Constructing the Job-Finding Rate and Separation Rate of Hong Kong Labor Market*

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Abstract

This paper constructs two essential time series of aggregate labor market in Hong Kong: the job-finding rate and separation rate. The average job-finding rate per month is 27.54% while the average separation rate per month is 1.29%, similar to the numbers of Nordic and Anglo-Saxon countries. Variance decomposition shows that the separation rate contributes more than one half to the variation of the unemployment rate.

Keywords: Job-finding rate; Separation rate; Labor Market Frictions; Hong Kong.

JEL Codes: E24; J64.

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1. Introduction

The search and matching model has become the workhorse paradigm to analyze the dynamics of aggregate labor market. Unemployment and vacancies lie in the center of the whole picture that unemployment is negatively related to vacancies, which is called the Beveridge curve. The dynamics of this correlation counts closely on ins and outs of unemployment pool. The former depends on the separation rate and the latter depends on the job-finding rate. Hence, job-finding rate and separation rate are two essential time series to illustrate the dynamics of aggregate labor market.

These two series have been intensively explored for some advanced economies such as the U.S. by Shimer (2005, 2012) and OECD areas by Elsby et al. (2013). However, the two series haven't been constructed for Hong Kong. Lubik (2012) estimates the search and matching model using Bayesian method. He estimated the average separation rate, 4.5%, by fitting the linearized employment law of motion by least squares. The posterior mean 0.044 is close to the prior mean. The posterior standard error is high, 6.6% from the steady state. However, the job-finding rate is not explored and separation rate is not measured from the first principle.

In this paper, we construct the job-finding rate and separation rate of Hong Kong labor market by extending Shimer (2012)'s method. These two series are backed out from the unemployment pool equality that ins and outs of unemployment contribute to the next period unemployment. However, there is one difficulty that hinders constructing these two series directly: the aggregation bias. The resource data are measured discretely. The workers who are considered unemployed in two subsequent measure time slots can still find jobs in the middle and the workers who are considered employed in two subsequent measure time slots can get fired in between. The measurement of job-finding rate and separation rate should take this bias into consideration.

Shimer (2012) constructs the job-finding rate and separation rate per month in a continuous time environment. He uses the unemployment data with duration less than four weeks to adjust the aggregation bias. We extend his method to find these two series which are perhaps dependent on unemployment duration. The average job-finding rates and separation rates per month in the subsequent one month, two months, a quarter and half a year may be different, depending on the unemployment duration. We find that the two rates within one, two, and three months horizon are quite similar in terms of mean and standard deviation and the two rates within six months are a little lower and less volatile than the other three horizons. The separation rate contributes more than one half to the variation of the unemployment rate. This is different from the U.S. where the job-finding rate contributes more than one half in Shimer (2012).

Our approach is similar to Elsby et al. (2013). They also extend Shimer (2012)'s method to use additional unemployment duration information to correct the aggregation bias and construct the job-finding rate and separation rate per month in the subsequent one month, three months, half a year, and a year. We differ from Elsby et al. (2013) in three aspects. First, we construct the two series from the continuous time environment while they use the discrete period model. Second, the timing of job-finding rates and separation rates are also different. Third, they abstract from the growth of labor force while we retain the labor force information in the measurement.

Our contributions are two-folds. One is that this paper is the first attempt to construct the job-finding rate and separation rate series of Hong Kong labor market. The other is that we extend Shimer (2012)'s method to construct the two series within different horizons instead of four weeks.

This paper relates to two strands of literature: one is the literature about the Hong Kong aggregate labor market dynamics. Tse et al. (2002) focuses on the Beveridge curve and the relationship between unemployment and vacancies in Hong Kong. Lubik (2012) estimates the textbook search and matching model of Hong Kong labor market with unemployment and vacancies data. The other is the literature about the construction of job-finding rate and separation rate for various economies, Shimer (2012) for the U.S., Hobijn and Sahin (2009) and Elsby et al. (2013) for OECD economies, Lin and Miyamoto (2014) for Japan, and Hairault et al. (2015) for France.

The rest of the paper is structured as follows. The second section introduces the econometric framework including the empirical model to measure the job-finding rate and separation rate and the data source. The third section analyzes the constructed series and their dynamics. The fourth section concludes.

2. The Econometric Framework

2.1 The Empirical Model

We model a continuous time environment in which data are available only at discrete dates. One period is a month indexed by m instead of a quarter. In the whole paper, one quarter is indexed by q where applicable.

Let $\mathrm{m} \in \{0,1,2,\cdots\}$ refers to the interval $[\mathrm{m}, \mathrm{m}+1]$ as period m or month m. In the period m, unemployed workers find a job according to a Poisson process with arrival rate $\mathrm{f}_{\mathrm{m}}^{\mathrm{d}} = -\log{(1-\mathrm{F}_{\mathrm{m}}^{\mathrm{d}})} \geq 0$ per month within time interval $[\mathrm{m}, \mathrm{m}+\mathrm{d}]$ that is probably dependent on subsequent time horizon d months and all employed workers lose their job according to a Poisson process with arrival rate $\mathrm{s}_{\mathrm{m}}^{\mathrm{d}} = -\log{(1-\mathrm{S}_{\mathrm{m}}^{\mathrm{d}})} \geq 0$ per month within time interval $[\mathrm{m}, \mathrm{m}+\mathrm{d}]$ that is probably dependent on subsequent time horizon d months.

Here we differentiate the rate from probability that $\mathrm{f}_{\mathrm{m}}^{d}$ and $\mathrm{s}_{\mathrm{m}}^{d}$ refer to the job-finding rate and separation rate per month within time interval $[\mathrm{m}, \mathrm{m}+\mathrm{d}]$ whereas $\mathrm{F}_{\mathrm{m}}^{d}$ and $\mathrm{S}_{\mathrm{m}}^{d}$ are corresponding job-finding probability and separation probability over the same period.

Fix $\mathrm{m} \in \{0,1,2,\cdots\}$ and let $\tau \in [0, \mathrm{d}]$ be the time elapsed since the last measurement. Let $\mathrm{U}_{\mathrm{m}+\tau}, E_{m+\tau}, \tau \in [0,d]$ to be the unemployed and employed workers at time $\mathrm{m}+\tau$. Define $\mathrm{U}_{\mathrm{m,d}}^{s}(\tau), \tau \in [0,d]$ to be short-term unemployment, workers who are unemployed at time $\mathrm{m}+\tau$ but were employed at some time $\mathrm{m}' \in [\mathrm{m}, \mathrm{m}+\tau]$. Then the relevant differential Equations are

$$\mathrm{dU}_{\mathrm{m}+\tau} = E_{m+\tau} s_m^{\tau} \mathrm{d}\tau - U_{m+\tau} f_m^{\tau} d\tau, \quad \tau \in [0,d]. \tag{1}$$

$$\mathrm{dU}_{\mathrm{m,d}}^{s}(\tau) = E_{m+\tau} s_m^{\tau} d\tau - U_{m,d}^{s}(\tau) f_m^{\tau} d\tau, \ \ \tau \in [0,d]. \tag{2}$$

Equation (1) equates the change of unemployment $\mathrm{dU}_{\mathrm{t}+\tau}$ to the flow-in of unemployment when workers exit employment $\mathrm{E}_{\mathrm{t}+\tau}$ at a rate $\mathrm{s}_{\mathrm{m}}^{d}$ per month times the time elapsed $\mathrm{d}\tau$ and the flow-out when unemployed workers $\mathrm{U}_{\mathrm{m}+\tau}$ find a job at a rate $\mathrm{f}_{\mathrm{m}}^{\tau}$ times the elapsed time $\mathrm{d}\tau$.

Equation (2) equates the change of short-term unemployed workers $\mathrm{dU}_{\mathrm{m,d}}^{s}(\tau)$ to the flow-in when workers exit employment $\mathrm{E}_{\mathrm{t}+\tau}$ at a rate $\mathrm{s}_{\mathrm{m}}^{\tau}$ per month times the elapsed time $d\tau$ and the flow-out when short-term unemployed workers $U_{m,d}^{s}(\tau)$ find a job at a rate f_m^τ times the elapsed time $d\tau$.

Combine above two equations into a differential equation in $U_{m+\tau} - U_{m,d}^{s}(\tau)$.

$$dU_{m+\tau} - dU_{m,d}^{s}(\tau) = -\left(U_{m+\tau} - U_{m,d}^{s}(\tau)\right) f_m^\tau d\tau.$$

The initial condition is $U_m - U_{m,d}^{s}(0) = U_m$. We get the solution

$$U_{m+\tau} - U_{m,d}^{s}(\tau) = u_m \cdot e^{-f_m^\tau \cdot \tau}. \tag{3}$$

Let $\tau = d$, and use the condition that $U_{m,d}^{s}(d) = U_{m+d,d}^{s}$[1].

$$f_m^d = -\frac{1}{d}\log\left(\frac{U_{m+d} - U_{m+d,d}^{s}}{U_m}\right). \tag{4}$$

This formula is a generalization of Shimer (2012)'s Equation (4) and is exactly the same as Elsby et al. (2013)'s Equation (9). As in Elsby et al. (2013), f_m^d cannot be understood as the job-finding rate of unemployment worker with duration d months. Rather, it is the job-finding rate associated with the job-finding probability that an unemployed worker at time m completes her spell within the subsequent d months.

Solve the differential Equation (1) and use the definition of labor force $L_m = E_m + U_m$.

$$U_{m+\tau} = \left(U_m - \frac{L_{m+\tau} s_m^\tau}{f_m^\tau + s_m^\tau}\right) e^{-\tau(f_m^\tau + s_m^\tau)} + \frac{L_{m+\tau} s_m^\tau}{f_m^\tau + s_m^\tau}.$$

Let $\tau = d$

$$U_{m+d} = U_m e^{-d(f_m^d + s_m^d)} + \left(1 - e^{-d(f_m^d + s_m^d)}\right)\frac{L_{m+d} s_m^d}{f_m^d + s_m^d}. \tag{5}$$

This formula is a generalization of Shimer (2012)'s Equation (5). It is similar to Elsby et al. (2013)'s Equation (2) but differs in the timing of job-finding rates and

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[1] The former $U_{m,d}^{s}(d)$ denotes the short-term unemployment who are unemployed at time $m + d$ but were employed at some time $m' \in [m, m + d]$ in the continuous time environment. The latter one $U_{m+d,d}^{s}$ is the short-term unemployed at time $m + d$ with duration less than d months in the discrete environment and the observations are available. The two variables are equal.

separation rates. They assume that these two rates are constant within the measurement interval (one year). Additionally, they abstract from the labor force growth but we use the exact formula here.

Similar to the job-finding rate, s_m^d should be understood as the separation rate associated with the separation probability that an employed worker at time m completes her spell within subsequent d months.

Equation (4) and (5) are two formulas to construct monthly-measured job-finding rate and separation rate per month within subsequent d months at time m once we have the data of monthly unemployment, labor force, and short-term unemployment.

The empirical results in Section 3 show that the job-finding rate series and separation rate series within horizons one month, two months, and a quarter are similar in terms of means and standard deviations while the longer horizon series within half a year are a little bit lower than the series of former three horizons. Details will be given in Section 3.

We define the monthly job-finding rate per month f_m and monthly separation rate per month s_m as the averages of the rates of former three horizons f_m^1, f_m^2, f_m^3 and s_m^1, s_m^2, s_m^3 respectively[2]. This is better than arbitrarily choose any rate among the three because more information is included.

$$f_m = \frac{1}{3}(f_m^1 + f_m^2 + f_m^3), \quad s_m = \frac{1}{3}(s_m^1 + s_m^2 + s_m^3). \tag{6}$$

The quarterly job-finding probability and separation probability are constructed from the Poisson distribution as:

$$F_q = 1 - e^{-3f_m}, \;\; S_q = 1 - e^{-3s_m}. \tag{7}$$

[2] We leave f_m^6 and s_m^6 out of the scope because the results of Hong Kong show that the two rates at six months' horizon are quite different from shorter horizons in terms of mean and standard deviation.

2.2 Data

We collect unemployment, labor force, and unemployment duration data from the Quarterly Report on Generalized Household Survey (later called the GHS) conducted by the Census and Statistics Department of the government of Hong Kong Special Administration Region of China. The data are measured quarterly, covering period from 1996:Q2 to 2016:Q2. The starting period depends on the availability of unemployment duration data.

The unemployment duration series can be divided into unemployment with duration less than d month but less than $d-1$ months $U_q^{>(d-1)m,\leq m}$ where $d = 1,2,3$ and unemployment with duration less than half a year but more than 3 months $\mathrm{U}_{\mathrm{q}}^{>3m,\leq 6m}$. The short-term unemployment measured quarterly can be backed out from the unemployment duration data. The short-term unemployment at time $\mathrm{q}+\mathrm{d}\cdot\mathrm{m}$ within interval $[\mathrm{q}, \mathrm{q}+\mathrm{d}\cdot\mathrm{m}]$ is the sum of unemployment at time $\mathrm{q}+\mathrm{d}\cdot\mathrm{m}$ with duration less than d months.

$$\mathrm{U}_{\mathrm{q+dm,d}}^{s} = U_{q+dm}^{\leq 1m} + \cdots + U_{q+dm}^{>(d-1)m,\leq dm}, \quad d = 1,2,3,6$$

The unemployment U_{q}, labor force L_{q}, and short-term unemployment $\mathrm{U}_{\mathrm{q,d}}^{s}$ are quarterly measured and we linearly interpolate these series to obtain the monthly versions. This interpolation strategy is different from Elsby et al. (2013). They interpolate quarterly unemployment to get the monthly unemployment series but consider the short-term unemployment constant within two subsequent measurement dates (one year). We interpolate both the unemployment and short-term unemployment and we do not abstract from labor force in our computation.

Then we can use the interpolated monthly unemployment, labor force, and short-term unemployment to construct the job-finding rate and separation rate following the method elaborated in Section 2.1.

3. Empirical Results

Table 1 shows the mean and standard deviation of the job-finding rates and separation rates within subsequent 1, 2, 3, and 6 months. The mean of $\mathrm{f}_{\mathrm{m}}^{6}$ is 0.237 per month, which is lower than the job-finding rate within 3 months f_m^3, and f_m^1, f_m^2, and f_m^3 are quite similar. It may imply that the long-term unemployed workers have a lower probability to find a job. In terms of standard deviation, the former three job-finding rates behave the same, around 0.05. The volatility of longer horizon job-finding rate f_m^6 is, 0.039, 20% less volatile than the former three rates.

[Insert Table 1 Here]

The separation rates show the same pattern as job-finding rates. The former three separation rates behave similarly in terms of mean and standard deviation. The long horizon separation rate s_m^6 is a little lower and less volatile than the shorter horizon series.

f_m^6 and s_m^6 are a bit different from other series of horizons one month, two months, and a quarter. Then we use the series of the former three horizons to construct the monthly rates and quarterly probabilities as in Equation (6) and (7).

Figure 1 shows the monthly job-finding rate and separation rate defined in Equation (6). The two series are seasonally adjusted by X-12-ARIMA method. The job-finding rate shows obvious business cycle feature while the separation rate has been heading down since the SARS episode of Hong Kong in 2003. The job-finding rate plumbed during the 1998 Southeast Asian financial crisis, the SARS epidemic episode, and the 2008 global financial crisis. Unlike the job-finding rate, separation rate doesn't show so many obvious business cycle features. Separation rate increased till the SARS epidemic episode and then decreased along till the near present. The series bounced back a little bit during the 2008 financial crisis but not as high as before.

[Insert Figure 1 Here]

The mean of monthly job-finding rate and separation rate are 27.54% and 1.29% respectively. These numbers look similar to Canada, Australia, New Zealand, Norway, and Sweden, the Nordic and Anglo-Saxon category underscored by Elsby et al. (2013). Hong Kong had been colonized by the U.K. so it's not such surprised that Hong Kong has similar unemployment inflow and exit rates as other British colonies. The standard deviation of separation rate accounts for 24.8% of the average, which is outstandingly volatile. This confirms Lubik (2012)'s estimated result that the standard deviation of separation rate shock is quite large.

The average job-finding probability and separation probability in a quarter are 55.75% and 3.8% respectively, shown in Table 2. Lubik (2012) estimates the prior and posterior mean of quarterly separation rate as 4.5% and 4.4%, which are close to our results.

[Insert Table 2 Here]

As Shimer (2012), we decompose the unemployment variance to contributions of job-finding rate and separation rate in Hong Kong.

From Equation (5), we can see that the unemployment rate is just separation rate over the sum of job-finding rate and separation rate if unemployment is constant.

$$\mathrm{u_q} = \frac{U_q}{L_q} = \frac{s_q}{s_q + f_q}$$

The correlation between $\mathrm{u_{q+1}}$ and $\frac{s_q}{s_q+f_q}$ in Hong Kong is 0.91 over 1996:Q2 and 2016:Q1, which is less than the number of U.S. 0.98. However, 0.91 is still a strong relationship. We use this formula to distinguish comparative importance of job-finding rate and separation rate in explaining the unemployment dynamics.

The hypothetical unemployment rates $\frac{\bar{s}}{\bar{s}+f_q}$ and $\frac{s_q}{s_q+\bar{f}}$ can quantify the contributions of job-finding rate and separation rate in the dynamics of unemployment rate. Each panel of Figure 2 shows the plot of one hypothetical unemployment rate and actual unemployment rate. The top panel depicts the contribution of job-finding rate while the bottom panel draws the contribution of separation rate. The bottom panel seems to fit the actual employment rate more closely. Over the period between 2003 and 2008, the decline of actual unemployment rate tightly follows the heading down of separation rate while the job-finding rate varied less.

[Insert Figure 2 Here]

As Shimer (2012), we also decompose the variance of unemployment according to the covariance of the cyclical components of $\frac{\bar{s}}{\bar{s}+f_q}$ and $\frac{s_q}{s_q+\bar{f}}$ with the cyclical part of unemployment rate. Over the whole period between 1996 and 2016, the separation rate contributes 53% to the variation of unemployment rate, more than that of job-finding rate 30%. These two add to 87% of variance of unemployment rate, close to the correlation between $\mathrm{u}_{\mathrm{q}+1}$and $\frac{\bar{s}}{\bar{s}+f_q}$ and $\frac{s_q}{s_q+\bar{f}}$ 0.91. In contrast with 75% contribution of job-finding rate in U.S., separation rate contributes more than half to the variation of unemployment in Hong Kong.

4. Conclusion

To my best knowledge, this is the first paper to construct the two essential series of Hong Kong labor market. We extend Shimer (2012)'s approach to construct the monthly job finding rates and separation rates in Hong Kong. We find that the average job-finding rate per month is 27.5% and the average separation rate per month is 1.29% over the period 1996 to 2016. The numbers are similar to Nordic and Anglo-Saxon economies like Norway, Australia, and New Zealand. The variance decomposition shows that separation rate contributes more than half to the variation of the unemployment rate.

The construction of these two series complements the literature of Hong Kong labor Market from the perspective of search and matching frictions. They can be used by other research like exploration of search and matching model's fit of Hong Kong labor market dynamics.

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Table 1: Mean and Standard Deviation

	f_m^1	f_m^2	f_m^3	f_m^6	s_m^1	s_m^2	s_m^3	s_m^6
Mean	0.2615	0.2767	0.2886	0.2372	0.0123	0.0129	0.0134	0.011
St. Dev.	0.0539	0.0498	0.0496	0.0385	0.0035	0.0033	0.0033	0.0026

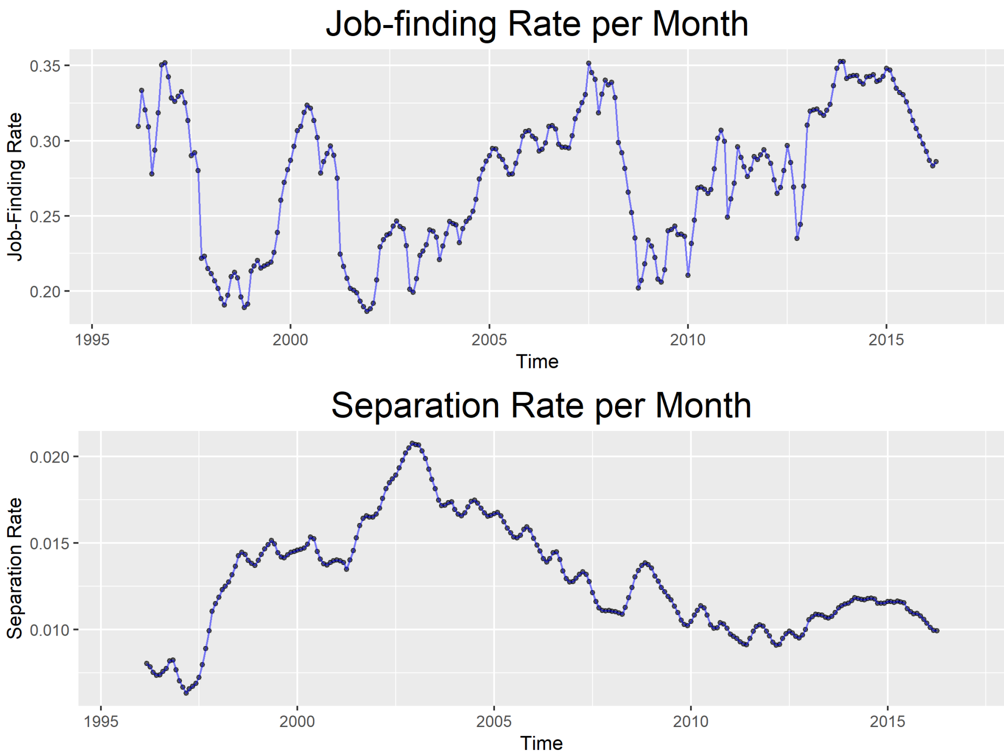
Notes: f_m^d is the average job-finding rate at time m per month associated with the job-finding probability that an unemployed worker can find a job within d months. s_m^d is defined likewise. $f_m^d, s_m^d, d = 1,2,3,6$ are computed from Equation (4) and (5). The original data are from the GHS. Data details are discussed in Section 2.

Table 2: Mean and Standard Deviation

	f_m	s_m	F_q	S_q
Mean	0.2754	0.0129	0.5575	0.038
Std. Dev.	0.0465	0.0032	0.0625	0.0092

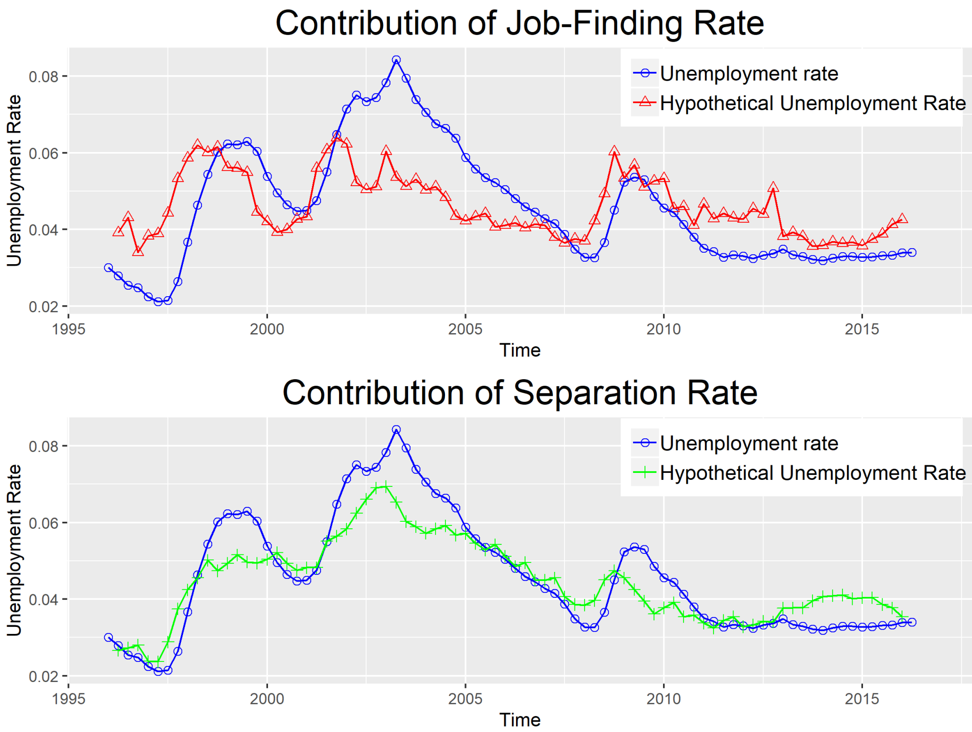
Notes: f_m and s_m are monthly job-finding rate and separation rate, computed as Equation (6). F_q and S_q are corresponding quarterly job-finding probability and separation probability, computed as Equation (7). All four series are seasonally adjusted by X-12-ARIMA method.

Figure 1: Monthly Job-Finding Rate and Separation Rate per Month



Notes: Monthly job-finding rate and separation rate are computed as Equation (6). The two series are seasonally adjusted by X-12-ARIMA method.

Figure 2: Variance Decomposition of Unemployment Rate



Notes: This figure illustrates the contribution of job-finding and separation rates to fluctuations in the unemployment rate, 1996:Q2-2016:Q1. The job-finding rate and separation rate are constructed according to Equation (6). The top panel shows the hypothetical unemployment rate if there were only variations of job-finding rate, $\frac{\bar{s}}{\bar{s}+f_q}$*, and the bottom panel shows the hypothetical unemployment rate if there were only variations of separation rate,* $\frac{s_t}{s_t+\bar{f}}$*. Three series are seasonally adjusted by X-12-ARIMA method.*