any changes over this period. A more extensive review of the data, including the vacancy-unemployment ratios, job-finding rates, and vacancy yields is in Appendix A2.

IV. Empirical Strategy

Our empirical strategy has two steps. First, we measure mismatch in the Japanese labor market from occupation types, age groups, and full-time or part-time jobs. Second, we measure the contribution of mismatch to changes in the unemployment rate in Japan by calculating the counterfactual unemployment rate in the absence of mismatch. The following subsections provide a brief summary of how mismatch indices under various assumptions and the counterfactual unemployment rate are calculated.

A. Mismatch Index

We measure mismatch for the Japanese economy following Sahin et al. (2013). Their mismatch index is a measure of the fraction of hires foregone due to a particular dimension of mismatch (e.g., age, employment-type, and occupation). Suppose there are I islands in the economy (e.g., occupation, age, and full-time or part-time positions) with a given number of vacancies and island-specific and aggregate matching efficiencies. On each island, the number of matches is determined by a matching function:

$$h_{it}(v_{it}, u_{it}) = \Phi_t \phi_{it} v_{it}^{\alpha} u_{it}^{1-\alpha}$$

where ϕ_{it} is the island-specific matching efficiency, Φ_t is the aggregate matching efficiency, v_{it} is the number of vacancies, and u_{it} is the number of unemployed on the island i in period t. We compute island-specific matching efficiencies, ϕ_{it}, and the vacancy share, α, by estimating the matching function using various specifications, including the GMM by Borowczyk-Martins et al. (2013) (Appendix A3). Vacancy share, α, is set to be 0.4.[7] Taking as given the aggregate and island-specific matching efficiency (Φ_t and ϕ_{it}), vacancy share (α), and vacancies (v_{it}), a social planner maximizes the total output in the economy by distributing a given number of unemployed workers to each island in the most efficient way.[8] The deviation of the hires in the data from

[7] Please see footnote 13 for sensitivity analysis regarding the parameter value of vacancy share, α.

[8] Due to data limitations, island-specific productivity and job separation rates are assumed to be the same across islands unlike the full-fledged model in Sahin et al. (2013). Efficient allocation by the social planner would be the same as maximizing the total number of hires in this economy.

the efficient allocation chosen by the social planner is considered as "mismatch." Under the assumptions of homogenous productivities and job separation rates across islands, the optimal allocation of unemployed workers, u_{it}^*, must satisfy[9]

$$\phi_{it}\left(\frac{v_{it}}{u_{it}^*}\right)^{\alpha} = \phi_{jt}\left(\frac{v_{jt}}{u_{jt}^*}\right)^{\alpha} \tag{1}$$

Given the observed allocations of unemployed workers (u_{it}) and the efficient allocations of unemployed workers (u_{it}^*) in each island, the observed total number of hires (h_t) and its efficient counterpart (h_t^*) in the economy in month t can be expressed as

$$h_t = \Phi_t v_t^{\alpha} u_t^{1-\alpha}\left[\sum_{i\in I}\phi_{it}\left(\frac{v_{it}}{v_t}\right)^{\alpha}\left(\frac{u_{it}}{u_t}\right)^{1-\alpha}\right] \tag{2}$$

$$h_t^* = \Phi_t v_t^{\alpha} u_t^{1-\alpha}\left[\sum_{i\in I}\phi_{it}\left(\frac{v_{it}}{v_t}\right)^{\alpha}\left(\frac{u_{it}^*}{u_t}\right)^{1-\alpha}\right] \tag{3}$$

By substituting the optimality condition (1) into (3), we obtain the mismatch index as follows:

$$M_{\phi t} = \frac{h_t^* - h_t}{h_t^*} = 1 - \sum_{i=1}^{I}\left(\frac{\phi_{it}}{\bar{\phi}_t}\right)\left(\frac{v_{it}}{v_t}\right)^{\alpha}\left(\frac{u_{it}}{u_t}\right)^{1-\alpha} \tag{4}$$

where $\bar{\phi}_t = \left[\sum_{i\in I}\phi_{it}^{\frac{1}{\alpha}}\left(\frac{v_{it}}{v_t}\right)\right]^{\alpha}$ and ϕ_{it} is the island-specific efficiency.

In the absence of heterogeneity in matching efficiency, the mismatch index would simply be

$$M_t = 1 - \frac{h_t}{h_t^*} = 1 - \sum_{i=1}^{I}\left(\frac{v_{it}}{v_t}\right)^{\alpha}\left(\frac{u_{it}}{u_t}\right)^{1-\alpha} \tag{5}$$

The mismatch indices, M_ϕ and M, measure the fractions of the hires lost because of mismatch.[10] To calculate the mismatch index described above, we need data for the following variables: (1) vacancies (v_i), (2) hires (h_i), and (3) unemployment (u_i). We would also need to estimate market-specific matching efficiencies (ϕ_{it}) and vacancy share (α) using matching functions (Appendix A3).

For comparison, the following conventional mismatch index is calculated as in Jackman and Roper (1987) and by the statistical bureau.

$$M_{st} = \frac{1}{2}\sum_{i\in I}\left|\frac{v_{it}}{v_t} - \frac{u_{it}}{u_t}\right| \tag{6}$$

The mismatch index (6) only requires data on vacancies and unemployment, its measure is less accurate as it does not take into account vacancy share (α) and matching efficiencies (ϕ_{it}).

[9]The optimal condition under heterogeneous productivity and job separations is shown in Appendix A4.

[10]It is important to note that the mismatch index is weakly increasing in the level of desegregation. It is therefore more relevant to focus on how it evolves over time. In this paper, we focus on how the unemployment rate was impacted by a particular dimension of labor mismatch during the recent global financial crisis.

There are three main advantages in the proposed mismatch indices M_ϕ and M over the simple mismatch index, M_s. First, higher vacancy-unemployment ratios do not necessarily translate into a greater number of observed matches and thus may provide misleading implications (Appendix A2). Second, our preferred mismatch indices, M_ϕ and M, have a clearer interpretation than the simple mismatch, M_s. Lastly, the mismatch index in the theory-based approach accounts for its contribution to the rise in the unemployment rates owing to mismatch.

B. Mismatch Unemployment

Given the initial level of unemployment chosen by the social planner, u_0^*, we can then obtain the sequence of the counterfactual unemployment rate by iterating forward on the following law of motion for the unemployment rate:

$$u_{t+1}^* = (1 - s_t - f_t^*)u_t^* + s_t$$

where s_t is the job separation rate from the data and f_t^* is the counterfactual job-finding rate which, in turn, is given by

$$f_t^* = f_t \frac{1}{1 - M_{\phi t}} \left(\frac{u_t}{u_t^*} \right)^\alpha$$

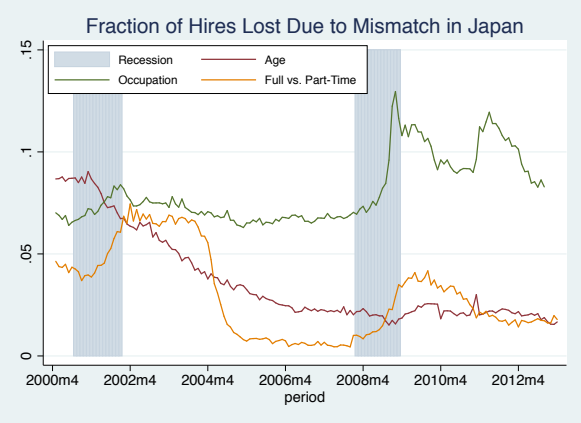
Note f_t is the observed job-finding rate from the data. Since mismatch index $M_{\phi t}$ is between 0 and 1, and the ratio of observed to counterfactual unemployment, $\frac{u_t}{u_{*t}}$, is greater than 1, the counterfactual job-finding rate, f_t^*, is always higher than the observed job-finding rate f_t, generating lower counterfactual unemployment rates. The difference between the actual and counterfactual unemployments, $u_t - u_t^*$, is the unemployment rate accounted for by mismatch, or mismatch unemployment.

V. Empirical Results

A. Mismatch Index in Japan

This section presents the results of our preferred mismatch index (M_ϕ) across different age, employment-type, and occupations (Figure 3) and of counterfactual unemployment rates in Japan (Figure 5). While we leave the details of the comparisons of the three mismatch measures (M_ϕ, M, M_s) to Appendix A5, it is worth mentioning that the comparison provides two additional reasons for preferring our proposed mismatch to the conventional mismatch index, M_s. First, the three measures of mismatch (M_ϕ, M, M_s) generally capture similar trends over time. Second, our preferred occupational mismatch index, M_ϕ, captures the rise in the mismatch after the 2011 earthquake and tsunami in Japan while the simple mismatch index, M_s, fails to do so. Therefore, these two empirical findings provide support for using our proposed mismatch index in addition to the aforementioned advantages: our proposed mismatch index, M_ϕ, provides a clear interpretation and it can be translated into counterfactual unemployment rates.

Figure 3: Mismatch Indices by Age, Employment-Type, and Occupational Groups



- **Age mismatch has declined steadily to a modest level**

Age mismatch has declined steadily since 2001 in Japan and does not exhibit a countercyclical pattern (Figure 3). In 2000, around 9 percent of hires were lost owing to age mismatch. By 2007, this number decreased to around 2.5 percent. The decline was partly explained by the legislation in 2001 that *encouraged* firms not to set a discriminatory age requirement when hiring workers. In addition, the labor law was amended to *prohibit* a discriminatory age requirement when hiring workers in 2007 and beyond. The impact of the initial amendment in 2001 seems large.

- **Mismatch across employment types exhibits a countercyclical pattern and is increasing again**

Employment-type mismatch declined in 2004 once; increased again toward the end of the 2008 global financial crisis; then stayed higher than the pre-recession level (Figure 3). The fraction of hires lost because of the employment-type mismatch hit the peak level of 7.4 percent in April 2002 and dropped sharply from 6 percent to 1 percent in 2004. The mismatch index stayed low at around 0.5 percent until it increased again during the 2008 global financial crisis and stayed at around 3 percent thereafter. It is worth noting that a sharp decline in the employment type mismatch index in 2004 coincided with the legislation that extended the maximum length of contracts for dispatched workers from one to three years and allowed the manufacturing sector to employ dispatched workers. The new legislation could have encouraged firms to substitute full-time dispatched workers for part-time employees. It also could have encouraged unemployed part-time workers to search for full-time dispatched jobs instead, contributing to a decline in employment-type mismatch.[11]

- **Occupational mismatch seems to play a significant role**

The occupational mismatch based on 9 occupational categories increased from the 2006 average of 6.7 percent to a peak of 12.9 percent in February 2009 (Figure 3). The

[11]The data on official full-time workers (*seishain*) became available only from November 2004. Note also that full-time and part-time workers in this paper do not correspond to the regular and non-regular workers that many papers on Japan's dual-labor market discuss. Part-time and full-time are defined solely by the length of hours worked in a day or a week and are not related to their contract durations.

Figure 4: Occupational Mismatch

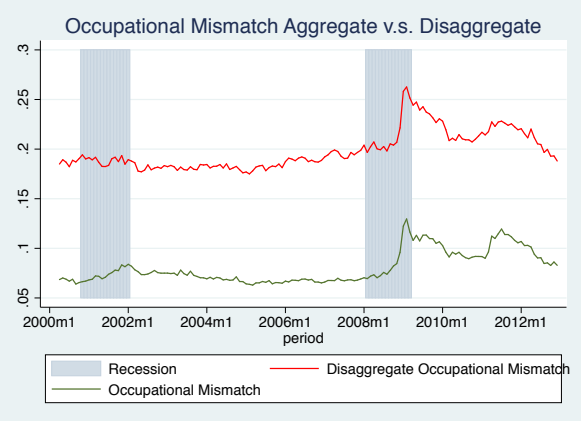


Figure 4 plots occupational mismatch indices based on 9 broad categories (green line) and 65 categories (red line).

average occupational mismatch since the 2008 recession has remained high at 10 percent on average. This means that an additional 6.2 percent of hires were lost owing to occupational mismatch during the great recession. Based on 65 occupation categories (Figure 4), the occupational mismatch index rose from the 2006 average of 19 percent to 26 percent in February 2009, showing an increase of 7 percent. Occupational mismatch has declined modestly since the 2008 recession, but it remains higher than pre-recession levels. Although the disaggregate occupational mismatch index is always higher throughout the period than the broad 9 occupational category index, both series showed a similar pattern over time.[12]

In sum, while age mismatch seems to have declined over time, employment-type and occupational mismatch showed a sharp increase during the global financial crisis, and the increase in the occupational mismatch seems particularly significant.

B. Mismatch Unemployment in Japan

The contributions of mismatch to the rise in the unemployment rate during the global financial crisis varied across various types of mismatch (Figure 5 and Table 2). The contribution of age mismatch to the increase in the unemployment rate was negligible or even negative, ranging between -0.02 to 0.01 percent out of 1.38 percent. The employment-type mismatch accounted for an approximately 0.2 percent increase in the unemployment rate. Occupational mismatch contributed 0.37 percent and 0.58 percent to the total increase in the unemployment rate based on 9 and 65 occupation

[12]Higuchi et al. (2012) studied the Japanese labor market after the Great East Japan earthquake and argue for increased mismatch in the construction sector. However, our robustness check indicates that the increase in the overall unemployment rate was not driven by one specific occupation. Specifically, our robustness check calculated mismatch unemployment separately excluding one occupational category out of nine broad occupational types at a time and checked whether that particular occupation drives the occupational mismatch. The overall mismatch index is not particularly driven by one particular occupation. We also conducted the same analysis using the 65 disaggregate occupation categories and excluding three occupations in the construction sector (construction-related machinery, construction-frame related, and construction workers) and the impact of the exclusion on the mismatch in the overall economy was negligible.

Figure 5: Actual versus Counterfactual Unemployment

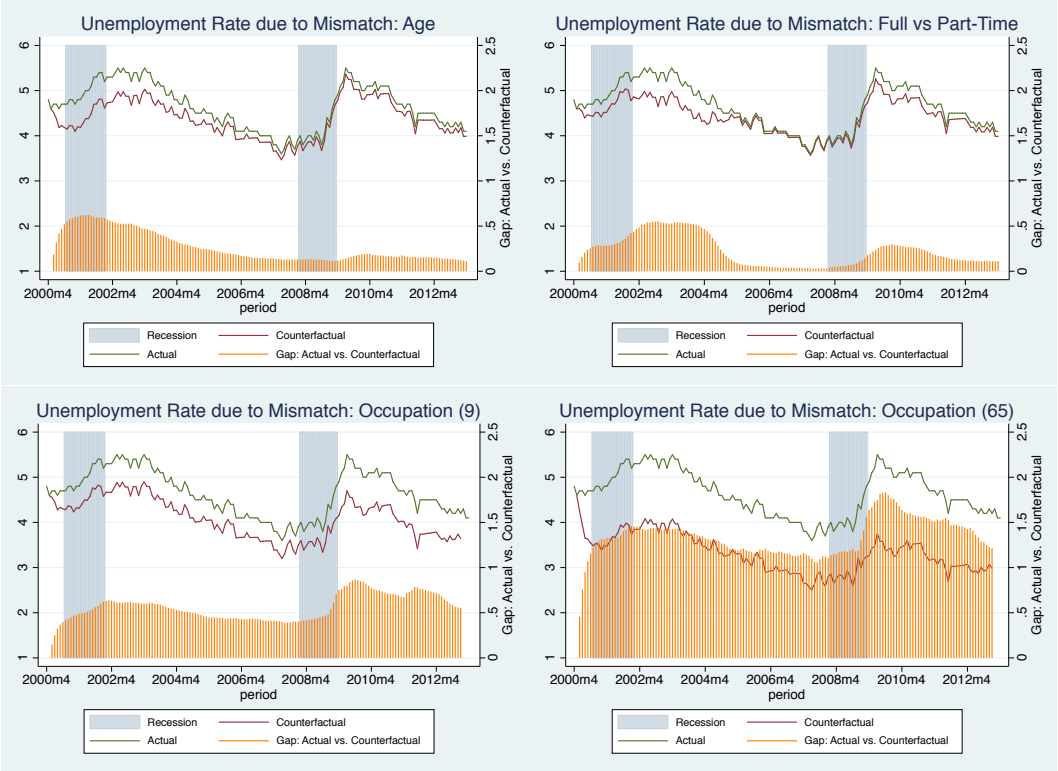


Figure 5 plots actual unemployment (green line) against counterfactual unemployment (red line) by age (top left), employment-type (top right), 9 occupational categories (bottom left) and 65 occupational categories (bottom right). The orange bars show the mismatch unemployment; that is, the difference between actual and the counterfactual unemployment.

categories, respectively. Occupational mismatch, therefore, accounted for 26.7 percent to 41.8 percent of the rise in the unemployment rate during the global financial crisis. These results are robust to the parameter value of vacancy share (α).[13] One caveat of the analysis, however, is that the contributions of various types of mismatch are not additive.[14]

Occupational mismatch in Japan is similar to that in the U.K. and the U.S. in terms of its countercyclical pattern and the magnitude of its contribution to the recent rise in unemployment.[15] Occupational mismatch in Japan increased during the most

[13]When vacancy share (α) ranges from 0.3 to 0.5, age, employment-type, and occupational mismatch explains 1.0-2.7 percent, 12.1-15.9 percent, and 24.3-32.2 percent of the rise in the unemployment rate during the global financial crisis, respectively.

[14]Note that a particular worker belongs to a particular age, employment-type, and occupational group. There could be a correlation between/among three dimensions of mismatch if a particular age group, for instance, tends to be concentrated in a particular occupational type. In this case, the occupational mismatch could be accounted for as the age mismatch, therefore overstating the age mismatch. Although such correlation would bias our estimates of the mismatch, they would not overturn our results. If there was a perfect correlation between age and occupational groups, then age and occupational mismatch should have shown the exact same patterns over time and shown the same magnitudes of mismatch. Our results, however, showed that various dimensions of mismatch have shown different patterns over the period studied and different magnitudes.

[15]Since a higher level of disaggregation mechanically increases the mismatch index, the quantitative

Table 2: Contribution of Mismatch to the Rise in the Unemployment Rate in Japan

		Contribution to Increase in Unemployment Rate (in percent)	**Percentage Explained**
Change in Unemployment Rate between 2006 and July 2009		**1.38**	-
Age	M_ϕ	-0.02	1.7
	M	0.01	0.9
Full and Part Time	M_ϕ	0.19	13.9
	M	0.06	4.0
Occupation (9)	M_ϕ	0.37	26.7
	M	0.32	23.2
Occupation (65)	M_ϕ	0.58	41.8
	M	0.32	23.2

recent recession and remained slightly higher than its pre-recession level as in the U.K and the U.S. (Patterson et al. (2013) and Sahin et al. (2013)). In the U.S., the contribution of occupational mismatch to the rise in the recent unemployment rate accounted for 11.1 to 21.3 percent based on 2-digit occupational categories and for 17.4 to 29.3 percent based on 3-digit occupation categories.[16] In the U.K., the occupational mismatch accounted for 17.1 to 18.9 percent based on 2-digit occupation categories and for 25.2 to 26.9 percent based on 3-digit occupational categories. Under various specifications, occupational mismatch in the U.K. and the U.S. accounted for 1/4-1/3 of the total rise in the unemployment rates during the global financial crisis.

Similarly in Japan, approximately 20-40 percent of the recent rise in the unemployment was due to occupational mismatch. The occupational mismatch accounted for from 23.2 to 26.7 percent of the rise in the unemployment rate during the global financial crisis based on 9 occupational categories and for 23.0 to 41.8 percent based on 65 disaggregate occupation categories. This finding suggests that, in Japan, occupational mismatch is as large an issue as it is in the U.S. and U.K. Policymakers in Japan should, therefore, be as concerned about occupational mismatch as U.S. and U.K. policymakers.

comparison of mismatch across three countries should not be taken at its face values. Moreover, while the other two papers provide the results of the two measures of mismatch, M (homogenous matching efficiency) and M_x (heterogenous matching efficiencies, productivities, and job separation rates across markets), we present the results for M and M_ϕ (heterogeneous matching efficiencies but homogenous productivities and job separations across markets). We also limit the comparison to the occupational mismatch because it is the only index that the three papers have in common. Nonetheless, the disaggregation levels among the present study, Sahin et al. (2013, and Patterson et al. (2013) are somewhat comparable (Japan: 8-65, U.K.:24, U.S.: 22-93) and it would still be a good exercise to compare our results to theirs to see whether the overall results are similar.

[16]The U.K. and U.S. studies report results of mismatch (M and M_x) based on 2-digit (24 and 22 occupational categories in the U.K. and U.S., respectively) and 3-digit occupational categories (93 categories in the U.S.).

VI. Conclusions And Policy Discussions

Our initial question was: "Is labor market mismatch a big deal in Japan?" After conducting our analysis, we have found the answer to be yes, it is. It *is* an important issue and policy measures and structural reforms that can successfully reduce labor market mismatch in Japan will play an important role in the future.

In particular, this paper estimated how much age, employment-type, and occupational mismatch contributed to the rise in the Japanese unemployment rate during the global financial crisis. By applying the methodology in Sahin et al. (2013), we found that while age and employment-type mismatch seem negligible, occupational mismatch accounted for a significant portion (20-40 percent) of the rise in the Japanese unemployment rate during 2008-2009. The estimated magnitudes are comparable to those in the United Kingdom and the United States.

In this regard, policies aimed at reducing occupational mismatch could help limit the rise in the Japanese unemployment. Policies could build on existing training programs and matching processes to reduce mismatch with more focus aimed at reducing occupational mismatch. At the same time, structural reforms could be designed to promote a more flexible labor market.

Several policy measures have already been put in place in Japan with regard to training programs and improving the job matching process through existing public employment security offices (e.g., MIAC, 2012). These training programs could be enhanced to help unemployed workers acquire skills necessary for future occupations. In addition, the matching process could include additional platforms through which matches between firms and workers are formed. One option of improvement would be to open job-matching services to private sector providers.

In addition, structural reforms could further enhance the flexibility of the Japanese labor market. Given that firing costs of regular workers in Japan are comparatively higher than such costs in other advanced countries (Bernal-Verdugo et al., 2012), policies to reduce such costs while promoting mid-career recruitment by firms could be considered. Although high firing costs reduce layoffs during recessions, such costs tend to discourage firms from hiring full-time regular workers, and, therefore, reduce job mobility even as the economy improves.[17] This observation appears to be consistent with a recent rise in the share of new hires of dispatched workers (dual-labor market), who have less employment protection. Although the near-term net effects of reducing firing costs on employment are uncertain, evidence among advanced countries in Northern Europe (OECD, 2005) suggests that a more flexible labor market could generate higher job security for individual workers in the long term, often named "flexicurity."[18] While an individual worker may face less security at a particular job, one could be employed at another firm more easily given high job mobility across firms. Such flexibility, along with adequate safety nets (e.g., severance payments), could improve overall job security (flexicurity). The net effects of such structural reforms would depend on the relative

[17]Bentolila and Bertola (1990) and Hopenhayn and Rogerson (1993), for instance, provide the theoretical discussions on the effects of firing costs on employment.

[18]Lommerud and Straume (2012), for instance, also argue that flexicurity would unambiguously increase firms' incentives to adopt technology.

size of flows into unemployment driven by lower firing costs and flows into employment from greater job mobility. Further research could examine whether the evidence in other advanced countries is also applicable to Japan.

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Appendix

A1: Data Definitions

***Unemployed, Vacancies, and Hires*:** Data on the number of unemployed, vacancies (job openings), and hires by occupational types, age group, and employment types (full-time and part-time) are obtained from monthly *Employment Referrals for General Workers (Ippan Shokugyo Shokai Jokyo)* conducted by the Ministry of Health, Labour, and Welfare (MHLW). The survey collects information on vacancies, unemployed person, and the number of people who found employment through the Public Employment Security Offices. Note that data on unemployed, vacancies, and hires exclude workers newly graduated from college. Owing to the exclusion of this category, the total number of unemployed in this survey is different from that in the survey by the Ministry of Internal Affairs and Communications (MIAC). The number of unemployed persons in this survey represents approximately 80 percent of the number of unemployed reported by the Cabinet Office for the period between April 2000 and April 2013. The latter is used to calculate the unemployment rate for Japan. Lastly, except for the employment-type level data series, which were already seasonally adjusted, all the other data are seasonally adjusted using X-12-ARIMA by the author.

***Part-time Workers*:** Part-time workers in the Employment Referrals are those whose hours worked are less than those of regular workers at the same establishment. The MHLW category of part-time workers consists of regular part-time workers who have an indefinite period or longer-than-four-month period and temporary part-time workers whose contract is one month or longer but shorter than four months or whose employment period is fixed and normally responds to seasonal demand. Please go to the link, http://www.mhlw.go.jp/toukei/list/114-1_yougo.html, to read the detailed definition (in Japanese).

***Full-Time Workers*:** Those who are not part-time workers.

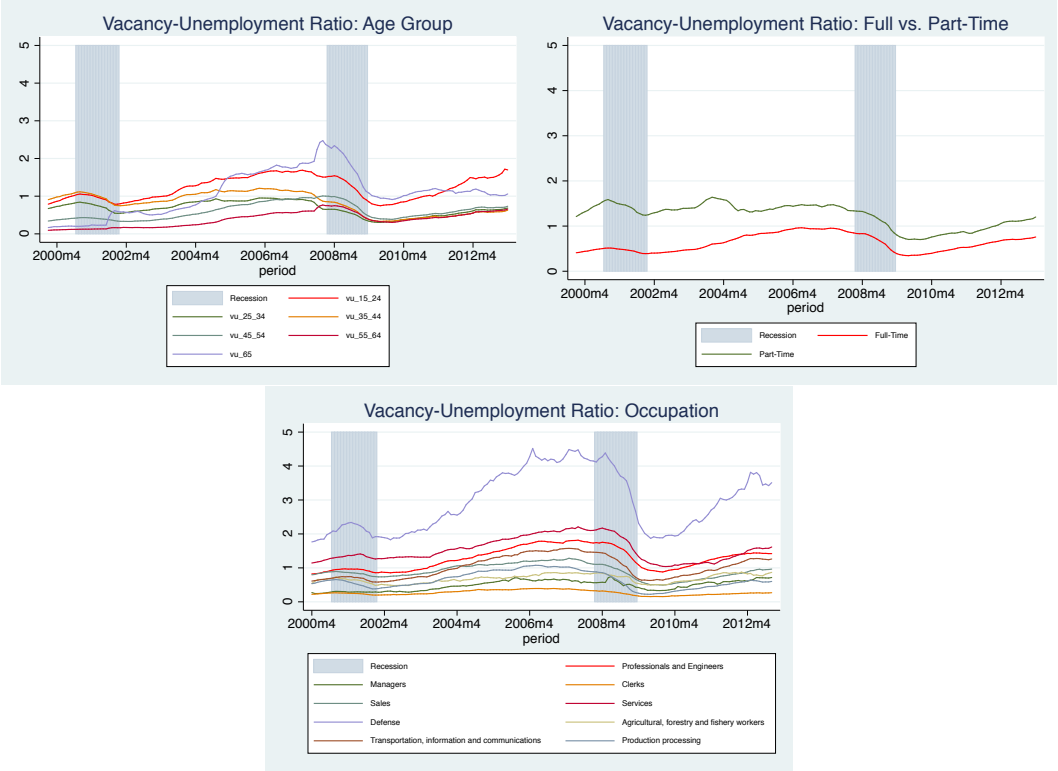
***Job Separation Rate*:** Data on the job separation rate is obtained from the MHLW's *Monthly Labour Survey* (*Maitsuki Kinro Toukei Chosa*). This survey is conducted on about 33,000 establishments with 5 or more regular workers including both the private and public sector. The job separation rate is given by the total decrease of regular employees divided by the number of such workers at the end of the previous month at establishment level and averaged across the sample. The total decrease in regular employees includes those who have retired as well as those who have been transferred to another establishment within the same firm. Details of the definition and the coverage are given in the following link: http://www.mhlw.go.jp/english/database/db-slms/dl/slms-01.pdf

***Unemployment Rate*:** Data on the unemployment rate is provided by the Ministry of Internal Affairs and Communications.

A2: Descriptive Statistics

This section provides background information on the Japanese labor market. We first show the vacancy-unemployment ratio by submarkets (i.e., age, employment-type, occupational groups)–a measure typically used to gauge labor market conditions. By

Figure 6: Vacancy-Unemployment Ratios: April 2000-April 2013



Sources: Ministry of Health, Labour, and Welfare: Author's calculations. Figure 6 plots vacancy to unemployment ratios by age (top left), employment-type (top right), occupational (bottom) groups.

doing so, we show which submarkets are generally considered to be tighter than others. We then show our preferred matching function-based assessment of labor market conditions. In particular, we show how likely an unemployed worker in a submarket finds a job (job-finding rate) and how likely a firm fills a vacant position (vacancy yields) by age, employment-type, and occupational group.

- **Vacancy-Unemployment Ratio**

The vacancy-to-unemployment ratio $\left(\frac{v_{it}}{u_{it}}\right)$ or market tightness indicates how many vacancies are available per unemployed person in a submarket i in month t. When it is greater than one, there is, on average, more than one vacant position for an unemployed person in that market, implying a higher chance for the unemployed workers to find a job and a lower chance for the firms to fill the position.[19] Dispersion of the vacancy-unemployment ratios across different labor markets indicates misallocations of vacant positions and unemployed workers in the economy. When there is no misallocation, the vacancy-unemployment ratios should be equalized across submarkets if matching efficiencies are homogenous. A higher value of the ratio, however, does not necessarily translate into a higher number of matches formed. Nonetheless, we present vacancy-unemployment ratios because they are often used by the Japanese Statistical Bureau to gauge labor market conditions.

[19]This may not be necessarily true if matching efficiencies across various markets are different.

Figure 6 plots vacancy-to-unemployment ratios by age, employment-type, and occupational groups. All of the age groups except the oldest age group (65 and over) showed a similar countercyclical trend for the period. The vacancy-to-unemployment ratio for the youngest age group (15-24 years old) is generally highest and is above one for most of the months between April 2000 and April 2013. The oldest age group (65 years old and over) saw a large increase in the ratio between 2001 and 2008 and dropped sharply during the 2008 recession. The ratios across all of the age groups dropped during the recession, suggesting a countercyclical pattern especially during the global financial crisis. This figure suggests that the labor market for the youngest age group is less tight than those markets for older age groups, and the labor market for the oldest age group (65 years old and over) seems to have seen an improvement during this period. The variance of the ratios across age groups seems to have declined in this period, indicating a declining misallocation across such groups.

Figure 6 (top right) plots the vacancy ratios by employment type (full-time vs. part-time). The vacancy-to-unemployment ratio is higher for the part-time workers throughout the period. This means that there are, on average, more vacant positions for an unemployed worker searching for a part-time position than an unemployed person searching for a full-time position. Lastly, Figure 6 (bottom) plots the vacancy to unemployment ratios by a broad category of occupational groups. The ratios co-move and show a procyclical pattern.

If matching efficiencies were the same across submarkets, a vacancy-unemployment ratio would reflect relative labor demand. Based on this assumption, a higher vacancy-unemployment ratio for the youngest age group (15-24 years old) indicates higher labor demand for this group. The oldest age group saw an increase in their labor demand over this period. Looking at the employment-types, the part-time workers seem to have a higher labor demand than the full-time workers over the period. Lastly, the relative scales of the vacancy-unemployment ratios among the different occupations seem to have remained the same over time. The services occupational group seems to have faced higher labor demand than most other groups except for defense followed by professionals and engineers.

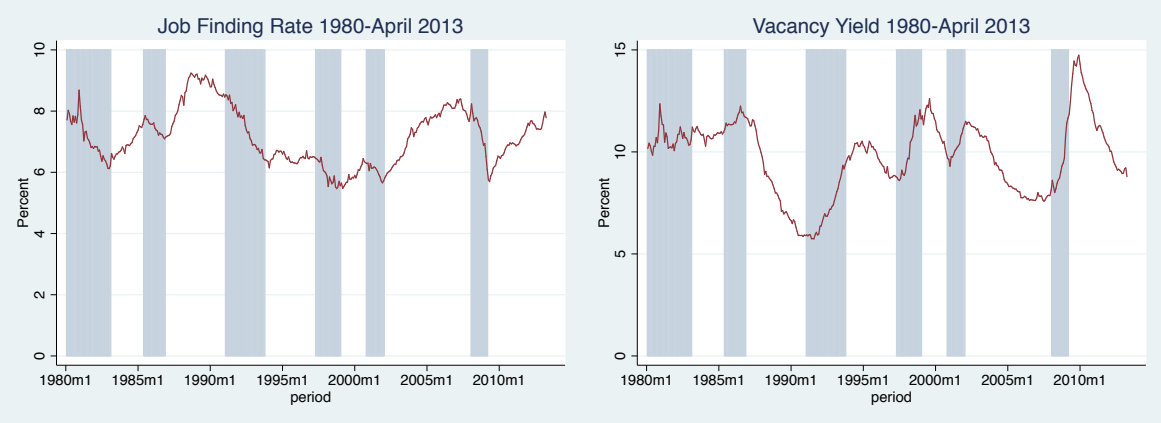
A higher vacancy ratio, however, does not directly translate into more hires in reality. It could be the case that some submarkets are more efficient at generating the matches than others given the same number of vacancies and unemployed. For instance, conditional upon the number of vacancies and the unemployed, it may be the case that younger unemployed people are better at searching for jobs on the internet and thus can have higher chances of landing a job than the older unemployed workers. The approach in the next subsection takes such differences into account in matching efficiencies and thus provides an different perspective on labor market conditions. In particular, we show a monthly average of probability of an unemployed person (a vacancy) landing in a match.

- **Matching Function**

To represent the relationship among vacancies (v), hires (h), and the number of unemployed (u), labor economists have used a constant returns-to-scale matching function as follows:

$$h_t(v_t, u_t) = \Theta_t v_t^{\alpha} u_t^{1-\alpha} \tag{7}$$

Figure 7: Job-Finding Rate and Vacancy Yield: Jan 1980-April 2013



Source: MHLW; Author's calculations

where h_t represents the number of matches (hires), Θ_t represents a matching efficiency, V represents vacancies, u_t is the number of unemployed, and $\alpha \in (0,1)$ is the vacancy share. The matching function indicates that the number of hires (matches formed) is increasing in both the number of vacancies (v_t) and the number of the unemployed (u_t).[20]

- **Job-Finding Rates**

Using the matching function, we can express the fraction of the unemployed who find a job in a given month by dividing the matching function by the number of unemployed. We call this the job-finding rate:

$$f_t = \frac{h_t(v_t, u_t)}{u_t} = \Theta \left(\frac{v_t}{u_t}\right)^{\alpha} \tag{8}$$

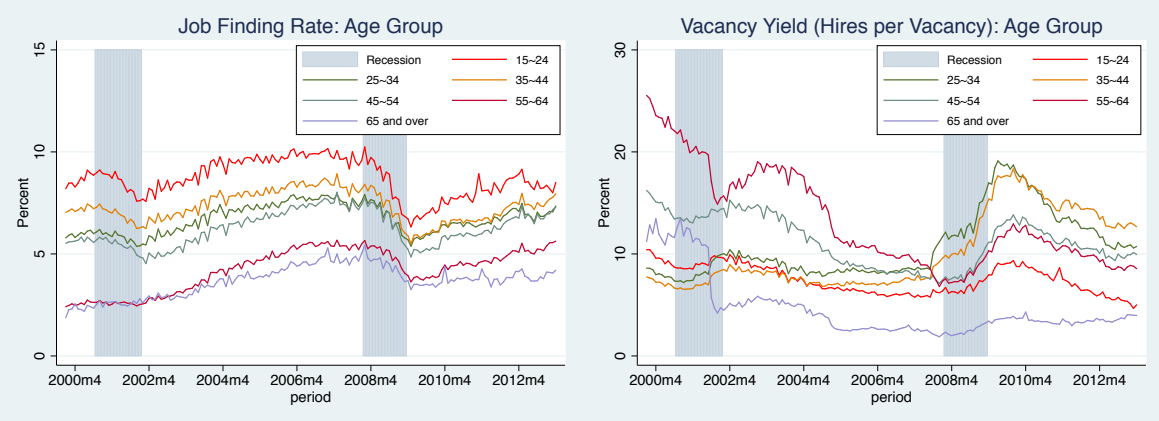
Figure 7 plots the job-finding rate in Japan between 1980 and April 2013. Conditional upon matching efficiency, Φ and the vacancy share, α, the job-finding rate is increasing in the number of vacancies and decreasing in the number of unemployed. From a different perspective, if we assume that the aggregate matching efficiency and the vacancy share are constant over time, the job-finding rate implies labor demand by the firm given the number of unemployed, similar to the vacancy-unemployment ratios in the previous section. In recession, the job-finding rate tends to decrease as there tends to be more unemployed workers, and firms tend to post fewer vacancies. Therefore, the series should be pro-cyclical. The job-finding rate in the data confirms this procyclical pattern within the range of 5 to 10 percent since 1980 (Figure 7).

- **Vacancy Yields**

From the firm's perspective, we can obtain an average probability of finding a worker by dividing the number of matches by the vacancy. By dividing both sides of the matching

[20] The sector-specific matching function is given by $h_{it} = \Phi_t \phi_{it} v_{it}^{\alpha} u_{it}^{1-\alpha}$ where h_{it} is the number of those who are hired in sector i and $\alpha \in (0,1)$ is the vacancy share.

Figure 8: Job-Finding Rate and Vacancy Yields by Age Group: April 2000-April 2013



Source: MHLW; Author's calculations

function by the vacancy, we obtain the vacancy yield.[21]

$$y_t = \frac{h_t(v_t, u_t)}{v_t} = \Theta \left(\frac{u_t}{v_t}\right)^{1-\alpha} \tag{9}$$

Again, if we assume that matching efficiency and vacancy share are constant, then this measure would proxy labor supply. Given the number of vacancies, more unemployed persons (a greater labor supply) would make it easier for an average firm to fill a vacancy (find a worker). Figure 7 plots vacancy yields for the period between 1980 and April 2013. It increases toward the end of recessions because there are more unemployed persons searching for a job.

- **Job-Finding Rates and Vacancy Yields for Disaggregated Data**

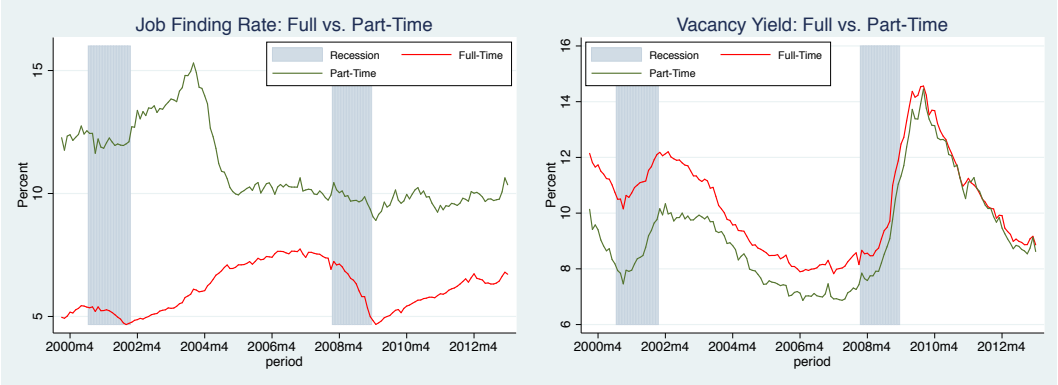
In this section, we show job-finding rates and vacancy yields for different age, employment type, and occupational groups to be able to understand how the sub-labor markets in Japan have been changing over time. We limit our descriptive statistics to the period between 2000 and April 2013 to compare the data across different groups.

(1) Age groups

Figure 8 plots job-finding rates and vacancy yields (hires per vacancy) for different age groups. We find that the youngest age group (15-24 years old) has the highest chance of finding a job and the older age groups (55-64 and 65 and over) have lower chances of landing a job throughout the period. Job-finding rates for the older workers seem to have improved but only modestly. Although the vacancy-to-unemployment ratio of the oldest group in the previous section indicated an improvement in the labor market for that group, their low job-finding probability implies that that is not necessarily the case. The job-finding rates for younger age groups (15-54) are more sensitive to business cycles than the two oldest age groups (55-64 and 65 and over).

[21] While Davis et al. (2013) define vacancy yields in month t as the number of hires in month t (h_t) divided by the number of vacancies in the previous month (v_{t-1}) instead of the same month (v_t), the two series are very similar.

Figure 9:
Job-Finding Rate and Vacancy Yields by Employment Type: April 2000-April 2013



Source: MHLW; Author's calculations

When we look at the vacancy yields, we find that hires per vacancy (vacancy yield) have declined for the age groups of 55-64 years old and 65 years old and over. This indicates that the probability of firm finding an older worker decreased. This decline coincides with the legal change in 2001 that discouraged firms from posting vacancies targeting particular age groups. While this law increased the vacancies for older age groups, it did not necessarily result in more hires. Lastly, the probability of hiring a worker in the age groups of 25-34 and 35-44 years old became higher after the 2008 recession.

(2) Full-Time vs. Part-Time Workers

Figure 9 plots job-finding rates and vacancy yields for full-time and part-time workers. The probability of finding a job has been higher for part-time workers than for full-time workers. The job-finding rate for part-time workers declined after 2004 and continued to be stable, unaffected by the 2008 recession. From the firms' point of view, it was also easier to fill a full-time position than a part-time position. It has been easier to fill a position toward the end of the recession when there were many unemployed in the market. The probabilities of job seekers finding part-time and full-time positions positions became almost the same after the global financial crisis.

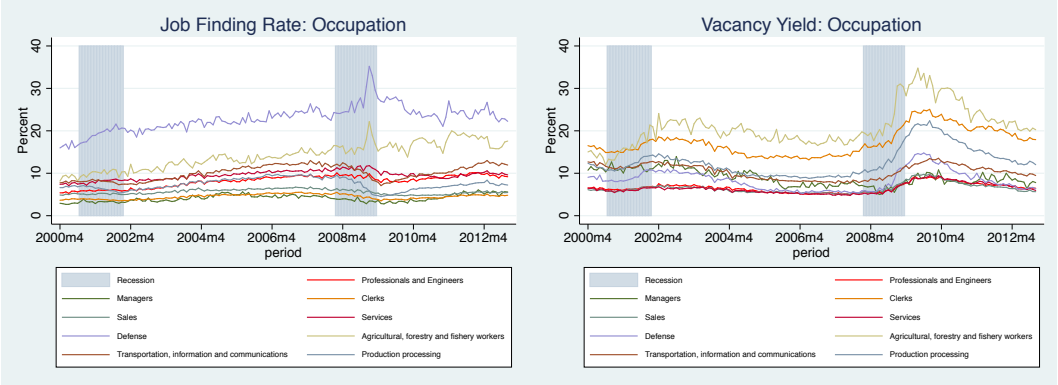
(3) Occupations

Figure 10 plots the job-finding rates by occupational types. We see that the job-finding rates have been high for (i) production processing occupations and for (ii) agricultural, forestry, and fishery workers. From the firms' perspective, the probabilities of filling a vacant position were higher in (i) agricultural, forestry and fishery occupations and in (ii) clerical positions.

This section provided a brief overview of the Japanese labor market. In particular, we showed vacancy-unemployment ratios (market tightness: a typical measure of labor market conditions), job-finding rates, and vacancy yields by different age groups, employment types, and occupation.[22] Based on these measures, labor markets were tighter

[22]Potential analysis based on matching function other than job-finding rates and vacancy yields can

Figure 10: Job-Finding Rate and Vacancy Yields by Occupation:
April 2000-April 2013



Source: MHLW; Author's calculations

(smaller vacancy-unemployment ratios) during recessions and for full-time workers, for older workers, and for certain occupations than others. While the market-tightness loosened for the oldest age group over the period, that group's improved probability of finding work was still modest.

A3: Estimation of Matching Function and Vacancy Share

The vacancy share α in the aggregate matching function $h_t = \phi_t v_t^{\alpha} u_t^{1-\alpha}$ is estimated by two methods following Sahin et al. (2013).

The first method is to estimate the following equation:

$$\log\left(\frac{h_{it}}{u_{it}}\right) = const + \gamma' QTT_t + \eta \log\left(\frac{v_t}{u_t}\right) + \epsilon_t$$

where QTT_t is a vector of four elements for the quartic time trend that is meant to capture shifts in aggregate matching efficiency. The second method is by following the procedure in Borowczyk-Martins, Jolivet, and Postel-Vinay (2013) to account for the endogeneity. Both methods show that the estimate of the vacancy share for the Japanese data to be around 0.4 (0.34 based on GMM others being higher), which we use in our analysis. In the U.S. and U.K. studies, Sahin et al. (2013) and Patterson et al. (2013) set vacancy share, α, to be 0.5. Although we do not present the changes in the results when we set α to be 0.4 instead, the results were not that different.

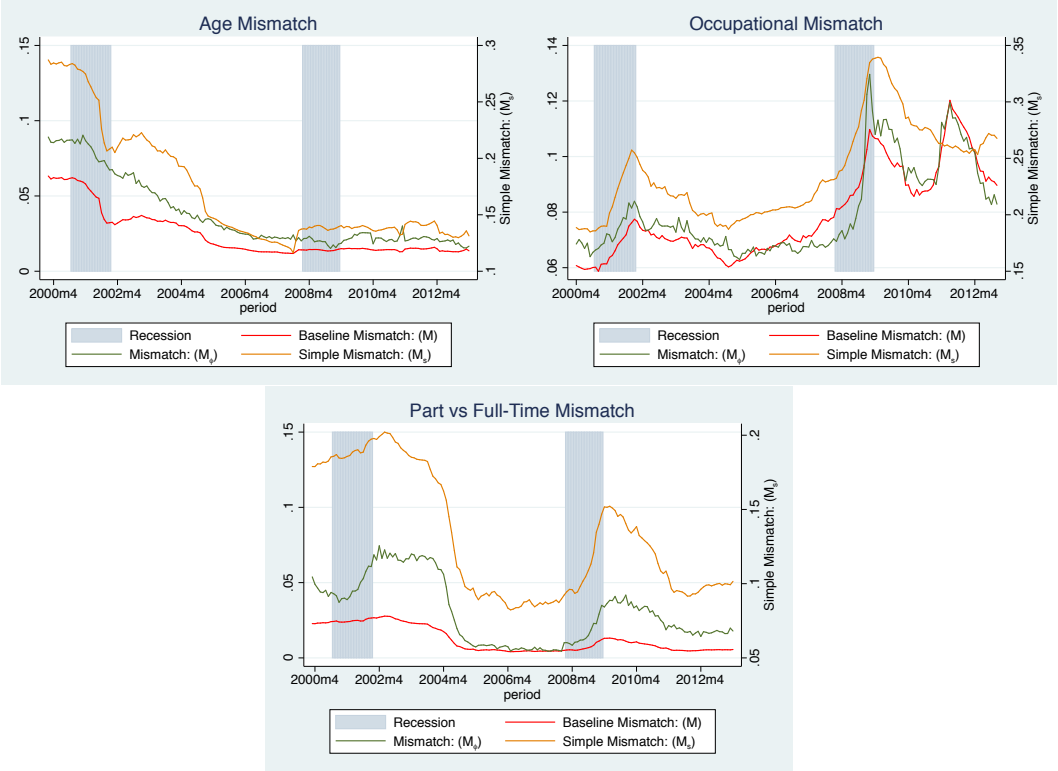
A4: Optimal Allocation under Heterogeneous Productivities and Job Separation Rates

Given sector specific productivities (z_i), matching efficiencies (ϕ_i), sector-specific vacancies (v_i) and job separation rates $(1-\Delta)(1-\delta_i)$, the social planner tries to allocate unemployed workers to each sector (u_i^*) such that the following term is equated across the sectors:

$$\frac{z_i}{1-\beta(1-\Delta)(1-\delta_i)}\phi_i m_{u_i}\left(\frac{v_i}{u_i^*}\right) = \frac{z_j}{1-\beta(1-\Delta)(1-\delta_j)}\phi_j m_{u_j}\left(\frac{v_j}{u_j^*}\right)$$

be found, for instance, in Barlevy, G. (2011)

Figure 11: Three Measures of Mismatch in Japan: April 2000-April 2013



In Figure 11, Simple Mismatch (orange line) shows M_s , Baseline Mismatch (red line) shows M, and Mismatch (green line) shows M_ϕ series.

$\forall i \neq j$ in $i, j \in I$

where Δ is the aggregate job destruction rate and δ_i is the sector-specific job destruction rate. This implies that the observed sector specific job separation rate s_i is defined as $(1 - s_i) \equiv (1 - \Delta)(1 - \delta_i)$.

A5: Three Measures of Mismatch (M, M_s, M_ϕ)

For comparison, Figure 11 plots three measures of mismatch: (i) Simple Mismatch Index based on equation (6) (M_s) (i.e. the measure of mismatch used by statistical agencies in Japan), (ii) Baseline Mismatch in equation (5) (M) (i.e. mismatch in the absence of heterogeneity in matching efficiencies), and (iii) Mismatch Index in equation (4) (M_ϕ). First, the three measures of mismatch (M_ϕ, M, M_s) generally capture similar trends in the mismatch in Japan. Second, our preferred occupational mismatch index, M_ϕ, captures the rise in the mismatch after the 2011 earthquake in Japan while the simple mismatch index, M_s, fails to do so. Third, our preferred mismatch measure, M_ϕ, offers a clear interpretation; that is, a fraction of hires lost owing to mismatch.