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**A Comparative Study of Regional Labour
Dynamics in Japan**

by

Masaaki Kawagoe

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Japan Center for Economic Research

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^{*} I appreciate comments on a draft of this paper from Mr. Naohiro Yashiro (President, JCER). The views expressed herein are my own and in no way represent those of JCER.

[†] Senior Economist, Japan Centre for Economic Research

Abstract

This paper examines how Japanese regional labour markets respond to external shocks, using a methodology by Decressin and Fátas (1995), and compares the results with theirs. The paper finds, first, dynamics in Japanese regions resembles those in European more than US regions. Labour participation rate plays a major role as an adjustment mechanism, even a larger role in Japan than in Europe. Second, rather surprisingly, labour mobility's role in the adjustment turn out to be smaller in Japan than in Europe.

Journal of Economic Literature Classification Numbers: C23, R11, R12

Key Words: panel time-series, regional labour market, labour participation rate, labour mobility

1 Introduction

Following Blanchard and Katz (1992) on regional labour markets in US, there are some studies of how regional labour markets respond to external shocks. For instance, Decressin and Fátas (1995) analysed dynamics of European regional labour markets, thereby comparing the results between Europe and US¹.

Adopting the similar methodology, this paper examines dynamics of Japanese regional labour markets and what characterises Japanese regional dynamics in comparison with their results. Here, ‘dynamics’ means response of regional labour markets to external shocks. Two kinds of shocks are under consideration: ‘macro’ shocks common to all regions in a country, and ‘idiosyncratic’ shocks specific to a region.

The next section explains the data used and defines the aforementioned shocks, following Decressin and Fátas (1995). The section 3 preliminarily examines the dynamics using a univariate model. The section 4 analyses regional panel time-series data, using three-variable VAR models. The section 5 concludes.

2 Data and Analytic Framework

2.1 Data

This paper uses 10-region² annual data obtained from Ministry of General Affairs, *Labour Force Survey* in the period of 1983 to 2003. Decressin and Fátas

¹See Fátas (2000) for an extension of the comparison implemented by Decressin and Fátas (1995).

²The 10 regions are: (1)Hokkaido, (2)Tohoku (Aomori, Iwate, Miyagi, Akita, Yamagata, Fukushima), (3)South Kanto (Saitama, Chiba, Tokyo, Kanagawa), (4)North Kanto and Koshin (Ibaragi, Tochigi, Gunma, Yamanashi, Nagano), (5)Hokuriku (Niigata, Toyama, Ishikawa, Fukui), (6)Tokai (Gifu, Shizuoka, Aichi, Mie), (7)Kinki (Shiga, Kyoto, Osaka, Hyogo, Nara, Wakayama), (8)Chugoku (Tottori, Okayama, Hiroshima, Yamaguchi), (9)Shikoku (Tokushima, Kagawa, Ehime, Kochi), (10)Kyushu (Fukuoka, Saga, Nagasaki, Kumamoto, Oita, Miyazaki, Kagoshima, Okinawa).

(1995) studied 51 regions in both US and Europe³ and in 1970 to 1990 and 1966 to 1987, respectively. Our data, thus, have about the same length, but fewer regions than Decressin and Fátas (1995). In order to apply panel time-series methodology, we prefer *Labour Force Survey* with longer time-series to *National Census* available every 5 years, despite more detailed regional information⁴. Although *Labour Force Survey* provides the quarterly data throughout the sample period, we stick to the annual data, placing a priority on consistency with Decressin and Fátas (1995).

Size of a ‘region’ could pose a problem in comparing results among different countries. Indeed, prefectural and municipal data are likely to tell different stories even in Japan. It seems reasonable that larger size may imply more relative importance of macro shocks due to more offsetting among idiosyncratic shocks, and thus more disaggregation may imply more importance of idiosyncratic shocks. On average, our regions are larger than those of Europe and US (see Table 1). For example, value added and population in our regions are twice as large as those of Europe and US. Area in US regions is very large, compared to European and Japanese counterparts, the former of which is still about 1.2 times as large as the latter.

2.2 Analytical framework

Let labour force, employment rate, and unemployment rate be LF_{it} , $E_{it} (\equiv N_{it}/LF_{it})$, and U_{it} , respectively. Then the relationship between the last two is expressed by an identity, $\log(E_{it}) = \log(1 - U_{it}) \approx -U_{it}$. Define population and participation rate as POP_{it} and $P_{it} (\equiv LF_{it}/POP_{it})$, respectively. An identity, $N_{it} = POP_{it} \times P_{it} \times E_{it}$,

³The following 11 countries are included: France, Germany, Italy, Spain, UK, Belgium, Greece, Ireland, Netherlands, Portugal.

⁴While *Labour Force Survey* has published prefectural data since 1997 on a trial basis, the data is not sufficiently long for panel time-series.

leads to the following:

$$g(N_{it}) = g(POP_{it}) + g(P_{it}) + g(E_{it}), \quad (1)$$

where the function, g , expresses growth rate. That is, a change in employment in a region is decomposed into changes in three factors *ex post*: population (mainly due to mobility), participation rate, and employment rate.

Now let's calculate macro and specific shocks in accordance with Decressin and Fátas (1995). First, estimate to what extent labour variables in each region are explained by macro variables. For employment(N_{it}), unemployment rate(U_{it}), participation rate (P_{it}) in each region, the following regressions are estimated. Note subscript i and J show a regional disaggregate ($i = 1, 2, \dots, 10$) and a national aggregate variable, respectively.

$$\Delta \log(N_{it}) = \alpha_{1i} + \beta_{1i} \Delta \log(N_{Jt}) + \eta_{1it} \quad (2)$$

$$U_{it} = \alpha_{2i} + \beta_{2i} U_{Jt} + \eta_{2it} \quad (3)$$

$$\log(P_{it}) = \alpha_{3i} + \beta_{3i} \log(P_{Jt}) + \eta_{3it} \quad (4)$$

The appendix table shows results for each region as well as their averages and standard deviations⁵. For comparison, the average and standard deviation for European regions are also calculated from Appendix of Decressin and Fátas (1995). The table shows Japanese regions are more homogenous than European ones. As for US regions, similar comparison is unavailable because Decressin and Fátas (1995) does not carry detailed results for US. However, judging from US 's average \bar{R}^2 of Eq. (2) equal to 0.60, regional heterogeneity is almost comparable between Japan and US.

⁵Note the average on the table is arithmetic mean, while the relation between regional and macro variables implies weighted average of the estimates β_{ki} ($k = 1, 2, 3$) should be equal to one.

Second, utilising the results of Eq.(2) to (4), idiosyncratic shocks to each region are calculated as below:

$$n_{it} = \log(N_{it}) - \hat{\beta}_{1i} \log(N_{jt}), \quad (5)$$

$$e_{it} = \log(E_{it}) - \hat{\beta}_{2i} \log(E_{jt}), \quad (6)$$

$$p_{it} = \log(P_{it}) - \hat{\beta}_{3i} \log(P_{jt}). \quad (7)$$

Here ADF tests are applied to the above three kinds of idiosyncratic shocks in 10 regions, i.e. 30 times in total. While We assume n_{it} to be $I(1)$ and e_{it} and p_{it} to be $I(0)$ although non-stationarity can not be rejected in most cases for the last two variables in order to keep consistency with Decressin and Fátas (1995).

3 Univariate analysis

This section estimates an autoregressive model for each of the three shocks, (n_{it}, u_{it}, p_{it}) , defined in the previous section, and examines their characteristics. The following fixed-effect models with two lags are applied to the panel data with 10 regions and the period of 1986 to 2003:

$$\Delta n_{it} = \gamma_{0i} + \sum_{j=1}^2 \gamma_j \Delta n_{it-j} + v_{it}, \quad (8)$$

$$u_{it} = \theta_{0i} + \sum_{j=1}^2 \theta_j u_{it-j} + \zeta_{it}, \quad (9)$$

$$p_{it} = \phi_{0i} + \sum_{j=1}^2 \phi_j p_{it-j} + \rho_{it}. \quad (10)$$

According to literature of dynamic panel, in the data with $N \times T$, the obtained estimator may not meet consistency for fixed T even as $N \rightarrow \infty$, while it does for fixed N as $T \rightarrow \infty$ (Smith and Fuertes, 2004)⁶. Note Decressin and Fátas (1995)

⁶In this paragraph, N expresses not the number of employment, but that of individuals, according to usual panel data econometric usage.

does not take any means to correct possible biases due to short time dimension. This paper does not take any measures to correct the small sample biases, either, in order to ensure comparability with the results of Decressin and Fátas (1995).

Table 2 summarises the estimation results, along with those for US and Europe taken from Decressin and Fátas (1995). Figure 1 and 2 show impulse response functions for Japanese, US, and European regions. Note here the initial shocks are normalised to be unity at $t = 1$ in all the three cases because the size of shocks might be related to degree of regional disaggregation.

First, look at US and European results as benchmarks. An idiosyncratic shock to employment causes larger effects in US than in Europe (Figure 1). Unlike in Europe, the initial shock is amplified more than twice until it comes to stabilise in the seventh year in US. Decressin and Fátas (1995) argues that the magnification in US may be brought about by larger labour mobility, or more fundamentally, more specialisation of production, among regions. With regard to unemployment rate, the idiosyncratic shock exerts longer lasting effects in US than in Europe (Figure 2). Note, in contract, when Eq. (9) is applied to a regional unemployment rate itself, (U_{it}), its effects are more persistent in Europe than in US (Figure 3). Decressin and Fátas (1995) thus argues persistent unemployment rate in Europe is caused by macro shocks.

Superimposing the impulse response function for Japan on those for Europe and US in Figure 1 to 3 reveals the following two points. First, Japanese impulse response function for employment is more similar to European than US counterparts. The initial shock is not magnified, but dampened, rather surprisingly. Because border matters in transactions, as shown in McCallum (1995), inter-regional trade volume should be much larger in Japan than in Europe (i.e. across several borders), and could be comparable to that in US. Therefore, the perception that more ‘division of labour’ of production could be developed in Japan leads to the

following question: why is the impulse response function for Japan nonetheless not much different from European counterpart?

Second, the macro shock to unemployment rate is more important than the idiosyncratic one in Japan, exerting permanent effects on it. This is a feature shared by European case. Because the sum of coefficients on lagged regional unemployment rate is close to unity for Japan and Europe, as shown in Table 2, regional unemployment rate follows an $I(1)$ process in both countries⁷. Figure 3 also suggests that US regional unemployment rate is rather close to $I(0)$ process. Moreover, as for the idiosyncratic shock, the effects are as persistent in Japan as in US. Thus, ‘stickiness’ of changes in Japanese regional unemployment rate is outstanding, compared to Europe and US ones.

4 Three-variable VAR model

This section examines panel data of 10 regions and 18 years (1986-2003) by three-variable VAR model with each variable being an idiosyncratic shock to employment, participation rate, and unemployment rate, respectively. Allowing fixed-effect for each region and 2 lags, the below are estimated,

$$\mathbf{X}_{it} = \mathbf{A}_{i0} + \mathbf{A}_1 \mathbf{X}_{i,t-1} + \mathbf{A}_2 \mathbf{X}_{i,t-2} + \boldsymbol{\varepsilon}_{it}. \quad (11)$$

Here \mathbf{X}_{it} is defined as $[\Delta n_{it}, e_{it}, p_{it}]'$, and \mathbf{A}_{i0} and $\mathbf{A}_j (j = 1, 2)$ are three-by-one, and three-by-three coefficient matrices, respectively. The fixed-effect, \mathbf{A}_{i0} , represents steady forces driving the economies toward their steady state, for example, population mobility to offset income disparity. Identification restrictions assume a shock to Δn_{it} to be labour demand shock, thereby affecting e_{it} and p_{it} simultaneously, but

⁷Strictly speaking, in Japan, the sum is slightly larger than unity, and therefore the shock tend to grow as time passes, as is observed in Figure 3. Note, however, the sum is not significantly different from unity. As for Europe, because the sum is less than unity, the shock tends to die down gradually.

not vice-a-versa. Likewise, a shock to e_{it} is assumed to affect p_{it} simultaneously, but not vice-a-versa.

The estimation results are shown in Table 3 and imply impulse response function corresponding to labour demand shock in Figure 4. Comparison of this figure with European and US counterparts in Fig.10 and 11 of Decressin and Fátas (1995) clarifies the following points. First, low explanatory power of employment rate, e_{it} , which is shared by Europe and US regions in Decressin and Fátas (1995), is also true to Japanese ones. Second, as for participation rate, p_{it} , Japan belongs to European camp: labour participation rate mainly absorbs effects of labour demand shocks especially in early stages. Third, a close look at the response of labour participation rate indicates its more persistence in Japan than in Europe. While the rate loses explanatory power in the third year in Europe⁸, it still accounts for more than 20 per cent of the initial shock in the fifth year in Japan⁹. Fourth, the residual not accounted for by either e_{it} or p_{it} , i.e. a role played by labour mobility (see Eq. (1)), is quite large in US even at early stages. In Europe, it can explain about 100 per cent of the effects after the third year. However, in Japan, because of long lasting effects due to changes in labour participation rate, the effects of labour mobility are delayed, compared to US and Europe.

In sum, Japan's response to the labour demand shock resembles that of Europe in that labour participation rate mainly absorbs the shock, especially in early stages, which is followed by labour mobility. However, labour participation rate plays a larger role in Japan than in Europe: the other side of the same coin, given a limited role of unemployment rate, is that labour mobility plays a smaller role in Japan. This is rather surprising because it seems unnatural that adjustment across country

⁸Note, because a shock is given in $t = 1$ in Figure 4, $t = 4$, when labour participation rate is close to zero, means the third year after the shock.

⁹This is calculated as $0.14/0.67$ in $t = 5$ as read from Figure 4a.

borders is conducted mainly through labour mobility.

Two remarks are in order, regarding labour mobility's role. First, the result might be influenced by the degree of disaggregation of Japanese regional data, which is noted in section 2.1. In order to investigate this effect, it is necessary to use more disaggregate regional data. Second, small labour mobility in Japan may reflect larger employment security. The effect needs to overwhelm the "border effects" in Europe to provide a coherent picture.

5 Conclusion

This paper applies methodology of Decressin and Fátas (1995) to Japanese regional labour data to investigate how Japanese regions response to external shocks, and compares the results with theirs. Three-variable VAR model, which consists of employment, labour participation rate, and employment, is estimated. The results are interpreted, taking advantage of identity of the variables that a change in the first should be accounted for by a change in population and the other two variables. Comparison of the three variables' responses to a labour demand shock tells that Japanese response resembles European rather than US one at a first approximation. A feature of a large role of a change in labour participation rate in absorbing the shocks is common to US and Europe, while it is outstanding in Japan. A change in employment rate (or unemployment rate) plays a small role in the adjustment in Japan as is observed in Europe and US. Hence, labour mobility's role is more limited in Japan than in Europe. This is rather surprising because "border effects" may be still working in Europe, thereby limiting movement of labour force and goods trade across borders. Note, however, unavailability of regionally disaggregated data with long time-series might affect our results.

References

- Blanchard, Olivier Jean and Lawrence Katz (1992) “Regional Evolutions.” *Brook-
ing Papers on Economic Activities*. Vol. 1. pp. 1–75.
- Decressin, Jörg and Antonio Fátas (1995) “Regional Labor Market Dynamics in
Europe.” *European Economic Review*. Vol. 39. pp. 1627–1655.
- Fátas, Antonio (2000) “Intranational Labor Migration, Business Cycles, and
Growth.” In Gregory D. Hess and Eric van Wincoop. eds. *Intranational Macroe-
conomics*. Chicago, USA: University of Chicago Press. pp. 156–186.
- McCallum, J. C. P. (1995) “National Borders Matter: Canada-U.S. Regional Trade
Patterns.” *American Economic Review*. Vol. 85. pp. 615–623.
- Smith, Ron P. and Ana-Maria Fuertes (2004) *Panel Time-Series*. mimeo.

Table 1 Comparison of size of regions

	number of regions	area 000 km ²	population 2001, 000s	value added 2002, billion \$
Japan	10	37.8	12,729.1	399.3
USA	51	183.8	5,598.9	203.6
Europe	51	46.4	6,944.4	157.4
<i>Memorandum item</i>				
Japanese prefectures	47	8.0	2,708.3	85.0

注： Value added in dollars is calculated by market exchange rate
 Calculated from OECD, *OECD in Figures*, 2003 edition.

Table 2 Estimation results of univariate models

	Lag	Japan (10 regions) (1986-2003)		Europe (51regions) (1966-1987)		USA (51regions) (1970-1990)	
		estimate	s.e.	estimate	s.e.	estimate	s.e.
n(it)	1	-0.0417	0.0719	-0.0017	0.0371	0.6481	0.0333
	2	-0.1817	0.0551	0.0466	0.0372	-0.0845	0.0354
u(it) (idiosyncratic shocks to regional unemployment rate)	1	0.4660	0.0903	0.9787	0.0337	0.8770	0.0322
	2	0.2039	0.0679	-0.4858	0.0331	-0.1630	0.0320
U(it) (regional unemployment rate)	1	1.1767	0.0555	1.305	0.034	0.922	0.032
	2	-0.1576	0.0652	-0.374	0.034	-0.263	0.032
p(it)	1	0.7739	0.0750	0.476	0.054	0.665	0.040
	2	-0.0253	0.0702	-0.015	0.047	-0.197	0.040

注 Results for Europe and USA are taken from Deccassin and Fatas (1995).

Figure 1 Responses to an idiosyncratic shock to employment

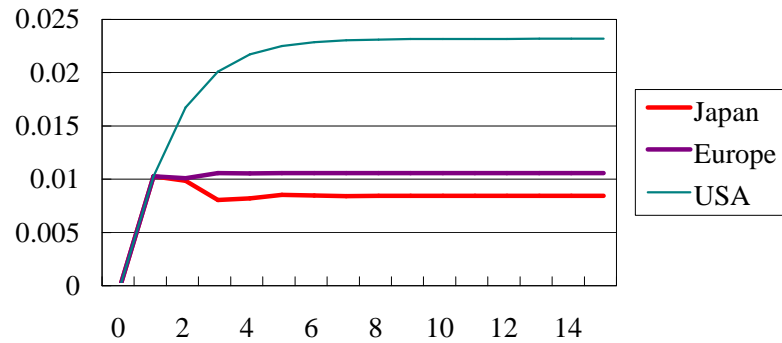


Figure 2 Responses to an idiosyncratic shock to unemployment rate

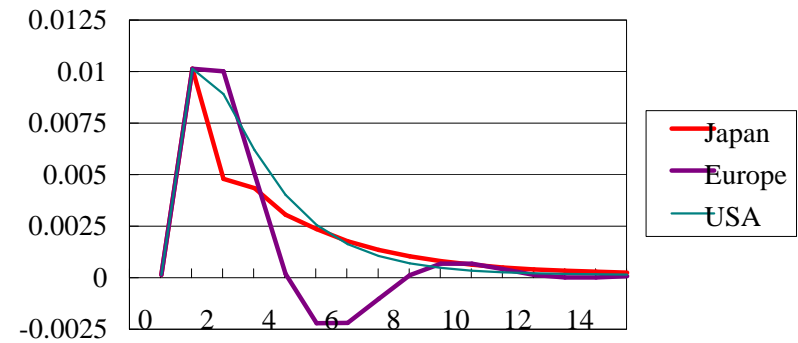
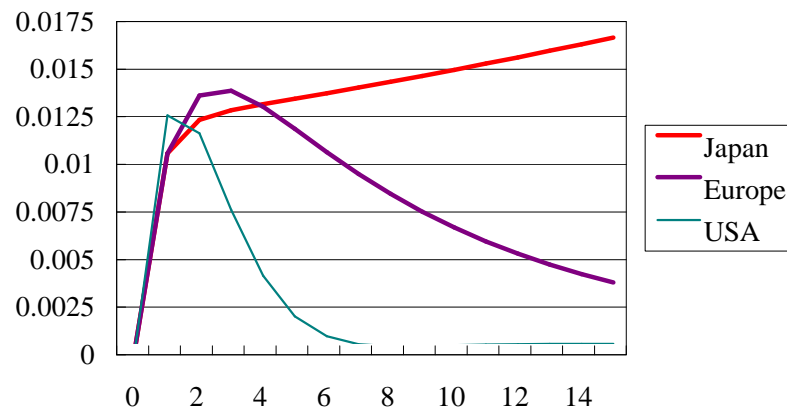
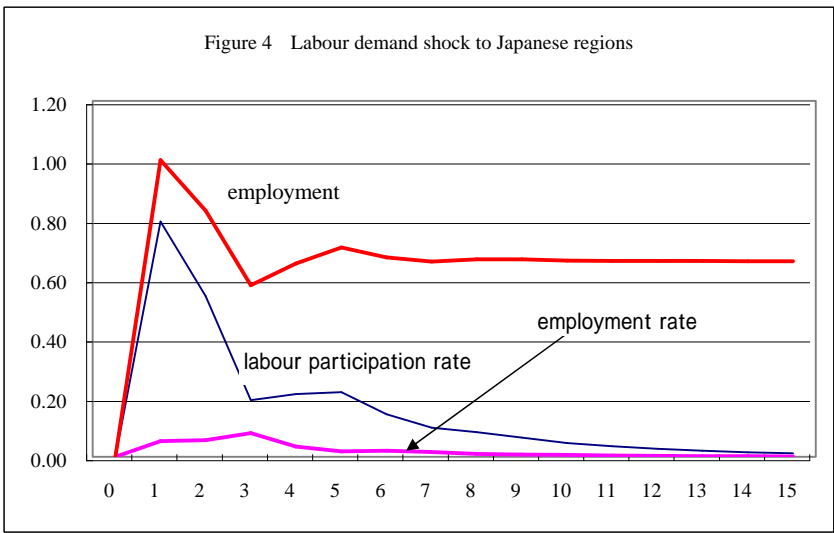


Figure 3 Responses to a shock to unemployment rate



Note : Estimates for Europe and USA are calculated based on Decressin and Fatas (1985).

Figure 4 Labour demand shock to Japanese regions



Appendix Estimation results for Eq.(2) to (4)

	Eq.(2)		Eq.(3)		Eq.(4)	
	$\beta 1$	adj-R ²	$\beta 2$	adj-R ²	$\beta 3$	adj-R ²
Hokkaido	0.940	0.434	0.910	0.780	0.720	0.574
Tohoku	0.974	0.682	1.079	0.946	1.206	0.555
South Kanto	1.012	0.811	1.009	0.953	0.639	0.268
North Kanto and Kosin	1.136	0.787	0.955	0.976	1.328	0.598
Hokuriku	0.925	0.520	0.815	0.971	1.432	0.803
Tokai	0.939	0.712	0.838	0.977	1.218	0.828
Kinki	1.336	0.864	1.294	0.991	1.186	0.717
Chugoku	0.955	0.591	0.775	0.957	1.369	0.663
Shikoku	0.601	0.315	0.800	0.898	1.439	0.408
Kyushu	0.768	0.605	0.961	0.927	0.617	0.524
Japanese 10 regions						
average	0.958	0.632	0.944	0.938	1.115	0.594
standard deviation	0.195	0.174	0.158	0.062	0.328	0.172
EU 51 regions						
average	1.070	0.198	1.085	0.893	1.569	0.269
standard deviation	0.769	0.175	0.646	0.114	2.334	0.288

Note : Values for EU 51 regions are calculated from Deccassin and Fatas (1995) Appendix Table A.1.