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# How strong is co-movement in employment over the business cycle? Evidence from state/sector data

Gerald A. Carlino<sup>a,\*</sup> and Robert H. DeFina<sup>b</sup>

<sup>a</sup> *Federal Reserve Bank of Philadelphia, 10 Independence Mall, Philadelphia, PA 19106, USA*

<sup>b</sup> *Department of Economics, Villanova University, 800 Lancaster Ave., Villanova, PA 19085, USA*

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## Abstract

This study measures the extent of co-movement in employment across states and sectors at business-cycle frequencies. The strength of co-movement is quantified using the cohesion measure developed by Croux, Forni, and Reichlin (Rev. Econ. Statist. 83 (2001) 232). The data indicate that cohesion is generally positive for the state/sector pairs, although the distributions mass around relatively low values. The results suggest that cohesion has risen over time and that cohesion increases with spatial aggregation. Evidence reveals that the measured degree of co-movement is sensitive to the chosen periodicity of the data and that there is much greater cohesion across states for a given sector than across different sectors within a state. An investigation into the sources of cross-state variation in cohesion reveals that important determinants include the share of state employment in manufacturing, the different effects of monetary policy actions on each state's employment, and the degree of sectoral diversity within a state.

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## 1. Introduction

The tendency of output and employment to co-move positively across broad sector categories is a well-documented feature of national business cycles.<sup>1</sup> Much less is known, however, about the degree of co-movement at the state and regional levels. Local economies are

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\* Corresponding author.

*E-mail address:* [jerry.carlino@phil.frb.org](mailto:jerry.carlino@phil.frb.org) (G.A. Carlino).

<sup>1</sup> Relevant theoretical and empirical analyses include Long and Plosser [25,26], Startz [35], Cooper and Haltiwanger [13], Murphy et al. [30] and Shea [33].

clearly influenced by aggregate and sector-specific shocks. Moreover, propagation mechanisms that transmit shocks across sectors at the national level also operate at the sub-national level.<sup>2</sup> But influences specific to regions and to particular sectors within regions can intervene to alter cyclical behavior, such as the extent of co-movement, relative to that observed for sectors at the national level. Indeed, the notions of a “rolling recovery” and of a “bicoastal recession” used in journalistic discussions suggest an awareness that the magnitude and timing of fluctuations in business activity vary across regions.

In this study, we quantify the degree of co-movement in quarterly one-digit sectoral employment within and across states and regions. The analysis spans the years 1942 to 1995, a period that includes ten national business cycles as defined by the National Bureau of Economic Research (NBER). The measurements are important for several reasons. First, they represent basic stylized facts needed for regional business-cycle analysis. Indeed, they help to understand whether local economies experience what are commonly thought of as business cycles. While previous studies have explored the sources of shocks to regional economies and the presence of regional spillovers, they have offered little evidence on the strength and direction of sector co-movement that results.<sup>3</sup> Second, the estimates allow a comparison with the degree of co-movement at the national level and so give insight into the importance of national versus region-specific shocks in local business activity. Third, they provide data for an investigation into the reasons for regional differences in co-movement.

Two things are needed to study sector co-movement: a measure of the business-cycle component of the data and a definition of co-movement. The business-cycle components of the employment data are extracted using a band-pass filter to remove frequencies shorter than six quarters and longer than 32 quarters, a standard approach in the literature describing business cycles (see, e.g., Burns and Mitchell [5], McCarthy and Steindel [28], Baxter and King [2] and Christiano and Fitzgerald [10]). The measure of co-movement used in this study consists of the dynamic correlation between the band-passed series, as described in Croux, Forni and Reichlin [17] (hereafter CFR [17]). CFR [17] refer to this measure as cohesion and argue that it is better suited to gauging the degree of co-movement than are other commonly used techniques such as squared coherence, co-integration, common features, and common cycles.

The study reports six main findings. First, the distribution of bivariate cohesions for all state/sector pairs is widely dispersed but generally positive, confirming the idea of cross-sector co-movement of employment. However, the distribution masses around a relatively low value, suggesting considerable idiosyncratic variation in state sectoral employment cycles. Second, state/sector cohesion has risen over time. Possible reasons include technical innovations in communication and transportation technologies that have helped to transmit shocks across states and sectors to a greater extent than previously. Third, cohesion increases with spatial aggregation. That is, cohesion of sector cycles at the national level is substantially greater than at the state level. Fourth, the degree of sector co-movement is sensitive to the chosen periodicity of the data. Cohesion indexes computed

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<sup>2</sup> Among these are demand and input–output relationships among industries, imperfect competition and inventory holdings, and external economies of scale.

<sup>3</sup> Clark and Shin [12] provide a thorough review of relevant literature.

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