国際大学
INTERNATIONAL UNIVERSITY OF JAPAN

Economics & Management Series *EMS-2011-15*

Unemployment and Labor Force Participation in Japan

Makoto Kakinaka
International University of Japan

Hiroaki Miyamoto
International University of Japan

March 2011

IUJ Research Institute
International University of Japan

Unemployment and Labor Force Participation in Japan

Makoto Kakinaka
International University of Japan

Hiroaki Miyamoto*
International University of Japan

March 25, 2011

Abstract

This paper studies a long-run relationship between the labor force participation rate and the unemployment rate in Japan. By using cointegration analysis, we demonstrate that there exists a long-run relationship between the two variables for male workers but not for female workers. Furthermore, using labor force data by age group, we find the added-worker effect for young males and the discouraged worker effect for middle-aged and old male groups.

Keywords: Labor force participation, Unemployment, Discouraged-worker effect, Added-worker effect, Cointegration

JEL Classification: E24, J60

*Corresponding Address: Hiroaki Miyamoto, International University of Japan, Graduate School of International Relations, 777 Kokusai-cho, Minami Uonuma-shi, Niigata 949-7277 JAPAN. E-mail: hmiyamot@iuj.ac.jp. TEL.:+81-25-779-1464. FAX:+81-25-779-1187

1 Introduction

The dynamics of unemployment is determined by worker flows. Workers move between employment, unemployment, and not-in-the labor force, and worker movements determine aggregate labor market indicators such as unemployment, employment, and labor participation rates. Previous work on the labor market flows demonstrates that worker inflows and outflows from not-in-the labor force status are substantial (see, e.g., Blanchard and Diamond, 1990; Burda and Wyplosz, 1994; Bell and Smith, 2002; Gomes 2009; Lin and Miyamoto, 2010). This suggests that there is a causal link between unemployment and labor-force participation.

The purpose of this paper is to study a long-run relationship between labor-force participation and unemployment in Japan. The fact that a simultaneous steady fall in the labor participation and an increase in the unemployment rate in Japan over past 20 years leads us to believe that there exists a negative relationship between the two variables. By using cointegration techniques, we demonstrate that while there is a long-run relationship between the labor-force participation rate and the unemployment for male workers, there does not exist a long-run relationship between the two variables for female workers. We also find the added-worker effect for young male workers and the discouraged worker effect for middle-aged and old male workers.

The facts established in this paper are important to researchers who are interested in the Japanese labor market or the international comparison of working of labor markets in different countries. Furthermore, this paper provides a guideline of the empirical features that theoretical models should ideally have.

Our paper is closely related to Österholm (2010) and Emerson (2011) on the relationship between unemployment rates and labor-force participation rates in Sweden and in the U.S.,

respectively. They find that there is a long-run relationship between the two variables, which leads to a questioning of the empirical relevance of the unemployment invariance hypothesis in these countries.[1] By using the Japanese data, we demonstrate that there is a long-run relationship between unemployment and labor-force participation for male workers but not for female workers. These findings complement the results of Österholm (2010) and Emerson (2011).

2 Data and empirical analysis

We use the monthly labor-force participation rate for ages 16 and over, p_t, and the unemployment rate for ages 16 and over, u_t, in Japan over the sample period from January 1980 to December 2010. We also conduct our analysis on gender and age-group for the robustness check for our findings. The data comes from Labour Force Survey (LFS), conducted by the Statistics Bureau and the Director-General for Policy Planning.[2]

Figure 1 shows the evolution of the labor-force participation rate and the unemployment rate over the past 30 years. The total unemployment rate was significantly low until the middle 1990s with an average of 2.5%. Then it increased gradually and exceeded 5% in 2001. In the early 2000s, the unemployment rate gradually declined but it started to increase after the 2007 recession. The movements of the male and female unemployment rates are similar. The labor-force participation rate has the downward trend and it declined from 63% in 1980 to 59.5% in 2010. This downward trend is mainly due to a decrease in the male labor-force participation rate. The female labor-force participation rate has a different picture from a male's one. It increased

[1] The unemployment invariance hypothesis suggests that the long-run unemployment rate is independent of the labor force. While Layard, Nickell, and Jackman (1991) provide evidence in support of this hypothesis, Karanassou and Snower (2004) provide a critique of it.

[2] The data for the sample period are released from the website of the Japanese Ministry of Internal Affairs and Communications, http://www.stat.go.jp/.

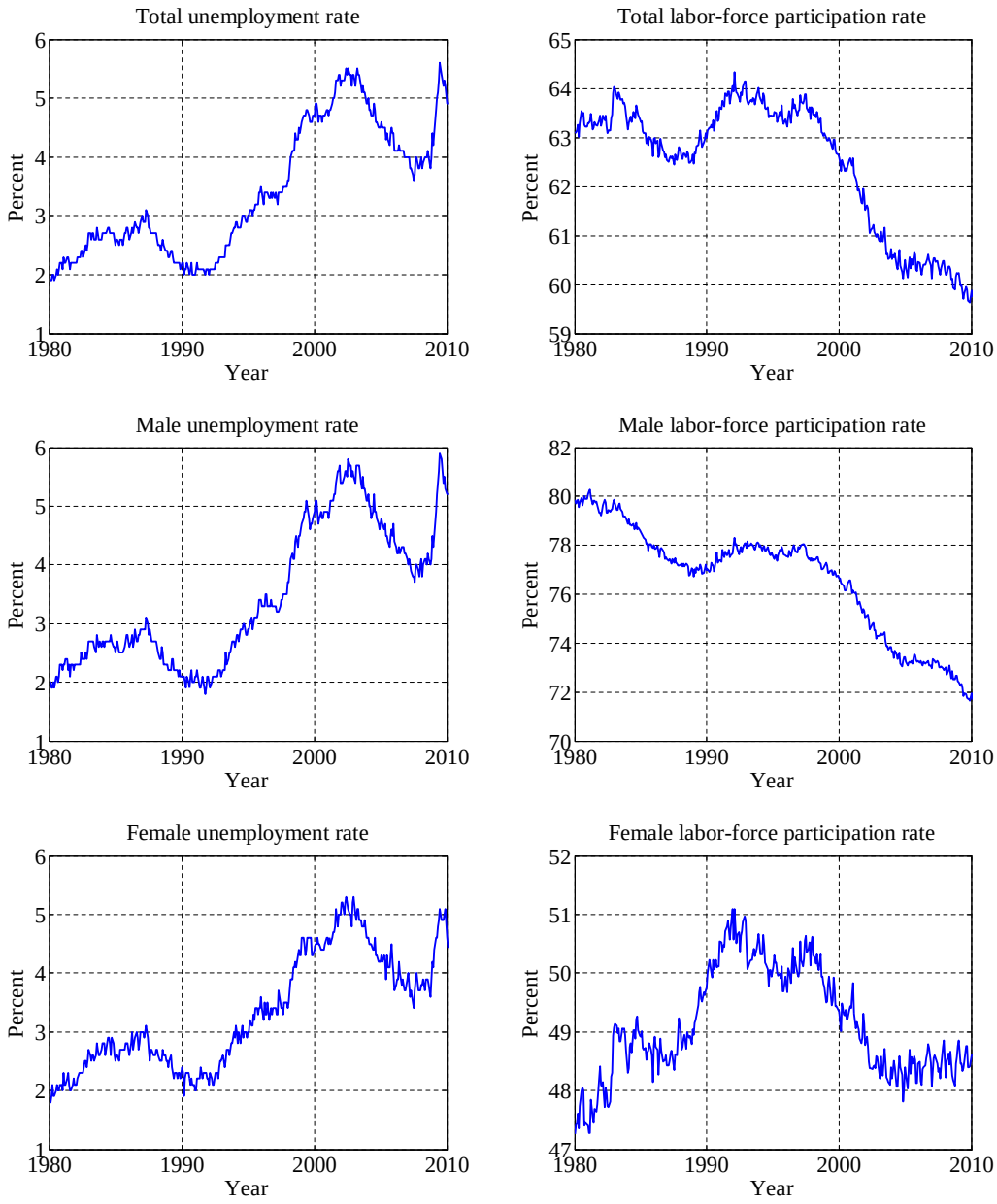

Figure 1: Unemployment and labor-force participation rates in Japan, January 1980 through December 2010.

Note: Monthly unemployment rates and labor-force participation rates are from LFS. Sample covers January 1980 to December 2010.

gradually in 1980s and the early 1990s, and then declined in the late 1990s. In 2000s, it has neither upward nor downward trend but exhibits strong fluctuations.

First, the time series properties of the data are examined using two unit root tests: the Augmented Dickey and Fuller test with GLS detrending test for the null hypothesis of non-stationarity (Elliott et al., 1996) and the KPSS test for the null hypothesis of stationarity (Kwiatkowski et al., 1992). The results are summarized in Table 1. The two unit root tests confirm that both labor-force participation and unemployment rates are not stationary. Thus, we can check the existence of a long-run relationship between the two variables in a cointegration framework. If the variables are conintegrated, there exists a long-run relationship between them. On the other hand, if the variables are not cointegrated, there is not a long-run relationship between relevant variables.

We test for conintegration between the labor-force participation rate and the unemployment rate by applying Johansen's methodology (Johansen, 1988; 1991). Our benchmark model is a finite-order VAR of the form:

$$x_t = c + \sum_{i=1}^{k} A_i x_{t-i} + \varepsilon_t,$$

where $x_t = (p_t, u_t)'$ is a vector of non-stationary variables containing the labor-force participation rate, p_t, and the unemployment rate, u_t, A_i is a 2×2 matrix of parameters, and ε_t is a 2×1 vector of residuals. This unrestricted VAR can be rewritten as:

$$\Delta x_t = c + \sum_{i=1}^{k-1} \Gamma_i \Delta x_{t-i} + \Pi x_{t-k} + \varepsilon_t,$$

where $\Gamma_i = \sum_{i=1}^{k-1} A_i - I$ and $\Pi = \sum_{i=1}^{k} A_i - I$. If the coefficient matrix Π has rank equal to one, p_t and u_t are cointegrated, and Π is decomposed as $\Pi = \alpha\beta'$, where α and β are 2×1 vectors,

α contains the adjustment parameters in the vector error correction model, and β contains the co-integration vector.

The cointegrating relationship between the labor-force participation rate and the unemployment rate is examined by Johansen's trace and maximum eigenvalue tests. To select the lag length of the VAR, we use the Akaike information criterion, the Hannan-Quinn criterion, and the Schwarz information criterion. Table 2 reports the results of the cointegration tests, which show that there is one cointegrating vector in the cases of all workers and male workers, and there is no cointegrating vector in the case of female workers. This suggests that a long-run relationship exists between the labor-force participation rate and the unemployment rate for male workers, but it does not present a clear evidence of a long-run relationship for female workers.

We have demonstrated that there exists a long-run relationship between the labor force participation rate and the unemployment rate in the cases of all workers and male workers. To understand the properties of the observed long-run relationship, the estimated cointegrating vectors are shown in Table 3. The results can be interpreted as favoring discouraged worker effect in the sense that a higher unemployment rate is associated with a lower labor-force participation rate.

To access the robustness of our findings, we repeat the exercises by using the male and female labor force data by age group. We consider three age groups: young (15-29 years old), middle (30-54 years old), and old (55 years old and over). Table 4 reports the results of the unit root tests for each variable. Similar to the previous cases, the labor-force participation rate and the unemployment rate are not stationary for each age group, so that the existence of a long-run relationship can be examined in a cointegration framework.

Table 5 reports the results of cointegration tests for each age group data. It is observed

that irrespective of age groups, there is one cointegrating vector in all cases of male workers and no cointegrating vector in all cases of female workers. These results are consistent with our previous results. Finally, Table 6 presents the estimated cointegration relationship for male workers. Young males are more likely to enter the labor force when the unemployment rate is high. This result can be interpreted as favoring added worker effects. In contrast, for the middle and old males, a high unemployment rate is associated with a low labor-participation rate, which implies that the discouraged worker effects prevail.

3 Conclusion

The relationship between unemployment and labor force participation has important implications not only for theory but also for empirical modeling and policy in macroeconomics and labor economics. This paper studies the long-run relationship between the unemployment rate and the labor force participation rate in Japan. We demonstrate that there is a long-run relationship between the two variables for male workers but not for female workers by using cointegration analysis. Analysis of data by age group finds the added-worker effects for young male workers and the discouraged worker effect for middle-aged and old male workers.

References

[1] Bell, B., Smith, J., 2002. On gross worker ows in the United Kingdom: evidence from the Labour Force Survey. Bank of England Working Paper no. 160.

[2] Blanchard, O. J., Diamond, P., 1990. The Cyclical Behavior of the Gross Flows of U.S. Workers. Brookings Papers on Economic Activity 2, 85–155.

[3] Burda, M., Wyplosz, C., 1994. Gross worker and job ows in Europe. European Economic Review 38 (6), 287-15.

[4] Elliott, G., Rothenberg, T.J., and Stock, J.H., 1996. Efficient tests for an autoregressive unit root. Econometrica 64, 813-836.

[5] Emerson, J., 2011. Unemployment and labor force participation in the United States. forthcoming in Economics Letters.

[6] Gomes, P., 2009. Labour Market Flows: Facts from the UK. Manuscript. London School of Economics.

[7] Johansen, S., 1988. Statistical analysis of cointegration vectors. Journal of Economic Dynamics and Control 12, 231-254.

[8] Johansen, S., 1991. Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregression models. Econometrica 59, 1551-1580.

[9] Karanassou, M. and Snower, D.J., 2004. Unemployment invariance. German Economic Review 5, 297-317.

[10] Kwiatkowski, D., Phillips, P.C.B, Schmidt, P., and Shin, Y., 1992. Testing the null hypothesis of stationarity against the alternative of a unit root. Journal of Econometrics 54, 159-178.

[11] Layard, R., Nickell, S.J., and Jackman, R., 1991. Unemployment: macroeconomic performance and the labour market. Oxford University Press, Oxford.

[12] Lin, C-Y., Miyamoto, H., 2010. Gross Worker Flows and Unemployment Dynamics in Japan. Economics & Management Series-2010-04, International University of Japan.

[13] Österholm, P., 2010. Unemployment and labour-force participation in Sweden. Economics Letters 106, 205-208.

Table 1: Univariate unit-root tests on individual series

	All		Male		Female	
	p_t	u_t	p_t	u_t	p_t	u_t
ADF-GLS	1.338	0.491	3.745	0.404	-0.659	0.364
KPSS	1.701**	1.902**	2.066**	1.889**	0.516*	1.912**

Note: ADF-GLS is the test statistic from the augmented Dickey-Fuller test with GLS detrending, where lag length is chosen based on the Schwarz information criterion. KPSS is the test statistic from the Kwiatkowski, Phillips, Schmidt, and Shin test. * and ** indicate significance at the 5% and 1% levels, respectively. Sample covers January 1980 to December 2010.

Table 2: Cointegration tests

	All		Male		Female	
	J_{trace}	$J_{\max}$	J_{trace}	$J_{\max}$	J_{trace}	$J_{\max}$
$H_0 : r = 0$	21.781*	19.457*	19.931*	19.460*	14.268	10.632
$H_0 : r = 1$	2.324	2.324	0.471	0.471	3.635	3.635

Note: Lag length of the VAR is selected using the Akaike information criterion, the Hannan-Quinn criterion, and the Schwarz information criterion. * and ** indicate significance at the 5% and 1% levels, respectively. Sample covers January 1980 to December 2010.

Table 3: Estimated cointegrating vector

	All	Male	Female
p_{t-1}	1.00	1.00	1.00
u_{t-1}	2.033	3.480	0.903
	(0.348)	(0.594)	(0.354)
constant	-69.420	-88.695	-52.154

Note: Sample covers January 1980 to December 2010.

Table 4: Univariate unit-root tests on individual series

Age-group	15-29		30-54		55+	
	p_t	u_t	p_t	u_t	p_t	u_t
Male						
ADF-GLS	-1.034	0.348	-0.792	0.209	0.296	-2.340*
KPSS	1.079**	2.110**	0.721*	1.965**	2.103**	0.720*
Female						
ADF-GLS	1.730	0.195	3.515	0.229	-0.944	-1.087
KPSS	2.312**	1.862**	2.202**	2.000**	2.166**	1.670**

Note: ADF-GLS is the test statistic from the augmented Dickey-Fuller test with GLS detrending, where lag length is chosen based on the Schwarz information criterion. KPSS is the test statistic from the Kwiatkowski, Phillips, Schmidt, and Shin test. * and ** indicate significance at the 5% and 1% levels, respectively. Sample covers January 1980 to December 2010.

Table 5: Cointegration tests

	15-29		30-54		55+	
	J_{trace}	$J_{\max}$	J_{trace}	$J_{\max}$	J_{trace}	$J_{\max}$
Male						
$H_0 : r = 0$	21.626***	18.986***	14.962*	14.205*	39.477***	39.189***
$H_0 : r = 1$	2.640	2.640	0.757	0.757	0.288	0.288
Female						
$H_0 : r = 0$	15.398	11.949	6.922	5.885	15.495***	14.265***
$H_0 : r = 1$	3.448	3.448	1.037	1.037	3.841**	3.841**

Note: Lag length of the VAR is selected using the Akaike information criterion, the Hannan-Quinn criterion, and the Schwarz information criterion. *** indicates significance at the 1% level, ** indicates significance at the 5% level, and * indicates significance at the 10% level. Sample covers January 1980 to December 2010.

Table 6: Estimated cointegrating vector

Male	15-29	30-54	55+
p_{t-1}	1.00	1.00	1.00
u_{t-1}	-0.835	0.275	20.994
	(0.252)	(0.098)	(3.056)
constant	-57.480	-97.838	-147.284

Note: Sample covers January 1980 to December 2010.