Assessing the Regional Business Cycle Asymmetry in a Multi-level Structure Framework: A Study of the Top 20 U.S. MSAs

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Abstract

This paper examines the asymmetric behavior of the regional economies in a multi-level framework. Using a Markov-switching model to date the regional cycle phases, the results reveal that the cycle phase transitions of regional economies are dependent on the national cycle phase. By identifying the national factor loadings of the regional economies at each phase, the national shock transmission to the regional economy asymmetrically depends on the national cycle phase and the regional cycle phase. Conceptually, the propagation of the national cycle phase into the regional economy can be understood as the propagation of the market environment into the regional economies, whereas the national factor loadings of each regional economy at each cycle phase should be regarded as the shock transmission mechanism that is characteristic of a specific region at a specific cycle phase. The regional economies are different from each other only in terms of the timing and the duration of the cycle phase because of the differences in the national cycle/shock transmission channel.

Research Procedure – 2 Step

1. Cycle Phase Identification (Markov-switching Model)

- Regional Series (\(f_t^r\)) are dated with High-growth Phases (\(S_{1t} = 1\)) and Low-growth Phases (\(S_{1t} = 0\))

\[
\begin{align*}
\text{Regional Phase Identification using Regional r Business Activity Index, } f_t^r \\
\rho_{1^t} = \mu_{1^t} + \varepsilon_{1^t}, \quad \varepsilon_{1^t} \sim N(0, \sigma_{1^t}^2)
\end{align*}
\]

where, \(\rho_{1^t} = \mu_{1^t} + \varepsilon_{1^t}, \quad 0 < \rho_{1^t}, \quad \text{and } S_{1^t} = (0,1)\)

- The Regional Cycle Phase Transition Probability is dependent on the National Cycle Phase (\(S_1\))

\[
\begin{bmatrix}
\pi_{00}^r \\
\pi_{01}^r \\
\pi_{10}^r \\
\pi_{11}^r
\end{bmatrix}
= \text{Pr}(S_{1^t} = j | S_{1^t} = i, C_{1^t} = r)
\]

The Transition Probability Depends on the National Cycle Phase, \(S_1\)

2. Factor Loadings (Phase-augmented ARIMAX Model → IRF)

\[
\begin{align*}
\rho_t = \mu_t^r + \varepsilon_t, \quad \varepsilon_t \sim N(0, \sigma_t^2)
\end{align*}
\]

where, \(\rho_t = \mu_t^r + \varepsilon_t, \quad \text{where } \mu_t^r = \mu_{1^t} + \varepsilon_t \sim N(0, \sigma_{1^t}^2)\)

* \(\varepsilon_t^r\) is also dependent on the national phase state \(S_r\)

\[
\begin{align*}
f_t^r = \rho_t \theta_{1^t} + \theta_{2^t} f_{t-1}^r + \theta_{3^t} f_{t-2}^r + \theta_{4^t} f_{t-3}^r + \varepsilon_t \sim N(0, \sigma_{t^r}^2)
\end{align*}
\]

where, \(S_r\) and \(S_t\): cycle phase notation of national economy and regional r economy,
\(\mu_{1^t}^r\): average growth rate of regional r economic activity at t given state \(S_r\),
\(\mu_{1^t}^r\): average growth rate of national economic activity at t given state \(S_r\),
\(\theta_{3^t}\): lagged regional factor loading of regional r given state \(S_r\),
\(\theta_{4^t}\): national factor loading of regional r given state \(S_r\),

Coefficients are also dependent on the Regional Business Cycle Phase, \(S_r\)

Impulse Response Results

The Magnitude of the Response at the Regional Level is Larger when the National Economy is in Expansion Phase

- Impulse: one standard deviation amount of positive national shock
- Cumulative Response: Chicago Metropolitan Area