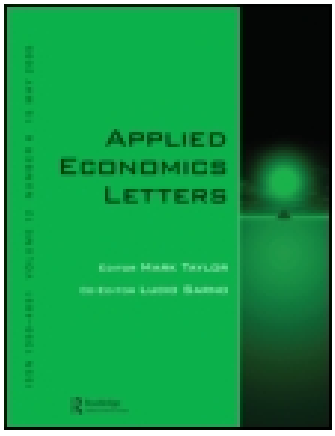

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Unemployment and labour force participation in Japan

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Unemployment and labour force participation in Japan

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This article studies a long-run relationship between the labour-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 labour-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: labour-force participation; unemployment; discouraged-worker effect; added-worker effect; cointegration

JEL Classification: E24; J60

I. Introduction

The dynamics of unemployment is determined by worker flows. Workers move between employment, unemployment and not-in-the labour force, and worker movements determine aggregate labour market indicators such as unemployment, employment and labour participation rates. Previous work on the labour market flows demonstrates that worker inflows and outflows from not-in-the labour 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 labour-force participation.

The purpose of this article is to study a long-run relationship between labour-force participation and unemployment in Japan. The fact that a simultaneous steady fall in the labour 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 labour-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 article are important to researchers who are interested in the Japanese labour market or in the international comparison of working of labour markets in different countries. Furthermore, this article provides a guideline of the empirical features that theoretical models should ideally have.

Our article is closely related to Österholm (2010) and Emerson (2011) on the relationship between unemployment rates and labour-force participation rates in Sweden and in the United States, 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 labour-force

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

participation for male workers but not for female workers. These findings complement the results of Österholm (2010) and Emerson (2011).

II. Data and Empirical Analysis

We use the monthly labour-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 come 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 labour-force participation rate and the unemployment rate over the

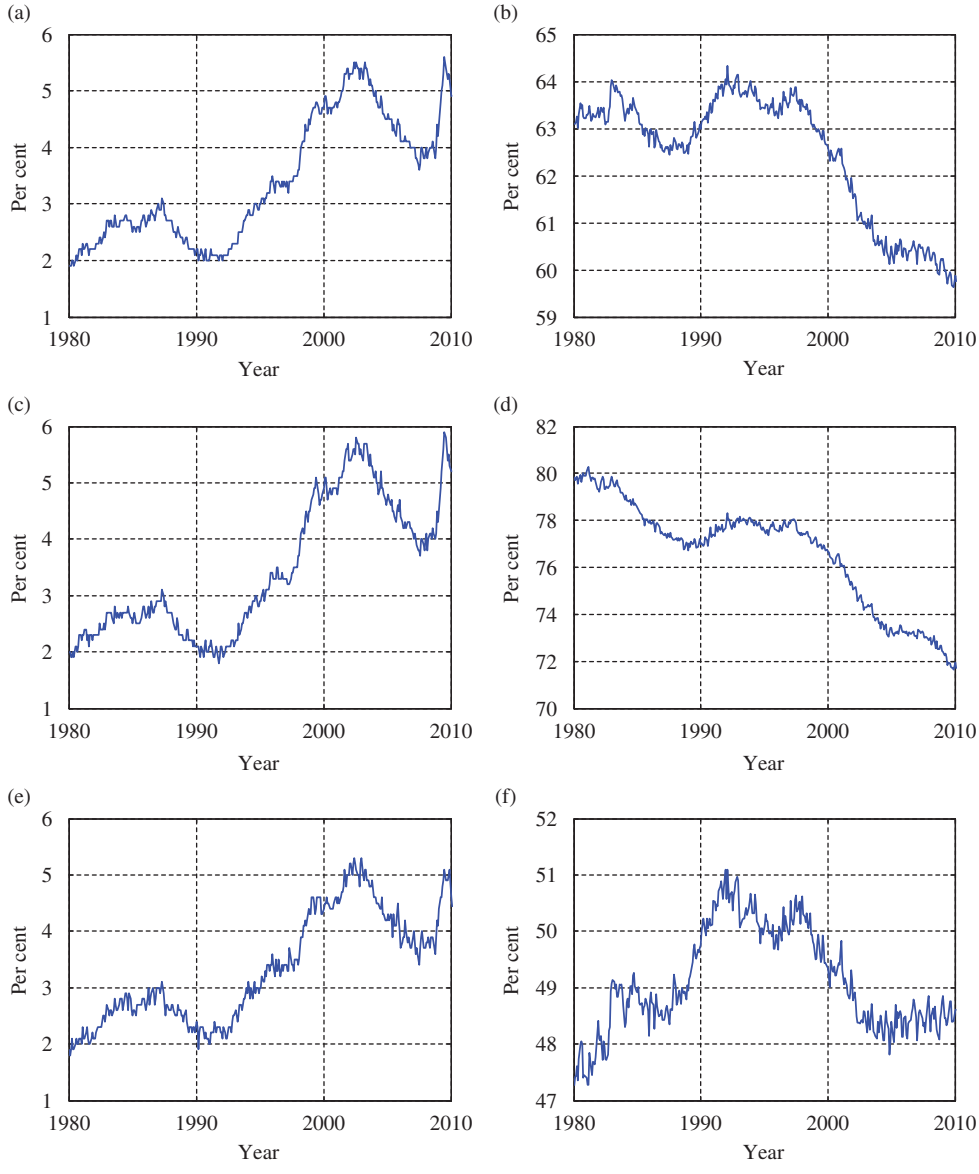

Fig. 1. Unemployment and labour-force participation rates in Japan: (a) total unemployment rate; (b) total labour-force participation rate; (c) male employment rate; (d) male labour-force participation rate; (e) female unemployment rate; (f) female labour-force participation rate

Notes: Monthly unemployment rates and labour-force participation rates are from Labour Force Survey (LFS). Sample covers January 1980 to December 2010.

[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/.

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 labour-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 labour-force participation rate. The female labour-force participation rate has a different picture from the male's one. It increased gradually in the 1980s and the early 1990s, and then declined in the late 1990s. In the 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 (ADF) test with GLS detrending test for the null hypothesis of nonstationarity (Elliott *et al*., 1996) and the Kwiatkowski, Phillips, Schmidt and Shin (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 labour-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 cointegrated, 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 cointegration between the labour-force participation rate and the unemployment rate by applying Johansen's methodology (Johansen, 1988, 1991). Our benchmark model is a finite-order Vector Auto-Regressive (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 nonstationary variables containing the labour-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 1, 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 cointegration vector.

The cointegrating relationship between the labour-force participation rate and the unemployment rate is examined by Johansen's (1988, 1991) 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

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**

Notes: 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. Sample covers January 1980 to December 2010.
* and **Indicate significance at 5% and 1% levels, respectively.

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

Notes: Lag length of the Vector Auto-Regressive (VAR) is selected using the Akaike information criterion, the Hannan–Quinn criterion and the Schwarz information criterion. Sample covers January 1980 to December 2010.
*Indicates significance at 5% level.

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 labour-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 labour-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 favouring discouraged-worker effect in the sense that a higher unemployment rate is associated with a lower labour-force participation rate.

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.

To access the robustness of our findings, we repeat the exercises by using the male and female labour-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). Table 4 reports the results of the unit root tests for each variable. Similar to the previous cases, the labour-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 labour force when the unemployment rate is high. This result can be interpreted as favouring added-worker effects. In contrast, for the middle and old males, a high unemployment rate is associated with a low labour-participation rate, which implies that the discouraged-worker effects prevail.

Table 4. Univariate unit-root tests on individual series

	15–29		30–54		55+	
Age group	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**

Notes: 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. Sample covers January 1980 to December 2010.
* and **Indicate significance at 5% and 1% levels, respectively.

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**

Notes: Lag length of the Vector Auto-Regressive (VAR) is selected using the Akaike information criterion, the Hannan–Quinn criterion and the Schwarz information criterion. Sample covers January 1980 to December 2010.
***, ** and *Indicate significance at 1%, 5% and 10% levels, respectively.

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.

III. Conclusion

The relationship between unemployment and labour-force participation has important implications not only for theory but also for empirical modelling and policy in macroeconomics and labour economics. This article studies the long-run relationship between the unemployment rate and the labour-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.

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