Explaining the Cyclical Behavior of the Korean Labor Market

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I would like to thank Ouk Heon Song, Daesoo Kim, Bae-Geun Kim, Wooyoung Kim, and seminar participants at the Bank of Korea for their helpful comments. Any errors appearing here are mine.

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The Korean labor market is characterized recently by (1) more volatile employment and OLF than unemployment and (2) employment much more correlated with OLF than with unemployment. Based on these facts, the role of the unemployment rate as a business cycle indicator would seem to have been weakened, and the significant amounts of employment fluctuations to be explainable primarily by the fluctuations of nonparticipation. In this paper, I evaluate existing models and modify the standard matching model. The distinction between search and OLF becomes clear, and the model generates the OE transition without an assumption that nonparticipants are inactive searchers. Moreover, some parameters which determine the model dynamics are assumed to be time-varying. The modified model accounts quite well for the Korean labor market of the last two decades. Among other time-varying parameters, the stochastic nonparticipant's probability of entering the labor force, which co-moves with the state of the labor market, explains the Korean labor market. A quantitative analysis of the reduced-form dynamics shows clearly that a change in the participation rate is capable of generating the cyclical movements of employment, unemployment and OLF that we observe in the 2000-2007 data.

Keywords: Search and Matching, Business Cycle, Labor Force Participation

JEL Classification: E24, E32, J63, J64

Ⅰ. Introduction

According to the Economically Active Population Survey (EAPS), reported monthly by the National Statistical Office of Korea, the volatility of the unemployment rate (and the unemployment-to-population ratio) has decreased considerably in recent years, while that of the nonparticipation rate has not decreased much. The volatilities of the unemployment and nonparticipation rates have been .43 and .39 percent, respectively, for the last two decades, but .12 percent and .25 percent over the last seven years.[1] The correlation between employment-to-population and unemployment-to-population ratios has also decreased dramatically, from -.86 to -.65 in terms of absolute values, while the correlation between the employment-to-population ratio and the nonparticipation rate has increased from -.82 to -.93. The employment-to-population ratio is now much more correlated with the nonparticipation rate than it is with the unemployment-to-population ratio. This evidence gives arise to the argument that the role of the unemployment rate as an indicator for the business cycle has been weakened, and that a portion of employment fluctuation can be accounted for by fluctuations of nonparticipation.

I evaluate existing models such as a real business cycle (RBC) model with both labor market frictions and nonparticipation and a Mortensen-Pissardies (1994) matching model with nonparticipation. First, I show that the RBC model accounts for the cyclical aspects of the Korean labor market with the exception of the relationship between unemployment and vacancies. It is well known that the RBC model with labor market frictions does not produce the Beveridge re-

1) All time series data are Hodrick-Prescott filtered with smoothing parameter 14,400. The volatility of the unemployment-to-population ratio was .43 percent over the last two decades, but just .12 for the last seven years. Throughout I will use interchangeably employment and the employment-to-population ratio, unemployment and the unemployment-to-population ratio, and OLF and the nonparticipation rate. If necessary, I will distinguish among them.

lationship between vacancies and unemployment.[2] Second, I investigate the standard Mortensen-Pissarides matching model in which, following Kim (2004) and Pries and Rogerson (2004), nonparticipation is defined as an inactive search. The reduced-form dynamics derived from the standard matching model predict a nonparticipation rate 20 times more volatile than the unemployment-to-population ratio. Since the size of nonparticipation is comparable to the size of employment, and nonparticipants find jobs with some time-varying probability and then move to employment, the model generates a quite volatile nonparticipation rate which predominates over the unemployment fluctuations.

In this paper, I modify the standard matching model in several ways: First, those who do not engage in job search are classified as out of the labor force, which is consistent with the EAPS data. Second, the employed consist of both those who have been working and those who search and find employment. Then the transition from OLF to employment occurs between two consecutive periods, and it is not necessary to assume that nonparticipants are inactive searchers. Third, although the transition rate from unemployment to employment is much higher than the transition rate from OLF to employment, the conditional job-finding probability that a nonparticipant who reenters the labor market faces is much higher than that an unemployed worker faces. This leads those out of the labor force to participate in the labor market because nonparticipants have a higher job-finding probability reservation than the unemployed. Finally, some parameters which determine the model dynamics are assumed to be time-varying: the nonparticipant's probability of entering the labor force, the unemployed worker's probability of remaining in the labor force, and the employed worker's probability of leaving the labor force. The parameters are assumed to move stochastically with the aggregate productivity.

My model has a couple of novel features. One is that the direct transition

2) See Merz (1995), Andolfatto (1996), Tripier (2004) and Veracierto (2004).

from OLF to employment is generated with no assumption that nonparticipants are inactive searchers and without the time aggregation problem that Garibaldi and Wasmer (2006) point out. Another novel feature is that, like with Cole and Rogerson (1999), the reduced-form dynamics are easily derived from my model, and identifying the parameters governing the model is much easier than with a model having the labor force classification that Kim (2004) and Pries and Rogerson (2004) make.

The findings can be summarized as follows. The model with constant parameters accounts for the Korean labor market over the last two decades, which is mainly characterized by a high and volatile unemployment rate due to the 1998-1999 recession. The unemployment rate is the most volatile and the nonparticipation rate the least volatile among the labor market variables. The employment-to-population ratio is more negatively correlated with the unemployment-to-population ratio than with the nonparticipation rate. Especially, the model predicts the Beveridge relationship. Once the probability of a nonparticipant entering the labor force (which is stochastic and weakly positively correlated with the probability of moving from unemployment to employment) is introduced, the model matches the labor market of the last seven years. A quantitative analysis of the reduced-form dynamics shows clearly that a small change in the participation rate is capable of generating fluctuations of employment, unemployment and OLF that we observe in the 2000-2007 data.

Finally, the study suggests that policies for smoothing the business cycle which consider the unemployment rate as the main important indicator can be ineffective if many people move in and out of the labor force without remaining unemployed. Moreover, when they design labor market policies, policy-makers should consider the heterogeneity among those who are out of the labor force, because if there is considerable heterogeneity, people's responses can vary greatly. The results of the policies could then be different from those the policy-makers have in mind.

This work is not the first attempt to account for the cyclical behavior of the Korean labor market. However, to my knowledge, this paper is the first attempt to explain the joint behavior of the Korean labor market using the Mortensen-Pissarides matching model.

The paper is organized as follows. Section 2 presents some stylized facts about the labor market in Korea. I report the changes in volatilities of the labor market variables and the correlations among them. Section 3 evaluates whether the RBC model and the standard Mortensen-Pissarides matching model can match the cyclical behavior of the Korean labor market. Section 4 modifies the standard matching model, and suggests a possible extension. Section 5 quantifies the modified matching model, and Section 6 states my conclusions.

Ⅱ. Korean Labor Market Facts

In this section, I discuss the time series behavior of labor market variables in Korea. Especially, I employ the Economically Active Population Survey (EAPS, Korean National Statistical Office) from January 1986 to December 2006.

When asking respondents their the major activities during the reference week, the survey provides several possible responses. In 2000, for example, 'Working', 'Absent from work (including temporary leave)', 'Looking for work', 'Child care', 'Keeping house', 'Student', 'Senior', 'Disabled', and 'Other' were listed. In 2006, the possible responses had been increased to 17, to capture the youth labor force status.

Based upon the major activities indicated for the reference week, I classify respondents as follows: those working or absent from work as *employed*, tnose looking for work as *unemployed*, and all others as OLF. Even if persons are categorized as OLF, some are working for money and some have non-zero job-search duration. Those who work for money more than 15 hours during the reference week are classified as *employed*. For those who have non-zero job-search duration, I classify them as *unemployed* only if they are available for work.

To understand the dynamic behavior of the labor market, I need to analyze not only the transitions between employment and unemployment, but also movements in and out of the labor force. Measures of worker transitions take advantage of the rotating-panel aspect of the EAPS, which I have only since 1986. Furthermore, there are several months when I am not able to match workers across months.[3] I use matched worker data to construct the probability that a worker who is in labor force state X in month $\tau-1$ and state Y in month τ, i.e. the XY transition rate or equivalently h_{XY}.

1. Employment, Unemployment and Nonparticipation

Figure 1(a) presents the monthly employment-to-population ratio (or simply employment) and its estimated trend (a Hodrick-Prescott filter with smoothing parameter 14,400). In an average month from 1986 to 2006, 58.4 percent of the population was working or on temporary leave (see Table 1(a)). This time series exhibits some variation, starting from 52.8 percent in January 1986, reaching 60.9 percent in February 1997, falling to 54.5 percent in November 1998, but reaching 59.9 percent in December 2002 and in February 2004.

Figure 1(b) presents the monthly unemployment-to-population ratio (or simply unemployment) and its estimated trend, and Figure 1(c) presents monthly unemployment and the unemployment rate. In an average month, the unemployment rate is 3.5 percent and unemployment 2.1 percent. Between the late

3) I used household ID, person ID, sex, and date of birth in my matching algorithm. The months for which I could not construct matches are January of every year, July 1988, and February 1993.

1980s and the early 1990s, the unemployment rate trended downward. In June 1993, it increased to 3.1 percent, but fell continuously after that to go below 2 percent in February 1996. In September 1998, at the worst point of the Korean Crisis, the unemployment rate reached 9.2 percent. Since then, it has fallen back to average levels. By September 2002, it had dropped to 3.1 percent, and from January 2003 through the end of 2006 it hovered at near 3.7 percent.

Figure 1(d) presents the monthly nonparticipation rate and its estimated trend. In an average month from 1986 to 2006, 39.5 percent of the population was out of the labor force (see Table 1(a)). In January 1986, the nonparticipation rate was as high as 44.6 percent. Since then, it has trended consistently downward and in February 1997 fell to the lowest level in the sample period, 37.5 percent. During the Korean Crisis, however, the nonparticipation rate reached 40.2 percent (February 1999). From 2003 through the end of 2006, it moved at around 38.6 percent.

To investigate high frequency fluctuations, I take the differences between the monthly time series data and their low frequency trends, Hodrick-Prescott (HP) filters with smoothing parameter 14,400. Table 1(b) shows the cyclical features of the data. The difference between the employment-to-population ratio and its trend has standard deviations of .69 percent for the entire period (1986-2006) and .32 percent for the subperiod (2000-2006). For the entire period, employment volatility was twice what it was for the subperiod.

The difference between the unemployment-to-population ratio and its trend has a standard deviation of .43 percent for the entire period and .12 percent for the subperiod. For the unemployment rate, the figures are .73 and .21 percent, respectively. The unemployment-to-population ratio and the unemployment rate are both more than three times as volatile than for the subperiod.

The difference between the nonparticipation rate and its trend has a standard deviation of .39 percent for the entire period and .25 percent for the subperiod.

Unlike the case with the employment-to-population ratio and the unemployment-to-population ratio, the difference in nonparticipation rate volatilities between the entire period and the subperiod is not great. For the subperiod, in particular, the nonparticipation rate is even more volatile than the unemployment rate.

Looking at the persistence of the detrended variables, all three series display strong positive autocorrelations. The monthly autocorrelations for the employment-to-population ratio, the unemployment-to-population ratio, and the nonparticipation rate are .87, .97, and .66 for the entire period, respectively. For 2000-2006, the autocorrelations for the employment-to-population ratio and the unemployment-to-population ratio decrease from .87 to .80 and from .97 to .74, respectively.[4] Interestingly, the monthly autocorrelation for the nonparticipation rate increases from .66 to .75.

As far as contemporaneous correlations are concerned, Table 1(b) shows the entire period and the subperiod presenting quite different pictures. The correlation between the employment-to-population ratio and the unemployment-to-population ratio is -.86 for the entire period, while it is -.65 for the subperiod. On the other hand, the correlation between the employment-to-population ratio and the nonparticipation rate is -.82 for the entire period and -.93 for the subperiod. For the subperiod, the employment-to-population ratio has a much larger negative correlation with the nonparticipation rate than with the unemployment-to-populatio ratio.[5]

2. Transition Probabilities

Figure 2(a) through Figure 2(c) present time-series for the transition proba-

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4) The autocorrelation for the unemployment rate is .97 for 1986-2006 and .75 for 2000-2006.

5) The correlations between the employment-to-population ratio and the unemployment rate are -.88 for 1986-2006 and -.70 for 2000-2006.

bilities, and Table 2(a) and Table 2(b) present the average transition probabilities for the entire period and the subperiod, respectively.

The first thing that stands out in the figures is that the probability of transition from E to U (hereafter the EU transition rate) and the OU transition rate maintain the lowest levels over twenty years, while the UE transition rate maintains the highest level. The EU transition rate, which had trended downward until 1996, went up to 1.9 percent in September 1998 due to the mass layoffs at that time when the unemployment rate was at its highest level of 9.1 percent. The EU transition rate is recently about .8 percent, a bit higher than before the Korean Crisis.

The OU transition rate shows a pattern at low frequency similar to that of the EU transition rate. During 1997-1998, the OU transition rate also increased considerably, from .4 percent on July 1997 to 2.5 percent on September 1998. The sharp increases are explained by those who were out of the labor force entering the labor market to search for jobs.

In an average month from 1986 to 2006, on the other hand, the UE transition rate was 26.2 percent. That is, about one-quarter of the unemployed found employment in a month. This time series exhibits considerable variation, starting from 23.8 percent in January 1986, reaching 40.5 percent in July 1990, falling to 16.9 percent in December 1997, and from January 2000 through the end of 2006 moving at around 25 percent with a standard deviation of 1.8 percent.

The UO transition rate trended upward in the late 1980s, but downward in the early 1990s. In the mid-1990s it reached its lowest level at about 4 percent, and has increased consistently over the last decade since then. Recently, more than 10 percent of the unemployed give up looking for employment and leave the labor force.

3. Cyclicality of Labor Market Variables

To investigate the cyclicality of the labor market variables, I look at the contemporaneous correlations between output and the labor market variables. I construct quarterly data by monthly averages because GDP data is not available at monthly frequencies. Tables 3(a) and 3(b) report the contemporaneous correlations between the labor market variables and per capita GDP at quarterly frequencies.[6] For most of the stock and flow variables, the correlation with output has decreased significantly since 2000.[7]

What has happened in the labor market? The labor market can be hit by various shocks. There are two kinds of productivity shocks: one economy-wide and the other specific to the labor market. The evidence given in Tables 3(a) and 3(b) may show that the recent labor market is much more driven by labor-market-specific shocks than economy-wide shocks.

The most important parameter in the labor market is the UE transition rate, which can be interpreted as the job-finding probability. First, the job-finding probability can capture both economy-wide and labor-market-specific shocks, whereas GDP only captures the former. Second, the job-finding probability is informative not only to unemployed persons, but also to employed persons and nonparticipants. Employed persons wishing to move to other jobs carefully look at the job-finding probability. Based upon it, they make their decisions. Nonparticipants also care about the probability, because it gives them useful information about the best time to enter the labor market and search for a job.

Table 3(c) shows correlations between the UE transition rate and other transition rates. A high U to E probability implies a good labor market in which it is easy for people to find jobs. Recently, as the labor market is good, em-

6) Since a quarterly population measure is not available, I use the population 15 years old or over.

7) Explaining why the correlations of all the labor market variables with output have declined is beyond the scope of this paper.

ployed and unemployed persons are more likely to leave the labor market (increases in the EO and UO transition rates), and nonparticipants are more likely to enter it (increases in the OE and OU transition rates). Even if the UE transition rate co-moves weakly with GDP over the recent business cycle, I focus on it rather than GDP, because the UE transition rate gives better quality information about the labor market than GDP does.

Ⅲ. Evaluating the Real Business Cycle Model and the Mortensen-Pissarides Matching Model

1. Real Business Cycle model

In this section, I evaluate the real business cycle (RBC) model in which the representative agent allocates his time between working, searching, and non-market activity.[8)] There is a friction of time allocation between working and searching, that is, a matching friction. The representative agent's preferences are represented by a utility function:

$$E_0 \sum_{t=0}^{\infty} \beta^t \{\ln c_t + \phi \ln(1 - n_t - s_t)\}$$

where c_t is consumption, n_t time spent in working, s_t time spent in searching, β the subjective discount factor, and ϕ the scale parameter. Note that total discretionary time is normalized to one.

The production technology uses as inputs capital k_t and labor n_t. The Cobb-Douglas production function is assumed: $y_t = z_t A k_t^{\alpha} n_t^{1-\alpha}$. The value of α corresponds to the average capital share in output. There is perfect substitution in production between investment i_t, consumption, and job-posting κv_t. The constraint on the uses of output is

8) For further details, see Merz (1995), Andolfatto (1996) and Tripier (2004).

$$c_t + i_t + \kappa v_t = z_t A k_t^{\alpha} n_t^{1-\alpha}$$

The laws of motion for the capital stock, labor, and technology are

$$k_{t+1} = (1-\delta)k_t + i_t$$

$$n_{t+1} = (1-\psi)n_t + m_t$$

$$\ln z_{t+1} = \rho \ln z_t + \epsilon_{t+1}$$

where δ is the depreciation rate, ψ the exogenous separation rate and z_t aggregate technology, ϵ follows a normal distribution with mean zero and standard deviation σ_{ϵ}, and m_t represents the number of job matches that are created in time period t. A standard Cobb-Douglas matching function is assumed:

$$m_t = \omega v_t^{\gamma} s_t^{1-\gamma}$$

The model is calibrated based on the data given in the previous section. Table 5(a) presents the parameter values of the model.[9)]

Table 7 reports the results of simulation to compute the relative standard deviations as ratios to the standard deviation of the employment-to-population ratio, and their correlations. Note that n is the employment-to-population ratio and s the unemployment-population ratio. The model statistics are obtained by 100 simulations and HP-filtered with smoothing parameter 14,400. The model-generated data look a lot like the actual data. The model predicts the relative volatilities of the unemployment-to-population ratio and the nonparticipation rate to be 30 and 89 percent, respectively, of the volatility of the employment-to-population ratio. The relative volatility of the unemployment rate is also 51 percent. The model-generated moments are very close to the moments from the 2000-2006 sample, in which the relative volatilities of the unemployment-to-population ratio, the nonparticipation rate and the unemployment rate are 39 percent, 81 percent and 66 percent of the volatility of the employ-

9) For the first order conditions and the steady state conditions, see the Appendix.

ment-to-population ratio, respectively.

With regard to the contemporaneous correlations, the RBC model matches the data, especially the sample of 2000-2006, in which the employment-to-population ratio and the nonparticipation rate are more negatively correlated than the employment-to-population ratio and the unemployment-to-population ratio, and the unemployment-to-population ratio and the nonparticipation rate are positively correlated. As Merz (1995), Andolfatto (1996) and Tripier (2004) point out, the RBC model does not predict the Beveridge relationship, a negative correlation between unemployment and vacancies. Merz (1995) reports that, in her model, the correlation between unemployment and vacancies is .32 when the search intensity is variable, and -.15 when the search intensity is fixed, but the correlation in her actual data is -.95. Andolfatto (1996) shows that, in his model, the correlation between unemployment and vacancies is -.19, but it is -.89 in his actual data. In particular, Tripier (2004) tests RBC models for various specifications of utility function and finds that the models do not produce the Beveridge relationship.

2. Mortensen-Pissarides matching model

In this section, I evaluate the Mortensen-Pissarides matching model. Since there is no participation decision in the standard matching model, I modify the standard model in line with the classification that Kim (2004) and Pries and Rogerson (2004) make. For simplicity, there are neither heterogeneities nor match specific shocks.[10)]

Figure 3 presents the flow chart describing how workers move between labor force states within a given period. At the beginning of a certain period, there are two types of workers: matched workers and unmatched workers. Matched

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10) Kim assumes that workers differ with regard to their productivity, and Pries and Rogerson assume that workers differ with regard to their valuation of leisure.

workers have employment opportunities, but unmatched workers do not.

First, matched workers choose to work on their current jobs with probability $1-\eta$ or not to work with probability η. Matched workers choosing not to work become unmatched workers. If a matched worker chooses to work, then (s)he is classified as *employed*. Conditional on working, workers separate with probability λ at the end of a certain period. Those who separate become unmatched, and those who do not separate remain matched in the subsequent period.

Second, unmatched workers choose to look for work *actively* with probability μ or look for work *inactively* with probability $1-\mu$. Unmatched workers choosing active searches are classified as *unemployed*. Conditional on searching, workers find jobs with probability p. Those who find employment become matched, and those who do not find employment become unmatched at the beginning of the subsequent period. If an unmatched worker chooses an inactive search, then (s)he is classified as *OLF*. Conditional on searching inactively, unmatched workers find employment with a different probability, say f. In Kim (2004) and Pries and Rogerson (2004), it is assumed that $p > f$, because those who search actively enjoy a higher job-finding probability than those who search inactively. At the end of the period, those who find employment become matched, and those who do not find employment become unmatched in the subsequent period.

Given the above classification and the flow chart of Figure 3, the following system of equations of the reduced-form labor market dynamics can be derived. I assume that the population is normalized to one. Time $t+1$ matched workers, M_{t+1}, and unmatched workers, N_{t+1}, are given as follows:

$$M_{t+1} = (1-\lambda)E_t + p_t U_t + f_t O_t$$

$$N_{t+1} = \lambda E_t + (1-p_t)U_t + (1-f_t)O_t$$

where E_t, U_t, and O_t denote employed workers (the employment-to-population ratio or employment), unemployed workers (unemployment-to-population ratio or unemployment), and nonparticipants (the nonparticipation rate or OLF), respectively. Thus, time $t+1$ employment, unemployment and OLF can be expressed in terms of matched workers and unmatched workers:

$$E_{t+1} = (1-\eta)M_{t+1}$$

$$U_{t+1} = \mu(\eta M_{t+1} + N_{t+1})$$

$$O_{t+1} = (1-\mu)(\eta M_{t+1} + N_{t+1})$$

Note that OLF depends on the job-finding probabilities, p_t and f_t. Since the population is normalized to one, the number of matched workers and the number of unmatched workers have the following relationship: $M = 1 - N$. The correlation between M and N is then -1, and the standard deviations of M and N are equal to each other. From the law of motion for employment, $E_{t+1} = (1-\eta)M_{t+1}$, we see that employment is perfectly positively correlated with the number of matched workers. The standard deviations of employment and the number of matched workers are almost the same, because the probability that a matched worker does not work on his (her) current job, η, is very small. Using $M = 1 - N$, the law of motion for unemployment can be expressed as a function of N:

$$U_{t+1} = \mu\eta + \mu(1-\eta)N_{t+1}$$

Unemployment and the number of unmatched workers are perfectly positively correlated, and the standard deviation of unemployment is smaller than that of the number of unmatched workers, because the probability that an unmatched worker chooses an active job search, μ, is small and so unemployment (or the unemployment-to-population ratio) is small. Finally, we find the relationship between unemployment and OLF:

$$O_{t+1} = \left(\frac{1-\mu}{\mu}\right) U_{t+1}$$

Unemployment and OLF are perfectly positively correlated. Suppose that in a steady state the unemployment-to-population ratio is 8 percent and the non-participation rate 32 percent. The probability of an active job search, μ, is given by .2 (8 percent divided by 40 percent). Then, OLF is four times more volatile than unemployment, because $(1-\mu)/\mu = 4$.

The standard Mortensen-Pissarides matching model with Pries and Rogerson (2004) modification gives the following implications: (1) the correlations between employment and unemployment, and between employment and OLF are -1; (2) the correlation between unemployment and OLF is 1; (3) the relative standard deviation of unemployment, expressed as a ratio to the standard deviation of employment, is μ; and (4) the relative standard deviation of OLF is $1-\mu$. Note that the relative volatilities of unemployment and OLF are irrelevant to η.

As an exercise, I simulate the reduced-form dynamics of the standard Mortensen-Pissarides matching model. For simplicity, I set the probability that a matched worker does not work on his(her) current job, η, to zero, because as mentioned above this does not affect the volatilities of the variables. Instead of computing an endogenous vacancy-to-unemployment ratio, I assume that an inactive searcher's job-finding probability, f_t, follows an AR(1) process:

$$f_{t+1} = (1-\rho) f^* + \rho f_t + \epsilon_{t+1}$$

where f^* is the steady state inactive searcher's job-finding probability, ρ is the persistence parameter, and ϵ follows a normal distribution with mean zero and standard deviation σ_ϵ. An active searcher's job-finding probability, p_t, is given by $p_t = x f_t$, where $x = p^*/f^*$ is the relative search intensity. The steady state active searcher's and inactive searcher's job-finding probabilities come from the

UE and OE transition rates of Table 2, which are 26.2 and 4.5 percent, respectively. The persistence parameter of the inactive searcher's job-finding probability is set to 0.9, and the standard deviation of the shock is set to 0.5 percent. Most importantly, the exogenous separation rate and the probability of the unmatched worker being an active searcher can be calculated from the steady state condition of the reduced-form dynamics. All parameters are summarized in Table 5(b).

Table 7 presents the simulation results. The model statistics are obtained by 100 simulations and HP-filtered with smoothing parameter 14,400. Table 7(a) reports the relative volatilities of unemployment and OLF expressed as the ratios to the standard deviation of employment. The relative volatility of unemployment is 5 percent of the volatility of employment, which is consistent with the probability of the unmatched worker being an active searcher, μ. Also, the relative volatility of OLF is 95 percent of the volatility of employment.

Given the reasonable parameters, the standard matching model predicts perfect correlations between employment, unemployment and OLF, and OLF about 20 times more volatile than unemployment. In the following section, I show that minor modifications of the timing of matches and labor force classification make the Mortensen-Pissarides matching model account for the Korean labor market.

Ⅳ. The Model

The model economy is a variant of the Mortensen and Pissarides (1994) matching model which consists of workers and firms (or entrepreneurs). Both workers and firms are homogeneous. Unlike in the standard Mortensen-Pissarides matching model, workers can be employed, unemployed, or out of the labor force.

1. Workers

There is a continuum of infinitely-lived and risk-neutral workers with total mass equal to one. Each worker has preferences defined by

$$\sum_{t=0}^{\infty} \beta^t c_t$$

where $0 < \beta < 1$ is the discount factor and c_t is consumption which takes the following values depending upon the worker's labor market status: w_t if the worker is working, b if the worker is searching for a job, and 0 if the worker is out of the labor force.

At the beginning of each period, there are three types of workers (based on the classifications made one period before): employed, unemployed, and out of the labor force (I discuss the classification of workers below). Employed workers choose to work on their current jobs with probability $1-\eta$ or not to work with probability η. If an employed worker chooses not to work, then (s)he is classified as *OLF*. Conditional on working, workers separate with probability λ at the end of that period. Those who separate are classified as *unemployed*, and those who do not separate are classified as *employed*.

Unemployed workers choose to look for work with probability π or not to look for work with probability $1-\pi$. If unemployed workers choose not to search, then they are classified as *OLF*. Conditional on searching, workers find a job with probability p. Those who find employment are classified as *employed*, and those who do not find employment are classified as *unemployed*.

Nonparticipants choose to look for work with probability ξ or not with probability $1-\xi$. If a nonparticipant chooses not to search, then (s)he is classified as *OLF*. Conditional on entering the labor force, nonparticipants find employment with probability f. Those who find employment are classified as *employed*, and those who do not are classified as *unemployed*.[11)] Figure 4 summarizes the worker flows.

2. Firms

There are also infinitely many risk-neutral firms in this economy. Each firm has preferences defined by

$$\sum_{t=0}^{\infty} \beta^t c_t$$

where $0 < \beta < 1$ is the discount factor and c_t consumption. In a certain period, firms can be active or vacant. An active firm is one that is matched with a worker and is currently producing output z, where z is an aggregate productivity level which is assumed to follow an AR(1) process in logs:

$$\ln z' = \rho \ln z + \epsilon'$$

where ϵ follows a normal distribution with mean zero and variance σ_ϵ^2. The steady state productivity level is normalized to 1. All active firms confront exogenous separation with probability λ. A vacant firm is one that is posting a vacant position and looking for workers. All vacant firms find workers with probability q. I assume that firms pay k units of the consumption good to post a vacancy.

3. Search and Matching

Table 2 reports the probabilities of transition between different labor force states for the Korean labor market. The UE transition rate is about 26.2 percent and the OE transition rate about 4.5 percent.[12)] Based on this fact, Kim

11) Moon (2007) discusses the classification in more detail.
12) U.S. data give similar numbers. See Kim (2004), Garibaldi and Wasmer (2005). and Moon (2007).

(2004) and Pries and Rogerson (2004) assume that the probability that an unemployed worker finds a job is much higher than the probability that a nonparticipant finds one.

Before making a job-search decision, a nonparticipant decides first whether to participate in the labor force. Nonparticipants' job-finding probability is defined as a conditional probability: conditional on participation in the labor force and searching for work, a nonparticipant finds a job with a certain specified probability. The unemployed workers' conditional job-finding probability is then about 29 percent and the nonparticipants' about 85.8 percent:

$$\Pr(UE|Labor\ Force) = \frac{h_{UE}}{h_{UE}+h_{UU}} = \frac{26.2\%}{26.2\%+64.3\%} = 29\%$$

$$\Pr(OE|Labor\ Force) = \frac{h_{OE}}{h_{OE}+h_{OU}} = \frac{4.5\%}{4.5\%+.8\%} = 85.8\%$$

where h_{UE} is the UE transition rate. If a nonparticipant decides to search, then (s)he will have a three times higher job-finding probability that an unemployed worker will. Let x denote the relative search efficiency:

$$x = \frac{\Pr(OE|Labor\ Force)}{\Pr(UE|Labor\ Force)}$$

A constant-returns-to-scale matching function is assumed:

$$m(s,v) = \omega v^{\gamma} s^{1-\gamma}$$

where s is the efficiency unit of the searchers, v the number of vacancies, γ the elasticity of the matching function, and ω a matching function parameter. Using the relative search efficiency, x, the number of searchers is $s = \pi U + x\xi O$, where U and O are the beginning-of-period unemployed workers and nonparticipants, respectively. The probability that a worker in the labor market finds a job, p, is given by

$$p = \frac{m}{s} = \omega\theta^{1-\gamma}$$

and the probability that a worker entering the labor market finds a job, f, is given by

$$f = x\frac{m}{s} = x\omega\theta^{1-\gamma}$$

where is $\theta = v/s$ is the vacancy-searcher ratio, and x the relative search efficiency. The worker-finding probability is

$$q = \frac{m}{v} = \omega\theta^{-(1-\gamma)}$$

4. Equilibrium

The individual worker's problem can be formulated recursively. Let $V^w(z,\varphi)$ denote the value function of a worker who works, $V_p^s(z,\varphi)$ the value function of a worker who was classified as unemployed in the previous period and who searches in the current period, $V_f^s(z,\varphi)$ the value function of a worker who was classified as OLF in the previous period and who searches in the current period, and $V^n(z,\varphi)$ the value function of a worker who does not search in the current period, where z denotes aggregate productivity and φ is the distribution of workers.

The value function of a worker who decides to work is given by

$$V^w(z,\varphi) = w(z,\varphi) + \beta(1-\lambda)E_z\left[\eta V^n(z',\varphi') + (1-\eta)V^w(z',\varphi')\right]$$
$$+\beta\lambda E_z\left[\pi V_p^s(z',\varphi') + (1-\pi)V^n(z',\varphi')\right]$$

where $w(z,\varphi)$ is a Nash bargaining wage and λ the exogenous separation rate. A worker earns wages $w(z,\varphi)$ in the current period. In the subsequent period, if the match survives with probability $1-\lambda$, then the worker will have to decide whether to continue or terminate the match, depending on probability η. However, if the match is dissolved exogenously with probability λ, then the worker will decide whether to search with probability π.

The value function of a worker who was classified as unemployed in the previous period and searches in the current period is given by

$$V_p^s(z,\varphi) = b + \beta p(z,\varphi) E_z\left[\eta V^n(z',\varphi') + (1-\eta) V^w(z',\varphi')\right]$$
$$+\beta(1-p(z,\varphi)) E_z\left[\pi V_p^s(z',\varphi') + (1-\pi) V^n(z',\varphi')\right]$$

where the job-finding probability is $p(z,\varphi) = \omega\theta(z,\varphi)^{1-\gamma}$. A worker who is looking for work receives unemployment insurance benefits, b, in the current period, and in the subsequent period finds a job with probability $p(z,\varphi)$. If a worker finds a job, then (s)he will choose to work on that job or not depending on probability η. Otherwise, (s)he will have to decide whether to search again or not, with probability π.

The value function of a worker who was classified as OLF in the previous period and searches in the current period is given by

$$V_f^s(z,\varphi) = \beta f(z,\varphi) E_z\left[\eta V^n(z',\varphi') + (1-\eta) V^w(z',\varphi')\right]$$
$$+\beta(1-f(z,\varphi)) E_z\left[\pi V_p^s(z',\varphi') + (1-\pi) V^n(z',\varphi')\right]$$

where the job-finding probability is $f = x\omega\theta(z,\varphi)^{1-\gamma}$. Note that a worker who was out of the labor force in the last period and is looking for work does not receive unemployment insurance benefits in the current period.

Finally, the value function of a worker who does not search is given by

$$V^n(z,\varphi) = \beta E_z\left[\xi V_f^s(z',\varphi') + (1-\xi) V^n(z',\varphi')\right]$$

A worker who does not search in current period decides whether to search or not in the subsequent period with probability ξ.

The firm's problem is also formulated recursively. Let $J(z,\varphi)$ denote the value function of a firm matched with a worker. The value function of this matched firm is given by

$$J(z,\varphi) = z - w(z,\varphi) + \beta(1-\lambda) E_z\left[(1-\eta) J(z',\varphi')\right]$$

where z is output, $w(z,\varphi)$ a Nash bargaining wage, and the remaining term the discounted expected values of the match weighted by the probability that the match survives, $(1-\lambda)$.

The equilibrium number of job vacancies is determined by the following free-entry condition which states that vacancies earn zero profits:

$$k=\beta q(z,\varphi)E_z[(1-\eta)J(z',\varphi')]$$

where k is the job posting cost, and $q(z,\varphi)=\omega\theta(z,\varphi)^{-(1-\gamma)}$ the worker-finding probability.

Let $S(z,\varphi)$ denote the match surplus between a worker and a firm. The match surplus is defined to be the difference in the sum of the payoffs of the worker and the firm:

$$S(z,\varphi)=V^w(z,\varphi)-V^n(z,\varphi)+J(z,\varphi)$$

where the threat point of the worker is the value from being out of the labor force. A worker who breaks up the match is then out of the labor force, but never becomes a job-seeker because (s)he cannot find a better wage through a search in this framework.

The wage is derived by assuming that fixed fractions of the surplus accrue to the worker and the firm. The total match surplus is shared in accordance with the following Nash product:

$$w(z,\varphi)=\arg\max[V^w(z,\varphi)-V^n(z,\varphi)]^\gamma J(z,\varphi)^{1-\gamma}$$

where γ is the worker's bargaining power, which is set to equal the elasticity of the matching function with respect to search, so that the Hosios (1990) condition is satisfied. Following Hall (2005), I assume that wages are rigid over the business cycle so that they are given by $w(z,\varphi)=w(z^*,\varphi^*)$ for all z and φ, where z^* is the steady state productivity level, φ^* the steady state distribution of workers, and $w(z^*,\varphi^*)$ the Nash bargaining wage at (z^*,φ^*).

Finally, the evolution of the aggregate state is described by the function $T(z,\varphi)$, where for each (z,φ) this function specifies a distribution over the next period's values of the state variables.

The recursive equilibrium is a list of functions $V^w(z,\varphi)$, $V_p^s(z,\varphi)$, $V_f^s(z,\varphi)$, $V^n(z,\varphi)$, $J(z,\varphi)$, $p(z,\varphi)$, $f(z,\varphi)$, $q(z,\varphi)$, and $w(z,\varphi)$ such that:

1. Taking the functions $p(z,\varphi)$, $f(z,\varphi)$, $q(z,\varphi)$, and $w(z,\varphi)$ as given, $V^w(z,\varphi)$, $V_p^s(z,\varphi)$, $V_f^s(z,\varphi)$, $V^n(z,\varphi)$, and $J(z,\varphi)$ solve the Bellman equations.
2. The free-entry condition is satisfied for all (z,φ), where (z',φ') is the next period's aggregate state of the economy.
3. Wages are determined by Nash bargaining:

$$w(z,\varphi) = \arg\max [V^w(z^*,\varphi^*) - V^n(z^*,\varphi^*)]^\gamma J(z^*,\varphi^*)^{1-\gamma}$$

for all (z,φ).

4. For each (z,φ), decisions generate a distribution over the next period's state that is equal to the distribution given by $T(z,\varphi)$.

5. Reduced-Form Labor Market Dynamics

Following Cole and Rogerson (1999), I also characterize the implications of the model for the time series. The model implies the following times series of employment, unemployment and OLF:

$$E_{t+1} = (1-\eta)(1-\lambda)E_t + \pi p_t U_t + \xi f_t O_t$$

$$U_{t+1} = (1-\eta)\lambda E_t + \pi(1-p_t)U_t + \xi(1-f_t)O_t$$

$$O_{t+1} = \eta E_t + (1-\pi)U_t + (1-\xi)O_t$$

Note that OLF is independent of the job-finding probabilities, p_t and f_t. Recall that in the standard matching model, OLF is a function of the job-finding probabilities. The standard matching model predicts linear relationships between employment, unemployment and OLF, which imply the perfect correlations. My model, however, does not give any linear relationship between the variables, and no perfect correlations are derived.

Another advantage of my model is that the UE and OE transition rates, πp and ξf, are directly identified from the data, because they represent conditional probabilities which are consistent with intuition. For example, the OE transition rate, ξf, consists of two parts: the first part the probability of entering the labor force and the second the job-finding probability conditional on being in the labor force. Although we observe that the UE transition rate is quite high and the OE transition rate quite low, this does not necessarily imply that p is greater than f. Suppose that p is *less* than f. If the probability of remaining unemployed, π, is much higher than the probability of entering the labor force, ξ, then a higher UE transition rate is observed in the data.

6. Extension of the Basic Model

So far, we have considered the textbook matching model in which only the job-finding probabilities are time-varying, but other variables such as the separation rate (λ), the rates of leaving the labor force ($1-\pi$ and η), and the labor force participation rate (ξ) are constant over time. Leaving other things the same, I assume that the parameters are time-varying over time.[13)]

First, the labor market participation decision, ξ, can vary over time. Table 4 shows the correlations between the detrended UE transition rate and the detrended rate of transition from OLF to the labor force, which are .38 for 1986-2006 and .62 for 2000-2006 at monthly frequencies. As the labor market gets better, those out of the labor force are more likely to participate in the labor market by looking for work. Thus, I assume that the parameter governing labor force participation follows an AR(1) process:

$$\xi' = \rho\xi + (1-\rho)\bar{\xi} + \nu'$$

13) As a parameter changes over the business cycle, the equilibrium market tightness is affected. However, I do not consider the equilibrium effects.

where $\bar{\xi}$ is the average participation rate, ρ is the persistence parameter, and ν follows a normal distribution with mean 0 and variance σ_ν^2.

Second, the probability that an unemployed worker leaves the labor force, $1-\pi$, which captures the discouraged worker effect, can be time-varying. If the labor market is hit by a positive shock, the unemployed are less likely to leave because they expect higher value from being in the labor force through increases in the job-finding probability and labor income. That is, π is increasing when the labor market is good. In the data given in Table 4, however, the correlations between the detrended UE transition rate and the detrended rate of transition from unemployment to the labor force are -.09 for 1986-2006 and -.17 for 2000-2006, at monthly frequencies and we do not observe a significant discouraged worker effect. In order to examine the implications from the model, I assume that the probability follows an AR(1) process:

$$\pi' = \rho\pi + (1-\rho)\bar{\pi} + \zeta'$$

where $\bar{\pi}$ is the average probability of being in the labor force, ρ is the persistence parameter, and ζ follows a normal distribution with mean 0 and variance σ_ζ^2.

Finally, the parameter which determines the EO transition rate, η, can be time-varying. In the EO transition rate, two different effects are mixed: voluntary separation (or a reservation wage effect) and involuntary separation. A worker who has a job can decide not to work if his value from working is not as high as his value from non-working. He then moves from employment to OLF. This is a voluntary separation or a reservation wage effect. On the other hand, a worker who separates from his employer can decide to leave the labor market but not search because he does not think the labor market is good. This is an involuntary separation. When the labor market gets better, then voluntary separation increases and involuntary separation decreases. In the data (Table 4), the correlations between the detrended UE and EO transition rates are .13 for 1986-2006 and .31 for 2000-2006, at monthly frequencies. That is, the EO transition rate is likely to be increasing when the labor market is good, and voluntary separations seem to predominate over involuntary separations. To assess the EO transition from the model, I assume that η, which determines the EO transition rate follows, an AR(1) process:

$$\eta' = \rho\eta + (1-\rho)\overline{\eta} + \tau'$$

where $\overline{\eta}$ is the average probability of being OLF, ρ the persistence parameter, and τ follows a normal distribution with mean 0 and variance σ_τ^2. All of the shocks may co-move with the productivity shock, ϵ.[14)]

Ⅴ. Quantitative Analysis

1. Calibration

The model operates at a monthly frequency, and therefore the discount factor is set to $\beta = 0.9963$, equivalent to an annual interest rate of 4.5 percent[15)]. Workers' bargaining power and the matching function elasticity with respect to search are set to $\gamma = 0.5$. The level of unemployment benefits (or the replacement ratio) is set to 0.4.

The probability that an unemployed worker stays in the labor force is computed from the UO transition rate, $\pi = 1 - h_{UO}$. The steady state probability that an unemployed worker finds a job is $p^* = h_{UE}/(h_{UE} + h_{UU})$. The proba-

14) According to the argument in Ⅱ-3, the correlations between the job-finding probability and all of the shocks should be considered. In the matching models, however, the correlation between the job-finding probability and productivity shock is very close to 1.

15) For 1991-2006, the annual call rate is 8.90 percent and the annual inflation rate (CPI) 4.37 percent. The annual interest rate is therefore about 4.5 percent.

bility that a nonparticipant enters the labor force is $\xi = h_{OE} + h_{OU}$. The steady state probability that a nonparticipant finds a job is $f^* = h_{OE}/(h_{OE} + h_{OU})$. The probabilities of a worker leaving the labor force and of being laid off are calculated from the steady-state condition of the reduced-form labor market dynamics:

$$\eta = \frac{\xi O^* - (1-\pi)U^*}{E^*}$$
$$\lambda = \frac{(1-\pi+\pi p^*)U^* - \xi(1-f^*)O^*}{(1-\eta)E^*}$$

where E^*, U^*, and O^* are the steady state employment-to-population ratio, unemployment-to-population ratio and nonparticipation rate, respectively. The relative search efficiency is given by $x = f^*/p^*$.

The worker-finding probability comes from the Monthly Report of Public Employment Service Worknet data (see Figure 5). I use only observations for 7 years (2000-2006), as there were numerous measurement errors prior to 2000. The probability, q^*, is estimated by dividing the total number of new hires by the total number of new vacancies, which yeilds .5. Accordingly, the steady state vacancy-to-searcher ratio and matching function parameter are pinned down. That is, $\theta^* = p^*/q^*$ and $\omega = p^* \theta^{*-\gamma}$. Finally, the persistence parameters of the productivity shock and the other shocks, ρ, are set to 0.97. The standard deviations of the innovation to the productivity shock, σ_ϵ, is set to 0.7 percent. The other standard deviations of the innovations to ξ, π, and η, (σ_ν, σ_ζ, and σ_τ) are set at .05 percent, .6 percent, and .03 percent, respectively.[16)] The correlations between shock to productivity, ϵ, and other shocks such as ν, ζ, and τ are assumed to have values between 0 and 1. All parameters are summarized in Table 6.

16) The standard deviations are chosen to match the volatility of OLF.

2. Results

The time period of the model is 200 months, and the associated statistics are obtained by 100 simulations. The model-generated data are detrended by an HP filter with smoothing parameter 14,400. Standard errors are given in parentheses.

Table 8 presents the performance of the benchmark model. In the sample of 1986-2006, the unemployment rate is most volatile. The ratio of the volatility of the unemployment rate to that of the employment-to-population ratio is 1.05. Both the unemployment-to-population ratio and the unemployment rate are more volatile than the nonparticipation rate. Compared to the volatility of the employment-to-population ratio, the relative volatility of the unemployment-to-population ratio is 63 percent while that of the nonparticipation rate is 56 percent. Looking at the contemporaneous correlations, the employment-to-population ratio is more negatively correlated with the unemployment-to-population ratio (-.86) than with the nonparticipation rate (-.82). There is a weak positive correlation between the unemployment-to-population ratio and the nonparticipation rate.

The benchmark model is able to generate the stylized facts of the Korean labor market for 1986-2006. The model predicts that the unemployment rate is most volatile with a relative standard deviation of 1.4. In addition, consistent with the data, the relative volatility of the unemployment-to-population ratio (.84) is greater than that of the nonparticipation rate (.29).[17)]

The benchmark model accounts for the contemporaneous correlations and the Beveridge relationship, with a negative correlation between unemployment and vacancies of -.49. As Tripier (2004) points out, the RBC models cannot gen-

17) The Mortensen-Pissarides matching model modified along with the Pries and Rogerson (2004) classification generates much higher relative volatility of the nonparticipation rate than that of the unemployment-to-population ratio.

erate the Beveridge relationship. This result is not sensitive to functional forms of the preferences. Veracierto (2004) also reaches a similar conclusion, using Lucas and Prescott's island model.

The benchmark model, however, does not match the data of 2000-2006, for which the nonparticipation rate is more volatile than both the unemployment-to-population ratio and the unemployment rate, and the employment-to-population ratio is more negatively correlated with the nonparticipation rate than the unemployment-to-population ratio.

I now discuss the results from the extended model. Table 9 presents the results when the stochastic participation rate is introduced. The results listed in the second rows, for "Model $\sigma_{\nu}=0$", correspond to the results of the benchmark model with a constant participation rate, Table 8. Once the stochastic participation rate is brought into the benchmark model, the volatility of the nonparticipation rate increases while the volatilities of the unemployment-to-population ratio and the unemployment rate decrease. A small deviation of the participation rate, with $\sigma_{\nu}=0.05\%$, increases the nonparticipation rate considerably and decreases the unemployment rate dramatically. This is because the job-finding probability for a nonparticipant deciding to enter the labor force is much higher than that which an unemployed worker confronts.

The correlations between the employment-to-population ratio and the unemployment-to-population ratio, and between the unemployment-to-population ratio and the nonparticipation rate decrease considerably, but the correlation between the employment-to-population ratio and the unemployment-to-population ratio goes up when the participation rate is time-varying. As the correlation between a shock to productivity and a shock to the participation rate increases, however, all correlations also increase in terms of absolute values. If the correlation between shock to productivity and shock to participation is about .5, the model matches the data of 2000-2006.[18)]

For sensitivity analysis, Tables 11 and 12 present the results when the probability that an unemployed worker leaves the labor force and the EO transition rate are both time-varying. The model accounts for the data if (1) the probability that an unemployed worker does not leave the labor force, π, is highly positively correlated with the labor market productivity shock, and (2) the probability that an employed worker leaves the labor force, η, is weakly negatively correlated with the labor market productivity shock. In the data (Table 4), however, π is weakly negatively correlated or not correlated with the UE transition rate, and η is weakly positively correlated with the UE transition rate. Therefore, other factors do not seem to play important roles in explaining the joint behaviors of the labor market in Korea.

Ⅵ. Conclusion

The Korean labor market is characterized recently by (1) more volatile employment and OLF than unemployment and (2) employment much more correlated with OLF than with unemployment. Based on these facts, the role of the unemployment rate as a business cycle indicator would seem to have been weakened, and the significant amounts of employment fluctuations to be explainable primarily by the fluctuations of nonparticipation.

In this paper, I evaluate existing models and modify the standard matching model. The distinction between search and OLF becomes clear, and the model generates the OE transition without an assumption that nonparticipants are inactive searchers. Moreover, some parameters which determine the model dynam-

18) The same experiment is applied to the benchmark model in which the parameters cover the entire sample period, 1986-2006 (see Table 10).

ics are assumed to be time-varying.

The modified model accounts quite well for the Korean labor market of the last two decades. Among other time-varying parameters, the stochastic non-participant's probability of entering the labor force, which co-moves with the state of the labor market, explains the recent Korean labor market. A quantitative analysis of the reduced-form dynamics shows clearly that a small change in the participation rate is capable of generating the cyclical movements of employment, unemployment and OLF that we observe in the 2000-2007 data.

Finally, the study suggests that policies for smoothing the business cycle which consider the unemployment rate as the main important indicator can be ineffective if numerous people are moving directly in and out of the labor force. This is because the unemployment rate does not reflect the cyclicality of the labor market. Employment would then be a better measure of labor market cyclicality for determining policies based on it.

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Appendices

Appendix A. First Order and Steady State Conditions of the RBC Model

The first order conditions are

$$
\begin{aligned}
\frac{1}{c_t} &= \lambda_t \\
\lambda_t \kappa &= \mu_t \gamma \omega v_t^{\gamma-1} s_t^{1-\gamma} \\
\phi \frac{1}{1-n_t-s_t} &= \mu_t (1-\gamma) \omega v_t^{\gamma} s_t^{-\gamma} \\
\lambda_t &= \beta E_t \left[\lambda_{t+1} \left\{ \alpha z_{t+1} A k_{t+1}^{\alpha-1} n_{t+1}^{1-\alpha} + 1 - \delta \right\} \right] \\
\mu_t &= \beta E_t \left[-\phi \frac{1}{1-n_t-s_t} + \lambda_{t+1} (1-\alpha) z_{t+1} A k_{t+1}^{\alpha} n_{t+1}^{-\alpha} + \mu_{t+1} (1-\psi) \right]
\end{aligned}
$$

together with the constraints, where λ_t and μ_t are Lagrange multipliers with respect to the laws of motion for capital stock and labor.

In the steady state,

$$
\begin{aligned}
\frac{1}{c} &= \lambda \\
\frac{\mu}{\lambda} &= \frac{\kappa v}{\gamma m} \\
\phi \frac{1}{1-n-s} &= \mu (1-\gamma) \frac{m}{s} \\
1 &= \beta \left\{ \alpha \frac{y}{k} + 1 - \delta \right\} \\
\phi \frac{1}{1-n-s} &= \lambda (1-\alpha) \frac{y}{n} + \mu \left(1 - \psi - \frac{1}{\beta} \right) \\
c + \delta k + \kappa v &= y \\
\psi n &= m
\end{aligned}
$$

where output (y) is normalized to one, and the employment-to-population ratio (n), the unemployment-to-population ratio (s), the worker-finding probability (q), and the other parameters are set to the available data moments (see Table 3(a)). All other variables such as consumption ($c = .72$), capital stock ($k = 10.26$), number of matches ($m = .06$), number of vacancies ($v = .12$), Lagrange multipliers ($\lambda = 1.38$, $\mu = .92$), the scale parameters of the matching function, production function and utility function ($\omega = 1.23$, $A = .61$, $\phi = .56$), and the job-posting cost ($\kappa = .17$) are then determined. In particular, the total cost of job-posting, κv, and the scale parameter of the utility function, ϕ, are

$$\kappa v = \frac{(1-\alpha)y/n}{(1-\gamma)m/s-(1-\psi-1/\beta)}\gamma m$$

$$\phi = \mu(1-\gamma)(1-n-s)m/s$$

Appendix B. Tables

Table 1: Summary Statistics of Economically Active Population Survey (EAPS)

(a) Means and Standard Deviations

	Means (%)				Standard Deviations (%)			
	E	U	O	$\widetilde{U}$	E	U	O	$\widetilde{U}$
1986-2006	58.42	2.09	39.49	3.46	1.62	0.90	1.36	1.49
2000-2006	59.02	2.32	38.66	3.79	0.51	0.24	0.33	0.40

(b) Standard Deviations and Contemporaneous Correlations of Detrended Data

	Standard Deviations (%)				Correlations		
	$Std(e)$	$Std(u)$	$Std(o)$	$Std(\tilde{u})$	$Corr(e,u)$	$Corr(e,o)$	$Corr(u,o)$
1986-2006	.69	.43	.39	.73	-.86	-.82	.42
2000-2006	.32	.12	.25	.21	-.65	-.93	.31

* Data are seasonally adjusted (Census X-12) and HP filtered with smoothing parameter 14400. E, U, and O denote the employment-to-population ratio, the unemployment-to-population ratio and the nonparticipation rate, respectively. e, u, and o denote detrended E, detrended U, and detrended O, respectively. $\tilde{u}$ denotes the detrended unemployment rate. $Std(x)$ and $Corr(x,y)$ denote the standard deviation of variable x and the correlation between x and y.

Table 2: Transition Probabilities of EAPS

(a) January 1986 - December 2006

%	Employed $(t+1)$	Unemployed $(t+1)$	OLF $(t+1)$
Employed (t)	96.37 (0.78)	0.70 (0.28)	2.93 (0.69)
Unemployed (t)	26.20 (3.36)	64.27 (4.56)	9.53 (2.94)
OLF (t)	4.53 (1.00)	0.75 (0.37)	94.72 (1.02)

(b) January 2000 - December 2006

%	Employed $(t+1)$	Unemployed $(t+1)$	OLF $(t+1)$
Employed (t)	96.51 (0.29)	0.77 (0.10)	2.73 (0.22)
Unemployed (t)	25.37 (1.83)	63.09 (2.53)	11.54 (1.57)
OLF (t)	4.20 (0.35)	0.94 (0.15)	94.85 (0.42)

* Data are seasonally adjusted. Standard deviations are given in parentheses.

Table 3: Contemporaneous Correlations

(a) Correlations between Output and Labor Market Stock Variables

per capita GDP	Employed Persons	Unemployed Persons	Nonparticipants	e	u	o
1986-2006	.88	-.90	-.74	.89	-.90	-.69
2000-2006	.56	-.52	-.38	.56	-.51	-.39

(b) Correlations between Output and Labor Market Flow Variables

per capita GDP	Probability					
	E→U	E→O	U→E	U→O	O→E	O→U
1986-2006	-.86	-.33	.53	-.16	-.09	-.76
2000-2006	-.30	.05	.09	-.17	.10	-.35

(c) Correlations between Transition Probabilities

Probability U→E	Probability				
	E→U	E→O	U→O	O→E	O→U
1986-2006	-.44	.08	.24	.32	-.28
2000-2006	.21	.52	.36	.69	.42

* Per capita GDP is real GDP divided by the population aged 15 or over. All data are converted to quarterly frequencies, seasonally adjusted, and HP-filtered with smoothing parameter 1,600. GDP comes from the National Accounts and the other data from the EAPS.

Table 4: Correlation with Detrended UE Transition Rate

Probability U→E	Probability		
	O → E or U	U → E or U	E → O
1986-2006	.38	.09	.13
2000-2006	.62	-.17	.31

* Monthly data are used. All data are seasonally adjusted and HP-filtered with smoothing parameter 14400.

* Source: EAPS

Table 5: RBC and MP Model Parameters

(a) RBC Model Parameters

Variables	Description	Parameter Value
β	discount factor	.99
δ	depreciation rate	2.5%
α	share of capital	.39
ψ	separation rate	10.42%
γ	worker's bargaining power, matching function elasticity	.5
ρ	persistence parameter	.95
σ_ϵ	standard deviation of the shock	.7%
n	employment-to-population ratio	58.5%
s	unemployment-to-population ratio	2.0%
q	worker-finding probability	.5

(b) MP Model Parameters

Variables	Description	Parameter Value
p^*	steady state job-finding probability	26.2%
f^*	steady state job-finding probability	4.53%
ρ	persistence parameter of f	0.9
σ_ϵ	standard deviation of the shock to f	0.5%
λ	separation rate	4%
μ	probability of the unmatched worker being an active searcher	5%

Table 6: Parameters

(a) Model Parameters

Variables	Description	Parameter Value	
		1986-2006	2000-2006
β	discount factor	.9963	
γ	worker's bargaining power, matching function elasticity	2.5%	
b	unemployment insurance benefits	.4	
ω	matching function parameter	.3805	
$p*$	job-finding probability	.2896	.3787
x	relative search efficiency	2.9639	2.8468
$q*$	worker-finding probability	.5	
$\theta*$	market tightness	.5793	.5736
π	probability that unemployed workers stay in the labor force	.9047	.8846
ξ	probability that nonparticipants enter the labor market	.0528	.0515
η	probability that workers leave the labor force	.0323	.0292
λ	probability of being laid off	.0080	.0086
ρ	persistence parameter	.97	
σ_ϵ	standard deviation of shock to productivity	.7%	
E	employment-to-population ratio	.5842	.5902
U	unemployment-to-population ratio	.0209	.0232

(b) Additional Parameters

Variables	Description	Parameter Value
σ_ν	standard deviation of shock to probability that nonparticipants enter the labor market	.05%
σ_ζ	standard deviation of shock to probability that unemployed workers stay in the labor force	.6%
σ_τ	standard deviation of shock to probability that workers leave the labor force	.03%

Table 7: Comparison: Data, RBC Model and MP Model

(a) Standard Deviations of Detrended Variables

	$Std(e)$, %	$\frac{Std(u)}{Std(e)}$	$\frac{Std(o)}{Std(e)}$	$\frac{Std(\tilde{u})}{Std(e)}$
Data: 1986-2006	.69	.63	.56	1.05
Data: 2000-2006	.32	.39	.81	.66
RBC model	.19	.30	.89	.51
MP model	1.74	.05	.95	

(b) Correlations of Detrended Variables

	$Corr(e,u)$	$Corr(e,o)$	$Corr(u,o)$	$Corr(u,v)$
Data: 1986-2006	-.86	-.82	.42	
Data: 2000-2006	-.65	-.93	.31	
RBC model	-.50	-.96	.22	.97
MP model	-1.00	-1.00	1.00	

* Data are seasonally adjusted (Census X-12) and HP filtered with smoothing parameter 14400. e, u, o, and $\tilde{u}$ denote the detrended employment-to-population ratio, the detrended unemployment-to-population ratio, the detrended nonparticipation rate, and the detrended unemployment rate, respectively. $Std(x)$ and $Corr(x,y)$ denote the standard deviation of variable x and the correlation between x and y. The time period of each model is 200 months, and the associated statistics are obtained by 100 simulations. The model-generated data are also HP-filtered with smoothing parameter 14,400.

Table 8: Benchmark Model Results

(a) Standard Deviations of Detrended Variables

	$Std(e)$, %	$\frac{Std(u)}{Std(e)}$	$\frac{Std(o)}{Std(e)}$	$\frac{Std(\tilde{u})}{Std(e)}$	$\frac{Std(v)}{Std(e)}$
Data: 1986-2006	.69	.63	.56	1.05	
Data: 2000-2006	.32	.39	.81	.66	
Benchmark Model	.12 (.022)	.84 (.017)	.29 (.008)	1.40 (.029)	1.23 (.016)

(b) Correlations Between Detrended Variables

	$Corr(e,u)$	$Corr(e,o)$	$Corr(u,o)$	$Corr(u,v)$
Data: 1986-2006	-.86	-.82	.42	
Data: 2000-2006	-.65	-.93	.31	
Benchmark model	-.96 (.003)	-.64 (.058)	.41 (.063)	-.49 (.077)

* Data are seasonally adjusted (Census X-12) and HP filtered with smoothing parameter 14,400. e, u, o, $\tilde{u}$, and v denote the detrended employment-to-population ratio, the unemployment-to-population ratio, the nonparticipation rate, the unemployment rate, and the vacancies, respectively. $Std(x)$ and $Corr(x,y)$ denote the standard deviation of variable x and the correlation between x and y. The time period of each model is 200 months, and the associated statistics are obtained by 100 simulations. The model-generated data are also HP-filtered with smoothing parameter 14,400.

Table 9: Extended Model Results Ⅰ

(a) Standard Deviations of Detrended Variables

	$Std(e)$, %	$\frac{Std(u)}{Std(e)}$	$\frac{Std(o)}{Std(e)}$	$\frac{Std(\tilde{u})}{Std(e)}$	$\frac{Std(v)}{Std(e)}$
Data: 2000-2006	.32	.39	.81	.66	
Model $\sigma_\nu = 0$,	.12 (.02)	.78 (.02)	.38 (.01)	1.29 (.03)	1.19 (.02)
Model $\sigma_\nu = .05\%$, $\rho(\epsilon,\nu) = 0$	.18 (.04)	.52 (.01)	.87 (.04)	.85 (.02)	.83 (.01)
Model $\sigma_\nu = .05\%$, $\rho(\epsilon,\nu) = 1/4$	.20 (.04)	.46 (.01)	.83 (.04)	.75 (.02)	.81 (.02)
Model $\sigma_\nu = .05\%$, $\rho(\epsilon,\nu) = 2/4$	.22 (.04)	.40 (.01)	.80 (.04)	.68 (.02)	.80 (.02)
Model $\sigma_\nu = .05\%$, $\rho(\epsilon,\nu) = 3/4$	.23 (.04)	.36 (.01)	.77 (.04)	.61 (.02)	.79 (.02)
Model $\sigma_\nu = .05\%$, $\rho(\epsilon,\nu) = 1$	.25 (.05)	.32 (.01)	.76 (.04)	.55 (.02)	.77 (.02)

(b) Correlations Between Detrended Variables

	$Corr(e,u)$	$Corr(e,o)$	$Corr(u,o)$	$Corr(u,v)$
Data: 2000-2006	-.65	-.93	.31	
Model $\sigma_\nu = 0$,	-.94 (.01)	-.69 (.05)	.39 (.06)	-.51 (.08)
Model $\sigma_\nu = .05\%$, $\rho(\epsilon,\nu) = 0$	-.48 (.19)	-.84 (.09)	-.05 (.22)	-.44 (.11)
Model $\sigma_\nu = .05\%$, $\rho(\epsilon,\nu) = 1/4$	-.56 (.17)	-.88 (.06)	.12 (.21)	-.46 (.10)
Model $\sigma_\nu = .05\%$, $\rho(\epsilon,\nu) = 2/4$	-.64 (.14)	-.92 (.04)	.30 (.19)	-.48 (.09)
Model $\sigma_\nu = .05\%$, $\rho(\epsilon,\nu) = 3/4$	-.73 (.09)	-.95 (.02)	.47 (.15)	-.51 (.08)
Model $\sigma_\nu = .05\%$, $\rho(\epsilon,\nu) = 1$	-.83 (.01)	-.97 (.01)	.67 (.02)	-.54 (.06)

* σ_ν is the standard deviation of the shock to the participation rate, and $\rho(\epsilon,\nu)$ is the correlation between the shock to productivity and the shock to **the participation rate**. Data are seasonally adjusted (Census X-12) and HP filtered with smoothing parameter 14,400. e, u, o, $\tilde{u}$, and v denote the detrended employment-to-population ratio, the unemployment-to-population ratio, the nonparticipation rate, the unemployment rate, and the vacancies, respectively. $Std(x)$ and $Corr(x,y)$ denote the standard deviation of variable x and the correlation between x and y. The time period of each model is 200 months, and the associated statistics are obtained by 100 simulations. The model-generated data are also HP-filtered with smoothing parameter 14,400.

Table 10: Extended Model Results Ⅱ

(a) Standard Deviations of the Detrended Variables

	$Std(e)$, %	$\frac{Std(u)}{Std(e)}$	$\frac{Std(o)}{Std(e)}$	$\frac{Std(\tilde{u})}{Std(e)}$	$\frac{Std(v)}{Std(e)}$
Data: 1986-2006	.69	.63	.56	1.05	
Model $\sigma_\nu = 0$,	.12 (.02)	.84 (.02)	.29 (.01)	1.40 (.03)	1.23 (.02)
Model $\sigma_\nu = .022\%$, $\rho(\epsilon,\nu) = 0$	.13 (.02)	.77 (.02)	.57 (.02)	1.27 (.03)	1.13 (.01)
Model $\sigma_\nu = .022\%$, $\rho(\epsilon,\nu) = 1/4$	.15 (.03)	.69 (.02)	.56 (.02)	1.16 (.03)	1.08 (.02)
Model $\sigma_\nu = .022\%$, $\rho(\epsilon,\nu) = 2/4$	.16 (.03)	.64 (.02)	.56 (.02)	1.07 (.03)	1.04 (.02)
Model $\sigma_\nu = .022\%$, $\rho(\epsilon,\nu) = 3/4$	.17 (.03)	.59 (.02)	.56 (.02)	.99 (.03)	1.01 (.02)
Model $\sigma_\nu = .022\%$, $\rho(\epsilon,\nu) = 1$	.18 (.03)	.55 (.02)	.55 (.02)	.92 (.03)	.98 (.02)

(b) Correlations of the Detrended Variables

	$Corr(e,u)$	$Corr(e,o)$	$Corr(u,o)$	$Corr(u,v)$
Data: 1986-2006	-.86	-.82	.42	
Model $\sigma_\nu = 0$,	-.96 (.01)	-.64 (.06)	.41 (.06)	-.49 (.08)
Model $\sigma_\nu = .022\%$, $\rho(\epsilon,\nu) = 0$	-.82 (.08)	-.63 (.15)	.10 (.21)	-.47 (.08)
Model $\sigma_\nu = .022\%$, $\rho(\epsilon,\nu) = 1/4$	-.84 (.07)	-.73 (.11)	.25 (.19)	-.48 (.08)
Model $\sigma_\nu = .022\%$, $\rho(\epsilon,\nu) = 2/4$	-.86 (.06)	-.80 (.08)	.39 (.16)	-.49 (.08)
Model $\sigma_\nu = .022\%$, $\rho(\epsilon,\nu) = 3/4$	-.88 (.04)	-.86 (.05)	.52 (.12)	-.49 (.07)
Model $\sigma_\nu = .022\%$, $\rho(\epsilon,\nu) = 1$	-.91 (.01)	-.91 (.02)	.65 (.03)	-.50 (.07)

* σ_ν is the standard deviation of the shock to the participation rate, and $\rho(\epsilon,\nu)$ is the correlation between the shock to productivity and the shock to **the participation rate**. Data are seasonally adjusted (Census X-12) and HP filtered with smoothing parameter 14,400. e, u, o, $\tilde{u}$, and v denote the detrended employment-to-population ratio, the unemployment-to-population ratio, the nonparticipation rate, the unemployment rate, and the vacancies, respectively. $Std(x)$ and $Corr(x,y)$ denote the standard deviation of variable x and the correlation between x and y. The time period of each model is 200 months, and the associated statistics are obtained by 100 simulations. The model-generated data are also HP-filtered with smoothing parameter 14,400.

Table 11: Sensitivity Analysis Ⅰ

(a) Standard Deviations of Detrended Variables

	$Std(e)$, %	$\frac{Std(u)}{Std(e)}$	$\frac{Std(o)}{Std(e)}$	$\frac{Std(\tilde{u})}{Std(e)}$	$\frac{Std(v)}{Std(e)}$
Data: 2000-2006	.32	.39	.81	.66	
Model $\sigma_{\zeta}=0$,	.12 (.02)	.78 (.02)	.38 (.01)	1.29 (.03)	1.19 (.02)
Model $\sigma_{\zeta}=.6\%$, $\rho(\epsilon,\zeta)=0$	.14 (.04)	.74 (.02)	.80 (.03)	1.21 (.03)	1.05 (.01)
Model $\sigma_{\zeta}=.6\%$, $\rho(\epsilon,\zeta)=1/4$	.15 (.03)	.63 (.02)	.78 (.03)	1.02 (.02)	1.00 (.01)
Model $\sigma_{\zeta}=.6\%$, $\rho(\epsilon,\zeta)=2/4$	.16 (.03)	.52 (.01)	.77 (.03)	.86 (.02)	.96 (.01)
Model $\sigma_{\zeta}=.6\%$, $\rho(\epsilon,\zeta)=3/4$	.17 (.03)	.42 (.01)	.76 (.03)	.70 (.02)	.92 (.02)
Model $\sigma_{\zeta}=.6\%$, $\rho(\epsilon,\zeta)=1$	.18 (.04)	.32 (.01)	.76 (.03)	.55 (.02)	.89 (.02)

(b) Correlations Between Detrended Variables

	$Corr(e,u)$	$Corr(e,o)$	$Corr(u,o)$	$Corr(u,v)$
Data: 2000-2006	-.65	-.93	.31	
Model $\sigma_{\zeta}=0$,	-.94 (.01)	-.69 (.05)	.39 (.06)	-.51 (.08)
Model $\sigma_{\zeta}=.6\%$, $\rho(\epsilon,\zeta)=0$	-.61 (.17)	-.65 (.16)	-.16 (.21)	-.40 (.12)
Model $\sigma_{\zeta}=.6\%$, $\rho(\epsilon,\zeta)=1/4$	-.61 (.16)	-.76 (.11)	-.01 (.22)	-.42 (.12)
Model $\sigma_{\zeta}=.6\%$, $\rho(\epsilon,\zeta)=2/4$	-.64 (.15)	-.85 (.07)	.16 (.21)	-.46 (.11)
Model $\sigma_{\zeta}=.6\%$, $\rho(\epsilon,\zeta)=3/4$	-.70 (.12)	-.92 (.04)	.36 (.18)	-.50 (.10)
Model $\sigma_{\zeta}=.6\%$, $\rho(\epsilon,\zeta)=1$	-.83 (.02)	-.97 (.01)	.67 (.03)	-.59 (.06)

* σ_{ζ} is the standard deviation of the shock to **the probability that an unemployed worker does not leave the labor force,** and $\rho(\epsilon,\zeta)$ is the correlation between the shock to productivity and the shock to that probability. Data are seasonally adjusted (Census X-12) and HP filtered with smoothing parameter 14,400. e, u, o, $\tilde{u}$, and v denote the detrended employment-to-population ratio, the unemployment-to-population ratio, the nonparticipation rate, the unemployment rate, and the vacancies, respectively. $Std(x)$ and $Corr(x,y)$ denote the standard deviation of variable x and the correlation between x and y. The time period of each model is 200 months, and the associated statistics are obtained by 100 simulations. The model-generated data are also HP-filtered with smoothing parameter 14,400.

Table 12: Sensitivity Analysis Ⅱ

(a) Standard Deviations of Detrended Variables

	$Std(e)$, %	$\frac{Std(u)}{Std(e)}$	$\frac{Std(o)}{Std(e)}$	$\frac{Std(\tilde{u})}{Std(e)}$	$\frac{Std(v)}{Std(e)}$
Data: 2000-2006	.32	.39	.81	.66	
Model $\sigma_\tau = 0$,	.12 (.02)	.78 (.02)	.38 (.01)	1.29 (.03)	1.19 (.02)
Model $\sigma_\tau = .03\%$, $\rho(\epsilon,\tau) = -2/4$	.23 (.04)	.41 (.01)	.75 (.04)	.69 (.03)	.62 (.01)
Model $\sigma_\tau = .03\%$, $\rho(\epsilon,\tau) = -1/4$	.21 (.04)	.44 (.01)	.77 (.03)	.74 (.02)	.67 (.01)
Model $\sigma_\tau = .03\%$, $\rho(\epsilon,\tau) = 0$	.19 (.04)	.49 (.01)	.79 (.03)	.80 (.02)	.74 (.01)
Model $\sigma_\tau = .03\%$, $\rho(\epsilon,\tau) = 1/4$	.17 (.03)	.55 (.01)	.83 (.03)	.90 (.02)	.84 (.01)
Model $\sigma_\tau = .03\%$, $\rho(\epsilon,\tau) = 2/4$	.14 (.03)	.66 (.01)	.90 (.03)	1.06 (.02)	1.00 (.01)
Model $\sigma_\tau = .03\%$, $\rho(\epsilon,\tau) = 3/4$	.11 (.02)	.86 (.01)	1.06 (.03)	1.38 (.02)	1.32 (.01)
Model $\sigma_\tau = .03\%$, $\rho(\epsilon,\tau) = 1$	.06 (.01)	1.66 (.01)	1.82 (.02)	2.61 (.02)	2.54 (.01)

(b) Correlations Between Detrended Variables

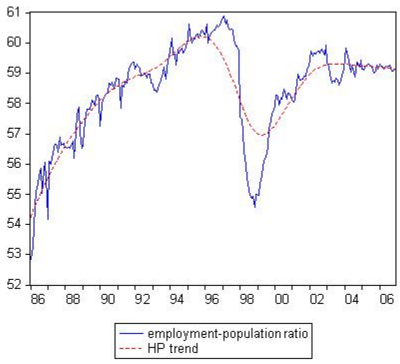
	$Corr(e,u)$	$Corr(e,o)$	$Corr(u,o)$	$Corr(u,v)$
Data: 2000-2006	-.65	-.93	.31	
Model $\sigma_\tau = 0$,	-.94 (.01)	-.69 (.05)	.39 (.06)	-.51 (.08)
Model $\sigma_\tau = .03\%$, $\rho(\epsilon,\tau) = -2/4$	-.73 (.10)	-.93 (.03)	.44 (.17)	-.47 (.07)
Model $\sigma_\tau = .03\%$, $\rho(\epsilon,\tau) = -1/4$	-.67 (.13)	-.90 (.04)	.31 (.20)	-.48 (.07)
Model $\sigma_\tau = .03\%$, $\rho(\epsilon,\tau) = 0$	-.61 (.16)	-.87 (.06)	.16 (.22)	-.50 (.07)
Model $\sigma_\tau = .03\%$, $\rho(\epsilon,\tau) = 1/4$	-.54 (.18)	-.82 (.08)	-.01 (.22)	-.51 (.07)
Model $\sigma_\tau = .03\%$, $\rho(\epsilon,\tau) = 2/4$	-.46 (.20)	-.74 (.12)	-.22 (.22)	-.53 (.07)
Model $\sigma_\tau = .03\%$, $\rho(\epsilon,\tau) = 3/4$	-.36 (.20)	-.62 (.17)	-.48 (.18)	-.54 (.07)
Model $\sigma_\tau = .03\%$, $\rho(\epsilon,\tau) = 1$	-.14 (.13)	-.41 (.12)	-.84 (.01)	-.56 (.07)

* σ_τ is the standard deviation of the shock to **the probability that an employed worker leaves the labor force**, and $\rho(\epsilon,\tau)$ is the correlation between the shock to productivity and the shock to that probability. Data are seasonally adjusted (Census X-12) and HP filtered with smoothing parameter 14,400. e, u, o, $\tilde{u}$, and v denote the detrended employment-to-population ratio, the unemployment-to-population ratio, the nonparticipation rate, the unemployment rate, and the vacancies, respectively. $Std(x)$ and $Corr(x,y)$ denote the standard deviation of variable x and the correlation between x and y. The time period of each model is 200 months, and the associated statistics are obtained by 100 simulations. The model-generated data are also HP-filtered with smoothing parameter 14,400.

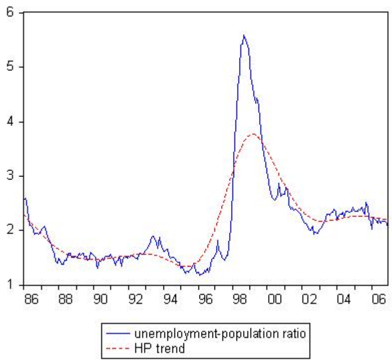
Appendix C. Figures

Figure 1: Employment, Unemployment and OLF

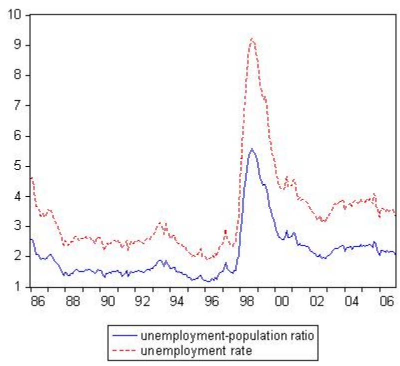
(a) Employment-to-Population Ratio



(b) Unemployment-to-Population Ratio



(c) Unemployment-to-Population Ratio and Unemployment Rate



(d) Nonparticipation Rate

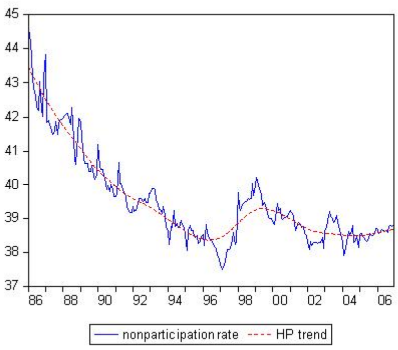
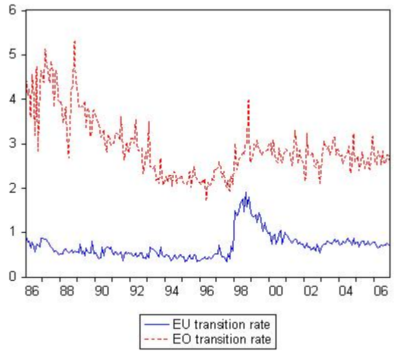
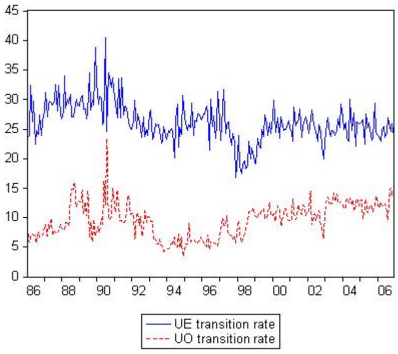


Figure 2: Transition Probabilities

(a) EU and EO Transition Rates



(b) UE and UO Transition Rates



(c) OE and OU Transition Rates

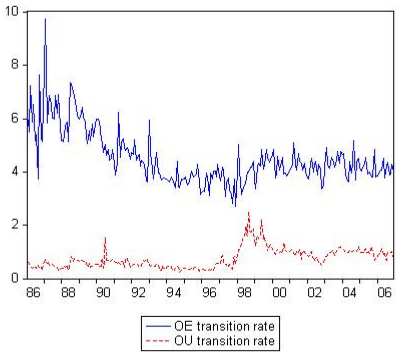


Figure 3: Flow Chart

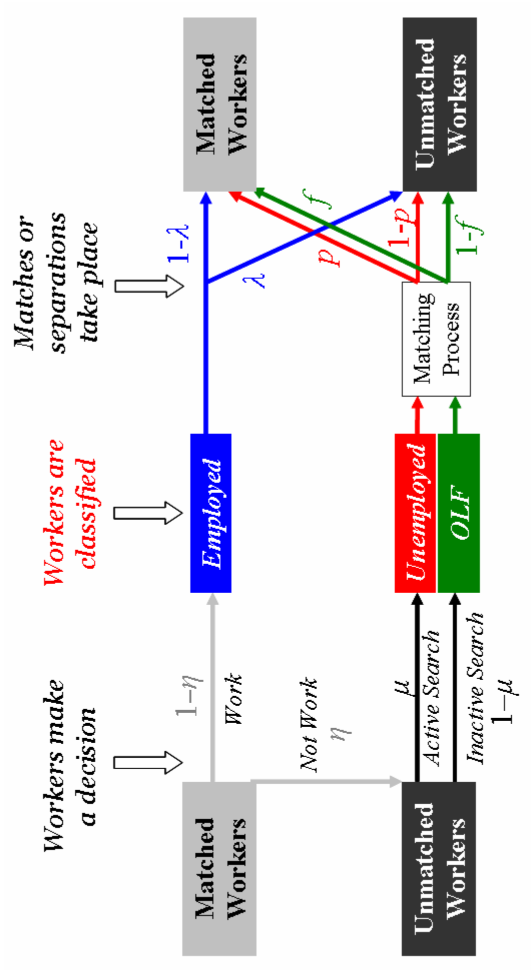


Figure 4: Flow Chart

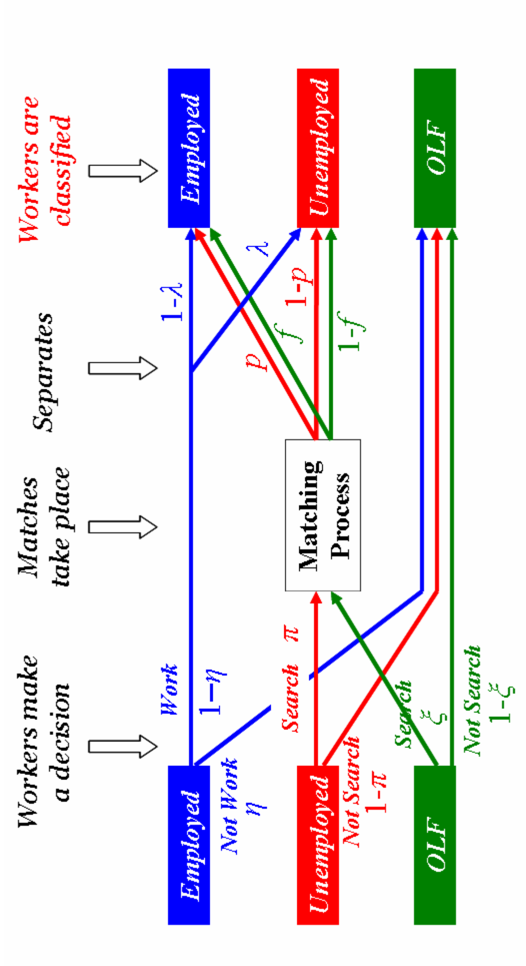
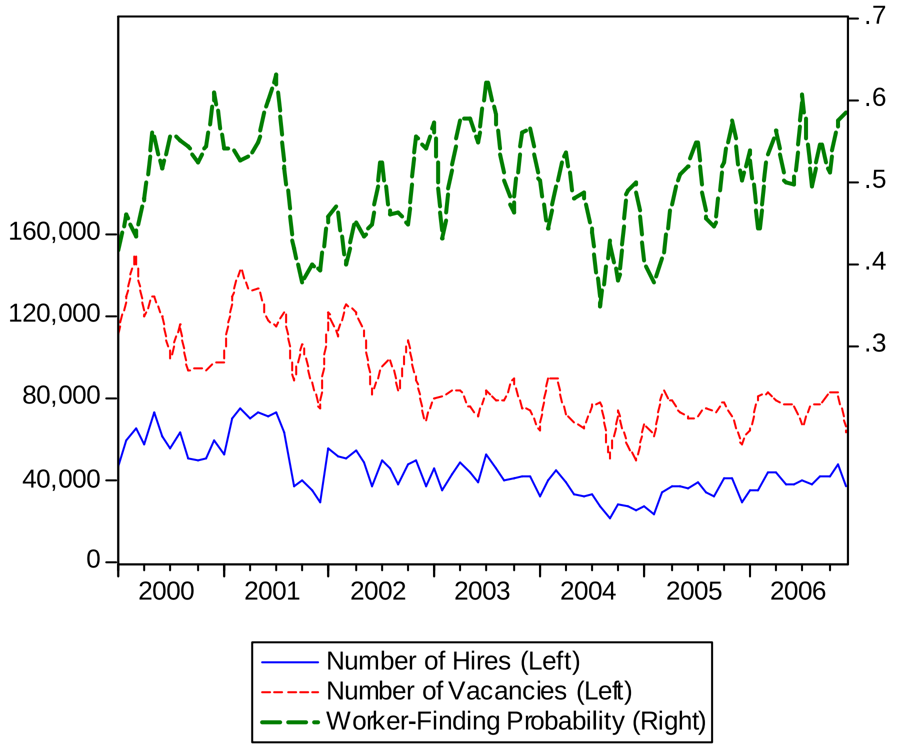


Figure 5: Vacancies, Hires, and Worker-finding Probability



1. The monthly average worker-finding probability is .5, and its standard deviation is .06.
2. Source: Public Employment Service Worknet Monthly Report (2000-2006), Korea Employment Information Service.

〈 Abstract in Korean 〉

문외솔*

우리나라의 실업률은 경기변동에 따라 움직이는 변동성과 연관성이 약하다는 지적이 제기되어 왔다. 실제로 통계청 조사에 따르면 1986년 이후 20년과 최근(2000~2006)을 비교해 보면 실업률의 변동성이 1/3 정도 수준으로 크게 줄어들었으며(표준편차 : 0.73→0.21%) 경기상황을 반영하는 취업자수와의 상관관계도 약화되었다(상관계수 : -0.86→-0.65). 반면 비경제활동인구의 경우에는 변동성이 축소되었으나 실업률에 비해서는 크며(표준편차 : 0.39→0.25%) 취업자수와의 상관관계는 오히려 강화되었다(상관계수 : -0.82→-0.93). 이는 고용의 변화가 실업자보다는 상당 부분 비경제활동인구로부터의 유출입 변화로 설명될 수 있음을 시사한다.

노동시장의 분석에 많이 이용되는 매칭모형(matching model)을 우리나라 실정에 맞게 수정하여 분석한 결과 실업 및 비경제활동에서 취업으로 이동하는 확률이 크게 달라졌다. 즉, 수정모형에 따를 경우 비경제활동인구에 속한 사람이 구직활동을 하기로 결정한 경우 다음 기에 취업될 확률(85%)이 실업상태에 있었던 경우(29%)에 비해 2.9배 정도 높은 것으로 나타났다. 미국의 1.8배(65.3% 및 35.8%)에 비해 크게 높다.

이는 우리나라의 경우 경기가 안 좋을 경우 구직활동을 아예 포기하며 취업 가능성이 높을 경우에 구직활동에 참여하는 경향이 있는 것으로 해석할 수 있다. 이에 따라 실업률이 경기상황을 제대로 반영하지 못하는 것으로 판단된다. 아울러 동태확률일반균형(DSGE) 모형에 근거한 수정매칭모형을 이용하여 국내 고용상황을 분석한 결과도 이 같은 특징을 잘 설명하고 있는 것으로 나타났다.

이상의 분석결과에 비추어 볼 때 우리나라의 경우에는 경기상승(하강) 국면에서 상당수의 비경제활동(고용) 노동자가 취업(비경제활동)으로 직접 이동할 가능성이 높아 경기와 실업과의 관계가 약한 것으로 판단된다. 따라서 경기변동과 고용상황과의 관계를 설명함에 있어서는 실업률뿐만 아니라 취업자수 및 비경제활동인구의 움직임을 예의주시할 필요가 있다.

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