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

Bin Wang†
City University of Hong Kong

Yum K. Kwan‡
City University of Hong Kong

This Version: June 24, 2019

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 Nomadic and Ango-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.

JEL Codes: E24; J64.

*This paper is revised from the first Chapter of Bin Wang's Ph.D. thesis. This project is fully funded by the studentship provided by City University of Hong Kong.

†Corresponding author: Department of Economics and Finance, City University of Hong Kong; Address: Qishanxiangshujun, Dongsheng Road, Liaobu Town, Dongguan, China. Email: workbinwang@gmail.com Website: https://sites.google.com/view/workbinwang

‡Department of Economics and Finance, City University of Hong Kong. Email: efykkwan@cityu.edu.hk.

1 Introduction

The search and matching model has become the workhorse paradigm to analyze the dynamics of aggregate labor market. Unemployment and vacancies lies in the center of the whole picture that unemployment is negatively related to vacancies, which is called 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%, from 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. The separation rate contributes more than one half to the variation of the unemployment rate. This is different from the U.S. that the job finding rate contributes more than one half in Shimer (2012).

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.

Our approach is similar to Elsby et al. (2013). They also extend Shimer (2012)'s method to use additional unemployment duration information to find 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) that we construct the two series from the continuous time environment while they base on the discrete period model. And the timing of job-finding rates and separation rates are also not the same.

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.

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 empirical model to measure the job finding rate and separation rate. The third section discusses the data source and the constructed series. The fourth section analyzes the constructed series and their dynamics. The fifth section concludes.

2 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 $m \in \{0, 1, 2, \cdots\}$ refers to the interval $[m, m+1)$ as period m or month m. In the period m, unemployed workers find a job according to a Poisson process with arrival rate $f_m^d = -\log(1-F_m^d) \geq 0$ per month within time interval $[m, m+d]$ 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 $s_m^d = -\log(1 - S_m^d) \geq 0$ per month within time interval

$[m, m+d]$ that is probably dependent on subsequent time horizon d months.

Here we differentiate the rate from probability that f_m^d and s_m^d refer to the job-finding rate and separation rate per month within time interval $[m, m+d]$ whereas F_m^d and S_m^d are corresponding job-finding probability and separation probability over the same period.

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

$$\begin{aligned} dU_{m+\tau} &= E_{m+\tau} s_m^\tau d\tau - U_{m+\tau} f_m^\tau d\tau, \qquad \tau \in [0, d]. && (1) \\ dU_{m,d}^s(\tau) &= E_{m+\tau} s_m^\tau d\tau - U_{m,d}^s(\tau) f_m^\tau d\tau, \quad \tau \in [0, d]. && (2) \end{aligned}$$

Equation (1) equates the change of unemployment $dU_{t+\tau}$ to the flow-in of unemployment when workers exit employment $E_{t+\tau}$ at a rate s_m^d per month times the time elapsed $d\tau$ and the flow-out when unemployed workers $U_{m+\tau}$ find a job at a rate f_m^τ times the elapsed time $d\tau$.

Equation (2) equates the change of short-term unemployed workers $dU_{m,d}^s(\tau)$ to the flow-in when workers exit employment $E_{t+\tau}$ at a rate s_m^τ 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 $U_{m+\tau} - U_{m,d}^s(\tau)$.

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

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 $U^s_{m,d}(d) = U^s_{m+d,d}$[1].

$$f^d_m = -\frac{1}{d}\log\left(\frac{U_{m+d} - U^s_{m+d,d}}{U_m}\right). \tag{4}$$

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^d_m 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 $L_m = E_m + U_m$.

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

Let $\tau = d$

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

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 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^d_m 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 4 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 mean and standard deviation 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 4.

[1] The former $U^s_{m,d}(d)$ 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 $U^s_{m+d,d}$ 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.

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. 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 rates are 3 times the monthly rates, which are just sum of the rates of the former three horizons.

$$f_q = 3 \cdot f_m = f_m^1 + f_m^2 + f_m^3, \quad s_q = 3 \cdot s_m = s_m^1 + s_m^2 + s_m^3. \tag{7}$$

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

$$F_q = 1 - e^{-f_q}, \qquad S_q = 1 - e^{-s_q}. \tag{8}$$

3 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 the 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 one month $U_q^{\leq 1m}$, unemployment with duration less than 2 months but more than 1 month $U_q^{>1m,\leq 2m}$, unemployment with duration less than 3 months but more than 2 months $U_q^{>2m,\leq 3m}$, unemployment with duration less than half a year but more than 3 months $U_q^{>3m,\leq 6m}$, and last unemployment with duration more than half a year $U_q^{>6m}$. We exclude the last series for our needs.

The short term unemployment measured quarterly can be backed out from the unemployment duration data. The short term unemployment at time $q + d \cdot m$ within interval $[q, q + d \cdot m]$ is the sum of unemployment at time $q + d \cdot m$ with duration less than d months.

$$U_{q+dm,d}^s = U_{q+dm}^{\leq 1m} + \cdots + U_{q+dm}^{>(d-1)m,\leq dm}, \quad d = 1, 2, 3, 6 \tag{9}$$

The unemployment U_q, labor force L_q, and short-term unemployment $U^s_{q,d}$ are quarterly measured and we interpolate these series to obtain the monthly versions.

$$\begin{aligned} X_m &= X_q \\ X_{m+1} &= \frac{2}{3}X_q + \frac{1}{3}X_{q+1} \\ X_{m+2} &= \frac{1}{3}X_q + \frac{2}{3}X_{q+1} \end{aligned} \tag{10}$$

where $X \in \{U, L, U^s_d\}$.

As in Equation (9), we set the value of the first month X_m in the quarter equal to the quarterly value X_q, the value of the second month X_{m+1} equal to the sum of two thirds of the quarterly series X_q and one third of the next period quarterly series X_{q+1}, and the value of the third month X_{m+2} equal to the sum of one third of the quarterly series X_q and two thirds of the next period quarterly series X_{q+1}.

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 also we do not abstract labor force in our computation.

Then we can use the interpolated monthly unemployment, labor force, and short-term unemployment to compute the monthly-measured job-finding rate f^d_m per month within time interval $[m, m + d]$ and separation rate s^d_m using equation (4) and (5).

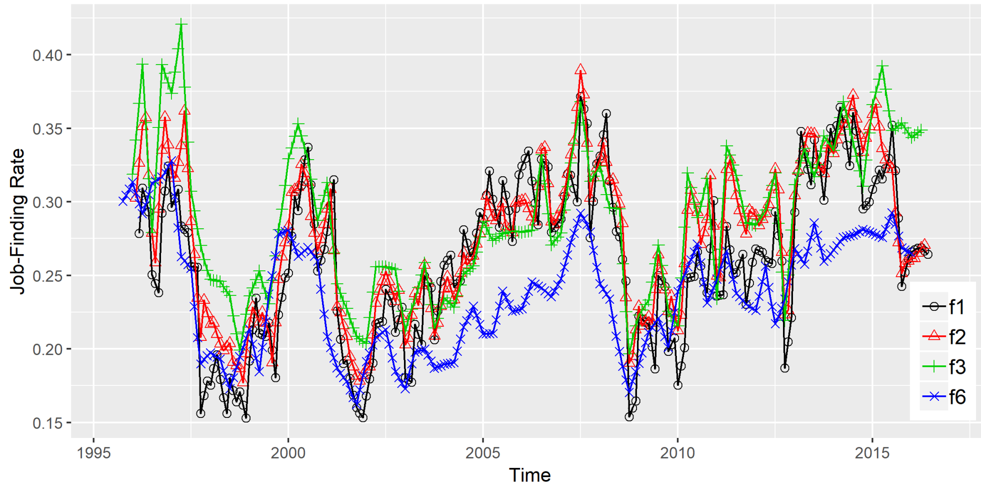
After we find the monthly horizon-dependent series, we can construct the monthly and quarterly job-finding rates and separation rates as in Equation (6) and (7). And quarterly job finding probability and separation probability are constructed as in Equation (8).

4 Empirical Results

4.1 Job Finding Rates and Separation Rates within Subsequent $d = 1, 2, 3, 6$ Months

Figure 1 depicts of the four job-finding rates. The four series behave similarly except f^6_m is a little bit lower. The job-finding rate plumbed during the 1998 Southeast Asian financial crisis, the SARS epidemic episode, and the 2008 global financial crisis.

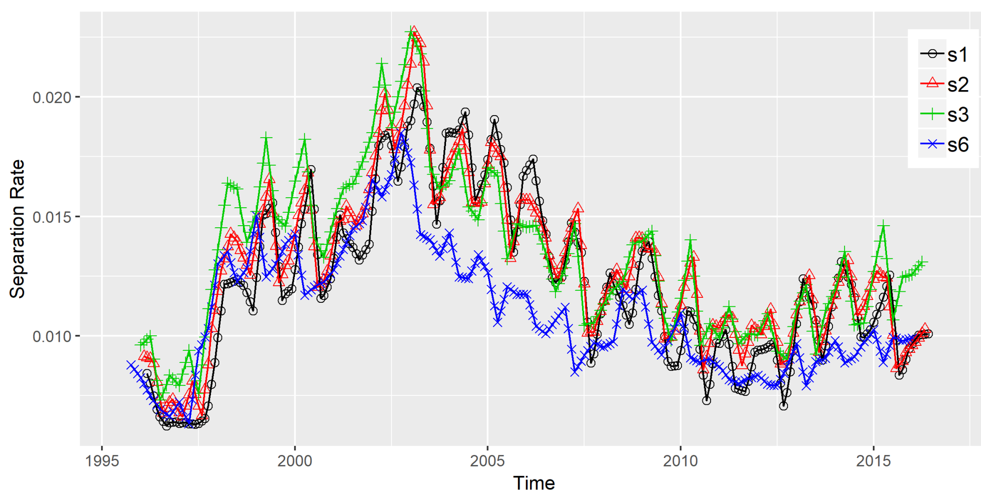
Figure 1: Average Job-Finding Rate per Month in Subsequent 1,2,3, and 6 Months



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. $f_m^d, d = 1, 2, 3, 6$ are computed from the equation (4). The original data are from the GHS. Data details are discussed in Section 3.

Figure 2 illustrates the four separation rates. The four series behave quite similarly except s_m^6 is a bit lower. Unlike the job-finding rate, the separation rate doesn't show so many obvious business cycle features. The 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.

Figure 2: Average Separation Rate per Month in Subsequent 1,2,3, and 6 Months



Notes: s_m^d is the average separation rate at time m per month associated with the separation probability that an employed worker gets fired within d months. $s_m^d, d = 1, 2, 3, 6$ are computed from the equation (5). The original data are from the GHS. Data details are discussed in Section 3.

Table 1 shows the means and standard deviations of the four job-finding rates and separation rates. The mean of f_m^6 is 0.237 per month, which is lower than the means of the job-finding rates of other three horizons while f_m^1, f_m^2, and f_m^3 are quite similar. It implies 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.

Table 1: Parameter Values in the Model Simulation

	f_m^1	f_m^2	f_m^3	f_m^4	s_m^1	s_m^2	s_m^3	s_m^4
Mean	0.2615	0.2767	0.2886	0.2372	0.0123	0.0129	0.0134	0.0110
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 the equation (4) and (5). The original data are from the GHS. Data details are discussed in Section 3.

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, quarterly rates, and quarterly probabilities as in Equation (6), (7), and (8).

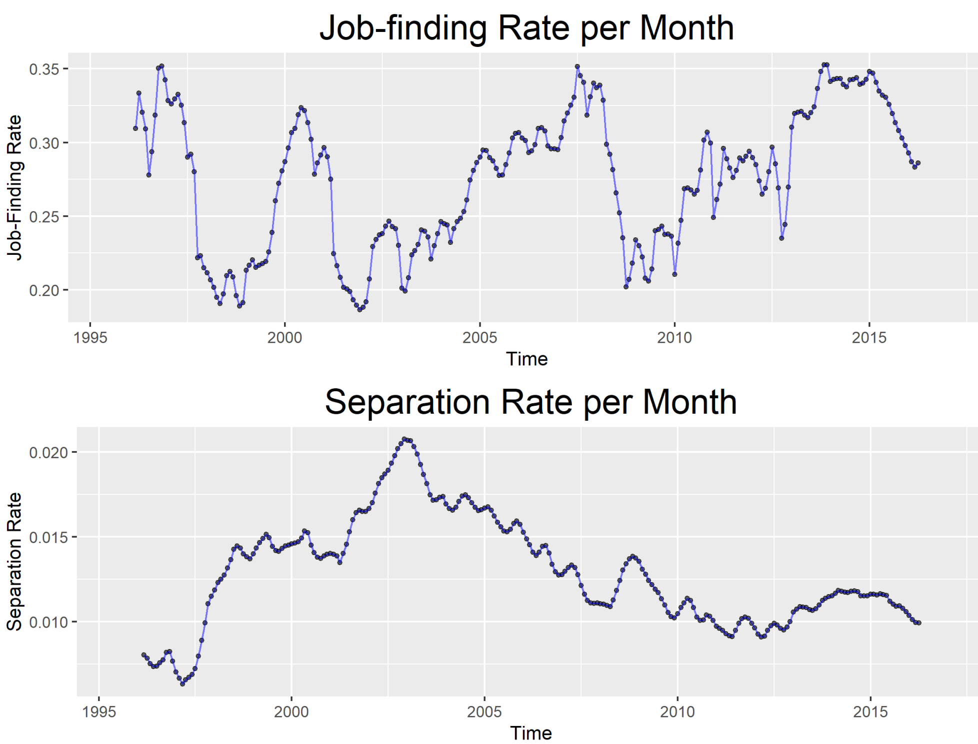
4.2 Monthly Rates and Corresponding Quarterly Probabilities

Figure 3 shows the monthly job-finding rate and separation rate defined in Equation (6). The two series are seasonally adjusted by X-12-ARIMA method. As in the analysis of these two rates of different horizons, 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 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 Nomadic and Anglo-Saxon category underscored by Elsby et al. (2013). The standard deviation of separation rate is 24.8% from the average, which is outstandingly volatile. This confirms Lubik (2012)'s posterior estimate that the separation rate shock is quite volatile.

The average job-finding probability and separation probability in a quarter are 55.75% and 3.8% respectively, shown in Table 2 and Figure 4. Lubik (2012) estimates the prior and

Figure 3: 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.

posterior mean of quarterly separation rate as 4.5% and 4.4%, which are close to our results.

Table 2: Mean and Standard Deviation

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

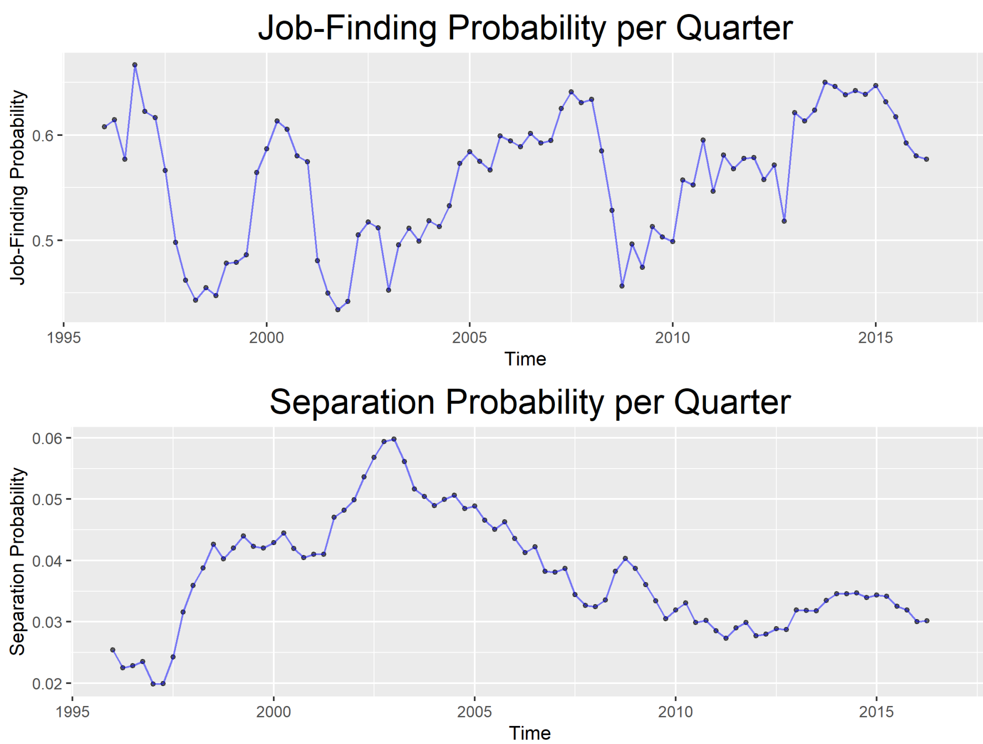
Notes: f_m and s_m are monthly job finding rate and separation rate, computed as Equation (6). F_q and S_q are corresponding quarterly job-finding probability and separation probability, computed as Equation (8). All four series are seasonally adjusted by X-12-ARIMA method.

4.3 Unemployment Rate Decomposition

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 jthe ratio of separation

Figure 4: Quarterly Job-Finding and Separation Probability per Quarter



Notes: Quarterly job-finding probability and separation probability are computed as Equation (7). The two series are seasonally adjusted by X-12-ARIMA method.

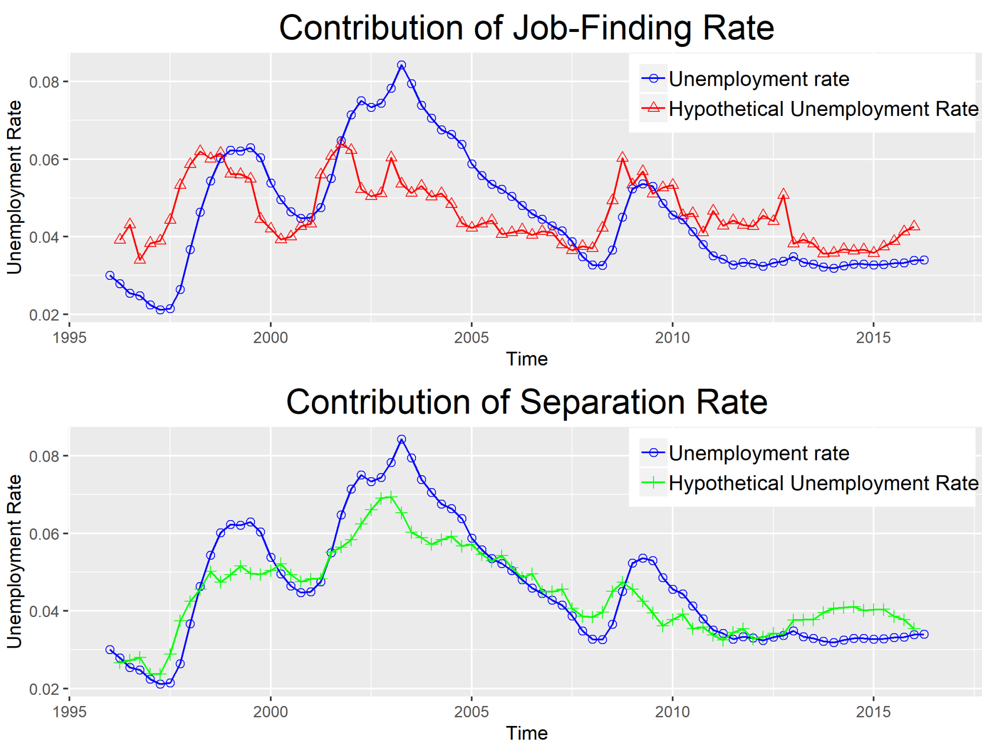
rate over the sum of job-finding rate and separation rate if unemployment is constant.

$$u_q = \frac{U_q}{L_q} = \frac{s_q}{s_q + f_q} \tag{11}$$

The correlation between u_{q+1} and $\frac{s_q}{s_q+f_q}$ in Hong Kong is 0.91 over the period from 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 5 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.

Figure 5: Variance Decomposition of Unemployment Rate



Notes: This figure illustrates the contribution of job-finding and separation rates to fluctuations in the unemployment rate in the period from 1996:Q2 to 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,* $\frac{s_q}{s_q+\bar{f}}$*. Three series are seasonally adjusted by X-12-ARIMA method.*

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 $\frac{\bar{s}}{\bar{s}+f_q}$ 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.

5 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 nomadic 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.

References

Elsby, M. W. L., Hobijn, B., and Şahin, A. (2013). Unemployment Dynamics in the OECD. *The Review of Economics and Statistics*, 95(2):530–548.

Hairault, J.-O., Le Barbanchon, T., and Sopraseuth, T. (2015). The cyclicality of the separation and job finding rates in France. *European Economic Review*, 76(C):60–84.

Hobijn, B. and Sahin, A. (2009). Job-finding and separation rates in the OECD. *Economics Letters*, 104(3):107–111.

Lin, C.-Y. and Miyamoto, H. (2014). An estimated search and matching model of the Japanese labor market. *Journal of the Japanese and International Economies*, 32(C):86–104.

Lubik, T. A. (2012). Aggregate Labour Market Dynamics In Hong Kong. *Pacific Economic Review*, 17(2):257–279.

Shimer, R. (2005). The Cyclical Behavior of Equilibrium Unemployment and Vacancies. *American Economic Review*, 95(1):25–49.

Shimer, R. (2012). Reassessing the Ins and Outs of Unemployment. *Review of Economic Dynamics*, 15(2):127–148.

Tse, C. Y., Leung, C. K. Y., and Chan, W. Y. F. (2002). Unemployment and vacancy in the Hong Kong labour market. *Applied Economics Letters*, 9(4):221–229.