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Information Theoretic Shift-Share Modeling for the Analysis of Change in Geographical Concentration of Manufacturing Employment

The study of change in the geographical concentration or decentralization of manufacturing employment within a nation or sub-nation has long been an important research activity for geographers, economists and policy analysts. Geographical concentration of manufacturing employment refers to the extent to which manufacturing employment is spatially concentrated within a few spatial areal units of the entire study region. Previous studies of geographical concentration of industrial employment have used the conventional shift-share model alone, or an overall measure of geographical concentration of industrial employment, such as the Gini coefficient, the coefficient of variation, the Shannon entropy, either alone or in combination with the conventional shift-share model. Each of the existing empirical approaches to the analysis of geographical concentration of industrial employment has serious limitations. First, the conventional shift-share approach for understanding a decrease or an increase in geographical concentration of manufacturing employment lacks a measure of the extent of such a spatial process. Secondly, the shift-share approach to the determination of the existence of decline in geographical concentration of industrial employment is both subjective and difficult to reproduce reliably, because the shift-share approach relies on visual tracking of the pattern of the industry-mix and competitive components in the core and periphery regions across two sub-periods. The shift-share based approach then determines of the existence of geographical deconcentration of industrial employment through visual identification of "a reversal of signs of industry-mix and competitive components in the two regions at the end of the study period" (Park and Lewis, 1991; Barkley, 1988; Rees, 1979). Thirdly, the shift-share approach mistakenly assumes the process of uneven regional employment growth is the same as the process of geographical concentration of industrial employment. Fourthly, in those studies of the geographical concentration of industrial employment that use an overall measure of geographical concentration, such as the Gini, the Shannon or similar measure, there is the absence of any accounting of the change in the geographical concentration of industrial employment that accommodates both differences in regional industrial specialization and differences in regional competitiveness across time.

The serious shortcomings of previous studies of geographical concentration of industrial employment certainly warrant modeling efforts to develop empirical models that enhance our understanding of the process of change in the geographical concentration of industrial employment. This dissertation proposal has three aims that contribute to the common goal of improving our understanding of the changing nature of the spatial concentration of manufacturing employment within regional systems. The first objective is to propose a new method for the decomposition of overall change in geographical concentration of manufacturing employment into information theoretic shift-share components. Decomposition of overall change in geographical concentration of manufacturing employment into information theoretic shift-share components refers to the determination of the contribution of each of several, information theoretic shift-share parts to the total change in geographical concentration of manufacturing employment. The new method is information theoretic because it uses an overall measure of geographical concentration of a variable that statisticians developed in the field of statistical information theory. Furthermore, the new method uses statistical information theory and the location quotient of each region to generate a detailed information-theoretic shift-share accounting of the observed change in geographical concentration of manufacturing employment. I propose two information theoretic shift-share models. The first

decomposition model integrates information theory and the Esteban-Marquillas (1972) shift-share extension. The second decomposition integrates information theory and the shift-share extension developed by Arcelus (1984).

The second aim is develop a new theoretical framework that links a region's industrial specialization and a region's competitive gains or losses to the region's contribution to change in overall geographical concentration of manufacturing employment, during a particular study period. The information theoretic shift-share method further uses the location quotient of each region to incorporate the effects of a region's overrepresentation (underrepresentation) in manufacturing on a region's contribution to overall decline in geographical concentration of manufacturing employment. For example, the information theoretic shift-share decomposition reveals that a particular region with a competitive employment gain must have underrepresentation in that industry in which the region possesses a competitive advantage, in order for the region's competitiveness to contribute to a decline in the geographical concentration of manufacturing employment within the region system. Such an insight is absent from shift-share approach to geographical deconcentration of manufacturing employment, because the shift-share approach incorrectly assumes that a region's competitive employment gain always contributes to spatial deconcentration of manufacturing employment. Furthermore, the new theoretical framework permits a delineation of hypotheses, which are consistent with existing geographic theories about the observed decline or increase in overall change in geographical concentration of manufacturing employment within a region system.

The third objective of the proposed study is to present three illustrations of the information theoretic shift-share method. Each empirical illustration uses the relative advantage theory of postwar geographical restructuring of manufacturing employment in developed economies to guide the specification of research hypotheses. Each empirical illustration uses the county as spatial unit of analysis and county manufacturing employment data in Indiana from the U.S. Bureau of the Census for the years 1950, 1960, 1970 and 1980. The first illustration examines the hypothesis that the primary sources of decline in the spatial concentration of manufacturing employment within Indiana were competitive employment losses within metropolitan areas and the concomitant increase of nonmetropolitan competitiveness for manufacturing jobs. The second illustration of the information theoretic shift-share method explores empirical support for the hypothesis that competitive gains in manufacturing employment within small metropolitan areas contributed more to the decline of postwar metropolitan decentralization of manufacturing employment in Indiana than competitive manufacturing employment losses in large metropolitan areas. The third empirical illustration of the information theoretic shift-share method assesses the empirical support for the hypothesis that competitive gains in low-wage and non-urban areas led the geographical dispersal of manufacturing employment within nonmetropolitan system of the state of Indiana.