Research on Theoretical Analysis of Unemployment Rates – Interim Report

Summary

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1. Research Period

Fiscal 2006-2007

2. Research Objectives

If the employment policy is to be implemented appropriately, it is indispensable to analyze and resolve the realities of the unemployment structure, the background or factors behind unemployment, and factors behind difficulties in finding jobs. In this

respect, it is extremely important to grasp the structural/frictional unemployment rate accurately for assessing the employment situation and labor supply/demand mismatches.

The UV analysis which uses UV (U for the unemployment rate and V for the vacancy rate) curve and the NAIRU (non-accelerating inflation rate of unemployment) analysis using the expectations-augmented Phillips Curve are mainly adopted as a measure for estimating the structural/frictional unemployment rate and the equilibrium unemployment rate. But for both estimation methods problems are pointed out, resulting in different levels and changes of the structural/frictional unemployment rate.

Sufficient studies have not necessarily been accumulated on the concepts of unemployment rates, deficient demand unemployment, structural unemployment and frictional unemployment in particular, and on the theoretical background of the UV analysis and NAIRU and their relationship. Only a limited number of studies have fully verified whether substantial unemployment rate fluctuations since the 1990s have stemmed from macro labor market or any other structural economic changes.

Recognizing such situation, the JILPT has launched a "research panel on a theoretical analysis of unemployment rates" (i) to promote conceptual organization and theoretical rationalization of equilibrium, structural/frictional and deficient demand unemployment rates, (ii) to organize UV, NAIRU and other analysis methods theoretically, identify problems with estimation methods, improve estimation methods and make estimations based on latest data, and (iii) to grasp the realities of the unemployment structure including labor supply and demand mismatches and analyze factors behind changes in the structure.

Since the research covers a wide range of themes and details, we have compiled our past research achievements into this interim report. Table 1 indicates the relationship between major research objectives and this report's specific chapters.

Table 1 Relationship between Major Objectives of Theoretical Analysis of Unemployment Rates and Specific Chapters of This Report

	(1) Organization of Unemployment Rate Concepts and Theoretical Background of Unemployment		(2) Organization, and Improvement and Estimation of Equilibrium and Structural/Frictional Unemployment Rate		(3) Unemployment Structure Reality Check and Analysis of Factors behind Structural Changes	
	Unemployment Concept Theories	Concept and Theoretical Organization of Equilibrium Unemployment Rates	Organization of Issues	Improvement and Estimation	Unemployment Structure	Factors behind Unemployment Fluctuations
Chapter 2 "Estimation of Recent Structural/Frictional Unemployment Rates and Fluctuations in Unemployment Rates"	Overview	Overview	Overview and Consideration of Vacancy Statistics	UV Analysis and Extended Estimation	Review	Mismatch and Flow Data Analysis
Chapter 3 "Consideration of NAIRU Concepts and Estimation of Time-varying NAIRU with Kalman Filter"	Structural, frictional, deficient demand and natural unemployment rates	NAIRU		Time-varying NAIRU		
Chapter 4 "Beveridge Curve and Philips Curve -- Tentative Theory for NARIRU Estimation"		UV and NAIRU		UV/NAIRU Estimations		
Chapter 5 "Quarterly Macroeconometric Model to Analyze Structural Changes and Unemployment"					Macro Model to Check Structure	Macro Model Simulation
Chapter 6 "Relationship between Unemployment and Vacancies -- Theoretical Aspect"		UV Analysis		UV Simulation		

3. Outline of Analyses

(1) Chapter 2 "Estimation of Recent Structural/Frictional Unemployment Rates and Fluctuations in Unemployment Rates"

This chapter reviews Japan's recent structural/frictional unemployment rate estimation results and relevant points to consider, including a UV analysis in the 2005 White Paper on the Labor Economy, and looks into factors behind unemployment rate fluctuations in and after the 1990s.

Regarding structural/frictional unemployment rate estimation methods, the UV analysis has some problems including the difficult selection of explaining variables (including difficult separation of structural unemployment from frictional unemployment, and difficult identification of structural/frictional unemployment), the incompatibility between unemployment and vacancy statistics, difficult interpretation of UV curve data (including whether unemployment or vacancy rate moves are attributable to the economic cycle or a UV curve shift/fluctuation, etc.), and the failure to introduce explicit factors behind wage and price fluctuations. NAIRU estimations also have such problems as wide estimation result differences depending on estimation periods and methods of which we should take note. Earlier UV analysis and NAIRU studies indicated that the structural/frictional unemployment rate was dominantly estimated at between around 3% and 4%. Many of these studies indicate that the rate soared in the 1990s.

We have organized arguments about UV analysis estimations in and before the 2005 White Paper on the Labor Economy and extended estimations. As a result, indications are that the UV relationship has possibly been stable recently. Extended estimations indicate that the structural/frictional unemployment rate has declined by 0.1 to 0.3 percentage point from the level in the 2005 White Paper on the Labor Economy. More specifically, the structural/frictional unemployment rate as estimated by us for the second quarter of 2007 accounted for 3.49 percentage points (3.55 points in the 2005 White Paper) of the overall unemployment rate at 3.76% and the deficient demand unemployment rate for 0.27 point (0.21 point in the 2005 White Paper). Like traditional analyses, our analysis indicates that both deficient demand and structural/frictional unemployment contributed to a rise in the overall unemployment rate in the second half of the 1990s and that a decline in deficient demand unemployment has made great contributions to an overall unemployment rate drop during the economic recovery in and after 2002.

Regarding the UV analysis, the incompatibility between unemployment data in the Labor Force Survey and vacancy data in the Report on Employment Service has been

picked as a problem with estimations. We have compared vacancy data in the Survey on Employment Trends and those in the Report on Employment Service and found that the Survey on Employment Trends also has some problems. Therefore, for the immediate future, we may have to use the vacancy data in the Report on Employment Service while considering various conditions.

We have also looked into the background of unemployment rate fluctuations through indicators of mismatches between job offers and seekers and through flow data analyses. Our findings indicate that the increase in the unemployment rate in the second half of the 1990s resulted from growth in both deficient demand unemployment and structural/frictional unemployment and represented structural changes in the labor market. A deficient demand unemployment decline has been indicated as a factor behind the economic recovery in and after 2002, while no major rise or drop has been estimated in structural/frictional unemployment. These findings meet the UV analysis estimations.

This study is aimed at analyses for reaffirming facts. We may have to define factors behind unemployment rate fluctuations themselves and refine theories and methods of estimation of structural/frictional unemployment. It is also our task to organize statistical data including labor market vacancy indicators (job offers, job applications and employment).

(2) Chapter 3 "Consideration of NAIRU Concepts and Estimation of Time-varying NAIRU with Kalman Filter"

This chapter organizes concepts of unemployment types, the NAIRU and a natural unemployment rate and estimates the NAIRU.

In breaking down the unemployment rate, we must pay attention to three important unemployment types -- deficient demand unemployment (which emerges as a deficiency in gross demand for goods leading to a decline in gross demand for labor services), structural unemployment (which involves a mismatch between skills in demand and those available that emerges as workers fail to get employed due to the difficulty of interregional and cross-occupational change of jobs), and frictional unemployment (which emerges as job-offering employers and job-seeking workers have incomprehensive information in the labor market).

A method for finding the combination of structural and frictional unemployment rates is the NAIRU measurement using the Philips Curve. Although many studies view the NAIRU as identical to the natural unemployment rate, the two unemployment rates are different. The natural unemployment rate may represent a long-term combination

of structural and frictional unemployment level. The NAIRU is defined as the rate of unemployment at which inflation rate stabilizes in the absence of any temporary supply shock. If the NAIRU is a combination of structural and frictional unemployment rates, we may have to compute the combination of structural and frictional unemployment rates reflecting structural changes of the economy attributable to an ever-lasting supply shock. Generally, since the NAIRU changes on a new ever-lasting supply shock, it may be said that the NAIRU may change more easily than the natural unemployment rate. There is another difference. While the natural unemployment rate is linked to a general concept of equilibrium under reasonable expectations, the absence or presence of errors in expectations is not taken into account in the NAIRU concept.

The combination of structural and frictional unemployment rates as the equilibrium unemployment rate in the UV analysis reflects the labor market's quantitative aspect such as matching status between job-seeking workers and job-offering employers and corresponds to a labor market equilibrium. It is not strange that the combination differs from a natural unemployment rate or the NAIRU measured with the price-version Philips Curve indicating the relationship between the comprehensive unemployment rate in the labor market and the inflation rate in the goods market. The two should be used in a complementary fashion.

Finally, we have estimated Japan's time-varying NAIRU (NAIRU changing as time passes) using the Kalman Filter. The most applicable model uses "the import price index (covering oil, coal and natural gas) divided by the domestic corporate goods price index" as a control variable for the nonlinear price-version Philips Curve. For the fourth quarter of 2005 at the end of the estimation period, the NAIRU has been estimated at 3.64% through smoothing. We have also estimated the NAIRU for the case without any temporary supply shock in line with the OECD's NAIRU definition and found that the NAIRU fluctuates more narrowly in such case. Through smoothing, the NAIRU in the case has been estimated to 3.55% for the fourth quarter of 2005. The NAIRU has been estimated at relatively higher levels for the 1970s, and the NAIRU estimates have remained between 3.0% and 3.9% for the entire estimation period between the fourth quarter of 1976 and the same quarter of 2005. This point may have to be improved.

(3) Chapter 4 "Beveridge Curve and Philips Curve -- Tentative Theory for NARIRU Estimation"

This chapter puts forward a tentative theory as one of a few studies discussing the

Philips Curve (for the NAIRU) and the Beveridge Curve (for the UV curve) from an integrated viewpoint. In this respect, we have tested new estimation methods.

We have theoretically developed the Beveridge Curve from the matching function (linear homogeneous) and estimated the "trend unemployment rate" (or so-called the structural/frictional unemployment rate) using quarterly data between 1987 and 2006. Particularly, we have used the active job opening ratio instead of the conventional vacancy rate as the explaining variable for the unemployment rate. This has allowed us to develop a very simple trend unemployment rate series (with an analysis method according to Ball and Mankiw (2002)).

The trend unemployment rate series leveled off from 1987 to 1993 before turning up. Toward the second half of the 1990s, the actual unemployment rate rose faster than the trend unemployment rate, indicating strong impacts of economic deterioration on employment. Against the peak comprehensive unemployment rate of 5.4% in the second quarter of 2003, the trend unemployment rate has been estimated at around 4%. Structural and frictional factors have been found to have accounted for 50-60% of an unemployment rise from the first quarter of 1992 to the third quarter of 2002.

Next, we have used core CPI inflation data to estimate the time-varying NAIRU. When we used the same method as Ball and Mankiw (2002) for estimations, the estimated NAIRU series was not necessarily compatible with the structural/frictional unemployment rate series developed from the Beveridge Curve. Then, we introduced the active job opening ratio in addition to the unemployment rate as the explaining variable of inflation to improve the Philips Curve substantially and took advantage of the relationship between the unemployment rate and the active job opening ratio as developed from the Beveridge Curve to estimate a new NAIRU series.

New estimation results indicate that the NAIRU remained almost unchanged at around 3% during the bubble economy period, turned up in the middle of 1993, continued rising, reached 4.6% in early 2004, and began to show a slight decline recently. The actual unemployment rate remained below the NAIRU during the bubble economy period, stayed at almost the same level as the NAIRU until around 1998, and exceeded the NAIRU later before slipping below the NAIRU in around 2005.

There are three problems left to be solved: (i) These analyses are naive and estimates' sensitivity to analysis periods and parameters adopted have not been analyzed sufficiently. Overall analyses must be refined. (ii) The theoretical framework of the Philips Curve or the reasons why multiple labor market indicators become significant must be considered. (iii) We have fallen short of discussing the reasons why the NAIRU rose in Japan -- a key issue that must be considered.

(4) Chapter 5 "Quarterly Macroeconometric Model to Analyze Structural Changes and Unemployment"

This chapter analyzes whether unemployment rate changes in the 1990s stemmed from structural changes in the macro labor market and other sectors, or from economic environment changes, by developing a simple quarterly macroeconometric model (a Keynesian model featuring 49 equations including 20 definitional equations for an estimation period between the first quarter of 1992 and the fourth quarter of 2003) using quarterly data since the 1990s.

In the wage and labor sector, the labor supply/demand balance determines the unemployment rate, which determines nominal wage levels through the Philips Curve. Nominal wages are determined, along with the number of employees, to specify the distribution of compensation of employees. This means that changes in nominal wages (wages divided by working hours) are determined through the (nonlinear) Philips Curve using the inverse number of the unemployment rate and CPI changes as explaining variables. The labor demand function is a partially adjusted log-linear function using real wages (realized by the GDP deflator), real GDP and the previous quarter's labor demand as explaining variables. The labor supply function uses the labor force participation ratio as an explained variable and real wages (realized by the CPI), time trends and the previous quarter's explained variables as explaining variables. The unemployment rate is estimated through the logistic function that uses the supply/demand ratio estimated here as an explaining variable.

Model estimation results roughly correspond to actual data. Multiplier test results indicated small multiplier effects, indicating that the nonlinear model can work to relatively increase the effectiveness of demand policy under a relatively higher unemployment rate, while the demand policy itself has a high possibility to play only a limited role in curbing the unemployment rate.

Structural change tests and simulations have indicated the labor market excluding labor supply has not undergone any major structural change since the burst of economic bubbles. Particularly, the Philips Curve to grasp the relationship between wages and the unemployment rate has posted no significant structural change. Meanwhile, structural changes were found in the corporate price and consumer price functions around 1997.

Price function changes indicate that the flexible adjustment of price levels to labor costs were coupled with curbs on and structural changes of wages since 1997 to hold down any further rise in unemployment level, etc. In this regard, This finding is

compatible with structural changes that emerged on the modified Philips Curve. This indicates that if nominal wages are adjusted flexibly in line with unemployment rate and price level changes, it may work to curb the unemployment rate and benefit the entire economy. The downward rigidity of nominal wages might have affected a rise in the unemployment rate.

Regarding these analyses, we must note that when the coefficient values of the Philips Curve change, various cause-to-effect relations in the labor market often change along with the labor supply/demand structure and others. Our simulations indicate the case in which other conditions would remain unchanged and should be interpreted prudently.

(5) Chapter 6 "Relationship between Unemployment and Vacancies: Theoretical Aspect"

This chapter considers the theoretical aspect of the UV curve through a search and matching model, as few analyses have derived the theoretical background of the UV curve.

The search and matching model is a representative model for equilibrium unemployment that has explained the emergence of unemployment, or the simultaneous emergence of job losses and vacancies, starting from subjective rationality. In a job search model, the conditions of job offers differ from one employer to another. Job seekers' respective characteristics are also different. Workers are assumed to have limited knowledge about job information provided by employers. This indicates that job seekers may take time to find jobs. This is the same with employers. Therefore, this is the system where job losses and vacancies can emerge simultaneously in the labor market.

The UV curve aggregates stationary points where the ratio of unemployment to working population is identical to that of vacancies (or points where inflow into and outflow from the unemployment pool are identical). If an appropriate matching function is put between unemployment and vacancies, a downward-sloping curve emerge between them. In this respect, we must note that while the UV curve being used for models indicates a functional relationship between unemployment and vacancies in the stationary state, the real UV curve is not indicated as a curve in the stationary state.

Modeling of functions (using the wage equation and the job creation equation to indicate equilibrium solutions with four parameters -- the productivity, the discount rate, the recruitment cost and the match dissolution rate) can develop the UV curve.

(An increase in employees' share of wages and a fall in the matching rate lead to a rise in the equilibrium unemployment rate, while an increase in the productivity leads to a decline in the equilibrium unemployment rate.) We conducted simulations based on simple preconditions by giving specific values to the parameters. But the search model fell short of simulating actual job losses and vacancies completely. As a benchmark model, logical explanations should be emphasized about relations between specific preconditions and simulation results. The fact that an equilibrium unemployment rate does not necessarily represent any efficient social welfare state (the Pareto efficient distribution of resources between employers and employees) is suggestive from the policy viewpoint. The model's implication is that any policy based on numerical targets alone to reduce unemployment or increase job offers may be insufficient for improvement of welfare.

We are demonstratively required to grasp characteristics of job offers and applications in the market and specific matching processes, rather than refining any model.

4. Future Challenges

This report provides some findings. Particularly, the UV analyses, NAIRU estimation results and macromodel simulation analyses indicate the possibility that the structural/frictional unemployment rate increased in the second half of the 1990s, which led to structural changes in socio-economy and in labor market. Our future challenges include further refinement of theoretical and demonstrative aspects of research achievements and comprehensive compilation of studies. We plan to organize achievements comprehensively in our final report.