



Clusters, convergence, and economic performance



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ABSTRACT

This paper evaluates the role of regional cluster composition in regional industry performance. On the one hand, diminishing returns to specialization in a location can result in a convergence effect: the growth rate of an industry within a region may be declining in the level of economic activity of that industry. At the same time, positive spillovers across complementary economic activities can provide an impetus for agglomeration: the growth rate of an industry within a region may be increasing in the “strength” (i.e., relative presence) of related industries. Building on Porter (1998, 2003), we develop a systematic empirical framework to analyze the role of regional clusters – groups of closely related industries operating within a particular region – in the growth of regional industries. We exploit data from the US Cluster Mapping Project to examine the effects of agglomeration within regional clusters after controlling for convergence at the region–industry level. Our findings suggest that industries located in a strong cluster register higher employment and patenting growth. Regional industry growth also increases with the strength of related clusters in the region and with the strength of similar clusters in adjacent regions. We also find evidence of the complementarity between employment and innovation performance in regional clusters: both the initial employment and patenting strength of a cluster have a separate positive effect on the employment and patenting growth of the constituent industries. Finally, we find that new regional industries emerge where there is a strong cluster. These findings are consistent with multiple types of externalities arising in clusters, including knowledge, skills, and input–output linkages.

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1. Introduction

Significant variation in regional economic performance is a striking feature of the US economy as well as that of other nations. Numerous theories have been proposed to explain why some regions achieve significantly higher growth rates than others in the highly open US economy, with particular emphasis on the role of initial conditions, the potential for innovation and knowledge spillovers, and the composition of economic activity (Porter, 1990; Barro and Sala-i-Martin, 1991; Glaeser et al., 1992; Venables, 1996; Henderson, 1997; Fujita et al., 1999). Policymakers and researchers have focused considerable attention on regions such as Silicon Valley, which appear to have achieved strong economic performance linked to the presence of innovative clusters of related companies and industries (Porter, 1990, 1998; Saxenian, 1994; Swann,

1998; Bresnahan and Gambardella, 2004). The empirical literature examining the impact of the presence of related economic activity on regional performance is small but growing, with most studies focusing on particular dimensions of performance (Baptista and Swann, 1998; Feldman and Audretsch, 1999; Combes, 2000a; Porter, 2003; Glaeser and Kerr, 2009; Delgado et al., 2010).

This paper focuses on the role of clusters – groups of closely related industries co-located in a region – in the employment and innovation growth of the individual industries that constitute each cluster. Empirical investigation of region–industry growth must account for two economic forces: convergence and agglomeration. Convergence arises when the potential for growth is *declining* in the level of economic activity as a result of diminishing returns (Barro and Sala-i-Martin, 1991). While many studies focus on diminishing returns at the regional level, convergence also arises at the region–industry level (Henderson et al., 1995; Dumais et al., 2002). In this case, the region–industry growth rate will be declining in the initial level of economic activity due to mean reversion or diseconomies of agglomeration (e.g., congestion costs that increase the price of inputs).

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Agglomeration exerts a countervailing force on regional performance. In the presence of agglomeration economies, growth is *increasing* in the level of economic activity (Glaeser et al., 1992). Agglomeration arises from interdependencies across complementary activities that give rise to increasing returns. The literature has often contrasted two potential types of agglomeration forces: localization (increasing returns to activities within a single industry) and urbanization (increasing returns to diversity at the overall regional level). The impact of these types of agglomeration is often obscured by the influence of convergence on growth. If both convergence and agglomeration effects are present at the region-industry level, the economic growth of a regional industry will reflect a balancing of the two effects (Henderson et al., 1995).

This paper moves beyond this impasse by focusing on the role of clusters of related industries in region-industry growth. While convergence may prevail at the region-industry level, we examine agglomeration forces that operate across industries within a regional cluster. The presence of complementary activity in a cluster may give rise to externalities that will facilitate the growth of the constituent region-industries.

Our focus on clusters provides three related contributions. First, we are able to move beyond the traditional dichotomy of agglomeration forces: localization of individual industries and urbanization arising from the overall diversity of regional economic activity (Glaeser et al., 1992; Henderson et al., 1995; Combes, 2000a). Instead, building on Porter (1998, 2003), we study agglomeration forces arising among related industries that constitute clusters. By sharing common technologies, knowledge, inputs, outputs, and cluster-specific institutions, industries within a cluster may benefit from numerous complementarities.¹

We evaluate the role of clusters in the employment and innovation growth of regional industries. Our empirical methodology examines agglomeration within the set of related industries that surround a region-industry, while accounting for convergence at the region-industry level. We expect that a region-industry growth in employment (and innovation) will increase in the “strength,” or relative presence of the regional cluster within which that industry operates.

Second, we examine the duality between employment and innovation performance in regional clusters. An active debate has centered on whether co-location of production and innovation is important for employment and innovation outcomes (Dertouzos et al., 1989; Helper et al., 2012; Porter and Rivkin, 2012; Berger, 2013). Motivated by this debate, we assess the role of the initial employment and innovation strength of a cluster in the growth of the industries in the cluster. If innovation concentration matters for employment creation, the innovation strength of the cluster will positively relate to the employment growth of the industries in the cluster.

This analysis also allows examining the types of cluster agglomeration that are associated with regional industry growth. For example, if the initial innovation strength in the regional cluster is the dominant influence on employment growth, this would suggest that employment growth is mainly driven by knowledge spillovers. However, if both the initial employment and innovation strength of the cluster matter for employment growth, this would suggest

that a broader set of mechanisms is at work, including input–output linkages and access to demand as well as knowledge spillovers.

Finally, we use the cluster framework to examine the diversification of regional economies. Several studies suggest that the emergence of new industries in a region is affected by the pre-existing industry composition of the region (Swann, 1998; Porter, 1998; Klepper, 2007, 2010; Neffke et al., 2011). Externalities of various sorts may arise within a regional cluster and in related clusters that influence the emergence of industries in the cluster.

We investigate these questions utilizing a novel panel dataset developed by the US Cluster Mapping Project (CMP). This database, drawing on the County Business Patterns data, provides a classification system for mapping clusters within the US economy. The CMP identifies 41 clusters incorporating 589 “traded” industries. Traded industries are those that concentrate in particular regions and sell products or services across regions and countries, in contrast to local industries that primarily serve the local market.

The database includes attributes of cluster composition and economic performance at the region-cluster-industry level between 1990 and 2005, covering 177 mutually exclusive Economic Areas (EAs) in the contiguous United States. We explore several measures of the strength of related industries surrounding a region-industry. We refer to this group of measures as the “cluster environment,” which includes the strength of the cluster in the region, the strength of related clusters in the region, and the strength of similar clusters in neighboring regions. For example, motor vehicles and car bodies (SIC-3711) is one of 15 industries in the automotive cluster. We look at the presence in a region of this industry and of the other 14 industries. The automotive cluster can also be linked to as many as six related clusters (such as metal manufacturing) that may be present in the region and to automotive clusters in geographically adjacent regions.

In order to examine the role of cluster agglomeration in the growth of the regional industries operating in a cluster, we must account for bias from unobserved factors. This includes the size of the region or policies associated with certain types of regions or industries that may be correlated with a region's cluster composition and subsequent performance. Our core models specify region-industry growth between 1990 and 2005 as a function of the initial size of the region-industry, the initial strength of the cluster environment around that region-industry, and region and industry fixed effects. By accounting for the overall growth rate of a given region and industry, we are able to examine the relationship between clusters and region-industry growth.

Our findings provide support for the distinct influences of convergence and cluster-based agglomeration. We find that the employment growth rate of a region-industry is *declining* in the initial level of employment at the region-industry, but is *increasing* in the employment strength of the cluster environment to which that industry belongs. This suggests that agglomeration economies arise within a regional cluster, across related clusters, and with the same cluster in neighboring regions. Based on our results, cluster agglomeration seems to matter for the employment growth of various types of industries, including both high-tech and low-tech manufacturing as well as service.

We also find evidence on the duality between employment and innovation performance in clusters. The initial employment and patenting strength of a regional cluster each have a separate positive relationship with region-industry employment growth. The positive effect of the patenting strength of the cluster on employment suggests that innovation in a cluster facilitates employment creation. Since both the employment and patenting strength of the cluster matter for growth, this suggests that multiple types of externalities are at work.

¹ Other studies examine the influence of various industry interdependencies, notably input–output, patenting, and occupational linkages, on the co-agglomeration of manufacturing industries in a region (Ellison and Glaeser, 1997; Ellison et al., 2010). However, they do not address the broader array of interdependencies associated with clusters of related industries in both service and manufacturing, and the role of clusters in regional industry performance. Frenken et al. (2007) move beyond urbanization economies by separating out the role of “related” and “unrelated” economic diversity in regional growth. We discuss these measures in Section 4.

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