ABSTRACT. The purpose of the present paper is twofold. First, we formulate a general method of identifying clusters of economic activity in a country or region. The methodology is based on generally available industry data and does not start from a priori notions of geographic or technology clusters. Second, the proposed methodology is then used to identify the main clusters of economic activity in Ohio and Sweden and their evolution over the last twenty years.

Introduction

For several years now, a group of Swedish researchers has investigated the role of “technological systems” in economic growth (see Carlsson, 1995 and 1997). Technological systems refer to networks of agents in any given field of techno-industrial activity, interacting within a particular institutional infrastructure, to generate, diffuse, and utilize technology (Carlsson and Stankiewicz, 1991). Thus, a technological system is a form of cluster of economic activity, closely related to Erik Dahmén’s concept of development blocs (Dahmén 1950 and 1989), and similar in many ways to the type of clusters studied by Michael Porter in his *Competitive Advantage of Nations* (1990). The technological systems framework includes not only market interaction among firms but also non-market interaction (especially in the form of knowledge spillovers) among firms on the one hand and various components of the infrastructure (e.g., academic institutions, research institutes, financial institutions, government agencies, and industry associations) on the other.

A common feature in various approaches to cluster analysis is the ad hoc nature of selecting economic activity for study. But what if it is not clear a priori what economic activities are clustered together? There may be forward and backward linkages, and formal as well as informal networks, which may not be easily identifiable by simply observing existing data, but whose nature may be an important determinant of economic development of a region. The input-output links between, say, the steel industry and the downstream metalworking industries are well-known, but the same is not true for the interaction between manufacturing industries and service industries, especially in the area of business services. The relationships between new firms in emerging sectors and existing (older and larger) firms in traditional industries are of particular interest in a dynamic perspective.

The purpose of the present paper is twofold. The first is to propose a systematic method of identifying clusters of economic activity. The basic idea is to identify industry clusters in a country or region, based on generally available industry data, through the use of a common methodology which does not start from a priori notions of geographic or technology clusters. Second, we will apply the chosen methodology to the analysis of two regions of approximately the same size and industrial structure to see whether the results are in line with expectations. Possible avenues to further refinement of the proposed methodology will also be elaborated. By relating
the results of the analysis to the macroeconomic performance over the last 20 years for these regions, we will argue that the outcome on the macro level is influenced by the dynamics of these regions’ technological systems.

The two regions we will focus on are the state of Ohio and the country of Sweden, which exhibit a number of similarities and differences. They are similar in terms of population size (10.8 million in Ohio vs. 8.7 million in Sweden in 1993), overall level of development (GDP/capita in 1993 of $23,300 vs. $16,800) and industrial structure (21.5% vs. 18.3% of the total labor force in manufacturing in 1993). However, there are also distinct differences in terms of economic policy and industrial development in recent years. Economic policies, of course, define the rules of the game and thereby define the framework in which technological systems operate. For example, regulation of the labor market may affect small firms more than large, and taxation policies and the financial system may favor certain firms (e.g., existing firms as distinct from new ones) and industries, thus influencing the industry composition and structure.

The paper is organized as follows. We begin in the next section with a literature survey of analyses of industry clusters. This is followed by an overview of the present industrial structure in Ohio and Sweden and overall changes since 1975. We then present a methodology for identifying industry clusters. (For reasons of space, the geographic aspects of this clustering within each region will not be discussed here.) This methodology is used to identify the main clusters of economic activity in Ohio and Sweden and their evolution over the last twenty years. The final section presents our conclusions and raises some issues for further research.

The clustering of economic activities: previous research

In the theoretical literature, two main explanations of agglomeration in clusters can be discerned. The first explanation builds on supply and demand linkages, where market proximity is viewed as facilitating access to suppliers and customers. Second, the possibility of reaping spillovers which are “sticky” in nature (in the sense that they adhere to a particular location) fosters spatial concentration. This seems to be particularly relevant for knowledge, or R&D-intensive, firms. Hence, the literature has singled out two criteria as particularly important in defining clusters: economic activities should be spatially concentrated, and there should be a certain degree of interaction among economic agents. Whenever such agglomeration economies exist, they have a tendency to become reinforced over time. If firms locate where markets are large, this will further increase market size and attract other firms, and as Myrdal (1957) puts it, initiate a pattern of “cumulative causation”.

Demand and supply linkages

Agglomeration effects were first explicitly defined in Alfred Weber’s (1909) seminal work in locational economics. Weber distinguished between three different categories of determinants in location of manufacturing production: transport costs, labor, and agglomeration. The first two factors have to do with the technology of firms (labor- or raw material-intensive) and distance to markets. The third is linked to the exploitation of agglomeration economies, which, according to Weber, are defined as “. . . an ‘advantage’ or a cheapening of production or marketing which results from the fact that production is carried on to some considerable extent at one place . . .” (Weber, 1929, p. 126). More precisely, these advantages are divided into three categories: First, they can accrue from economies of scale related to the firm’s production. Second, clustering may occur because of proximity to suppliers, a pooled labor market, or localized diffusion of knowledge. Finally, concentration in production may give rise to external advantages such as a highly developed infrastructure, low costs of energy, etc., – i.e., what Weber refers to as urbanization economies.

The reasons for agglomeration are, in Weber’s view, based on a cost-minimization decision by the firms. Thus, firms would agglomerate into one spot only if the savings surpassed the costs. In other words, agglomeration was modeled as a trade-off between agglomeration economies and transport costs (see Krugman, 1991).2 Overall, however, locational economics became overshadowed by the dominance of the general equilibrium