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Hie Joo Ahn and Ling Shao

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Precautionary On-the-Job Search over the Business Cycle

Hie Joo Ahn [†] Federal Reserve Board

Ling Shao [‡] Amazon

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Abstract

This paper provides new evidence for cyclicality in the job-search effort of employed workers, on-the-job search (OJS) intensity, in the United States using American Time Use Survey and various cyclical indicators. We find that OJS intensity is countercyclical along both the extensive and intensive margins, with the countercyclicality of extensive margin stronger than the other. An increase in the layoffs rate and the deterioration in expectations about future personal financial situation are the primary factors that raise OJS intensity. Our findings suggest that the precautionary motive in the job search is a crucial driver of the countercyclicality in OJS intensity.

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[†]E-mail: hiejoo.ahn@frb.gov

[‡]E-mail: lshao@ucsd.edu

Introduction

How does the job-search effort of already employed workers vary over business cycles in the U.S. labor market? The pioneering work by Fallick and Fleischman (2004) shows that there are roughly twice as many employment-to-employment (EE) transitions as unemployment-to-employment (UE) transitions, and EE transitions are procyclical. Given the significant size of EE flows, the job-search behavior of employed workers could have important consequences in the aggregate dynamics of the labor market. However, not much is known about OJS intensity, particularly its cyclicality. This paper investigates the cyclical features of on-the-job search (OJS) intensity. We find that OJS intensity is countercyclical.

In the previous studies on search-and-matching models with OJS, the job-search effort of employed individuals has been either assumed to be constant or predicted to be procyclical. Influential studies including Pissarides (2000, Chapter 5), Nagypal (2006, 2007), and Kraus and Lubik (2010) show that OJS intensity goes down during economic downturns, mainly because the marginal benefit of a job search decreases when it is hard to find a better-paying job or to earn a higher wage at a new job. In particular, recent research has paid attention to the procyclicality of OJS intensity as a key driver of important labor market phenomena. For example, Gertler, Huckfeldt, and Trigari (2014) demonstrate that decreased OJS intensity of bad matches explains a fall in the overall match quality and the widened wage dispersion during economic downturns. In addition, Eeckhout and Lindenlaub (2015) propose a theory where procyclical OJS intensity can generate unemployment cycles even without an exogenous shock through strategic complementarity between OJS effort and vacancy postings.

Meanwhile, an empirical study by Fujita (2012) finds that a nontrivial fraction of U.K. workers engage in OJS from the fear of losing their jobs. This study suggests that OJS intensity could have countercyclical features. A similar insight has been found among unemployed individuals in the previous studies.[1] Gruber (1998) and Engen and Gruber (2001)

[1]Shimer (2004) and Schwartz (2014) argue that among unemployed individuals the ease of finding a job

show that a substantial chunk of job losers have no liquid wealth for their consumption. Barnichon, Fujita, and Zylberberg (2016) demonstrate that unemployed individuals with a low job-finding probability tend to search harder for a new job than others do in the U.S. labor market, and as a consequence the job-search intensity of the long-term unemployed is higher on average than that of the short-term unemployed. They argue that risk aversion and absence of insurance are important determinants of unemployed individuals' job search effort.[2]

These studies imply that OJS effort could have a feature similar to saving and thus rise during economic recessions, when workers are likely to experience negative wealth shocks originating, for instance, from job loss. A worker might be able to insure against income loss by looking for a new job if job search efforts ease switching to a better-paying job or finding a new job when losing a job. Overall, this possibility suggests that risk aversion and the absence of insurance could be crucial factors influencing OJS intensity and possibly driving its countercyclicality. Therefore, the assumption of procyclicality in OJS intensity often adopted in theoretical studies needs to be empirically verified.

For the empirical analysis, we use the American Time Use Survey (ATUS) and various datasets such as the Current Population Survey (CPS), Job Openings and Labor Turnover Survey (JOLTS), Current Employment Statistics (CES), Survey of Consumers (SoC), and Manufacturing Business Outlook Survey (BOS). OJS intensity is measured as the minutes per day employed workers spend on a job search in the ATUS. A limitation of the ATUS is that the sample period covers only one recession, as the survey begins in 2003. Therefore, it may be hard to make credible inferences about the cyclical characteristics of OJS intensity. To mitigate this problem, we use the cross-industry variation in the search effort of employed individuals and the labor market indicators.

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and job-search intensity could be either complements or substitutes with each other, so the job-search effort could rise or fall due to a rise in the job availability.

[2]Theoretical studies have discussed the role of wealth accumulation in workers' reservation wages or job search effort. See, for example, Acemoglu and Shimer (1999); Costain (1997); Lentz and Tranaes (2005); Alexopoulos and Gladden (2006); Krussel, Mukoyama, and Sahin (2010); Rendon (2006); Lentz (2009); and Lise (2013).

We find that OJS intensity is countercyclical. The countercyclicality is robust after we control for both observed characteristics of workers and the possible sample selection in the ATUS on unobserved heterogeneity of employed job seekers. There are three notable features. First, minutes spent on a job search by those who already have a job are positively correlated with the layoffs rate, job-fillings rate, and the volatility of employment growth—a measure of employment uncertainty—that are countercyclical, but are negatively correlated with procyclical indicators like the unemployment exit probability and the indexes of expected personal financial situations in the future.

Second, the countercyclicality of the intensive margin—time spent on a job search by those who engage in a job search on the survey day—is weaker compared to that of the extensive margin—whether a worker participates in a job search or not. This finding suggests that aggregate OJS intensity changes over business cycles more through the adjustment of the extensive margin than through the changes in the intensive margin. We also find that OJS intensity is positively associated with the real wage, and this association is mainly driven by the intensive margin which has a statistically significant positive correlation with the real wage. However, the cyclicality of the real wage is not clear, as discussed in the previous studies (e.g., Abraham and Haltiwanger, 1995), and, in fact, the median real weekly earnings of wage and salary workers rose during the Great Recession.[3] Therefore, the positive correlation between OJS intensity and the real wage also seems to support the countercyclical feature of OJS intensity.[4]

Lastly, the layoffs rate and the expectation of future financial situation are the two most important factors driving the countercyclical movements of OJS intensity in both the intensive and extensive margins among the economic indicators considered.[5] We find that

[3]The median real weekly earnings of wages and salaries rose about 4% between 2007Q4 and 2009Q2.

[4]The countercyclical real wage might also reflect the countercyclical labor productivity. Labor productivity shifted from weakly procyclical to strongly countercyclical since the early 1980s (Fernald and Wang, 2016). If the destruction of a low-productivity job is crucial in the rise of labor productivity during economic downturns, it could also explain the rise of OJS intensity from the fear of job loss, which is consistent with the other empirical results.

[5]Fallick and Fleischman (2004) show that among those who engaged in an OJS, the fraction of those who switched to a new employer was almost the same as that of those who either became unemployed or

1%p increase in the layoffs rate raises the aggregate OJS intensity by about 50%. Our results imply that the likelihood of involuntary separations and workers' liquidity or credit situations are crucial in determining how hard those who already have a job search for new employment.

What do these empirical results tell us? They all point to the precautionary motive in an OJS, that is, workers who already have a job are likely to look for a new job to insure against possible job loss in the future. Furthermore, this precautionary motive could play a crucial role in the countercyclicality of OJS intensity. To elaborate, an OJS is analogous to saving in the theory of precautionary saving. If workers engage in a job search by paying the search cost, they receive an option of either switching to a better job or having an opportunity to get employed if they lose their jobs. Consequently, employed individuals are more likely to search harder for a new job as the current labor market condition deteriorates, and they feel more uncertain about the future economic situation.[6]

This paper is the first to empirically investigate the cyclicality of OJS intensity in the U.S. labor market. In particular, it contributes to the literature on the cyclicality of job-search efforts.[7] So far, the literature on variable search efforts has focused on the job-search behavior of nonemployed individuals (Shimer, 2004; Deloach and Kurt, 2013; Faberman and Kudlyak, 2014; Mukoyama, Patterson, and Sahin, 2014; Gomme and Lkhagvasuren, 2015; and Hornstein and Kudlyak, 2016), but not on that of the employed.[8] Fallick and

left the labor force in the following month.

[6]In the online appendix, we provide a simple theoretical framework to characterize the empirical findings. We derive the conditions that enable the precautionary motive to operate and drive the countercyclical OJS effort.

[7]This paper also contributes to the literature that studies job-search behavior using the ATUS. See, for example, Krueger and Mueller (2010,2011); Aguiar, Hurst, and Karabarbounis (2013a, 2013b); Deloach and Kurt (2013); Kutyavina (2014); Mukoyama, Patterson and Sahin (2014); and Gomme and Lkhagvasuren (2015).

[8]Mukoyama, Patterson, and Sahin (2014) constructed a time series of search intensity among the jobless based on the correlation between their job-search times and the number of job-search methods that they adopted and found that the job-search intensity of nonemployed individuals is countercyclical. Meanwhile, Deloach and Kurt (2013) and Gomme and Lkhagvasuren (2015) measured the search intensity of the jobless directly from the ATUS. Deloach and Kurt (2013) argue for an acyclical search effort, while Gomme and Lkhagvasuren (2015) argue for a procyclical search effort. Gomme and Lkhagvasuren (2015) mention that the number of job-search methods is not an appropriate proxy for job-search effort, citing Tumen (2012), who finds that an increase in the number of search methods reduces the unemployment exit probability.

Fleischman (2004) presented a one-shot picture of OJS behavior of employed workers using the Contingent Worker Supplements to the CPS, as the data did not allow the authors to investigate how job-search behavior evolves over time.[9][10][11]

In addition, we use broader cyclical measures for the analysis, such as the establishment data and sentiment indicators, than those adopted in the existing literature on search intensity. This approach allows us not only to examine the cyclical features of OJS intensity but also to identify the key factors driving the cyclicality, which no previous studies attempted to do. The previous research that used ATUS to examine the cyclical features of the search effort often relied on the state-level unemployment rate in the household survey (CPS) as a cyclical indicator. To mitigate the problem coming from the short sample period covering only one recession, these studies used the cross-state variation in search intensity and unemployment rate as additional sources of heterogeneity in analyzing the cyclicality of job-search efforts. Unlike these studies, we base our analyses on both household and establishment surveys including labor flows by industry from JOLTS as the cyclical labor market indicators and use the cross-industry variations to infer the cyclicality of OJS intensity. From this approach, we identified that factors such as job loss and employment uncertainty are crucial in driving the countercyclical OJS intensity. Additionally, we shed light, for the first time in the literature, on the possible sample selection based on workers' unobserved heterogeneity in the ATUS and propose a method to correct the consequent bias.

This paper also contributes to the literature that emphasizes the role of risk aversion and incomplete insurance in a job search. We show empirically that uncertainty is important

He interpret this result as suggesting that unemployed workers use job-search methods sequentially, not simultaneously, so unemployed workers adopt more job search methods when it is hard to find a job.

[9]The surveys for Contingent Worker Supplements to the CPS were conducted in February of 1995, 1997, 1999, and 2001, and last conducted in February 2005.

[10]In the CPS, questions about the job search are asked only to those who are not employed. For this reason, the CPS does not have information about the job-search behavior of those who already have a job. The Contingent Worker Supplements to the CPS asks whether an employed individual engaged in a job search during the previous three months. Meanwhile, the ATUS asks survey participants about their activities during the previous day.

[11]OJS efforts have been studied more intensively in the European labor market due to data availability (Bell and Smith, 2002; Bloemen, 2005; Kahn, 2012; Fujita, 2012; Gomes, 2012).

in understanding the countercyclical OJS intensity. Most of the previous studies in this literature focused on the job-search effort of unemployed individuals in an environment where workers are risk averse and the market is incomplete (e.g., Costain, 1997; Acemoglu and Shimer, 1999; Lentz and Tranaes, 2005; Krussel, Mukoyama and Sahin, 2010) but not on that of already employed workers. Lise (2013) developed a model of on-the-job search that characterizes the job-search and saving decisions of risk-averse workers to explain the income and wealth distribution but did not consider uncertainty in his model.

Lastly, this paper further provides new insights to the literature on the role of OJS effort in the unemployment dynamics (e.g, Pissarides, 1994; Shimer, 2003; Nagypal, 2006, 2007). The countercyclicality of OJS intensity can be a new channel to resolve the Shimer puzzle[12], as the job-search effort of employed job seekers could crowd out the job search of unemployed individuals. Pissarides (1994) argued theoretically that the congestion in the job-search pool created by employed job seekers is particularly greater when the labor market improves. Our empirical result suggests the opposite: the countercyclical OJS intensity can crowd out the job search of unemployed workers more during economic recessions and bring down their job-finding probabilities further. This effect could be particularly strong if firms prefer workers with recent job experience over workers with jobless spells. The crowding-out effect could be an additional source of unemployment rate fluctuations and thus could be an important piece to resolve the Shimer puzzle.

This paper is organized as follows. Section 1 describes the data we use for the empirical analyses and provides the descriptive statistics. Section 2 discusses the time-series properties of OJS intensity, focusing on its relation with various labor market indicators. Section 3 introduces the models to analyze the cyclical and cross-sectional properties of OJS intensity and discusses the empirical results. Section 4 demonstrates the robustness of empirical results. Section 5 provides a simple theoretical framework to support the empirical findings.

[12]It refers to an observation that the standard labor market matching model predicts fluctuations in the unemployment rate much smaller than those actually observed over the business cycle (Cardullo, 2010).

1 Data

The ATUS provides data on the time employed individuals spend on job search during a day. The ATUS sample is drawn from the eighth outgoing rotation group of the CPS. For each selected household, one family member 15 years or older is asked to describe his or her activities during the previous day, referred to as the "diary day." Job-search activities include the following: (1) contacted employer directly/interview, (2) contacted public employment agency, (3) contacted private employment agency, (4) contacted friends and relatives, (5) contacted school/university employment center, (6) sent out resume/filled out applications, and (7) checked union/professional registers.[13] Our sample from the ATUS spans January 2003 to December 2015. We use the quarterly frequency for the empirical analysis to smooth out noise in the monthly data.

To analyze the cyclicality of OJS intensity, we compare the movements of OJS intensity to those of various cyclical labor market indicators. One challenge in the empirical analyses is that the sample period covers only one recession. Consequently, it may be hard to make credible inferences on cyclical variation of OJS intensity. To mitigate this problem, we use the cross-industry variation in the search effort of employed individuals and the labor market indicators.

For the labor market indicators, we consider the layoffs rate, quits rate, hires rate, job-openings rate, and job-fillings rate (often referred to as vacancy yield) by industry from the JOLTS[14]; the exit rate from unemployment by industry from the CPS[15]. As a proxy for the

[13]The ATUS Activities Lexicon provides the full list of job-search activities.

[14]The BLS computes the labor-turnover rates used in this analysis according to the Job Openings and Labor Turnover Technical Note (http://www.bls.gov/news.release/jolts.tn.htm). The layoffs rate is calculated by dividing the number of layoffs by employment and multiplying that quotient by 100. The quits and hires rates are computed similarly. The job openings rate is computed by dividing the number of job openings by the sum of employment and job openings and multiplying that quotient by 100.

[15]To be consistent with the labor market turnover rates from JOLTS, I define the exit rate from unemployment of those whose previous industry is j, p_{jt}, as

$$p_{jt} = \frac{U_{jt} - U_{jt}^1}{U_{j,t-1}} \times 100$$

where U_{jt} is the total number unemployed and U_{jt}^1 is the number of newly unemployed individuals from

volatility of employment growth, we use quarterly averages of the 12-month rolling standard deviation of employment growth rate[16] based on the number of employed individuals by industry from the CES.[17] For the real wage, we use the log of average weekly earnings of production and nonsupervisory employees on private nonfarm payrolls by industry adjusted for changes in the price level measured with CPI.[18] We link the datasets with ATUS by matching the industry where a survey respondent belongs.[19]

To investigate the role of expectation or economic sentiment in OJS intensity, we also consider consumer and business sentiment data. The Thomson Reuters/University of Michigan Survey of Consumers (SoC) provides data on consumer sentiment. A major benefit of the SoC is that it contains forward-looking questions such as how consumers view their own financial situation prospects and how they think about the general economy in the future. A drawback of the SoC is that it does not ask the respondent for the industry in which he or she works. Therefore, the measures of consumer sentiment only vary over time.

The Philadelphia Federal Reserve's Manufacturing Business Outlook Survey (BOS) pro-

industry j at time t. The total number of unemployed individuals and the number of newly unemployed individuals are not publicly available for the wholesale trade and retail trade industry separately. We used the average unemployment exit rate of the wholesale and retail trade industry as the exit rate of each industry, as the data of each industry is not separately available for the public.

[16]The volatility of a variable is defined as the standard deviation of unexpected changes in the variable (Orlik and Veldkamp, 2014). Moving standard deviation is often used as a proxy for changes in volatility.

[17]Let e_{jt} denote the monthly employment growth rate of industry j in month t. The volatility of employment growth in industry j in month t, vol_{jt}, is defined as

$$vol_{jt} = \sqrt{\frac{\sum_{s=0}^{11}(e_{j,t-s} - (\sum_{s=0}^{11} e_{j,t-s})/12)^2}{12}}.$$

We average monthly measure of employment ucertainty, vol_{jt} to the quarterly frequency. We do not use VIX, the implied volaility index of S&P 500 index options in our analysis, because the index is not available in the detailed industry level.

[18]We use the average weekly earnings rather than the average hourly earnings, since the average hourly earnings by industry is only available from 2006. To construct the real wage, we assume that the price level is fixed at the level of January 2003. In addition, the average weekly earnings are not available in the government (or public) sector.

[19]The industry classification that we use includes (1) mining and logging, (2) construction, (3) durable goods manufacturing, (4) nondurable goods manufacturing, (5) wholesale trade, (6) retail trade, (7) transportation, warehousing, and utilities, (8) information, (9) finance and insurance, (10) real estate, rental, and leasing, (11) professional and business services, (12) education, (13) health care and social services, (14) arts, entertainment, and recreation, (15) accomodation and food services, (16) other services, and (17) public administration.

vides data on business sentiment. The BOS is also a forward-looking survey on future business activities. Specifically, the BOS asks firms about current business conditions and what they expect business conditions to be in six months. Like the SoC, the BOS does not ask for the responding firm's industry. Another drawback of the BOS is that it is a local survey of manufacturing firms from the Philadelphia area. However, Nakamura and Trebing (2008) show that BOS indicators correlate very strongly with national measures of business sentiment.

1.1 On-the-job search summary statistics

We present summary statistics of OJS intensity over the sample period from 2003:Q1 to 2015:Q4. The first column of Table 1 shows the average minutes that an individual in each labor force status category spends on job search during the diary day. Employed individuals search for a new job for 0.5 minutes per day. Full-time workers spend 0.4 minutes on job search, while part-time workers spend around 1 minute. Unemployed individuals spend 22 minutes on job search per day. Nonemployed individuals who do not engage in what the CPS terms active job search, and hence are considered to be out of the labor force actually do "non-active" job search activities such as checking job listings for 0.4 minutes per day, which is similar to the average job-search time of employed individuals.

The second column of Table 1 shows the extensive margin—the share of employed individuals who report spending positive minutes on job search—by labor force status. The extensive margin is the fraction of employed people who participate in job search. Job search is relatively rare for employed individuals. A half percent of employed persons reported spending nonzero minutes searching for a job during the diary day.[20] Only 0.4% of full-time workers engaged in OJS, and 1% of part-time workers engaged in OJS.

It is notable that unemployed individuals—those who were not employed during the

[20]Fallick and Fleischman (2004) show that 4.4% of employed individuals engaged in active OJS during the previous three months. Out of those employed who engaged in active job search, 11.3% switched employers the following month.

reference week but had actively looked for work in the prior four weeks—did not look for a job every day. Only 15% of unemployed workers reported nonzero job-search time during the diary day. More interestingly, individuals out of the labor force—those who were not employed during the reference week and had not actively looked for work in the prior four weeks—actually did job-search activities: 0.3% of people out of the labor force reported spending time looking for a job.

The last column of Table 1 shows the intensive margin—how many minutes people spend on job search, if they spend nonzero minutes during the diary day. Employed job seekers spend 104 minutes in searching for a new job. Interestingly, even though a smaller fraction of full-time workers engage in job search, they spend a longer time on job search than part-time workers do. Full-time workers spend 109 minutes, while part-time workers spend 98 minutes. Unemployed individuals spend 143 minutes, which is longer than the time spent by job seekers in other labor-force-status categories. Job seekers not in the labor force spend, on average, more minutes on job search (128 minutes) than employed job seekers do.

One may be tempted to conclude that OJS is unimportant to the labor market dynamics, given the small fraction of workers engaged in job search and the consequent short average job-search time. However, we can see that OJS is an important piece, once we consider the magnitude in the aggregate. Suppose that the unemployment rate is 5%, so there are 19 employed persons for each unemployed person. Given a labor force of approximately 150 million, back-of-the-envelope calculations imply that employed workers spend a total of 1.2 million hours on job search per year, while unemployed individuals spend 2.7 million person-hours on job search. These back-of-the-envelope calculations imply that OJS makes up about a third of the job-search intensity in the labor force and 45% of the aggregate job-search effort of unemployed individuals.

It should also be noted that the ATUS is likely to undercount OJS intensity, as it only asks the respondent's primary activity at any given time. Employed workers may also engage in OJS as a secondary activity while working at their primary job. For example, the ATUS

would not count time spent browsing *LinkedIn* or *Monster.com* while attending a meeting. Unemployed workers may be more likely to report job search as their primary activity, as they are not working. Due to this reason, both the extensive and intensive margins of OJS are likely to be understated compared with those of unemployed individuals' search intensity.

2 Time-series properties of OJS intensity

2.1 OJS intensity: Extensive and intensive margin

To understand the dynamic features of OJS intensity, we plot the time series of average minutes spent on job search of employed individuals (hereafter, average OJS time), the extensive and intensive margins. Figure 1 plots the raw series and the centered four-quarter moving averages of average OJS time from 2003:Q1 to 2015:Q4.[21] We use the moving averages to smooth out seasonality and some measurement errors. The vertical dashed lines bracket the duration of the Great Recession as determined by the National Bureau of Economic Research.

Compared to the pre-recession movements, the average OJS time exhibits greater variability after the Great Recession. It jumped in 2007:Q4 when the Great Recession began, and then started to fall in the latter part of the recession, reaching the pre-recession level at the end of 2009. It rose again in 2011:Q2 and fell to the pre-recession level in 2012:Q4. After 2013, the average OJS time showed volatile movements, going up for 1-2 quarters and then going back down right after the rise.

The extensive and the intensive margins of OJS intensity are plotted in Figure 2. The extensive margin shows a clear double-humped shape after the Great Recession. It rose during the Great Recession and fell to the pre-recession level after the end of the recession. It went up again from the 2010:Q3 to the end of 2011 and decreased until 2012:Q3. Meanwhile,

[21] For example, the centered four-quarter moving average for the value of 2012:Q1 is calculated from [0.5(2011:Q3) +2011:Q4 + 2012:Q1 + 2012:Q2 + 0.5(2012:Q3)].

the intensive margin shows rather noisy movements and does not seems to exhibit distinct cyclical fluctuations.

The dynamic features in the search intensity of unemployed individuals and part-time workers are quite different from those of full-time workers. Figure 3 and 4 plot the average minutes spent on job search by unemployed individuals and part-time workers, respectively, against those of full-time workers. The formers continued to go up both during the recession and several years into the recovery; in contrast, the latter fell substantially in the later part of the recession and the early recovery phase, and then picked up again. It is notable that the average job-search time of both part-time workers and unemployed individuals were rising from 2009 to 2011 when the long-term unemployment continued to go up. This suggests that unemployed individuals and part-time workers might share some similarity in their job-search behavior.

2.2 OJS and cyclical labor market indicators

To see cyclical properties of OJS intensity in more detail, we plot the average minutes spent on OJS and the extensive margin against various cyclical indicators of the labor market.[22]

We first compare job-to-job transition rates from Fallick and Fleischman (2004) with minutes spent on OJS (Figure 5, Panel A) and with the extensive margin (Figure 5, Panel B).

The average OJS intensity is higher than the pre-recession average, while the exact opposite patterns are observed in job-to-job transition rates. This implies that the job-switching rate per unit of search effort and per employed job-seeker could have fallen further during the economic downturn than is suggested by the observed rate of job-to-job transitions without changes in OJS intensity taken into account.[23]

[22]We plot the four-quarter moving averages of cyclical indicators to be consistent with the time series of OJS intensity. We do not plot the intensive margin against cyclical indicators, as the intensive margin exhibits rather noisy movements.

[23]A study by Carrillo-Tuleda, Hobijn, Perkowski, and Visschers (2015) shows that most of the job switch-

Figure 6 shows further graphical comparison of OJS intensity to labor turnover rates from the JOLTS. We plot the average OJS time and the extensive margin against the layoffs rate (Panels A and B), the hires rate (Panels C and D), and the job-openings rate (Panels E and F). Average OJS time and the extensive margin both rose during the Great Recession, while the layoffs rate rose and the hires and job-openings rate fell. Average OJS time and the extensive margin co-moved with the cyclical labor turnover rates closely until 2009. However, the co-movement became weaker after the recession was over. Between 2010 and 2011, both the average minutes spent on OJS and the extensive margin rose, when the layoffs rate was falling and the hires and job-openings rates were rising. This seems to suggest that OJS intensity might also have procyclical features.

However, it should be noted that there was a concern of a double-dip recession in 2010 and 2011. The possible withdrawal of stimulus measures, the euro zone debt crisis, and the U.S. debt-ceiling negotiations made people worried about another recession. Because of these reasons, we cannot rule out the possibility that the second rise in OJS intensity could have been due to the heightened uncertainty or concern that the economy would get worse in the near future, leading to potential job losses or wage cuts. We examine how search intensity co-moves with expectations of the future economic situation and economic uncertainty, paying particular attention to whether the subjective measures can explain the second rise of OJS intensity observed during 2010 and 2011.

We use the indicators of economic sentiment from the SoC and BOS. Among various indices from the SoC, Figure 7 shows that the indices of expected changes in financial situation in a year (Panels A and B), buying conditions for vehicles (Panels C and D), and the probability of an increase in the stock market in a year (Panels E and F) are closely correlated with OJS intensity, and can explain the second rise in OJS intensity. These indicators representing optimism about future economic situations all decreased during 2010 and 2011,

ers in the United States never reported having looked for a job and claims that job-to-job transitions are driven by poaching rather than active job search of employed job-seekers. However, it is not known what fraction of job-to-job transitions is the outcome of active job search of employed job-seekers or poaching of employers and how the contribution of each factor to job-to-job transitions varies over business cycles.

while the average OJS time and the extensive margin rose. We also compare business sentiment against OJS intensity (Figure 8). The co-movement of OJS intensity with business sentiment indices during the post-recession period seems to be weaker than that with the indices from the SoC. This implies that the perception of workers about their own financial situations and the general economy can be more important in OJS intensity than that of firms.

Finally, we relate the measure of uncertainty with OJS intensity in Figure 9. As the aggregate uncertainty measure, we use VIX.[24] VIX also rose during the year 2011, when there was a second rise of average OJS time and the extensive margin. This implies that uncertainty perceived by workers could be an important determinant of OJS intensity.

3 Empirical analyses

3.1 Baseline analyses

The previous section explored suggestive evidence on the relation of OJS intensity with cyclical labor market indicators. To investigate the hypothesis more rigorously, in this section we turn to regression analyses. We use the quarterly data for the empirical exercises. The sample period is from 2003:Q1 to 2015:Q4.

In the previous literature, when the dependent variable is bound to zero, like time spent on job search, Tobit, truncated normal regression (Cragg, 1971) or a two-tier model with log-normal distribution have been frequently used for the empirical analyses. In the case of the ATUS, however, a large fraction of reported time spent in a certain activity has values of zero, as the ATUS collects what an individual did during the day prior to the survey. Stewart (2009) compares the performance of OLS, Tobit, and truncated normal regression (Cragg, 1971) through simulations in an environment similar to the ATUS and finds that,

[24]The CBOE Volatility Index (VIX) is a measure of market expectations of near-term volatility conveyed by S&P 500 stock index option prices. (http://www.cboe.com/micro/vix/vixintro.aspx)

of the three, only OLS generates unbiased estimates. Therefore, we use OLS as the baseline estimation method for our empirical analyses. The results are robust regardless of estimation methods.

The basic empirical specification is

$$S_{ijt} = c_l l_{jt} + c_x X_i + D_j + D_Q + \epsilon_{ijt}. \tag{1}$$

The term S_{ijt} denotes minutes spent on OJS per day of worker i who works in industry j at time t (hereafer, OJS time). Time, t, is indexed by quarter. l_{jt} is the labor market indicator of industry j at time t, and c_l is the coefficient on l_{jt}. X_i is the vector of individual characteristics of worker i and c_x is the vector of coefficients on X_i. D_j is the industry dummy. D_Y and D_Q are the year and quarter dummies, respectively. ϵ_{ijt} is the error term.

The vector X_i includes person i's individual characteristics such as gender, education, age, marital status, having children at home, part-time/full-time employment status, weekly wage earnings and hours worked during the workweek. We include a quartic function of age following Shimer (2004) and Mukoyama, Patterson and Sahin (2014) to consider a possible nonlinear relationship between age and OJS intensity and also an interaction term between the variables of being female and having children at home. We also include a worker's wage and hours worked following Gomme and Lkhavasuren (2015) to control for some individual heterogeneity that is not well captured by basic demographic characteristics but could be important in determining the cyclical properties of OJS intensity.[25][26]

We further replace l_{jt} with forward-looking indices from the SoC and BOS to analyze the effect of economic sentiment and expectation on OJS intensity. The indices are only indexed

[25]Bils, Chang and Kim (2012) show that the labor market turnovers of high-wage and high-hour workers exhibit cyclicality greater than others.

[26]We do not consider the wealth effect on OJS intensity by including stock price index or housing price index, because they are likely to be correlated with other cyclical variables. In addition, the data on individual asset portfolios are not available. Nonetheless, including stock and housing indices in the regression does not change the results, and the coefficients are not statistically significant. We also considered spouse or unmarried partner's hours of worked per week and the four occupation categoryies of Jaimovich and Siu (2012) —routine/manual, routine/cognitive, non-routine/manual, and non-routine/cognitive—in the regression, but the coefficients are not statistically significant.

by time, as the surveys do not contain industry information.

In addition, we separately analyze the cyclicality of OJS intensity in the extensive and intensive margins. First, for the empirical specification of the extensive margin, we estimate the following linear probability model with OLS:

$$E_{ijt} = c_l^e l_{jt} + c_x^e X_i + D_j^e + D_Q^e + \epsilon_{ijt}^e, \tag{2}$$

where E_{ijt} is the indicator of the participation of job search. $E_{ijt} = 1$, if individual i in industry j spends nonzero minutes on job search in month t, and $E_{ijt} = 0$ if the individual reports spending zero minutes on job search. c_l^e is the coefficient on l_{jt}, and c_x^e is the vector of coefficients on X_i. D_j^e and D_Q^e are the industry and quarter dummies, respectively. ϵ_{ijt}^e is the error term.[27]

Lastly, the empirical specification for the intensive margin, OJS time of those who spend nonzero minutes on job search, is as follows:

$$M_{ijt} = c_l^m l_{jt} + c_x^m X_i + D_j^m + D_Q^m + \epsilon_{ijt}^m, \tag{3}$$

where c_l^m is the coefficient on l_{jt}, and c_x^m is the vector of coefficients on X_i. D_j^m and D_Q^m are the industry and quarter dummies, respectively. ϵ_{ijt}^m is the error term.

3.2 Empirical results

Table 2 presents the estimation result of equation (1). Time spent on job search of employed individuals is countercyclical. It has positive correlations with countercyclical indicators such as the layoffs rate (Layoffs), job-fillings rate (Job fillings), and employment growth volatility (Volatility), but has negative correlations with procyclical indicators such as quits rate (Quits), hires rate (Hires), job-openings rate (Job openings), and the exit

[27] We also estimate a probit model for the extensive margin with the same set of independent variables. The results are similar to those of OLS.

probability from unemployment (U. Exit). Among these, the coefficients on the layoffs rate, job-fillings rate, and the exit probability from unemployment are statistically significant.[28] The layoffs rate is the most important determinant of OJS time. The coefficient on the layoffs rate is larger in absolute value than the others. A 1%p increase in the layoffs rate raises the OJS time by 0.27 minutes, which is about half of the average minutes spent on job search of employed workers in the sample (0.5 minute). In the aggregate, this approximates 15% of the aggregate search intensity of the labor force and 22% of the aggregate search intensity of unemployed individuals.[29] This suggests that involuntary separation is crucial in determining how hard those who already have a job search for a new job.

The extensive margin is also countercyclical (Table 3). Notably, the layoffs rate, job-fillings rate, and volatility of employment growth rate are all positively correlated with the extensive margin and is statistically significant, while the exit rate from unemployment has a negative correlation and is statistically significant. The coefficients on quits rate and job-openings rate are negative, and the coefficient on hires rate is positive, but they are not statistically significant. Similar to the result of OJS intensity, the layoffs rate is the most important determinant of whether a worker engages in job search. A 1%p increase in the layoffs rate raises the probability of an employed individual engaging in job search by 0.0015, about 1/3 of the average OJS participation rate in the sample (0.005). In the aggregate, this magnitude approximates to around 9.3% of the aggregate search intensity of the labor force and 13.6% of the aggregate search intensity of unemployed individuals.[30]

The layoffs rate is also an important factor driving the countercyclical movements of minutes spent on OJS, conditional on reporting nonzero minutes on job search. Table 4

[28] One might think that OJS should be closely associated with quits, as workers who plan to quit their jobs are likely to look for a new job before they quit. However, the coefficient of OJS time on quits is negative and not statistically significant. Our empirical result suggests that those who lose their jobs involuntarily are a more important group than job quitters, and that the concern of job or income loss is a crucial factor in determining the aggregate OJS intensity.

[29] The approximated values are based on the earlier back-of-envelope calculations with assumptions that the unemployment rate is 5% and the search intensity of unemployed individuals is held at the average values in Table 1.

[30] The same assumptions of the earlier back-of-the-envelope calculations are used.

shows that the layoffs rate is the only labor turnover rate that has a statistically significant correlation with the intensive margin. A 1%p increase in the layoffs rate raises the intensive margin by 23 minutes. In the aggregate, this magnitude approximates 7% of the aggregate search intensity of the labor force and 10% of that of unemployed individuals.[31] The overall results from Tables 2 through 4 suggest that the countercyclicality in the intensive margin is weaker than that of the extensive margin. This implies that average minutes spent on OJS change over business cycles more through the adjustment of extensive margin than through the changes of intensive margin.

Meanwhile, log real wage (Real wage) and OJS intensity are positively associated and are statistically significant (last column of Table 2). In addition, the positive association is mainly driven by the intensive margin that is positively correlated with the log real wage with statistical significance (last column of Table 4). The extensive margin does not have a statistically significant correlation with the log real wage (last column of Table 3). However, the effect of the real wage on job-search efforts of employed individuals is somewhat limited. A 1% increase in the real wage raises OJS intensity by 0.02 minutes, and the intensive margin by 3.6 minutes.[32] Moreover, the cyclicality of the real wage is not clear, as discussed in the previous studies (e.g., Brandolini, 1995; Abraham and Haltiwanger, 1995; Fernald and Wang, 2016).[33] In fact, the median real weekly earnings of wage and salary workers rose about 4% between 2007Q4 and 2009Q2.[34] One explanation for this phenomenon is that the destruction of low productivity jobs could have raised the labor productivity and thus the real wage during the Great Recession. As low-productivity jobs disappeared, employed workers may have searched harder, which would have resulted in the positive correlation

[31] The same assumptions of the earlier back-of-the-envelope calculations are used.

[32] We also considered the 12-month percentage change in real wage. The coefficients on OJS minutes and the intensive margin are positive but are not statistically significant.

[33] Abraham and Haltiwanger (1995) conclude that correcting for all of the measurement problems, estimation problems, and composition problems does not lead to a finding of systematically procyclical and countercyclical real wages. In addition, Brandolini (1995) argue that it is doubtful that a stylized fact exists and that no undisputed empirical regularity has emerged so far.

[34] Labor productivity has shifted from weakly procyclical to strongly countercyclical since the early 1980s (Fernald and Wang, 2016).

between OJS intensity and the real wage. This possibility is also consistent with the other empirical findings supporting the countercyclical OJS intensity.

Tables 5 through 7 present how OJS intensity is associated with economic sentiments. Table 5 shows that workers' expectation on their finanial situations and the general economy in the future are found to be important determinants of OJS time. Minutes spent on OJS have statistically significant negative correlations with expected changes in financial situation in a year, buying conditions for durables, the probability of increases in stock prices in a year, and general business conditions that firms will face in six months. OJS time is positively correlated with the expected interest rate in a year with statistical significance. This implies that increases in interest-rate payment could impair workers' liquidity, and thus make them search harder for a better-paying job. Among the indices, buying conditions for durables is the subjective indicator that has the largest absolute correlation with OJS time, followed by the index of expected change in financial situation in a year. The association of OJS time with buying conditions for durables and expected changes in personal finance situations, stock prices, and interest-rate payment suggests that individuals' liquidity or their expectations of access to credit in the near future is an important determinant of how hard a worker who already has a job searches for a new job.

Table 6 documents the correlation between economic sentiment and the extensive margin. Similar to the results of OJS intensity, the extensive margin is also negatively correlated with the indices of buying conditions for durables, probability of increase in stock price in a year, and general business conditions in six months and is positively correlated with the expected interest rate with statistical significance. These results imply that workers consider their financial situation and future economic conditions when they make a decision on whether to look for a new job or not.

The intensive margin is negatively correlated with the expected changes in financial situation in a year, the only indicator that has statistical significance on the intensive margin among the sentiment indices considered (Table 7). Employed job seekers spend seven minutes

more on job search, if they perceive their finance situation will deteriorate in a year by one standard deviation.

The estimation results with subjective indices show that both the extensive and intensive margin share countercyclical features. The countercyclicality is found to be stronger in the extensive margin than is found in the intensive margin. This implies that the aggregate OJS intensity goes up during economic recessions, mainly because a larger fraction of employed individuals start to look for a new job rather than employed job seekers spend a longer time on job search.

3.3 OJS intensity in the cross section

In this section, we focus on individual and industry characteristics associated with OJS intensity in the cross section. In addition to the individual characteristics considered so far, we investigate if persons who work in industries with high employment turnover are more likely to engage in an OJS for their next job. The models we use for the analysis are as follows:

$$S_{ijt} = c_L L_j + c_x X_i + D_Y + D_Q + e_{ijt}, \tag{4}$$

$$E_{ijt} = c_L^e L_j + c_x^e X_i + D_Y^e + D_Q^e + e_{ijt}^e, \tag{5}$$

$$M_{ijt} = c_L^m L_j + c_x^m X_i + D_Y^m + D_Q^m + e_{ijt}^m. \tag{6}$$

The notations L_j is the average labor turnover rate of industry j. The notation c_L, c_L^e, and c_L^m are the coefficients on L_j; D_Y, D_Y^e, and D_Y^m are the year dummies; and e_{ijt}, e_{ijt}^e, and e_{ijt}^m are the error terms of equations (4),(5), and (6), respectively.

Table 8 documents the relation between individual characteristics and OJS time. Male workers, workers with higher education, and part-time workers tend to search harder for a new job, while married workers and female workers who have children at home tend to

spend fewer minutes on a job search with statistical significance.[35][36][37] Age has a nonlinear relation with time spent on OJS. The coefficients on age terms suggest that workers search harder for a new job as they get older until age 37, after which they search less.[38] Weekly wage earnings and weekly hours worked have statistically significant negative correlations with minutes spent on an OJS. This finding implies that those who have a low-quality job tend to search harder for a new job. The coefficients on individual characteristics do not change much, if we remove the average labor turnover rates.[39] This finding suggests that the associations between individual characteristics and OJS intensity are fairly constant across industries.

In addition, overall the average labor turnover rates have a statistically significant positive correlation with OJS intensity. These results suggest that workers search harder for a new job if they are in an industry where churn rates are high. Meanwhile, one exception is the average exit probability from unemployment. The coefficient is negative but not statistically significant. Besides, the average volatility of employment growth and the average log real wage have a positive correlation with OJS time, but the coefficients are not statistically significant.[40]

Table 9 shows how the cross-sectional characteristics of employed job seekers are associated with OJS on the extensive margin. The results are similar to those of OJS time except the coefficients on being male, having children at home and age. First, men are more likely to engage in an OJS, but the correlation is not statistically significant. Second, workers who

[35] Aliprantis, Chen, and Vecchio (2014) also find that among the unemployed, more-educated individuals spend a longer time on job search.

[36] Married workers could be less likely to be financially constrained due to their spouse's income than those who do not have other sources of income when they lose their jobs. In addition, women who have children to take care of at home might trade their job-search time for child care.

[37] We also considered the dummy variable, $Women * Married$, instead of $Women * Children$, but the coefficient of the latter is larger in the absolute value and statistically more significant. Aliprantis and Vecchio (2015) show that a similar phenomenon is found among unemployed women with at least a bachelor's degree.

[38] Aliprantis, Chen, and Vecchio (2014) also find a similar nonlinear relation between age and time spent on a job search among unemployed women with a bachelor's degree.

[39] The result is robust, if we replace the average labor turnover rates with industry fixed effects.

[40] Instead of the average log real wage, we also considered the average 12-month change in the log real wage. The coefficient is positive, but not statistically significant.

have children at home also tend to participate in an OJS more with statistical significance. Lastly, the nonlinear correlation with age is not found in the extensive margin. Rather, the extensive margin increases monotonically with age.

Table 10 documents the correlation between individual characteristics and the intensive margin. Unlike the results of OJS time and the extensive margin, the intensive margin has statistically significant correlations only with hours worked, having a bachelor's degree, having children at home, and having a part-time job. Having a bachelor's degree is positively associated with the intensive margin, while having children at home and hours worked have negative correlations with it. It is notable that part-time workers tend to spend fewer minutes on job search, although they are more likely to engage in an OJS. In addition, the intensive margin is also positively correlated with industry labor-market turnover, but the coefficients are not statistically significant, unlike the previous cases.

4 Robustness check

4.1 Sample selection based on unobserved heterogeneity

In this section, we examine whether our empirical analysis based on the ATUS could potentially bias the cyclicality of OJS intensity. In the CPS, people are classified as unemployed if they do not have a job during the reference week, have actively looked for work in the past four weeks, and are currently available for work. According to this definition, a jobless individual is an active job searcher, if the person did any job-search activities listed in the questionnaire[41] during the prior four weeks. This definition of a job searcher has been largely used, and the number of unemployed job seekers has been measured accordingly. However, the CPS does not ask employed workers about job searches. If the CPS

[41] Actively looking for work may consist of any of the following activities: (1) contacting an employer directly; having a job interview; or contacting a public or private employment agency, friends or relatives, or a school or university employment center, (2) submitting a resume or filling out applications, (3) placing or answering job advertisements, (4) checking union or professional registers, or (5) some other means of an active job search (http://www.bls.gov/cps/faq.htm).

had questions about job searches for an employed individual, the survey would have asked whether the person had actively looked for a job during the four weeks prior to the reference week to identify whether the person is a job seeker. Meanwhile, in the ATUS we define a job seeker as an individual who reports spending nonzero minutes on any job search activity on a specific day.[42] The difference in the length of period being surveyed about job-search activities could bias our inference about the cyclicality of OJS intensity if those employed who report nonzero minutes for job search efforts in the ATUS are different from those who would have been classified as employed job seekers in the CPS.

Because the ATUS records the activities that an individual did on a specific day of month, those who look for a job frequently are more likely to report nonzero minutes for a job search and to be captured as a job seeker in the ATUS than others. Therefore, the share of frequent job searchers would be larger in the ATUS than it would be in the CPS. If the frequent job searchers' job search efforts are different from others in response to a change in labor market conditions, then the correlation between job-search time and labor market indicators estimated from the ATUS may not be representative. For example, employed individuals with high risk aversion might look for a job more frequently than others. Then, the frequent job searchers will raise their job-search effort much more than any other workers do when the labor market condition deteriorates. In this case, the countercyclicality of OJS intensity measured with ATUS could be overstated.

To mitigate this problem, we use the two-step approach of Heckman (1979). Selection on unobserved attributes occurs when the error term in the equation of the intensive margin is correlated with selection into the sample used for estimation. To obtain unbiased estimates, the Heckman approach uses a control function of exogenous variables that are correlated with whether an employed individual does job-search activities but uncorrelated with how many minutes the job seeker spends on the job search. We use the day of the week as the exogenous

[42]Share of employed individuals who engaged in job search on each day of the week: Sunday (17.6%), Monday (14.9%), Tuesday (13.7%), Wednesday (13.2%), Thursday (14.3%), Friday (10.6%), Saturday (15,7%).

variable.[43] We assume that highly risk-averse individuals would look for a job almost every day, even on the week days, because they are desperate to find a new job facing negative wealth shocks possibly originating from job loss or wage cuts, and are willing to spend time looking for a job on week days when they work at the current jobs. Meanwhile, less frequent job searchers might be less risk averse about their financial situations or employment stability and would be more likely to look for a job on weekends. In the first stage, a probit model is used to predict the probability of engaging in a job search with the exogenous variables included in the regression. The inverse-Mills ratio is calculated from the first stage and is included as a regressor in the second-stage regression. The second-stage model is estimated with OLS.

The first-stage probit model is as follows.

$$
\begin{aligned}
&E^*_{ijt} = c^e_l l_{jt} + c^e_x X_i + D^e_j + D^e_Q + D^e_D + \epsilon^e_{ijt} \\
&\epsilon^e_{ijt} \sim N(0,1) \\
&E_{ijt} = \begin{cases} 1 & \text{if } E^*_{ijt} > 0 \\ 0 & \text{if } E^*_{ijt} \leq 0 \end{cases}
\end{aligned} \tag{7}
$$

E^*_{ijt} is a latent variable that determines whether individual i in industry j spends nonzero minutes on job search in month t. D^e_D denotes the dummy variable that captures the day of the week that the individual i in industry j did job-search activities. ϵ^e_{ijt} is a continuously distributed variable independent of the regressors drawn from a standard normal distribution. If E^*_{ijt} is greater than 0, then E_{ijt} takes the value 1; otherwise, E_{ijt} is zero. As the cyclical indicator that goes into the regression, I use the layoffs rate, as it has the highest correlation with the extensive margin as shown in Table 3 and is available at the industry level.

The coefficients of the probit model are obtained by estimating the following model with

[43]The day of the week is frequently used to control sample selection based on unobserved heterogeneity. See, for example, Attanasio and Kaufmann (2009) and Tumen and Zeydanli (2013).

maximum likelihood:

$$P(E_{ijt} = 1|x) = \Phi(Z_i\beta),$$

where Z_i denotes the vector of regressors in equation (7), β denotes the vector of coefficients on Z_i; $\Phi(\cdot)$ and $\phi(\cdot)$ denote the cdf and pdf of the standard normal distribution, respectively.

Let $\hat{\beta}$ be the vector of coefficients estimated from the probit model. The inverse-Mills ratio, $\hat{\lambda_i}$, is calculated from the following:[44]

$$\hat{\lambda_i} = \frac{\phi(Z_i\hat{\beta})}{\Phi(Z_i\hat{\beta})}.$$

The term, $\hat{\lambda_i}$ is included in the second-stage regression as follows;

$$M_{ijt} = c_l^m l_{jt} + c_x^m X_i + c_\lambda^m \hat{\lambda_i} + D_j^m + D_Q^m + \epsilon_{ijt}^m, \tag{8}$$

where c_λ^m is the coefficient on $\hat{\lambda_i}$. Equation (8) is estimated with OLS. To compare the results with the baseline results, we report the marginal effect of each covariate on OJS time ($E(S)$) and the extensive margin ($P(S > 0)$).[45]

Table 11 documents the estimation results with the layoffs rate as the cyclical indicator. There are three notable features. First, the coefficients on day-of-the-week variables that are included in the selection equation are all statistically significant. Workers are more likely to participate in job search on the week days. The inclusion of day-of-the-week variables slightly lowers the coefficient on the layoffs rate and its statistical significance from 23.9 (t-statistics: 2.03) to 17.6 (t-statistics: 1.50). Overall, the average marginal effect on OJS time of a 1%p rise in the layoffs rate is 0.18 (last column of Table 11), lower than the OLS estimate (0.27). These results suggest that the ATUS sample tends to be somewhat over-represented by frequent job searchers who are likely to spend a longer time on job search

[44]The details on the derivation of inverse-Mills ratio are found in Wooldridge (2010).

[45]Since the probit model is nonlinear, we cannot interpret the coefficients as we interpret the OLS estimates. I report marginal effects at means that summarize how changes in response are related to changes in covariates around the means.

when the labor market condition deteriorates. Nonetheless, the countercyclicality in the average OJS intensity, extensive margin, and intensive margin is still robust, even if we control for the sample selection based on unobserved heterogeneity that could overstate the countercyclicality.

5 Theoretical Explanation

From the empirical exercises, we have found that employed individuals, on average, search harder for a new job as the current labor market condition deteriorates, and they feel more uncertain about the future economic situation and pessimistic about their financial situation. These results suggest that workers who already have a job are likely to look for a new job to insure against possible income or job loss in the future—a precautionary motive.[46] This implies that job search activity can be seen as analagous to saving. In this section, we present a simple theoretical model that captures the empirical finding. We study conditions under which the precautionary job-search motive operates and drives countercyclical OJS intensity.

1. Overview

Consider a two-period consumption model of a worker who already has a job in the first period.[47] The worker is risk averse and derives utility from consumption, but she derives disutility from the effort she spends on searching for a new job. Assume that workes do not have access to complete insurance market. Suppose, for simplicity, that saving technology does not exist in this economy.[48] The worker self-insures against possible income loss in the future by raising job-search effort in the first period, when she expects the labor market

[46]This is a concept similar to "precautionary saving" discussed in the literature of consumption and risk (for example, Leland, 1968; Lusardi, 1998; Kimball, 1990; Aiyagari, 1994).

[47]The extension to a multiple period model is straightforward. Just to provide the intuition, we consider a simple set-up. In addition, we do not separately analyze the extensive and intensive margin.

[48]We abstract saving in this model, as the interaction between saving and job search is not of main interest.

conditions to deteriorate in the second period or feels uncertain about the labor market situation in the future. It is because by searching hard for a new job, it becomes much easier for her to find a job in case she loses her current job or to switch to a better-paying employer when she experiences a wage cut at her current job. The model is a partial equilibrium model, so labor market variables such as the aggregate job-finding rate, job-loss rate, employment volatility, and wages are determined exogenously.[49]

2. Model Timing

1. *First period*: In the first period, the worker earns wage, w_1, and decides how much of her income she will spend on consumption, c_1, and job search, s_1.[50]

2. *Second period*: In the second period, separation takes place. The worker becomes unemployed with probability δ_2.

(1) When the worker loses her job: she remains unemployed and receives the unemployment insurance benefit b if the worker did not search for a job in the first period, or she can find a new job with probability p_2 and earn wage w_2 if the worker did job-search activities in the first period.

(2) When the worker does not lose her job: she can either stay with her current employer, and gets wage w_2 if she did not search for a new job, or she can switch to a new employer with probability p_2 and earn wage $w_2 + \mu$ with $\mu > 0$ if she looked for a new job in the first period.[51][52]

[49]These labor market variables could be determined endogenously, if we allow interactions between them and individual job-search effort in the general equilibrium sense. However, we do not consider possible general equilibrium effects of OJS intensity in this paper.

[50]Strictly speaking, s_1 , represents the cost of job search. For simplicity, we assume that the cost of job search has a positive linear correlation with the level of job-search effort.

[51]To make the problem simple, we assume that the probability of a job loser to find a new job is the same as the probability of an employed worker switching to a new job. In the data, the levels of two probabilities are different but share similar cyclicality. The result does not change, although we allow the job-finding probabilities of unemployed and employed workers in the model to be different, if we are willing to assume that the two probabilities have the same cyclicality.

[52]μ captures the difference in the wages of current employer and new employer. The difference could capture idiosyncratic productivity shock on each firm. μ could also represent the imputed non-monetary value coming from the preference toward a new job. For example, a worker might switch to a new job due

The worker has imperfect knowledge about the labor market condition in the second period. Therefore, her second-period consumption is a random variable that depends on her second-period income.

Let f_2 be the aggregate job-finding probability. Then, an employed individual's probability of finding a new job, p_2, is a function of s_1 and f_2 as follows:

$$p_2 = p(s_1, f_2).$$

We assume that $\frac{\partial p(s_1,f_2)}{\partial s_1} > 0$ and $\frac{\partial^2 p(s_1,f_2)}{\partial s_1^2} < 0$.

3. Model

In this set-up, the employed worker's problem is written into the following.

$$\begin{aligned} \max_{s_1} \quad & U(c_1, c_2) = u(c_1) + \beta E\{u(c_2)\} \\ \text{s.t.} \quad & c_1 = w_1 - s_1 \\ & c_2 = \delta_2\{b + p_2(w_2 - b)\} + (1 - \delta_2)(w_2 + p_2\mu) \end{aligned}$$

If we retain the assumption $\beta = 1$, for simplicity, the first-order necessary condition for optimal consumption and search effort is obtained from the following Euler equation

$$u'(c_1) = E[u'(c_2) \underbrace{\{\delta_2(w_2 - b) + (1 - \delta_2)\mu\} \frac{\partial p(s_1, f_2)}{\partial s_1}}_{\text{rate of return from one unit of job search}}]. \tag{9}$$

Equation (9) says that the worker should be indifferent between, on the one hand, consuming one more unit in period one and, on the other hand, spending one unit for job search in period one and consuming the units equivalent to the expected outcome of job search in period two. Note that the term in brackets is the rate of return from job search. The key difference from

to better commuting time or friendlier colleagues, even though there is no wage increase.

the usual consumption Euler equation is that the rate of return from one unit of job search depends on the expected values of stochastic parameters, δ_2, w_2, and f_2, while the rate of return from saving is a fixed parameter in a usual model of consumption and saving.

Suppose that there is a sufficient statistic of labor market condition in period two, denoted as ξ_2, that determines the labor market variables in the second period. Let $V(\xi_2)$ be the realized utility from consumption in the second period, then

$$V(\xi_2) = u(c_2). \tag{10}$$

Assume that $\frac{\partial V(\xi_2)}{\partial \xi_2}$, $\frac{\partial V^2(\xi_2)}{(\partial \xi_2)^2}$, and $\frac{\partial V^3(\xi_2)}{(\partial \xi_2)^3}$ exist. If we take derivatives of both sides of equation (10) with respect to s_1, then we have

$$\frac{\partial V(\xi_2)}{\partial \xi_2}\frac{\partial \xi_2}{\partial s_1} = u'(c_2)[\delta_2(w_2 - b) + (1 - \delta_2)\mu]\frac{\partial p(s_1, f_2)}{\partial s_1}. \tag{11}$$

Let $\bar{\xi}_2$ be the value of ξ_2 expected in period 1. Then, the optimal level of job search in the first period is also detemined by $\bar{\xi}_2$. Suppose that $s_1 = g(\bar{\xi}_2)$ where $\bar{\xi}_2 = h(s_1)$, and $\frac{\partial \bar{\xi}_2}{\partial s_1} = \frac{\partial h(s_1)}{\partial s_1} = h$. We assume that $h = 1$ to simplify our analysis, as suppressing the notation h does not influence the key feature of the model. Suppose in addition that $\xi_2 = \bar{\xi}_2 + e_2$ where $e_2 \sim IID(0, \sigma^2)$.

Approximating equation (11) using Taylor expansion, it follows that

$$E\left[\frac{\partial V(\xi_2)}{\partial \xi_2}\right] = \frac{\partial V(\xi_2)}{\partial \xi_2}|_{\xi_2 = \bar{\xi}_2} + \frac{1}{2}\left[\frac{\partial V^3(\xi_2)}{(\partial \xi_2)^3}|_{\xi_2 = \bar{\xi}_2}\right]\sigma^2.$$

Let $V'''(\bar{\xi}_2) = \frac{\partial V^3(\xi_2)}{(\partial \xi_2)^3}|_{\xi_2 = \bar{\xi}_2}$ for notational convenience. If we assume that the utility function is a log function, the equation (9) is rearranged into

$$\frac{1}{c_1} = \frac{1}{\bar{c}_2}\left[\frac{\bar{\delta}_2(\bar{w}_2 - b) + (1 - \bar{\delta}_2)\mu}{1 - \frac{1}{2}V'''(\bar{\xi}_2)\sigma^2(w_1 - s_1)}\frac{\partial p(s_1, \bar{f}_2)}{\partial s_1}\right], \tag{12}$$

where $E(\delta_2) = \bar{\delta}_2$, $E(w_2) = \bar{w}_2$, and $E(f_2) = \bar{f}_2$, and

$$\bar{c}_2 = \bar{\delta}_2\{b + (\bar{w}_2 - b)\bar{p}_2\} + (1 - \bar{\delta}_2)(\bar{w}_2 + \bar{p}_2\mu).$$

If we are willing to assume that δ, w, and f are persistent processes, then the expected values of δ_2, w_2, and f_2 are positively correlated with δ_1, w_1, and f_1 ($\frac{\partial\bar{\delta}_2}{\partial\delta_1} > 0, \frac{\partial\bar{w}_2}{\partial w_1} > 0, \frac{\partial\bar{f}_2}{\partial f_1} > 0$).[53] In addition, note that $1 - \frac{1}{2}V'''(\bar{\xi}_2)\sigma^2(w_1 - s_1)$ is not zero, as equation (12) implies that consumption in the first period should be zero, otherwise.

In addition, the rate of return from one unit of job search should be higher when there is uncertainty to compensate for the risk of job search. The following lemma provides the necessary condition for the risk premium associated with job search to be positive.

Lemma 1 *If $1 - \frac{1}{2}V'''(\bar{\xi}_2)\sigma^2(w_1 - s_1)$ is between 0 and 1, the rate of return from job search is higher when there is uncertainty.*

Proof. Without uncertainty about the labor market condition in the second period, the rate of return from job search implied by the Euler equation (9) is

$$[\bar{\delta}_2(\bar{w}_2 - b) + (1 - \bar{\delta}_2)\mu]\frac{\partial p(s_1, \bar{f}_2)}{\partial s_1}.$$

The Euler equation (12) suggests that the rate of return from job search when there is uncertainty is

$$\left[\frac{\bar{\delta}_2(\bar{w}_2 - b) + (1 - \bar{\delta}_2)\mu}{1 - \frac{1}{2}V'''(\bar{\xi}_2)\sigma^2(w_1 - s_1)}\right]\frac{\partial p(s_1, \bar{f}_2)}{\partial s_1}$$

For the rate of return from job search in the presence of uncertainty to be higher than that without uncertainty, $0 < 1 - \frac{1}{2}V'''(\bar{\xi}_2)\sigma^2(w_1 - s_1) < 1$. ■

Note that $1 - \frac{1}{2}V'''(\bar{\xi}_2)\sigma^2(w_1 - s_1)$ is the parameter determining the size of risk premium associated with the rate of return from OJS.

Based on the Euler equation (9), now we can analyze how $\bar{w}_2$, $\bar{\delta}_2$, $\bar{f}_2$ and σ^2 affect the job search effort in the first period.

[53] If δ, w, and f are random walks, then $\bar{\delta}_2$, $\bar{w}_2$, and $\bar{f}_2$ are the same as δ_1, w_1, and f_1, respectively.

Proposition 1 *If $V'''(\bar{\xi}_2)$ is positive, job search effort increases as labor market uncertainty, σ^2, rises.*

Proof. The Euler equation (9) is rearranged into

$$F = \frac{\bar{\delta}_2 b + (1-\bar{\delta}_2)\bar{w}_2}{\bar{\delta}_2(\bar{w}_2 - b) + (1-\bar{\delta}_2)\mu} + \bar{p}_2 - \left(\frac{w_1 - s_1}{1 - \frac{1}{2}V'''(\bar{\xi}_2)\sigma^2(w_1 - s_1)}\right)\frac{\partial p(s_1, \bar{f}_2)}{\partial s_1} = 0.$$

Using the implicit function theorem, the derivative is written into the following,

$$\frac{\partial s_1}{\partial \sigma^2} = -\left[\frac{\frac{\partial F}{\partial \sigma^2}}{\frac{\partial F}{\partial s_1}}\right],$$

where $\frac{\partial F}{\partial \sigma^2}$ and $\frac{\partial F}{\partial s_1}$ are the following:

$$\frac{\partial F}{\partial s_1} = \frac{\partial p(s_1, \bar{f}_2)}{\partial s_1}\left[1 + \frac{1}{\{1 - \frac{1}{2}V'''(\bar{\xi}_2)\sigma^2(w_1 - s_1)\}^2}\right] - \frac{\partial^2 p(s_1, \bar{f}_2)}{\partial s_1^2}\left\{\frac{w_1 - s_1}{1 - \frac{1}{2}V'''(\bar{\xi}_2)\sigma^2(w_1 - s_1)}\right\} > 0$$

$$\frac{\partial F}{\partial \sigma^2} = -\left[\frac{\frac{1}{2}V'''(\bar{\xi}_2)\sigma^2(w_1 - s_1)^2}{\{1 - \frac{1}{2}V'''(\bar{\xi}_2)\sigma^2(w_1 - s_1)\}^2}\right]\frac{\partial p(s_1, \bar{f}_2)}{\partial s_1}.$$

If $V'''(\bar{\xi}_2)>0$ and $\frac{\partial F}{\partial \sigma^2}<0$, then $\frac{\partial s_1}{\partial \sigma^2}>0$. ■

Corollary 2 *Job search effort increases, as the job loss rate rises. ($\frac{\partial s_1}{\partial \delta_1} > 0$)*

Proof. The implicit function theorem gives

$$\frac{\partial s_1}{\partial \bar{\delta}_2} = -\left[\frac{\frac{\partial F}{\partial \bar{\delta}_2}}{\frac{\partial F}{\partial s_1}}\right],$$

of which the sign is determined by

$$\frac{\partial F}{\partial \bar{\delta}_2} = \frac{-(\bar{w}_2 - b)[\bar{\delta}_2(\bar{w}_2 - b) + (1-\bar{\delta}_2)\mu] - [\bar{\delta}_2 b + (1-\bar{\delta}_2)\bar{w}_2](\bar{w}_2 - b - \mu)}{[\bar{\delta}_2(\bar{w}_2 - b) + (1-\bar{\delta}_2)\mu]^2} < 0.$$

Therefore, $\frac{\partial s_1}{\partial \bar{\delta}_2} > 0$, and thus $\frac{\partial s_1}{\partial \delta_1} > 0$. ■

Corollary 3 *Job search effort increases to a fall in future wages, if the wage gain associated with switching to a new job is sufficiently large. Job search effort decreases to a fall in future wages, otherwise.*

Proof. The implicit function theorem gives

$$\frac{\partial s_1}{\partial \bar{w}_2} = -\left[\frac{\frac{\partial F}{\partial \bar{w}_2}}{\frac{\partial F}{\partial s_1}}\right],$$

of which the sign is determined by

$$\frac{\partial F}{\partial \bar{w}_2} = -\bar{\delta}_2 b + (1-\bar{\delta}_2)^2 \mu.$$

$\frac{\partial s_1}{\partial \bar{w}_2} < 0$ if $\mu > \left[\frac{\bar{\delta}_2}{(1-\bar{\delta}_2)^2}\right] b$, and $\frac{\partial s_1}{\partial \bar{w}_2} > 0$ if $\mu < \left[\frac{\bar{\delta}_2}{(1-\bar{\delta}_2)^2}\right] b$. ■

The corollary implies the following. When workers expect the wage from current job to fall in the future, then they will search harder for a new job, if they can get a much higher wage at a new job. Otherwise, when wages fall, it is more beneficial for a worker to reduce job-search effort, and to stay unemployed receiving the unemployment insurance benefit when losing the current job.[54]

Proposition 2 *The correlation between job-search effort and the job-finding rate is either positive, negative, or zero depending on the functional form of* $p(s_1, \bar{f}_2)$.

Proof. The implicit function theorem gives

$$\frac{\partial s_1}{\partial \bar{f}_2} = -\left[\frac{\frac{\partial F}{\partial \bar{f}_2}}{\frac{\partial F}{\partial s_1}}\right],$$

[54]In the empirical section, we found that OJS intensity is positively correlated with the real wage. This positive association could have been driven by increased productivity during economic downturns due to the destruction of less productive jobs. Our theoretical prediction suggests that the association between OJS intensity and wage could be either positive or negative, but this may not show up in the empirial result, as the effect of countercyclical productivity on wages which we did not consider in the theory is dominant.

of which the sign is determined by

$$\frac{\partial F}{\partial \bar{f}_2} = \frac{\partial p(s_1, \bar{f}_2)}{\partial \bar{f}_2} - \frac{\partial^2 p(s_1, \bar{f}_2)}{\partial s_1 \partial \bar{f}_2} \left\{ \frac{w_1 - s_1}{1 - \frac{1}{2} V'''(\bar{\xi}_2) \sigma^2 (w_1 - s_1)} \right\}.$$

If $\frac{\partial^2 p(s_1, \bar{f}_2)}{\partial s_1 \partial \bar{f}_2} \geq \frac{\partial p(s_1, \bar{f}_2)}{\partial \bar{f}_2} \left\{ \frac{1 - \frac{1}{2} V'''(\bar{\xi}_2) \sigma^2 (w_1 - s_1)}{w_1 - s_1} \right\}$, then $\frac{\partial s_1}{\partial \bar{f}_2} \geq 0$ and thus $\frac{\partial s_1}{\partial f_1} \geq 0$. If $\frac{\partial^2 p(s_1, \bar{f}_2)}{\partial s_1 \partial \bar{f}_2} < \frac{\partial p(s_1, \bar{f}_2)}{\partial \bar{f}_2} \left\{ \frac{1 - \frac{1}{2} V'''(\bar{\xi}_2) \sigma^2 (w_1 - s_1)}{w_1 - s_1} \right\}$, then $\frac{\partial s_1}{\partial \bar{f}_2} < 0$ and thus $\frac{\partial s_1}{\partial f_1} < 0$. ■

The sign of correlation between job search effort and the aggregate job-finding probability is not straightforward. Rather, it depends on how the two variables interact to contribute to the job-finding probability of an employed individual searching for a new job.[55]

Corollary 4 *If $p(s_1, \bar{f}_2)$ is a linear production function, $\frac{\partial s_1}{\partial f_1} < 0$. If $p(s_1, \bar{f}_2)$ is a Cobb-Douglas production function, $\frac{\partial s_1}{\partial f_1} > 0$. If $p(s_1, \bar{f}_2)$ is a Leontief production function, $\frac{\partial s_1}{\partial f_1} = 0$ or $+\infty$.*

Proof. Suppose that $p(s_1, \bar{f}_2)$ is a linear production function of s_1 and $\bar{f}_2$ as follows,

$$p(s_1, \bar{f}_2) = \alpha s_1 + \beta \bar{f}_2.$$

It follows that $\frac{\partial^2 p(s_1, \bar{f}_2)}{\partial s_1 \partial \bar{f}_2} = 0$. Because $\frac{\partial F}{\partial \bar{f}_2} = \frac{\partial p(s_1, \bar{f}_2)}{\partial \bar{f}_2} = \beta > 0$, $\frac{\partial s_1}{\partial \bar{f}_2} < 0$. Therefore, $\frac{\partial s_1}{\partial f_1} < 0$.

Now suppose that $p(s_1, \bar{f}_2)$ is a Cobb-Douglas production function of s_1 and $\bar{f}_2$ as follows,

$$p(s_1, \bar{f}_2) = (s_1)^{\alpha} (\bar{f}_2)^{\beta}.$$

In this case, $\frac{\partial p(s_1, \bar{f}_2)}{\partial \bar{f}_2} = \beta (s_1)^{\alpha} (\bar{f}_2)^{\beta - 1}$ and $\frac{\partial^2 p(s_1, \bar{f}_2)}{\partial s_1 \partial \bar{f}_2} = \alpha \beta (s_1)^{\alpha - 1} (\bar{f}_2)^{\beta - 1}$. It follows that

$$\frac{\partial F}{\partial \bar{f}_2} = \beta (s_1)^{\alpha - 1} (\bar{f}_2)^{\beta - 1} \left\{ s_1 - \frac{\alpha (w_1 - s_1)}{1 - \frac{1}{2} V'''(\bar{\xi}_2) \sigma^2 (w_1 - s_1)} \right\}.$$

[55] Shimer (2004) and Schwartz (2014) show similar insights theoretically that the ease of finding a job and job-search intensity could be either complements or substitutes with each other, so the job-search effort of unemployed individuals could rise or fall due to a rise in the job availability.

Note that $\left\{ s_1 - \frac{\alpha(w_1 - s_1)}{1 - \frac{1}{2}V'''(\bar{\xi}_2)\sigma^2(w_1 - s_1)} \right\} < 0$, as the Euler equation (9) can be arrnaged into

$$s_1 - \frac{\alpha(w_1 - s_1)}{1 - \frac{1}{2}V'''(\bar{\xi}_2)\sigma^2(w_1 - s_1)} = -\frac{\alpha}{\frac{\partial p(s_1, \bar{f}_2)}{\partial s_1}} \left\{ \frac{\bar{\delta}_2 b + (1 - \bar{\delta}_2)\bar{w}_2}{\bar{\delta}_2(\bar{w}_2 - b) + (1 - \bar{\delta}_2)\mu} \right\} < 0.$$

Therefore, $\frac{\partial s_1}{\partial \bar{f}_2} > 0$, and thus $\frac{\partial s_1}{\partial f_1} > 0$, as $\frac{\partial F}{\partial \bar{f}_2} < 0$.

Lastly, consider the case that $p(s_1, \bar{f}_2)$ is a Leontief production function of s_1 and $\bar{f}_2$ as follows,

$$p(s_1, \bar{f}_2) = \min(\alpha s_1, \beta \bar{f}_2).$$

If $\alpha s_1 < \beta \bar{f}_2$, $p(s_1, \bar{f}_2) = \alpha s_1$. In this case, $\frac{\partial s_1}{\partial \bar{f}_2} = 0$, so $\frac{\partial s_1}{\partial f_1} = 0$. If $\alpha s_1 > \beta \bar{f}_2$, $p(s_1, \bar{f}_2) = \beta \bar{f}_2$. In this case, $\frac{\partial s_1}{\partial \bar{f}_2} = +\infty$, so $\frac{\partial s_1}{\partial f_1} = +\infty$. ■

The negative empirical correlations between job-finding probabilities (UE and EE transition probabilities) and OJS intensity imply that job-search effort and the aggregate job-finding probabilities are likely to be perfect substitutes to produce the job-finding probabilities of employed individuals.

6 Conclusion

We study the cyclical properties of OJS intensity of those who already have a job in the U.S. labor market with ATUS and various cyclical indicators from CPS, JOLTS, CES, Survey of Consumers and Manufacturing Business Outlook Survey. We find that OJS intensity is countercyclical along both the extensive and intensive margins, with the countercyclicality of the extensive margin stronger than that of the intensive margin. Both countercyclicalities are robust after controlling for various types of heterogeneity. An increase in the layoffs rate and the deterioration in expectations about future personal financial situation are the primary factors that raise OJS intensity. These empirical findings all suggest that the precautionary motive in job search could be an important channel that drives the countercyclicality of OJS intensity.

These findings provide the following implications on the development of the literature on search-and-matching models. First, the countercyclical OJS intensity driven by precautionary motives suggests that it is important to take risk aversion and incomplete insurance into account in the job search behavior of those who already have a job. In addition, it can be a new channel to resolve the Shimer puzzle, as the job-search effort of employed job seekers could crowd out the job search efforts of unemployed individuals during economic downturns. This congestion effect could be particularly strong if firms prefer workers with recent job experience over workers with jobless spells. The crowding-out effect could be an additional source of generating the volatility of the unemployment rate and thus could be an important piece to solve the Shimer puzzle.

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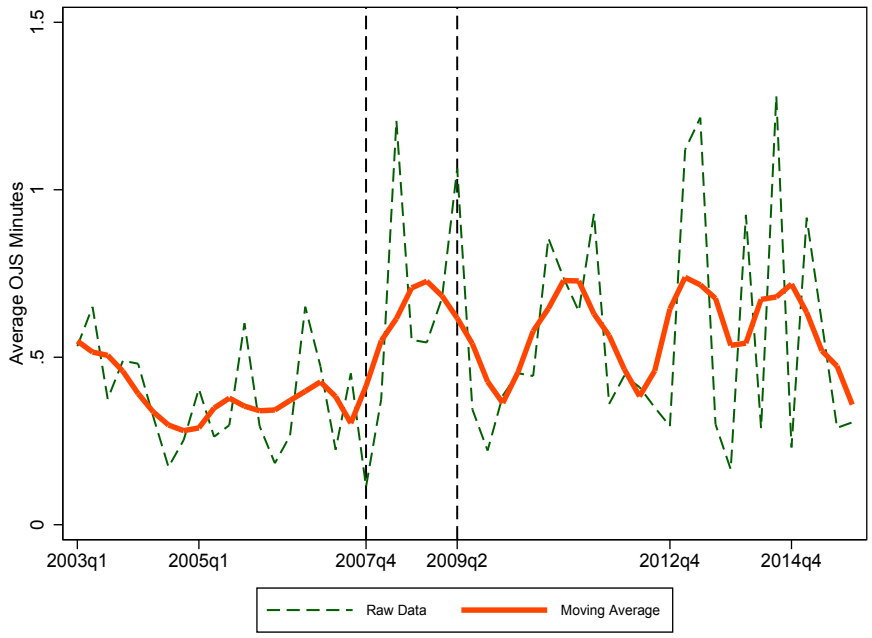
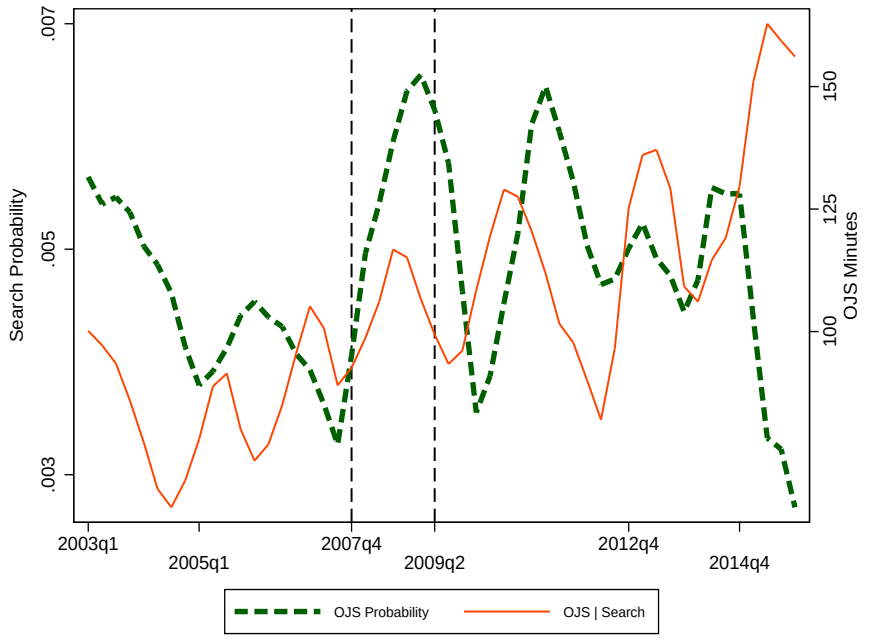
Figure 1. Average minutes employed job seekers spend on job search



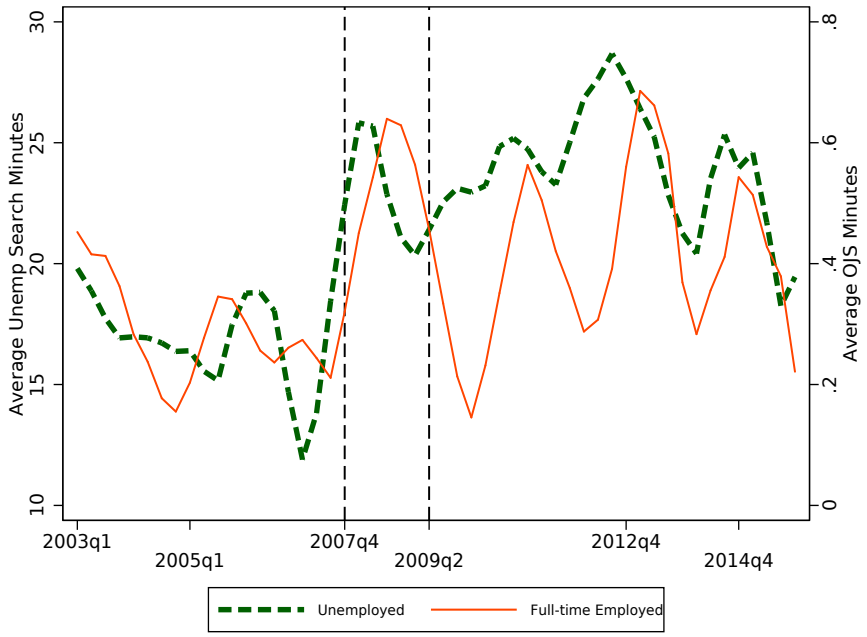
Source: author's calculation.

Figure 2. Extensive and intensive margin of OJS intensity
(Centered four-quarter moving averages)



Source: author's calculation.

Figure 3. Average job-search time of the full-time employed and the unemployed
(Centered four-quarter moving averages)

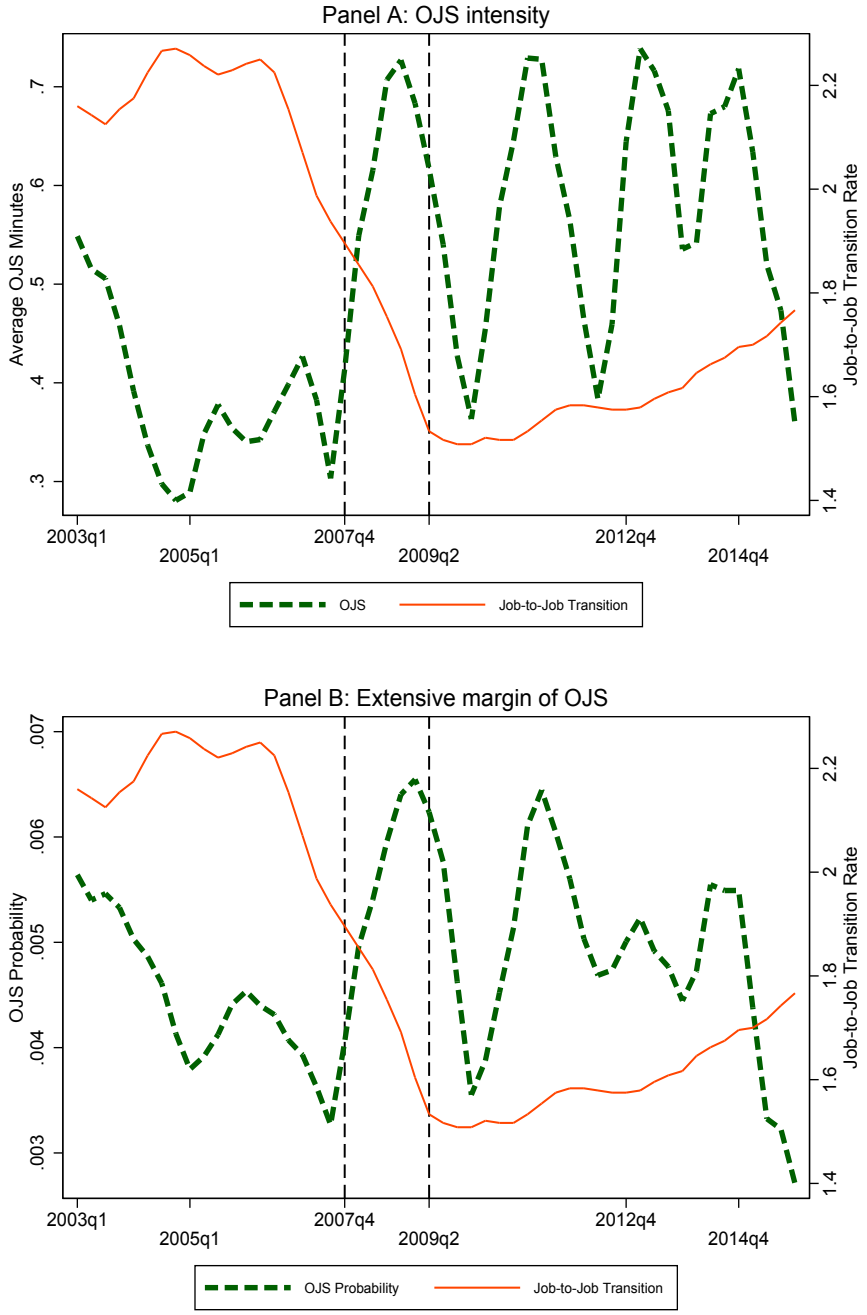


Source: author's calculation.

Figure 4. Average job-search time of the full-time and part-time employed
(Centered four-quarter moving averages)

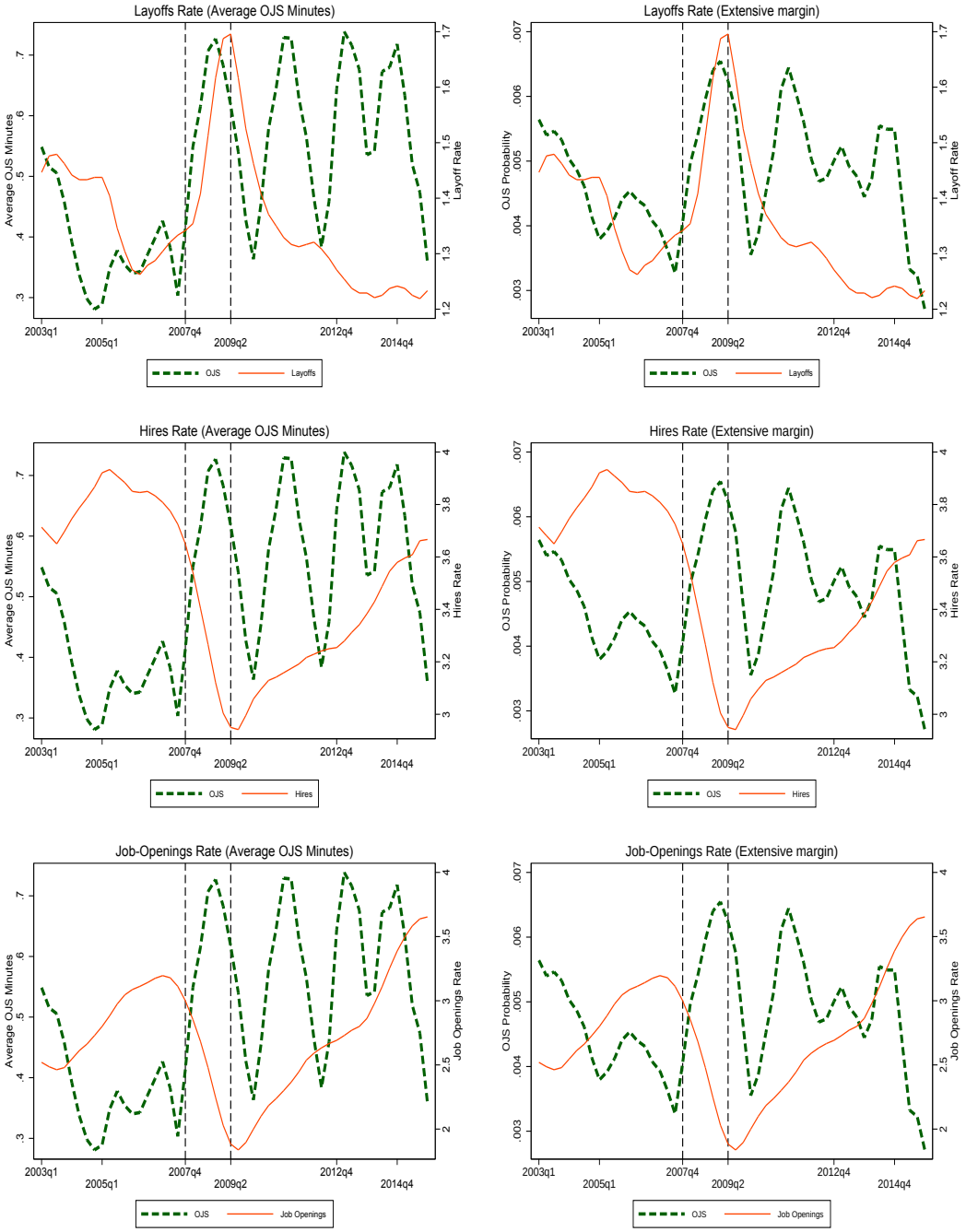
Source: author's calculation.

Figure 5. Average OJS time and job-to-job transition rate
(Centered four-quarter moving averages)



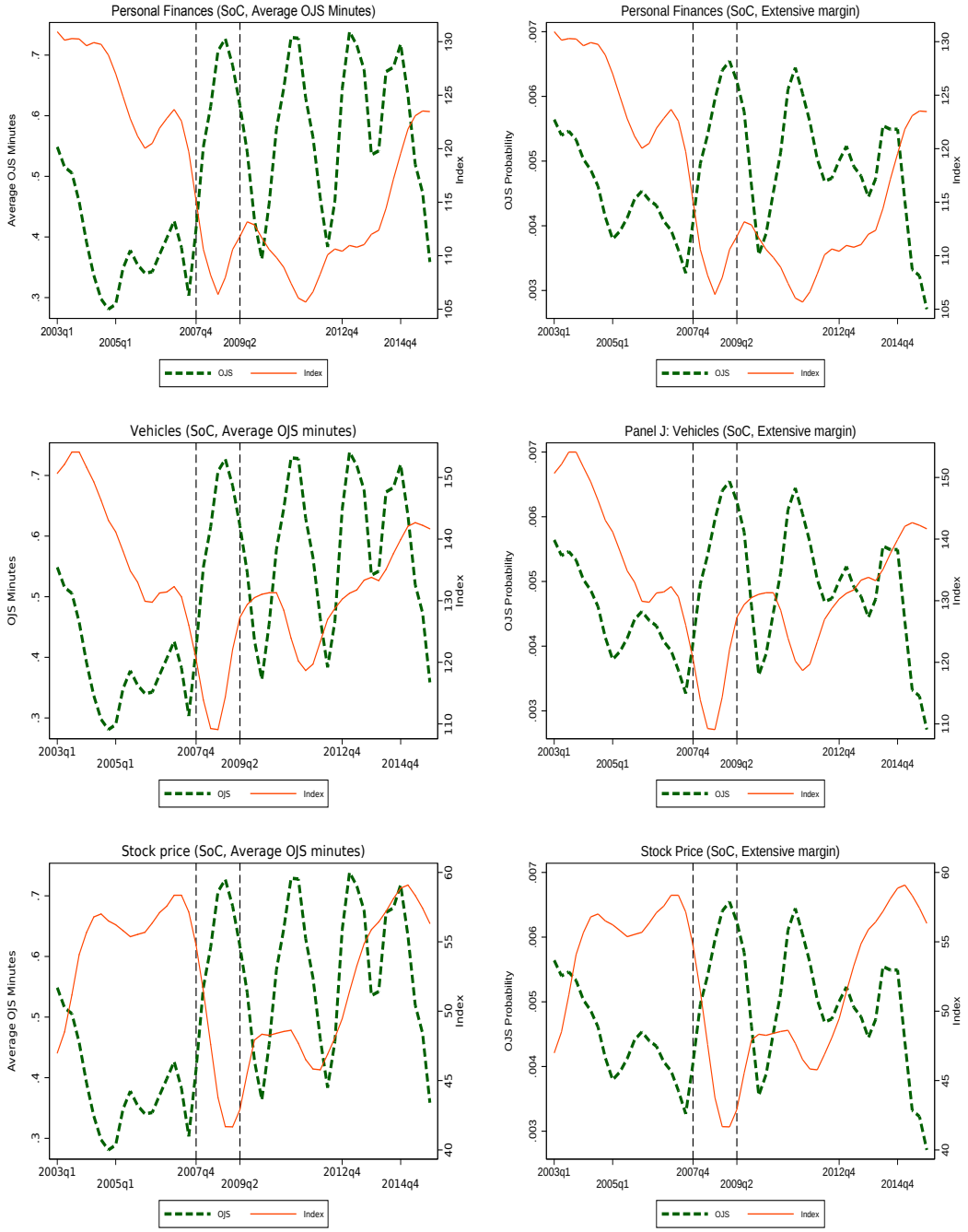
Source: For OJS intensity (Panel A) and OJS probability (Panel B), author's calculation. For job-to-job transition rate, Fallick and Fleschman (2004). The raw data of job-to-job transition rate is found at https://www.federalreserve.gov/pubs/feds/2004/200434/200434abs.html. The centered four-quarter moving averages are plotted.

Figure 6. OJS intensity and labor market indicators (JOLTS)



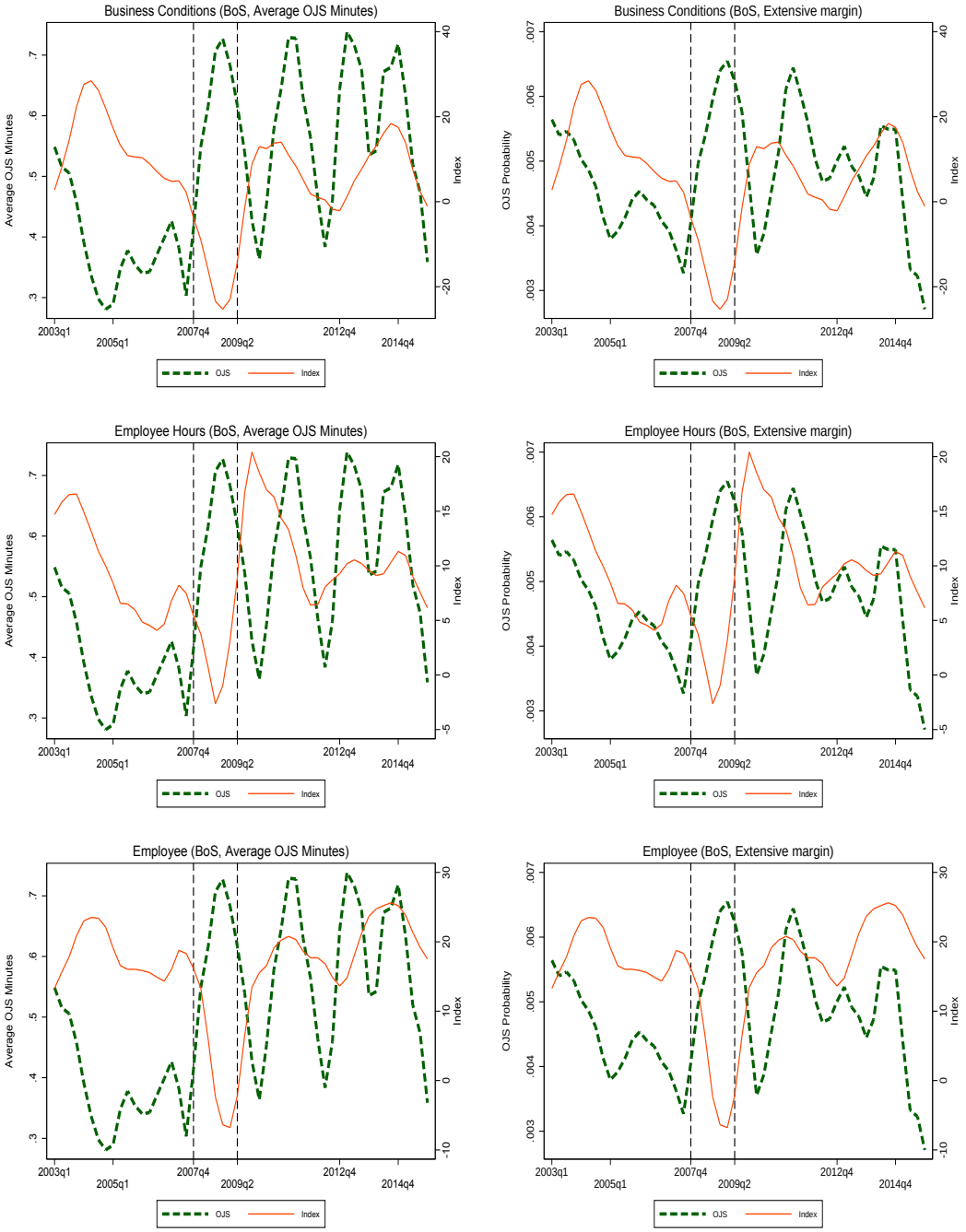
Source: For OJS intensity (panels in the left) and OJS probability (panels in the right), author's calculation. For layoffs rate, hires rate, and job-openings rate from JOLTS, BLS. The centered four-quarter moving averages are plotted.

Figure 7. OJS intensity and economic sentiments (SoC)



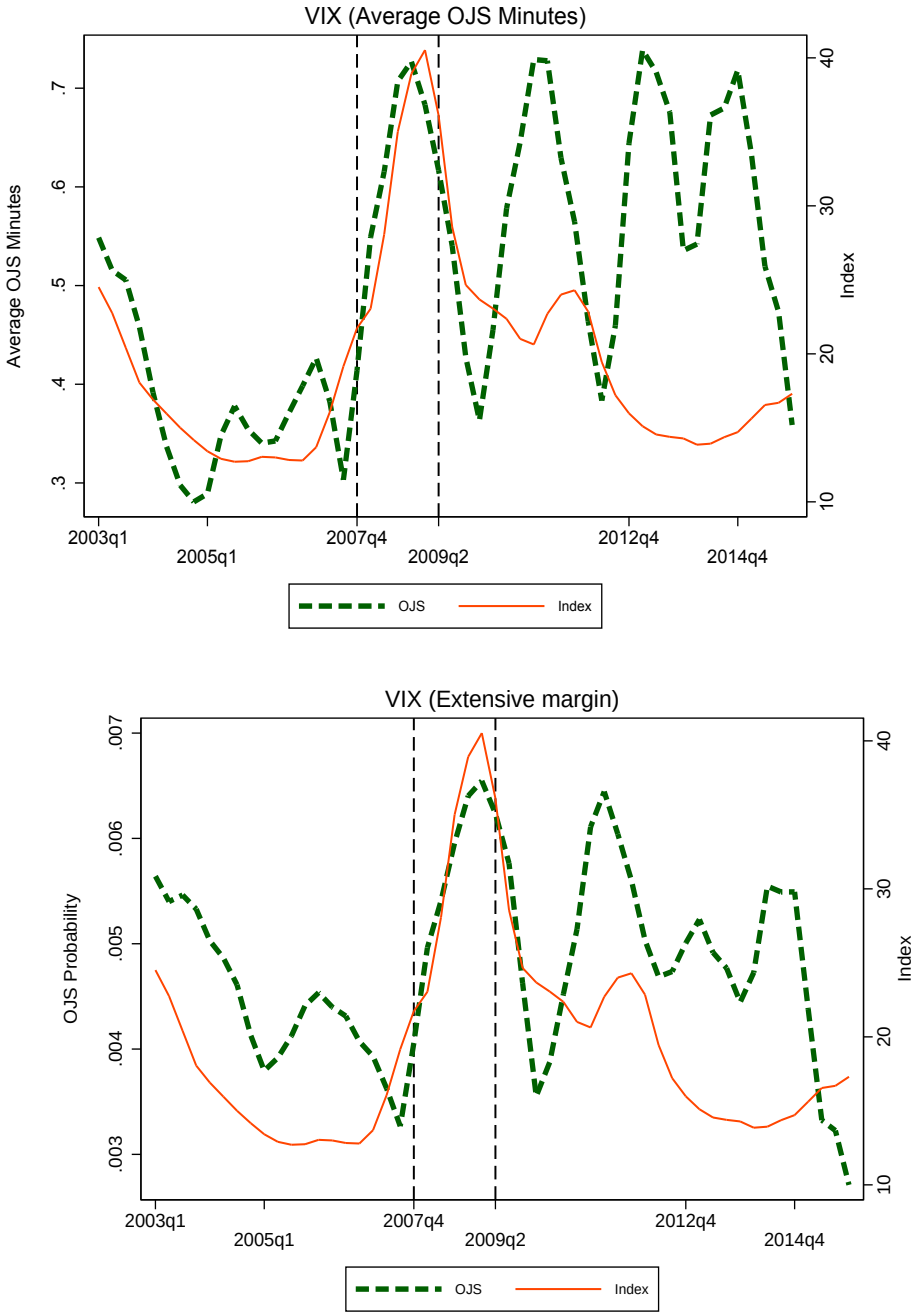
Source: For OJS intensity (panels in the left) and OJS probability (panels in the right), author's calculation. For the economic sentiment indicators from Survey of Consumers, University of Michgan. The centered four-quarter moving averages are plotted.

Figure 8. OJS intensity and economic sentiments (BOS)



Source: For OJS intensity (panels in the left) and OJS probability (panels in the right), author's calculation. For the economic sentiment indicators from Manufacturing Business Outlook Survey, Federal Reserve Bank of Philadelphia. The centered four-quarter moving averages are plotted.

Figure 9. OJS intensity and economic uncertainty



Source: For OJS intensity (upper panel) and OJS probability (lower panel), author's calculation. For VIX, Chicago Board Options Exchange. The centered four-quarter moving averages are plotted.

Table 1: Average minutes per day spent on job search by labor force status

Labor force status	Average minutes	Share of nonzero job-search time (%)	Job search minutes| nonzero job-search time
Employment	0.51	0.48	104.32
- Full time	0.38	0.35	109.15
- Part time	0.98	1.00	98.09
Unemployment	21.54	15.03	143.27
Not in the labor force	0.42	0.33	127.89

Source: author's calculation.

Table 2: Business-cycle property of OJS intensity

	Dependent variable: job-search time (minutes)							
	Layoffs	Quits	Hires	Job-openings	Job-fillings	Volatility	U.Exit.	Real wage
Labor market	0.27**	-0.10	-0.014	-0.050	0.029*	0.00081	-0.011**	0.024**
indicator (column)	(0.081)	(0.088)	(0.052)	(0.054)	(0.017)	(0.00064)	(0.0042)	(0.0093)
Male	0.16	0.15*	0.16*	0.16	0.16	0.16*	0.17*	0.11
	(0.093)	(0.093)	(0.093)	(0.093)	(0.093)	(0.093)	(0.093)	(0.10)
Some college	0.26**	0.26**	0.26**	0.26**	0.26**	0.26**	0.26**	0.28**
	(0.081)	(0.081)	(0.082)	(0.081)	(0.081)	(0.081)	(0.081)	(0.088)
College and higher	0.55**	0.55**	0.55**	0.55**	0.55**	0.55**	0.55**	0.59**
	(0.085)	(0.085)	(0.085)	(0.085)	(0.085)	(0.085)	(0.084)	(0.093)
Age	0.51**	0.50**	0.50**	0.50**	0.51**	0.50**	0.46**	0.49**
	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.15)	(0.17)
Age^2	-0.017**	-0.016**	-0.016**	-0.016**	-0.017**	-0.016**	-0.015**	-0.016**
	(0.0056)	(0.0056)	(0.0056)	(0.0056)	(0.0056)	(0.0056)	(0.0055)	(0.0062)
Age^3	0.00023**	0.00023**	0.00023**	0.00023**	0.00023**	0.00023**	0.00023**	0.00023**
	(0.000084)	(0.000084)	(0.000084)	(0.000084)	(0.000084)	(0.000084)	(0.000083)	(0.000092)
Age^4	-1.2E-06**	-1.2E-06**	-1.2E-06**	-1.2E-06**	-1.2E-06**	-1.2E-06**	-1.1E-06**	-1.2E-06**
	(4.5E-07)	(4.5E-07)	(4.5E-07)	(4.5E-07)	(4.5E-07)	(4.5E-07)	(4.4E-07)	(4.9E-07)
Married	-0.25**	-0.24**	-0.24**	-0.25**	-0.25**	-0.25**	-0.25**	-0.22**
	(0.071)	(0.071)	(0.071)	(0.071)	(0.071)	(0.071)	(0.071)	(0.077)
Any children	0.094	0.093	0.093	0.093	0.093	0.093	0.062	0.12
	(0.098)	(0.098)	(0.098)	(0.098)	(0.098)	(0.098)	(0.097)	(0.11)
Female*Children	-0.39**	-0.39**	-0.39**	-0.39**	-0.39**	-0.39**	-0.37**	-0.46**
	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.12)	(0.14)
Part-time workers	0.32**	0.32**	0.32**	0.32**	0.32**	0.32**	0.33**	0.33**
	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.11)
Hours worked	-0.016**	-0.016**	-0.016**	-0.016**	-0.016**	-0.016**	-0.015**	-0.016**
	(0.0026)	(0.0026)	(0.0026)	(0.0026)	(0.0026)	(0.0026)	(0.0025)	(0.0028)
Wage	-3.0E-06**	-3.1E-06**	-3.0E-06**	-3.0E-06**	-3.0E-06**	-3.0E-06**	-3.1E-06**	-3.2E-06**
	(5.7E-07)	(5.7E-07)	(5.7E-07)	(5.7E-07)	(5.7E-07)	(5.7E-07)	(5.6E-07)	(6.1E-07)
Number of obs.	104,771	104,771	104,771	104,771	104,771	104,771	106,622	93,872
Fixed effect (I/Q)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003

Notes to Table 2. Fixed effect I and Q each stands for industry and quarter fixed effect, respectively. The sample size of data used for the estimation with the unemployment exit rate is larger than that with the first five flows variables and the real wage that are from the establishment survey, because the establishment survey does not cover agriculture, fishing and hunting industry, while CPS from which the unemployment exit rate is calculated includes them. We regress job-search time of individual who works in the mining industry on the labor market indicators of mining and logging industry except for the unemployment exit rate. In addition, the sample size of data used for the estimation with the real wage is smaller than the rest, because the real wage of government sector is not available.

Table 3: Business-cycle property of OJS intensity on the extensive margin

	Dependent variable: job-search participation							
	Layoffs	Quits	Hires	Job-openings	Job-fillings	Volatility	U.Exit.	Real wage
Labor market	0.0015**	-0.00052	0.00026	-0.00060	0.00040**	9.0E-06**	-0.000050*	0.000044
indicator (column)	(0.00057)	(0.00061)	(0.00037)	(0.00037)	(0.00012)	(4.5E-06)	(0.000029)	(0.000064)
Male	0.00071	0.00070	0.00071	0.00071	0.00071	0.00071	0.00080	0.00049
	(0.00065)	(0.00065)	(0.00065)	(0.00065)	(0.00065)	(0.00065)	(0.00064)	(0.00070)
Some college	0.0020**	0.0020**	0.0020**	0.0020**	0.0020**	0.0020**	0.0020**	0.0021**
	(0.00056)	(0.00056)	(0.00056)	(0.00056)	(0.00056)	(0.00056)	(0.00056)	(0.00061)
College and higher	0.0036**	0.0036**	0.0036**	0.0036**	0.0036**	0.0036**	0.0036**	0.0038**
	(0.00060)	(0.00060)	(0.00060)	(0.00060)	(0.00060)	(0.00060)	(0.00059)	(0.00064)
Age	0.0029**	0.0028**	0.0029**	0.0028**	0.0029**	0.0028**	0.0026**	0.0031**
	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0012)
Age^2	-0.000095**	-0.000093**	-0.000095**	-0.000094**	-0.000096**	-0.000094**	-0.000086**	-0.00010**
	(0.000039)	(0.000039)	(0.000039)	(0.000039)	(0.000039)	(0.000039)	(0.000038)	(0.000042)
Age^3	1.3E-06**	1.3E-06**	1.3E-06**	1.3E-06**	1.4E-06**	1.3E-06**	1.2E-06**	1.4E-06**
	(5.9E-07)	(5.9E-07)	(5.9E-07)	(5.9E-07)	(5.9E-07)	(5.9E-07)	(5.7E-07)	(6.4E-07)
Age^4	-7.1e-09**	-7.0e-09**	-7.1e-09**	-7.1e-09**	-7.2e-09**	-7.1e-09**	-6.3e-09**	-7.6e-09**
	(3.2E-09)	(3.2E-09)	(3.2E-09)	(3.2E-09)	(3.2E-09)	(3.2E-09)	(3.1E-09)	(3.4E-09)
Married	-0.0029**	-0.0029**	-0.0029**	-0.0029**	-0.0029**	-0.0029**	-0.0028**	-0.0029**
	(0.00050)	(0.00050)	(0.00050)	(0.00050)	(0.00050)	(0.00050)	(0.00049)	(0.00053)
Any children	0.0022**	0.0022**	0.0022**	0.0022**	0.0022**	0.0022**	0.0020**	0.0025**
	(0.00069)	(0.00069)	(0.00069)	(0.00069)	(0.00069)	(0.00069)	(0.00067)	(0.00073)
Female*Children	-0.0046**	-0.0046**	-0.0046**	-0.0046**	-0.0046**	-0.0046**	-0.0044**	-0.0050**
	(0.00088)	(0.00088)	(0.00088)	(0.00088)	(0.00088)	(0.00088)	(0.00086)	(0.00094)
Part-time workers	0.0049**	0.0049**	0.0049**	0.0049**	0.0049**	0.0049**	0.0049**	0.0047**
	(0.00072)	(0.00072)	(0.00072)	(0.00072)	(0.00072)	(0.00072)	(0.00071)	(0.00077)
Hours worked	-0.000092**	-0.000092**	-0.000093**	-0.000092**	-0.000092**	-0.000092**	-0.000088**	-0.000095**
	(0.000018)	(0.000018)	(0.000018)	(0.000018)	(0.000018)	(0.000018)	(0.000018)	(0.000019)
Wage	-2.3E-08**	-2.4E-08**	-2.3E-08**	-2.3E-08**	-2.3E-08**	-2.3E-08**	-2.4E-08**	-2.4E-08**
	(4.0E-09)	(4.0E-09)	(4.0E-09)	(4.0E-09)	(4.0E-09)	(4.0E-09)	(3.9e-09)	(4.2e-09)
Number of obs.	104,771	104,771	104,771	104,771	104,771	104,771	106,622	93,872
Fixed effect (I/Q)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004

Notes to Table 3. Fixed effect I and Q each stands for industry and quarter fixed effect, respectively.

Table 4: Business-cycle property of OJS intensity on the intensive margin

	Dependent variable: job-search time (minutes) | participation							
	Layoffs	Quits	Hires	Job-openings	Job-fillings	Volatility	U.Exit.	Real wage
Labor market	22.6*	-7.02	-6.36	-0.91	-1.46	-0.052	-0.97	3.57**
indicator (column)	(11.5)	(12.0)	(6.56)	(7.33)	(1.77)	(0.074)	(0.62)	(1.25)
Male	19.0	19.0	19.0	18.9	18.7	19.2	18.2	15.4
	(13.0)	(13.1)	(13.1)	(13.1)	(13.1)	(13.1)	(13.1)	(14.0)
Some college	14.1	11.4	11.8	11.7	11.4	11.7	12.2	12.4
	(11.7)	(11.7)	(11.7)	(11.7)	(11.7)	(11.7)	(11.6)	(12.3)
College and higher	34.1**	31.4**	32.0**	32.0**	31.7**	32.0**	29.6**	34.1**
	(12.4)	(12.4)	(12.4)	(12.4)	(12.4)	(12.4)	(12.4)	(13.1)
Age	24.4	21.2	20.8	23.5	24.8	23.8	16.1	30.1
	(28.1)	(28.5)	(28.3)	(28.2)	(28.2)	(28.2)	(28.4)	(30.1)
Age^2	-0.73	-0.59	-0.58	-0.68	-0.73	-0.68	-0.38	-1.05
	(1.09)	(1.11)	(1.10)	(1.10)	(1.10)	(1.09)	(1.10)	(1.17)
Age^3	0.0085	0.0060	0.0060	0.0074	0.0083	0.0075	0.0025	0.0015
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.019)
Age^4	-0.000029	-0.0000014	-0.000014	-0.000022	-0.000027	-0.000022	0.0000066	-0.0000076
	(0.00010)	(0.00011)	(0.00011)	(0.00011)	(0.00011)	(0.00011)	(0.00011)	(0.00011)
Married	11.1	11.9	11.6	11.8	11.8	11.9	10.9	20.1*
	(10.1)	(10.2)	(10.2)	(10.2)	(10.2)	(10.2)	(10.1)	(10.9)
Any children	-26.9**	-25.9**	-26.3**	-26.0**	-25.7**	-26.2**	-24.9**	-24.5**
	(13.1)	(13.2)	(13.2)	(13.2)	(13.2)	(13.2)	(13.2)	(13.9)
Female*Children	21.3	20.8	21.4	20.0	19.8	19.7	20.3	19.9
	(17.7)	(17.8)	(17.8)	(17.7)	(17.7)	(17.7)	(17.7)	(18.8)
Part-time workers	-21.4*	-22.4*	-22.2*	-22.3*	-22.4*	-22.4*	-22.9*	-17.6*
	(12.3)	(12.3)	(12.3)	(12.4)	(12.3)	(12.3)	(12.3)	(12.9)
Hours worked	-0.67*	-0.74**	-0.72**	-0.74**	-0.76**	-0.75**	-0.74**	-0.68*
	(0.35)	(0.35)	(0.35)	(0.35)	(0.35)	(0.35)	(0.35)	(0.36)
Wage	-0.00012	-0.00011	-0.00011	-0.00011	-0.00011	-0.00012	-0.00011	-0.000090
	(0.00010)	(0.00010)	(0.00010)	(0.00010)	(0.00010)	(0.00010)	(0.00010)	(0.00011)
Number of obs.	514	514	514	514	514	514	517	517
Fixed effect (I/Q)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.124	0.118	0.119	0.117	0.119	0.118	0.130	0.123

Notes to Table 4. Fixed effect I and Q each stands for industry and quarter fixed effect, respectively.

Table 5: OJS intensity and Economic Sentiments (OLS)

	Dependent variable: job-search time (minutes)					
	(1)	(2)	(3)	(4)	(5)	(6)
Economic	-0.080**	-0.019	-0.053*	0.076**	-0.093**	-0.069**
sentiment (column)	(0.030)	(0.029)	(0.030)	(0.030)	(0.031)	(0.030)
Male	0.17*	0.18*	0.18*	0.18*	0.18*	0.18*
	(0.093)	(0.093)	(0.093)	(0.093)	(0.093)	(0.093)
Some college	0.26**	0.27**	0.27**	0.27**	0.27**	0.27**
	(0.080)	(0.080)	(0.080)	(0.080)	(0.080)	(0.080)
College and higher	0.55**	0.55**	0.55**	0.55**	0.55**	0.55**
	(0.084)	(0.084)	(0.084)	(0.084)	(0.084)	(0.084)
Age	0.46**	0.47**	0.47**	0.47**	0.47**	0.47**
	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)
Age^2	-0.015**	-0.015**	-0.015**	-0.015**	-0.015**	-0.015**
	(0.0055)	(0.0055)	(0.0055)	(0.0055)	(0.0055)	(0.0055)
Age^3	0.00021**	0.00021**	0.00021**	0.00021**	0.00021**	0.00021**
	(0.000082)	(0.000082)	(0.000082)	(0.000082)	(0.000082)	(0.000082)
Age^4	-1.1E-06*	-1.1E-06*	-1.1E-06*	-1.1E-06*	-1.1E-06*	-1.1E-06*
	(4.4E-07)	(4.4E-07)	(4.4E-07)	(4.4E-07)	(4.4E-07)	(4.4E-07)
Married	-0.25**	-0.25**	-0.25**	-0.25**	-0.25**	-0.26**
	(0.071)	(0.071)	(0.071)	(0.071)	(0.071)	(0.071)
Any children	0.057	0.059	0.061	0.061	0.060	0.058
	(0.097)	(0.097)	(0.097)	(0.097)	(0.097)	(0.097)
Female*Children	-0.37**	-0.37**	-0.37**	-0.37**	-0.37**	-0.37**
	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)
Part-time workers	0.34**	0.33**	0.33**	0.34**	0.34**	0.34**
	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)
Hours worked	-0.015**	-0.016**	-0.016**	-0.016**	-0.015**	-0.016**
	(0.0025)	(0.0025)	(0.0025)	(0.0025)	(0.0025)	(0.0025)
Wage	-3.1E-06**	-3.0E-06**	-3.0E-06**	-3.0E-06**	-3.0E-06**	-3.0E-06**
	(5.6E-07)	(5.6E-07)	(5.6E-07)	(5.6E-07)	(5.6E-07)	(5.6E-07)
Number of obs.	106,622	106,622	106,622	106,622	106,622	106,622
Fixed effect (I/Q)	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.003	0.003	0.003	0.003	0.003	0.003

Notes to Table 5. (1) expected change in financial situation in a year (SoC) (2) expected change in business condition in a year (SoC) (3) probability of increase in stock price in a year (SoC) (4) expected interest rate next year (SoC) (5) buying conditions for durables (SoC) (6) general business condition 6 months from now (BOS) Fixed effect I and Q each stands for industry and quarter fixed effect, respectively.

Table 6: OJS intensity and Economic Sentiments on the extensive margin (OLS)

	Dependent variable: job-search participation					
	(1)	(2)	(3)	(4)	(5)	(6)
Economic	-0.00029	0.00014	-0.00047**	0.00044*	-0.00059**	-0.00036*
sentiment (column)	(0.00021)	(0.00020)	(0.00021)	(0.00021)	(0.00022)	(0.00021)
Male	0.00080	0.00081	0.00080	0.00080	0.00079	0.00080
	(0.00064)	(0.00064)	(0.00064)	(0.00064)	(0.00064)	(0.00064)
Some college	0.0020**	0.0020**	0.0020**	0.0020**	0.0020**	0.0020**
	(0.00056)	(0.00056)	(0.00056)	(0.00056)	(0.00056)	(0.00056)
College and higher	0.0036**	0.0036**	0.0036**	0.0036**	0.0036**	0.0036**
	(0.00059)	(0.00059)	(0.00059)	(0.00059)	(0.00059)	(0.00059)
Age	0.0027**	0.0027**	0.0027**	0.0026**	0.0027**	0.0027**
	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0011)
Age^2	-0.000087**	-0.000089**	-0.000088**	-0.000088**	-0.000087**	-0.000088**
	(0.000038)	(0.000038)	(0.000038)	(0.000038)	(0.000038)	(0.000038)
Age^3	1.2E-06**	1.2E-06**	1.2E-06**	1.2E-06**	1.2E-06**	1.2E-06**
	(5.7E-07)	(5.7E-07)	(5.7E-07)	(5.7E-07)	(5.7E-07)	(5.7E-07)
Age^4	-6.4e-09**	-6.5e-09**	-6.5e-09**	-6.5e-09**	-6.4e-09**	-6.6e-09**
	(3.1e-09)	(3.1e-09)	(3.1e-09)	(3.1e-09)	(3.1e-09)	(3.1e-09)
Married	-0.0028**	-0.0029**	-0.0028**	-0.0028**	-0.0028**	-0.0028**
	(0.00049)	(0.00049)	(0.00049)	(0.00049)	(0.00049)	(0.00049)
Any children	0.0020**	0.0020**	0.0020**	0.0020**	0.0020**	0.0020**
	(0.00067)	(0.00067)	(0.00067)	(0.00067)	(0.00067)	(0.00067)
Female*Children	-0.0044**	-0.0044**	-0.0044**	-0.0044**	-0.0044**	-0.0044**
	(0.00086)	(0.00086)	(0.00086)	(0.00086)	(0.00086)	(0.00086)
Part-time workers	0.0049**	0.0049**	0.0049**	0.0049**	0.0049**	0.0049**
	(0.00071)	(0.00071)	(0.00071)	(0.00071)	(0.00071)	(0.00071)
Hours worked	-0.000089**	-0.000089**	-0.000089**	-0.000089**	-0.000088**	-0.000089**
	(0.000018)	(0.000017)	(0.000017)	(0.000017)	(0.000017)	(0.000017)
Wage	-2.4E-08**	-2.3E-08**	-2.3E-08**	-2.3E-08**	-2.4E-08**	-2.3E-08**
	(3.9e-09)	(3.9e-09)	(3.9e-09)	(3.9e-09)	(3.9e-09)	(3.9e-09)
Number of obs.	106,622	106,622	106,622	106,622	106,622	106,622
Fixed effect (I/Q)	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.004	0.004	0.004	0.004	0.004	0.004

Notes to Table 6. (1) expected change in financial situation in a year (SoC) (2) expected change in business condition in a year (SoC) (3) probability of increase in stock price in a year (SoC) (4) expected interest rate next year (SoC) (5) buying conditions for durables (SoC) (6) general business condition 6 months from now (BOS) Fixed effect I and Q each stands for industry and quarter fixed effect, respectively.

Table 7: Economic sentiments and OJS intensity on the intensive margin (OLS)

	Dependent variable: job-search time (minutes) | participation					
	(1)	(2)	(3)	(4)	(5)	(6)
Economic	-6.70*	-5.37	0.46	4.13	-4.11	-2.92
sentiment (column)	(4.02)	(4.05)	(4.16)	(4.27)	(4.30)	(4.00)
Male	17.9	18.4	18.9	18.6	18.4	18.4
	(13.1)	(13.1)	(13.1)	(13.1)	(13.1)	(13.1)
Some college	10.3	10.8	12.7	12.7	12.4	12.7
	(11.7)	(11.7)	(11.6)	(11.6)	(11.6)	(11.6)
College and higher	28.6**	30.4**	31.8**	31.6**	30.9**	31.8**
	(12.5)	(12.4)	(12.4)	(12.4)	(12.4)	(12.4)
Age	17.8	23.6	22.8	20.5	20.1	21.7
	(28.2)	(28.1)	(28.2)	(28.2)	(28.3)	(28.2)
Age^2	-0.43	-0.66	-0.63	-0.54	-0.52	-0.59
	(1.10)	(1.09)	(1.10)	(1.10)	(1.10)	(1.10)
Age^3	0.0030	0.0068	0.0067	0.0050	0.0047	0.0058
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Age^4	0.000005	-0.000017	-0.000017	-0.0000075	-0.0000052	-0.000011
	(0.00011)	(0.00010)	(0.00011)	(0.00011)	(0.00011)	(0.00011)
Married	11.8	12.2	11.4	11.0	11.2	11.2
	(10.1)	(10.2)	(10.2)	(10.2)	(10.2)	(10.2)
Any children	-26.6**	-27.4**	-25.8**	-26.1**	-26.1**	-26.1**
	(13.2)	(13.2)	(13.2)	(13.2)	(13.2)	(13.2)
Female*Children	20.4	20.6	19.6	20.4	20.3	20.0
	(17.7)	(17.7)	(17.7)	(17.7)	(17.7)	(17.7)
Part-time workers	-23.2*	-22.6*	-21.7*	-21.6*	-22.3*	-21.6*
	(13.2)	(13.2)	(13.2)	(13.2)	(13.2)	(13.2)
Hours worked	-0.77**	-0.79**	-0.76**	-0.76**	-0.76**	-0.76**
	(0.35)	(0.35)	(0.35)	(0.35)	(0.35)	(0.35)
Wage	-0.00012	-0.00012	-0.00011	-0.00011	-0.00011	-0.00012
	(0.00010)	(0.00010)	(0.00010)	(0.00010)	(0.00010)	(0.00010)
Number of obs.	517	517	517	517	517	517
Fixed effect (I/Q)	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.131	0.129	0.126	0.127	0.127	0.126

Notes to Table 7. (1) expected change in financial situation in a year (SoC) (2) expected change in business condition in a year (SoC) (3) probability of increase in stock price in a year (SoC) (4) expected interest rate next year (SoC) (5) buying conditions for durables (SoC) (6) general business condition 6 months from now (BOS) Fixed effect I and Q each stands for industry and quarter fixed effect, respectively.

Table 8: Cross-sectional determinants of OJS intensity

	Dependent variable: job-search time (minutes)							
	Layoffs	Quits	Hires	Job-openings	Job-fillings	Volatility	U.Exit.	Real wage
Average turnover	0.14**	0.12**	0.083**	0.10**	0.022*	0.0000075	-0.00088	0.00019
rate (column)	(0.042)	(0.038)	(0.023)	(0.040)	(0.013)	(0.00023)	(0.0127)	(0.0011)
Male	0.15*	0.19**	0.17*	0.23**	0.18*	0.20**	0.22**	0.16
	(0.092)	(0.091)	(0.091)	(0.091)	(0.092)	(0.091)	(0.090)	(0.099)
Some college	0.26**	0.25**	0.26**	0.23**	0.25**	0.24**	0.25**	0.26**
	(0.080)	(0.080)	(0.080)	(0.080)	(0.080)	(0.080)	(0.079)	(0.087)
College and higher	0.56**	0.55**	0.56**	0.51**	0.55**	0.53**	0.53**	0.56**
	(0.081)	(0.081)	(0.081)	(0.081)	(0.082)	(0.081)	(0.080)	(0.088)
Age	0.47**	0.50**	0.49**	0.48**	0.48**	0.48**	0.45**	0.47**
	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.15)	(0.17)
Age^2	-0.015**	-0.016**	-0.016**	-0.016**	-0.015**	-0.015**	-0.014**	-0.015**
	(0.0056)	(0.0056)	(0.0056)	(0.0056)	(0.0056)	(0.0056)	(0.0055)	(0.0062)
Age^3	0.00021**	0.00023**	0.00022**	0.00022**	0.00022**	0.00021**	0.00020**	0.00021**
	(0.000084)	(0.000084)	(0.000084)	(0.000084)	(0.000084)	(0.000084)	(0.000082)	(0.000092)
Age^4	-1.1E-06**	-1.2E-06**	-1.1E-06**	-1.1E-06**	-1.1E-06**	-1.1E-06**	-1.0E-06**	-1.1E-06**
	(4.5E-07)	(4.5E-07)	(4.5E-07)	(4.5E-07)	(4.5E-07)	(4.5E-07)	(4.4E-07)	(4.9E-07)
Married	-0.24**	-0.24**	-0.24**	-0.24**	-0.24**	-0.24**	-0.25**	-0.23**
	(0.071)	(0.071)	(0.071)	(0.071)	(0.071)	(0.071)	(0.071)	(0.077)
Any children	0.090	0.095	0.092	0.096	0.093	0.096	0.064	0.13
	(0.098)	(0.098)	(0.098)	(0.098)	(0.098)	(0.098)	(0.097)	(0.11)
Female*Children	-0.39**	-0.40**	-0.40**	-0.41**	-0.40**	-0.40**	-0.38**	-0.47**
	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.12)	(0.14)
Part-time workers	0.33**	0.30**	0.31**	0.32**	0.33**	0.33**	0.35**	0.34**
	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.11)	(0.10)	(0.11)
Hours worked	-0.016**	-0.016**	-0.016**	-0.016**	-0.016**	-0.016**	-0.015**	-0.016**
	(0.0026)	(0.0026)	(0.0026)	(0.0026)	(0.0026)	(0.0026)	(0.0025)	(0.0028)
Wage	-3.1E-06**	-3.0E-06**	-3.0E-06**	-3.2E-06**	-3.1E-06**	-3.3E-06**	-3.2E-06**	-3.3E-06**
	(5.6E-07)	(5.6E-07)	(5.6E-07)	(5.6E-07)	(5.6E-07)	(5.6E-07)	(5.6E-07)	(6.0E-07)
Number of obs.	104,771	104,771	104,771	104,771	104,771	104,771	106,622	93,872
Fixed effect (Y/Q)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.002

Notes to Table 8. Fixed effect Y and Q each stands for year and quarter fixed effect, respectively.

Table 9: Cross-sectional determinants of OJS intensity on the extensive margin

	Dependent variable: job-search participation							
	Layoffs	Quits	Hires	Job-openings	Job-fillings	Volatility	U.Exit.	Real wage
Average turnover	0.00082**	0.00088**	0.00056**	0.00077**	0.00012	2.5E-07	0.000012	4.4E-06
rate (column)	(0.00030)	(0.00027)	(0.00016)	(0.00028)	(0.000088)	(1.6E-06)	(0.000088)	(7.7E-06)
Male	0.00070	0.00092	0.00076	0.0012*	0.00084	0.00098	0.0010	0.00082
	(0.00064)	(0.00063)	(0.00064)	(0.00064)	(0.00064)	(0.00063)	(0.00062)	(0.00068)
Some college	0.0021**	0.0020**	0.0021**	0.0019**	0.0020**	0.0020**	0.0020**	0.0021**
	(0.00056)	(0.00056)	(0.00056)	(0.00056)	(0.00056)	(0.00056)	(0.00055)	(0.00060)
College and higher	0.0037**	0.0036**	0.0037**	0.0034**	0.0036**	0.0035**	0.0035**	0.0037**
	(0.00057)	(0.00057)	(0.00057)	(0.00057)	(0.00057)	(0.00057)	(0.00056)	(0.00060)
Age	0.0027**	0.0029**	0.0028**	0.0027**	0.0027**	0.0027**	0.0026**	0.0030**
	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0012)
Age^2	-0.000088**	-0.000095**	-0.000092**	-0.000090**	-0.000089**	-0.000089**	-0.000085**	-0.000098**
	(0.000039)	(0.000039)	(0.000039)	(0.000039)	(0.000039)	(0.000039)	(0.000038)	(0.000042)
Age^3	1.2E-06**	1.3E-06**	1.3E-06**	1.3E-06**	1.3E-06**	1.3E-06**	1.2E-06**	1.4E-06**
	(5.9E-07)	(5.9E-07)	(5.9E-07)	(5.9E-07)	(5.9E-07)	(5.9E-07)	(5.7E-07)	(6.4E-07)
Age^4	-6.6e-09**	-7.0e-09**	-6.9e-09**	-6.7e-09**	-6.7e-09**	-6.7e-09**	-6.2e-09**	-7.3e-09**
	(3.1E-09)	(3.1E-09)	(3.1E-09)	(3.1E-09)	(3.1E-09)	(3.1E-09)	(3.1E-09)	(3.4E-09)
Married	-0.0029**	-0.0029**	-0.0029**	-0.0029**	-0.0029**	-0.0029**	-0.0029**	-0.0030**
	(0.00050)	(0.00050)	(0.00050)	(0.00050)	(0.00050)	(0.00050)	(0.00049)	(0.00053)
Any children	0.0022**	0.0022**	0.0022**	0.0022**	0.0022**	0.0022**	0.0020**	0.0026**
	(0.00069)	(0.00069)	(0.00069)	(0.00069)	(0.00069)	(0.00069)	(0.00067)	(0.00073)
Female*Children	-0.0045**	-0.0046**	-0.0046**	-0.0046**	-0.0046**	-0.0046**	-0.0044**	-0.0050**
	(0.00088)	(0.00088)	(0.00088)	(0.00088)	(0.00088)	(0.00088)	(0.00086)	(0.00094)
Part-time workers	0.0050**	0.0048**	0.0049**	0.0050**	0.0051**	0.0051**	0.0050**	0.0049**
	(0.00071)	(0.00072)	(0.00072)	(0.00072)	(0.00071)	(0.00071)	(0.00070)	(0.00077)
Hours worked	-0.000091**	-0.000093**	-0.000092**	-0.000092**	-0.000091**	-0.000091**	-0.000090**	-0.000095**
	(0.000018)	(0.000018)	(0.000018)	(0.000018)	(0.000018)	(0.000018)	(0.000017)	(0.000019)
Wage	-2.3E-08**	-2.3E-08**	-2.2E-08**	-2.4E-08**	-2.4E-08**	-2.4E-08**	-2.3E-08**	-2.4E-08**
	(3.9E-09)	(3.9E-09)	(3.9E-09)	(3.9E-09)	(3.9E-09)	(3.9E-09)	(3.9e-09)	(4.2e-09)
Number of obs.	104,771	104,771	104,771	104,771	104,771	104,771	106,622	93,872
Fixed effect (I/Q)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004

Notes to Table 9. Fixed effect Y and Q each stands for year and quarter fixed effect, respectively.

Table 10: Cross-sectional determinants of OJS intensity on the intensive margin

	Dependent variable: job-search time (minutes) | participation							
	Layoffs	Quits	Hires	Job-openings	Job-fillings	Volatility	U.Exit.	Real wage
Average turnover	8.78	6.05	4.34	4.59	1.52	-0.0096	-1.20	0.041
rate (column)	(5.77)	(4.77)	(2.96)	(5.40)	(1.71)	(0.036)	(1.80)	(0.13)
Male	18.2	20.1	19.2	21.4*	19.0	20.8	23.2*	16.4
	(12.7)	(12.6)	(12.7)	(12.7)	(12.8)	(12.6)	(12.6)	(13.6)
Some college	10.3	9.08	9.66	8.96	10.0	8.99	9.83	11.1
	(11.5)	(11.5)	(11.5)	(11.5)	(11.5)	(11.5)	(11.6)	(12.2)
College and higher	29.2**	27.4**	28.5**	26.2**	28.0**	26.0**	25.3**	27.9**
	(11.9)	(11.8)	(11.8)	(11.7)	(11.9)	(11.8)	(11.8)	(12.4)
Age	13.7	16.0	15.4	14.3	13.9	13.4	10.3	19.1
	(28.0)	(28.1)	(28.0)	(28.1)	(28.1)	(28.1)	(28.1)	(30.2)
Age^2	-0.28	-0.35	-0.33	-0.30	-0.28	-0.26	-0.14	-0.58
	(1.09)	(1.09)	(1.09)	(1.09)	(1.09)	(1.09)	(1.09)	(1.17)
Age^3	0.00095	0.0018	0.0017	0.0012	0.00078	0.00056	-0.0016	0.0073
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.019)
Age^4	0.000015	0.0000098	0.000011	0.000013	0.000016	0.000018	0.000029	-0.000031
	(0.00010)	(0.00010)	(0.00010)	(0.00010)	(0.00010)	(0.00010)	(0.00010)	(0.00011)
Married	11.2	10.7	10.9	11.3	10.5	10.8	10.4	14.8
	(9.90)	(9.91)	(9.90)	(9.93)	(9.92)	(9.92)	(9.95)	(10.7)
Any children	-28.5**	-27.8**	-28.0**	-27.9**	-28.5**	-28.6**	-31.9**	-28.1**
	(12.8)	(12.8)	(12.8)	(12.8)	(12.8)	(12.8)	(12.8)	(13.7)
Female*Children	22.4	20.6	21.2	20.7	21.9	21.9	24.3	20.0
	(17.2)	(17.2)	(17.2)	(17.2)	(17.2)	(17.3)	(17.3)	(18.5)
Part-time workers	-24.5*	-27.1*	-26.4*	-26.3*	-25.4*	-25.5*	-24.7*	-20.8
	(12.0)	(12.0)	(12.0)	(12.0)	(12.0)	(12.0)	(12.0)	(12.8)
Hours worked	-0.84*	-0.91**	-0.88**	-0.90**	-0.87**	-0.88**	-0.94**	-0.75**
	(0.34)	(0.34)	(0.34)	(0.34)	(0.34)	(0.34)	(0.34)	(0.36)
Wage	-0.000086	-0.000082	-0.000081	-0.00098	-0.000086	-0.000098	-0.00010	-0.000091
	(0.00010)	(0.00010)	(0.00010)	(0.00010)	(0.00010)	(0.00010)	(0.00010)	(0.00011)
Number of obs.	514	514	514	514	514	514	517	473
Fixed effect (I/Q)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.132	0.131	0.132	0.129	0.129	0.132	0.132	0.120

Notes to Table 10. Fixed effect Y and Q each stands for year and quarter fixed effect, respectively.

Table 11: Heckman's two-step approach: layoffs rate

	Estimates		Marginal Effects	
	Intensive margin	Selection	P($S>0$)	E(S)
layoffs rate	17.57	0.12**	0.0011	0.18
	(11.73)	(0.040)		
Male	17.36	0.025	0.00024	0.082
	(12.71)	(0.048)		
Some college	8.84	0.15**	0.0016	0.21
	(12.88)	(0.043)		
College and higher	27.32	0.26**	0.0028	0.42
	(15.57)	(0.044)		
Age	13.77	0.36**	0.0034	0.42
	(30.65)	(0.11)		
Age^2	-0.013	-0.013**	-0.00013	-0.015
	(1.18)	(0.0041)		
Age^3	-0.0026	0.00021**	1.97E-06	-0.00023
	(0.019)	(6.75E-05)		
Age^4	3.97E-06	-1.18E-06**	-1.14E-08	-1.24E-06
	(0.00011)	(3.96E-07)		
Married	18.01	-0.22**	-0.0022	-0.18
	(12.71)	(0.038)		
Any children	-32.86**	0.19**	0.0019	0.10
	(14.53)	(0.050)		
Female*Child	30.75	-0.35**	-0.0028	-0.24
	(21.05)	(0.066)		
Part-time workers	-29.33	0.25**	0.0030	0.19
	(15.56)	(0.047)		
Hours worked	-0.48	-0.0059**	-0.000057	-0.0079
	(0.43)	(0.0013)		
Wage	-5.58E-05	2.00E-06**	-1.92E-08	-2.30E-06
	(0.00013)	(3.47E-07)		
Sunday		-0.039	0.00044	0.048
		(0.043)		
Monday		0.28**	0.0038	0.43
		(0.057)		
Tuesday		0.27**	0.0035	0.40
		(0.058)		
Wednesday		0.25**	0.0031	0.36
		(0.059)		
Thursday		0.29**	0.0038	0.44
		(0.058)		
Friday		0.19**	0.0023	0.26
		(0.062)		
λ	-33.07			
	(41.29)			
Number of obs.	514	104,771	-	-
Fixed effect (I/Q)	Yes	Yes	-	-

Note to Table 11. S denote OJS time.