Developing the Business Index by Japanese Power Supply Area
− Application to Regional Business Cycle Analysis −

Background

Since the industrial demand of electricity is strongly influenced by business cycles, the power company needs to capture the business conditions in its power supply area in order to estimate the electricity demand more accurately. So far, however, only a few studies have tried to develop the regional business index for analyzing regional business cycles consistently.

Objectives

The purpose of this study is to develop the business index by Japanese power supply area based on the general definition of business cycles, which is summarized by saying that "business cycles consist of the pattern of recurrent, serially correlated and cross-correlated movements in numerous economic activities." In addition, we illustrate the characteristics of each regional business cycle derived from the estimated business index in this study and provide useful information for a forecast of the regional electricity demand.

Principal Results

We have estimated nine regional business indices in Japan using monthly four economic indicators comprising (1) Index of industrial production, (2) Large-scale industrial power consumption, (3) Large-scale retail sales and (4) Effective job offer rate. The main results of our study are described as follows,

1. Nine regions of Japan can be classified into the following three groups with respect to the characteristics of business cycles,

(1) *The regions relatively influenced by production and consumption* - Chubu, Hokuriku, Chugoku and Kyushu, where the industrial production and the consumption change have more influence on each regional business index than the employment situation.

(2) *The regions relatively influenced by production and employment* - Tohoku, Kanto and Shikoku, where the employment situation as well as industrial production has more influence on each regional business index than the consumption change.

(3) *The regions influenced by all factors in balanced manner* - Kansai and Hokkaido, where the industrial production, the consumption change and the employment situation in a balanced manner have an influence on each regional business index.

2. Each region can be classified into the following four groups according to the business cycle turning points,

(1) *Regions with similar cycles to the nation-wide business cycles* - Kanto and Kansai, where the expected durations of the expansion and the contraction phases are close to those of the nation. The duration of a business cycle in these regions is similar to the national cycle.

(2) *Regions with shorter cycles than the nation-wide business cycles* - Hokkaido, Chubu, Hokuriku and Shikoku, where the expected duration of a business cycle is shorter than the national cycle.

(3) *Regions with higher share of the expansion phase* - Tohoku and Kyushu, where the expected duration of the expansion phase is longer than the national cycles. In these areas, the expansion phase tends to continue longer once the business condition hits a bottom.

(4) *Regions with higher share of the contraction phase* - Chugoku, where the expected duration of the contraction phase is shorter than the national and other regional cycles. In this case, the contraction phase is likely to continue longer once the business condition turns into the sluggish phase.

Future Developments

The spatial dependency among regions should be taken into account when analyzing the causality of regional economic activities. A further extension of this study is to examine the temporal and spatial causality of regional business cycles.

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Reference

Hayashida and Hitomi, 2007, "Developing the Business Index by Japanese Power Supply area", CRIEPI Report Y07003 (in Japanese)

Table 1 Estimation results of regional business cycles
－Three categories based on the characteristics of business cycles－

	Components	National Cycle	1. Regions relatively influenced by production and consumption				2. Regions relatively influenced by production and employment			3. Regions evenly influenced by all factors	
			Chubu	Hokuriku	Chugoku	Kyushu	Tohoku	Kanto	Shikoku	Hokkaido	Kansai
Factor loadings	Industrial production	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎
	Power consumption	◎	◎	◎	◎	◎	△	△	◎	◎	◎
	Retail sales	◎	◎	◎	◎	◎	△	△	△	◎	◎
	Job offer rate	△	△	△	△	△	◎	○	◎	○	○

Each regional business index is estimated by extracting a principal component related to business cycle change using four indicators, index industrial production, large-scale power consumption, large-scale retailsales and effective job offer rate. In this case, each factor loading indicates the influence of the component on the business index. The higher the factor loading, the more important role that component contributes to the change of business cycles. Note that "△" is used when the factor loading is less than 0.35, "○" when the factor loading is between 0.35 and 0.65, and "◎" when the factor loading is more than 0.65.

Table 2 Estimation results of business cycle turning points
－Four categories based on the duration of business cycle－

Calendar year		National cycle	1. Similar to national cycle		2. Shorter than national cycle				3. Higher share of expansion phase		4. Higher share of contraction phase
			Kanto	Kansai	Hokkaido	Chubu	Hokuriku	Shikoku	Tohoku	Kyushu	Chugoku
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Monthly expected duration	Expansion	30.4	32.3	26.8	16.3	17.0	23.2	22.0	35.1	32.3	5.4
	Contraction	12.7	13.2	13.6	6.4	9.5	5.4	7.7	7.8	8.0	10.5
	Total	43.0	45.6	40.3	22.7	26.5	28.6	29.7	42.9	40.3	15.9
Average Growth	Expansion	0.030	0.044	0.035	0.027	0.044	0.040	0.033	0.048	0.023	0.063
	Contraction	-0.046	-0.048	-0.073	-0.060	-0.048	-0.105	-0.094	-0.192	-0.051	-0.023
	Total	0.007	0.003	-0.001	0.007	0.011	0.013	0.000	0.004	0.008	0.007
Steady state prob.	Expansion	0.705	0.709	0.663	0.719	0.642	0.810	0.741	0.818	0.801	0.342
	Contraction	0.295	0.291	0.337	0.281	0.358	0.190	0.259	0.182	0.199	0.658

The estimation results of the regime switching model being used to estimate the turning points of business cycles are summarized here. The shading block indicates the contraction phase of each region. The monthly expected duration explains the average successive period of each phase. The average growth of business index of each phase is shown in the average growth row. Finally, the steady state probability indicates the probability that a contraction and an expansion phase will take place in the long run.