3 Clustering in Space Versus Dispersing Over Space

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3.1 Introduction

In a previous study (Polenske 2001b), I have maintained that assets should form the base of a regional economic-development strategy, where assets include both tangible (e.g., physical infrastructure) and intangible (e.g., skills and knowledge) ones. I laid out the underlying institutional, economic, and physical factors needed to have successful development. In this chapter, I analyse regional economic development from a different, but related, perspective to examine the role played by economies of scale and innovation in making regions competitive and to help make regional economic development sustainable.

I hypothesize that two types of economies of scale may enhance regional economic growth. The first type is the well known ‘agglomeration economies’. The second type is ‘dispersion economies’, a concept that I first introduced in an earlier paper (Polenske 2001a). Other analysts either have dealt with this concept only indirectly in their discussions of the grouping and dispersing of economic activities, or they have used it in a different sense than I use the term here. Storper (1997, pp. 299-300), for example, briefly discusses how agglomeration economies may be more regional than local or may operate at a “system-of-city level”.

Also, in an earlier book, Storper and Walker (1989, pp. 70-71) discuss dispersing as one of four types of locational patterns of industries, calling it “deagglomeration”. Analysts explain this process of growth, they say, using either neoclassical or product-life cycle theories. Of the five variants of their theories of growth, the third one (p. 83) comes closest to my dispersion economy perspective. They state that “...industry... has dispersed rapidly in the twentieth century thanks to the flexibility and speed of truck traffic”. They cite various factors as causes of deagglomeration, such as deindustrialization processes (p. 97), core-periphery relations, (p. 180), and deskilling of labour (p. 181), but they do not think in terms of regional and global supply-chains.

Dispersion economies/diseconomies, as I define them, may occur if cost-savings/cost increases result when firms disperse their activities away from the home office, often along regional or global supply-chains. One typical cost-saving method is the potential reduction in inventories when suppliers and customers of a
firm are distributed along a supply chain. The new information and communication technologies (ICTs) certainly play an important role in promoting the dispersion of firms over space, partly because they may allow firms to reduce costs, details of which I discuss later.

In contrast, cost savings/increases that occur when firms locate in one geographical location may create agglomeration economies/diseconomies. If firms belonging to the same sector locate in one area, they may take advantage, on one hand, of the same training facilities, reaping a savings for all firms of a given sector (locational economies) or for firms from all sectors in a given region (urbanization economies). On the other hand, by locating close to other firms producing similar goods, they may create so much traffic that the congestion increases the time to ship inputs and outputs (locational/urbanization diseconomies). Following Hoover (1937, pp. 90-91), in his now classic location study of the shoe and leather industries, I distinguish two types of agglomeration economies: locational and urbanization economies. I use locational economies for the agglomeration economies accruing when similar firms locate in one area and take advantage of the various facilities in the region (trade associations, training institutes, etc.) and urbanization economies for the agglomeration economies accruing to a firm from the many different suppliers and producers locating in a particular area, each of whom takes advantage of the presence of banks, universities, labour, etc. that service diverse industries.

Thus, the factors leading to agglomeration and dispersion economies differ. Such a distinction should help policy planners realize that they need not follow a clustering strategy in order to have increased regional growth. Rather, for some situations, analysts should consider dispersing activities to reap cost-savings and other benefits.

![Fig.3.1. Agglomeration and dispersion economies and diseconomies of scale, AC = average cost, Q = quantity](image-url)
An analyst can use the same theoretical structure, shifts in the average cost curve of the firm/industry, to measure both of these concepts. In other words, Fig. 3.1 represents both agglomeration and dispersion economies/diseconomies. A dispersion economy/diseconomy, for example, is external to the firm; thus, it moves the entire cost curve of the firm down (up) at all output levels, although the old and the new cost curves do not have to be parallel at different scales of output. An agglomeration economy/diseconomy has the same effect on the cost curve. I stress, however, that the causes for the shifts from agglomeration economies usually differ from those for dispersion economies.

I explore factors creating the agglomeration and dispersion economies and the formation of world-class information and communication technologies and practices, regardless of size and type of industry, by examining (1) industrial clusters, industrial complexes, industrial districts, growth poles, and interfirm networks; (2) learning regions, (3) innovations; and (4) supply chains.

### 3.2 Industrial Clusters, Growth Poles, Industrial Complexes, Industrial Districts, and Interfirm Networks

Location theories are partially distinguished by the type of agglomeration economy emphasized, partially by whether they can account for both initial firm location and firm mobility, and partially by the focus on one or more of five major spatial concepts: (1) industrial clusters, (2) industrial complexes, (3) industrial districts, (4) growth centres/poles, and (5) interfirm networks. Many analysts seem to have gravitated to the use of the word ‘cluster’. Martin and Sunley (2003, p. 2) effectively deconstruct the cluster concept to show the “many fundamental conceptual, theoretical and empirical questions”, indicating that their concerns “relate to the definition of the cluster concept, its theorization, its empirics, the claims made for its benefits and advantages, and its use in policy-making”. I would go even further than they have, because I believe that there is a strong similarity among the first four concepts I list above, including clusters, in the way in which they are used to define a spatial boundary. A discussion along similar lines can also be found in Chap. 7.

The “industrial-complex” and “industrial-district” concepts are very similar, in that both focus mainly on localization economies/diseconomies. Isard et al. (1959) and Isard and Viozis (1955), for example, use an input-output table to identify an “industrial complex” of interrelated Puerto Rican firms that have strong inter-industrial linkages. To achieve high rates of economic growth, countries (regions) are advised to concentrate investments in firms located within the boundaries of this industrial complex in order to achieve agglomeration economies (Isard and Schoorner 1959; Isard et al. 1959). This type of industrial concentration is very similar to the “industrial districts”, such as the Third Italy and Silicon Valley (Sabel 1989; Saxenian 1994), which became the centre of economic activity for certain types of industries, such as textiles, tiles, microcomputers, and electronics. One
important difference between the two concepts is that most industrial-complex analysts use quantitative methods to group firms and conduct regional-development analyses, while industrial-district analysts most frequently use qualitative methods (e.g., case studies and firm surveys) to make and analyse the groupings.

Storper and Walker (1989), Porter (1985, 1990, 2000, 2001), and Markusen et al. (1999), for example, use the “industrial cluster” concept, which is based upon the “innovation cluster” concept of Schumpeter (1939, pp. 100-101). These two concepts are closely related to the “growth-pole (growth-centre)” concept (Perroux 1951) in that both are based upon the need for urbanization economies. Using an input-output table, growth-pole analysts select the key sector(s), not necessarily just one, and determine which ones have the highest backward linkages with suppliers and forward linkages with customers or consumers (Hirschman 1958), hence create the largest multiplier effects.

Analysts who discuss an industrial cluster generally include firms from a number of sectors, whereas when they discuss an industrial-complex, they refer to industries that form a single set of interrelated sectors (e.g., petrochemicals in the case of the Isard et al. (1959) study of Puerto Rico). For the remainder of this chapter, I will use the terms ‘industrial cluster’ and ‘growth poles’ interchangeably and the terms ‘industrial districts’ and ‘industrial complexes’ interchangeably. All four concepts help analysts define spatial economic boundaries around industrial activities. In terms of the focus of this chapter, I stress that all four concepts relate to agglomeration economies, so that I will later show that analysts conducting regional analyses tend to overlook the possibilities of regional growth occurring because of dispersion economies.

What about interfirm networks? The interfirm network concept is sometimes the same as and sometimes different from other industrial group notions. Interfirm networks, industrial clusters, and growth-poles all deal with the economic effects of spatial agglomeration of innovations with a given set of interorganizational (network) relationships (DeBresson and Amesse 1991, p. 364; Karlsson 1997). Markusen et al. (1999) maintain that interfirm networking occurs more within than across district boundaries. Their perspective of an interfirm network is therefore almost identical to an industrial cluster (district) or growth pole. Locke (1995), however, shows that more and more interfirm networking is occurring across industrial-district and national boundaries.

Interfirm networks, however, can be very different from an industrial cluster or growth pole. Locke (1995), for example, defines three ideal-types of interfirm networks: (1) hierarchical, (2) polarized, and (3) polycentric, which differ in regard to the structure of intergroup relations, patterns of association, and linkages of central policymakers. To participate in an interfirm network, industry managers do not necessarily need the same spatial location. Firms can network across geographic, social, and political boundaries (Messner 1997; Podolny and Page 1997). Thus, the information-economy revolution is allowing firms to develop national or global networks, which, at times, can assist and, at other times, hamper firm mobility and regional economic development (Castells and Hall 1994; Glaeser and Ellison 1997). Considerably more research is required concerning networks to de-
termine (1) whether industrial clusters, industrial districts, or interfirm networks operate most efficiently in terms of agglomeration economies, especially in terms of reducing the average cost to the individual firm; (2) the relationship among distance, regional boundaries, and clusters/districts/networks for different types of interchange; and (3) the role of networking in helping clusters and districts to function effectively.

In Table 3.1, under Old Concepts, I show the relationship between these four grouping concepts and one or more of four types of agglomeration economies (diseconomies): (1) scale, (2) localization, (3) urbanization, and (4) spatial-juxtaposition, (the latter hereafter called social). Then, under New Concepts, I list some of the many types of chains that are discussed in the literature. Analysts should find the distinction among the four types of agglomeration economies and the four types of dispersion economies useful for developing new location theories, extending existing ones, testing the theories with empirical data, and providing appropriate industrial and regional-development advice to policy makers.

Because there is so much similarity among these industrial-concentration concepts, I discuss three major questions around which analysts can conduct systematic tests of the interaction between industrial concentration and innovation. First, do industrial concentration and innovation lead to new business growth, as posed by increasing-returns and some other location theorists?

Table 3.1. Agglomeration and dispersion economies/diseconomies

<table>
<thead>
<tr>
<th>Agglomeration/Dispersion Concept</th>
<th>Type of Agglomeration/Dispersion Economies/Diseconomies and Networks</th>
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<tbody>
<tr>
<td>Old Concepts</td>
<td></td>
</tr>
<tr>
<td>Industrial Cluster</td>
<td>Internal, Urbanization, Scope</td>
</tr>
<tr>
<td>Industrial Complex</td>
<td>Internal, Localization, Social, Scope</td>
</tr>
<tr>
<td>Industrial District</td>
<td>Internal, Localization, Social, Scope</td>
</tr>
<tr>
<td>Industrial Growth Pole/Center</td>
<td>Internal, Urbanization, Scope</td>
</tr>
<tr>
<td>New Concepts</td>
<td></td>
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<tr>
<td>Chain (Consumer-driven)</td>
<td>Dispersion, Scope, Horizontal Networks</td>
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<tr>
<td>Chain (Producer-driven)</td>
<td>Dispersion, Internal, Vertical Networks</td>
</tr>
<tr>
<td>Chain (Supply)</td>
<td>Dispersion, Internal, Vertical Networks</td>
</tr>
<tr>
<td>Interfirm Network</td>
<td>Dispersion, Scope</td>
</tr>
</tbody>
</table>

*Alfred Marshall (1890) is the first analyst to use the actual terms “internal economies” and “external economies”. Alfred Weber (1929), the father of location economics, used these terms to help explain the concentration of small workshops in Germany.*

DiPasquale and Wheaton (1996, pp. 170-172) conducted a test in eleven states, specifically to refute Krugman (1991). They used the 1987 share of national jobs for a given industry in each state and concentration ratios, i.e., the percentage of total jobs accounted for by a particular SIC (standard industrial classification) in-

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1 Spatial-juxtaposition economies/diseconomies, a distinction originated by Isard et al. (1959), are scale-economy (other than size) factors, such as quality control, training, and social-welfare economies that result when an industrial complex is located at only one site.
dustry. They conclude that for aggregate industries, concentration theory does not seem to hold, “but if done for four-digit SIC industries, it may hold” (p. 172). Even so, DiPasquale and Wheaton did not conduct a definitive test, partially because they were unable to control for industrial and subregional mixes. Also, their quantitative tests may not appropriately account for social and other agglomeration economies/diseconomies in the economy. Firms may cluster, for example, to take advantage of both physical and financial infrastructure support (Kaufman et al. 1994; Scott and Bergman 1995) and of external support organizations, such as trade and industrial associations, educational and training facilities, and research and development laboratories (Rosenfeld 1995; Sabel 1989; Saxenian 1994).

Concentration of firms may enhance the localization, social, and urbanization economies in the region. Over the last 70 years, for example, the Tooling and Manufacturing Association, to which many of Chicago's metalworking firms belong, helped to maintain the network of those firms as it went through various phases of a life cycle, enhancing its localization economies (McCormick 1996). Support systems, however, are sometimes inadequate. If industries are not making profits, for instance, the trade and industrial association formed by them will have a hard time to survive. Analysts testing statistically for concentration tendencies need to account for quantitative measures, such as profits, and other more qualitative measures, such as social networking.

Second, what other factors than transportation costs help firms determine whether or not to locate in a particular location? Labour costs usually represent a much larger cost to the firm than transport costs. In the United States in 1987, for example, transportation direct costs averaged less than three percent of total costs for all except one of 79 sectors, whereas labour direct costs were over 15 percent for most sectors (U.S. Department of Commerce 1994, pp. 64-71). Location theorists also can improve their theories by analysing not only transportation and labour costs, but also the relevance of various transportation characteristics. Supply-chain and other analysts (e.g., Pereria 1996; Polenske et al. 1996) show that for a significant number of firms, speed and reliability of shipments are of as much, or even more, concern than transport costs to both the shipping and receiving firm, with other attributes, such as accessibility, flexibility in delivery times, safety, and tracing of the shipments usually ranking high as well. These studies indicate that, although Glaeser and Ellison (1997) say that transportation cost is easy to model, it may not be the most critical location factor for most firms today.

Third, are dispersion economies benefiting regional development and, if so, how? Some evidence is surfacing that strong agglomeration tendencies seem to be counterbalanced by equally strong dispersion tendencies. Analysts, for example, find that industrial concentration in one region creates competitive disadvantages at given points of the business cycle and for large urban centres, especially if it is excessive. When technological change is rapid, the industrial complex of firms may be at a competitive disadvantage because firms resist, or do not have access to, information outside the complex (Glasmeier 1987; Glasmeier and Sugiuara 1991). This resistance may also lead these firms to be less innovative than they otherwise would be (Harrison 1994, Chap. 4). These findings suggest that an ag-
glomeration diseconomy may lead to firms moving to other locations in order to reap dispersion economies.

In addition, in countries as different as Brazil, Japan, Republic of Korea, and the United States, concentration of firms seems to create adverse economic impacts on urban size and income distribution among regions (Markusen et al. 1999). In some countries, the government may disperse industries from the core to the periphery, trading agglomeration economies for lower location costs and, if income distribution improves, helping to assure social and political stability. Industries may also disperse of their own accord. Another consideration is that excessive urbanization in New York and Pittsburgh was found to hinder the intergenerational transfer of entrepreneurial skills (Chinitz 1961).

Finally, firms usually concentrate in a region under distinct circumstances (Harrison et al. 1995; Harrison et al. 1996). If the economic activity does not already exist in a region, economic specialization in that activity is difficult to foster. An example is the lack of regional development in Appalachia (Hansen 1966). Analysts can devise ways to test for at least some of these agglomeration-dispersion tendencies.

In order to look at these concentration/dispersal tendencies in more detail, I first discuss analysts who have examined ‘learning regions’, which may be a leading example of an innovative concentration of firms taking advantage of agglomeration economies. I then contrast these agglomeration tendencies of the learning region with the dispersion tendency of regional and global supply chains, which are prime examples of some of the many ways firms are dispersing innovation across regions and the globe.

### 3.3 Learning Regions

I define regions to include communities, cities, provinces, and countries. Regardless of how analysts define a geographic region, in the learning region, the community/city/province/country combines with academic institutions, firms, and government in the ‘region’ in collective-learning environments (Keeble and Wilkinson 1999). What is the purpose of a learning region? Do learning regions/communities initiate and sustain the development of ICTs? If so, how? How do they affect these technologies? What type(s) of assets (human, physical, and/or natural) help them to achieve sustainable development? To answer these questions, at least partially, I briefly review some of the extensive literature on learning regions/communities. Underlying my discussion are ideas obtained from Lundvall and Johnson’s (1994) and Lundvall’s (1996) classic articles on learning economies, supplemented with the extensive writing on learning regions by Asheim (1996, 1998, 1999, 2001a,b), including two of his latest joint articles (Asheim and Herstad 2002; Asheim and Isaksen 2002).

For the firms, the learning may be based on intrafirm, interfirm, and/or regional coalitions. Analysts emphasize the importance of knowledge and learning and the need to increase the rate of change of learning. In this respect, ICTs play an im-
important role. As Lundvall (1996, p. 4) states, however, “The learning economy is affected by the increasing use of information technology, but it is not synonymous with what is often called ‘the information society’”.

A learning region is one in which industry, community, government, and educational centres in a region all work together to help the region develop (Polenske 2004). It is characterized by a set of horizontal relationships among the actors, who exchange and compare knowledge and experiences, so that problems are solved by “…extracting the best out of a broad range of experiences and ideas” (Asheim 2001b, p. 9). Networks and organizations in the region share the knowledge interactively (Lundvall 1996, p. 2); thus, knowledge becomes one of the intangible collective assets of the region (Polenske 2001b).

Although the term ‘learning region’ is relatively new, it has important roots in the flexible production, flexible-specialization literature (Plummer and Taylor 2001), and even in writings of Alfred Marshall (Asheim 2000). Valuable discussions of the concept are included in many articles, including those by Asheim (2001a, b), Asheim and Dunford (1997), Boekema et al. (2000), Florida (1995), Lundvall (1996), Lundvall and Johnson (1994), and Morgan (1997), to name just a few. One view is that the idea of a learning region modified the interpretation of industrial districts by incorporating social relations, competitiveness, networks, learning, knowledge, and innovations. By locating in industrial districts, Piore and Sable (1984) indicated firms were able to achieve the multiplier effects and agglomeration economies of growth poles. Another perspective of the learning region is that it modified the way in which policy makers use ‘flexible specialization’ at a regional level. Thus, analysts, such as Sabel (1989), Hirst and Zeitlin (1992), and Best (1990), use the term ‘flexible specialization’ to show policy makers that small and medium-size firms, research and development institutes, and contractual relations are important elements of the way firms can share distribution, production inputs, information, and technologies.

Porter (1998, p. 78) represents another perspective. He defines clusters as “geographic concentrations of interconnected companies and institutions in a particular field. Clusters encompass an array of linked industries and other entities important to competition”. According to Porter’s definition, all learning regions are clusters. Even so, usually, not all clusters are learning regions. Ennals and Gustavsen (1999) define a different type of learning region, namely, development coalitions, indicating that these coalitions may range all the way from small and medium workplaces to regions and larger networks of firms to entire nations. According to Ennals and Gustavsen’s definition, not all learning regions are clusters, which counters Porter’s definition.

Asheim (1996, 2001a), Lundvall and Johnson (1994), and other European analysts indicate that regional policy makers need to establish learning regions in order to achieve community revitalization. Authors such as Lundvall (1996) emphasize the need to build social capital and to create educational initiatives. Lundvall (1996, p. ii) maintains that in the learning economy, “…the capacity to learn increasingly determines the relative position of individuals, firms, and national systems”. For a learning region to be sustainable policymakers in the region must emphasize the distribution of capabilities to learn; otherwise the labour markets
will become increasingly polarized. Concerning the learning, Lundvall and Johnson (1994) distinguish four types of knowledge: (1) *know-what* (knowledge of facts, which is easy to codify), (2) *know-why* (knowledge of principles that exist in nature, the human mind, and the society, some of which is relatively easy to codify), (3) *know-how* (knowledge of skills, capabilities, and other knowledge that in today’s world creates incentives for firms to develop networks to exchange this know-how. Only some of this knowledge can be codified, (4) *know-who* (socially embedded knowledge, learned from customers, contractual arrangements, etc., that is difficult to transfer because it is tacit knowledge). The know-how and know-who forms of knowledge are playing increasingly important roles in society. Asheim (2001b, p. 10) maintains that, in a learning economy that is being globalized, there is a “transition from an internal knowledge base in specific industries (i.e., high-tech sectors) to a globally distributed knowledge base of firms, caused by the general increased knowledge intensity in post-Fordist learning economies”.

As the reader can see, these analysts are creating some confusion by calling the same notion by a different name, most with the word ‘learning’ attached. For example, Asheim uses the terms ‘learning organizations’, ‘learning regions’, ‘learning systems’, and ‘development coalitions’, but so far he has not clearly identified the differences, if any, among these concepts. He only says that a development coalition is one type of learning organization, which are organizations that are “fluid, transnational, continuously reshaping themselves to meet new challenges” (Asheim 2001b, p. 9).

What do these authors say about the effect of learning regions on the development of ICTs and vice versa? Lundvall (1996, p. ii) maintains that “the relationship between codified and tacit knowledge is symbiotic and that ... tacit knowledge and the learning of skills will be fundamental for the economic success of agents...” I leave the remainder of the answer to this question to the next section, because innovation is an important component of the ICT sector.

### 3.4 Innovation

The British government has called for an intensive investigation of the role that innovation is playing in regions in Britain and has provided a considerable amount of funding for studies of innovation and entrepreneurship in what is called CMI (an alliance between Cambridge University in England and the Massachusetts Institute of Technology in the United States). Fingleton et al. (2002, p. 1) state that high-technology production is increasing in economic importance for the biotechnology, telecommunications, electronics, and computer services sectors. As a result, the British government has declared knowledge to be the most important

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2 If this type of diffusion is occurring, then learning regions may be helped by dispersion economies, although my main argument in this section is that learning regions are prime examples of agglomeration economies.
‘driver’ of economic growth for economies that are trying to achieve an overall competitive advantage. This growth, they maintain, leads to geographically concentrated economic activity, that some economic analysts call ‘high-technology cluster’.

Innovation is important to the survival of most firms, but the type of innovation that occurs differs from firm-to-firm and depends partially on the size of the firm (Keeble 1997). Some innovations seem to occur when firms locate in one region, while other types of innovation need firms to be dispersed.

One example of differences even when firms are clustered is the innovative, cooperative, collaborative aspects of firms in the Silicon Valley versus the hierarchical, centralized decision-making of the firms along Route 128 (Saxenian 1994). Firms in both regions started producing electronics: semiconductors (1960s) and chips (1970s) in the Silicon Valley and transistors and other solid-state devices (1960s) and microcomputers (late 1970s) along Route 128. According to Saxenian, however, Silicon Valley firms soon dominated the semiconductor field and also took a lead with small workstations and personal computers. Although firms in both regions were relatively clustered, Saxenian maintains that it was the type of decision-making, not the clustering, that helps one type to succeed better than the other.

Instead of looking at the success of a cluster of innovative industries in a particular region, Gertler (1993) looks at the restructuring of particular innovative sectors, such as advanced technology machinery producers. Gertler (1995) has an intriguing way of looking at the successful relationships between the producers and users of this machinery, showing that they are enhanced by three types of ‘closeness’: (1) physical (geographical) distance, (2) organizational (interaction, collaboration, shared workplace practices, and training) distance, and (3) cultural (common language, modes of communication, customs, conventions, and social norms) distance.

Gertler (1995, 1996) articulates his approach clearly. Each type of distance, he claims, has a strong influence on whether or not new technology will be adopted and, if it will, on the ease with which it is adopted. Through an extensive postal survey of 400 so-called “technology-implementation experiences” in 170 plants, combined with personal interviews in 20 plants, he finds that implementation difficulties are persistent and significant (1996, p. 20). The greatest difficulties were experienced by small plants, by firms using foreign (especially overseas) technology, and by firms using technology that had one or more of the three ‘distance’ attributes. Physical distance did affect implementation for all firms, but especially for small firms. This finding would imply that dispersion economies differ for large and small firms. Gertler also found that when the ‘workplace culture’ between the producer and the user of the technology is distinctly different (cultural distance), implementation is very difficult. Such differences may be related to physical distance, but more often are associated with social diseconomies. In addition, he determined that institutions and regulatory systems that assist firms in maintaining long-term relations with their employees are important factors that

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3 Schumpeter (1939) differentiates between innovations and entrepreneurship.
shorten the organizational distance and lead to effective implementation on a timely basis.

In summary, Gertler found that long and extended interactions between producers and users are very important for small enterprises and those that are domestically owned, single-plant establishments and that large distances (in any of the three meanings) reduced the effectiveness of the implementation. Even large enterprises feel the need for closeness, not only in terms of distance, but also organizationally and culturally. He would maintain, I assume, that distance does create extra costs for innovators.

Block (1990) presents a treatise that tends to destroy the traditional concepts of capital. Based upon Block’s conceptions, Gertler discusses some of the qualitative changes that are occurring in process technologies, such as the use of microprocessors and electronic controls in industrial machinery\(^4\). The results of these changes include: lower machine prices and smaller size of plant (both of which lead to capital savings), lower capital/output ratios; and machines that are capable of producing a large number of products. At the same time, Gertler maintains that the plant size is being reduced (again creating cost savings) due to changes in the internal and interfirm organization of production, such as fewer inventories and fewer machines. He does not indicate however whether the decline in machinery costs is greater than the decline in plant costs.

If all of this is indeed occurring, physical accounts for the firm will show that fewer machines and floor space are needed than before such change occurred, and the value accounts of the firm will show a decline in the dollar value of investment. Yet, the productive capacity of a region where the firm is located will be greater than before. These and other dilemmas attached to accurate measurement have led some analysts, influenced by new growth theorists, to study only the machinery and equipment portion of annual investment, believing that technology and investment are closely linked, but their approach is still aggregate. Gertler favours examining the adoption of each new process technology individually, as he did in his survey discussed above, indicating that a socially constructed model of technology aids an understanding of the sectors and regions in which investment occurs and its relationship to the process of technological change.

Lam (1998a) has conducted an extensive study of an advanced information-technology Japanese and British firm who wish to collaborate to acquire skills and knowledge from each other. She finds that the socially embedded nature of knowledge can impede cross-national collaborative work and knowledge sharing. This is knowledge that “is not migratory, because it is embedded in complex social interactions and team relationships within organizations” (p. 10). In fact, the two firms have completely different methods of organizing work, with the Japanese having an ‘organizational’ method of structuring high-level work that relies on worker interaction and minimum hierarchy, thus relying on tacit knowledge that can mainly be obtained through experience. The British have a ‘professional’

\(^4\) Block supports his position by studies of the metalworking industries where productivity gains from these qualitative improvements range from 200 to 300 percent (Block 1990, pp. 142-143).
method in which workers rely on formulas, manuals, and blueprints. Considerable friction developed when the teams from each firm tried to work together, until finally, they divided most work between the two firms, rather than collaborating on it (Lam 1998a, b).

Her study is captivating because it lends yet one more example to the debate concerning whether tacit knowledge, as originally defined by Polanyi (1966) can be codified. Her example seems to say that it cannot be when the social differences are as great as those between Japan and Britain. She states that the “differences are deeply embedded in the contrasting national systems of skills formation, labour markets, and occupational structures”, concluding that “there is no evidence in the present study that the two partner firms, despite their long years of close collaboration, have become more alike in their organisational forms or knowledge bases. On the contrary, the two firms appear to have become more divergent in their distinctive and complementary capabilities” (Lam 1998a, p. 36). Lam’s findings are supported by her later study (Lam 1998b) and are partially based on the extensive study of these factors by Nonaka (1994) and Nonaka and Takeuchi (1995). Nonaka calls the Japanese type of factor “knowledge of experience”, which is tacit knowledge learned within a particular context.

The Japanese style of management is one factor that analysts are examining. Gertler’s research of German and Canadian firms tends to support Nonaka’s findings in that German workers seem able to fix problems as they arise on the job, whereas for many problems, Canadian workers need to call in someone to fix the problem. Thus, whereas location theorists stress the need for geographic proximity among firms, Gertler, Nonaka, Lam and others stress organizational and cultural proximity as well. Fine et al. (1995, p. 5) add electronic proximity, which refers “to the form and intensity of electronic communication between economic agents”. They indicate (1995, p, 11) that “…electronic proximity may act as a substitute or either physical or organization proximity, or both”.

Lundvall (1996, p. 11) is less optimistic indicating that firms introducing new automation and information technology in Denmark initially elicit a significant slowing of productivity growth for at least four years compared with firms that do not use the new technology. This slowing is caused, he says, by many factors, but especially by firm workers needing to accept substantial organizational change in order to learn the new technologies. For those firms that simultaneously introduce the new technology and new forms of organization, the learning costs are significantly reduced.

Leamer and Storper (2001) are more upbeat in their discussion of the economic geography associated with the Internet.

Some scholars (e.g., DeBresson and Amesse 1991, p. 388) argue that a network of innovators is needed to ensure success. This network supposedly could be dispersed across space. Scholars maintain that a network can help reduce transaction costs, foster collective learning, link the innovation to the market, overcome failures in market creation for technological services, establish social norms and standards for the new market, and generate trust (Sabel 1992; Teubel et al. 1991). Continuous innovation, timeliness, and rapid product development, in turn, requires cooperation and trust among firms (Saxenian 1994). According to Schmitz
(1996), the basis of trust between firm owners, workers, and others changes over time and evolves from an “ascribed” trust among those in the same social group within a region to “earned” trust among outsiders in the global market.

Cooperation allows firms to share research and development costs, access to credit, training, etc. (Sabel 1992). This sharing reduces the production costs of each small firm, which otherwise would not have low-cost access to such services. Firms in the Silicon Valley, for example, form a regional network where there is collective learning, dense social networks, open labour markets, with considerable horizontal communication among firm divisions and with outside suppliers, trade associations, and universities (Saxenian 1994). The Silicon Valley firms thus form a learning region. An important finding, if true, from the Silicon Valley case is that the firms were able to capture the economies of scale and scope simultaneously at the level of the district, not the individual firm.

Also, Porter (1998, pp. 85-86) maintains that “In fact, there is no such thing as a low-tech industry. There are only low-tech companies – that is, companies that fail to use world-class technology and practices to enhance productivity and innovation”. If this is so, technological and biological firms are not the only ones that can be competitive, productive, and innovative in the new global arena. Rather, most firms with the right set of tangible and intangible assets can succeed.

So far, I have dealt with dispersion economies only briefly, yet I maintain that they are playing an increasingly important role in today’s global economy, and I examine them through the concept of ‘supply chains’.

### 3.5 Supply Chains

Earlier in Table 3.1, I listed supply chains and then two specific types of supply chains, producer-driven and consumer-driven. In addition to reducing costs, managers of consumer-driven supply chains have as one of the primary goals helping to create improvements in customer service. Either type of supply chain can be internal to a firm/region or extend beyond the boundaries of the firm/region to the nation or globally. In an earlier chapter (Polenske 2001a), I examined some of the factors affecting both the internal and external types of supply chains. Most analysts discuss producer supply chains, or discuss supply chains without differentiating them. I note that the supply-chain terms used by regional scientists and economists often differ from those used by management and transportation analysts. As an example, a customer-driven chain is often called a ‘pull’ system, while a producer-driven chain is called a ‘push’ system.

In this chapter, I concentrate on the global supply chain, although many dispersion economies/diseconomies affect regional or internal supply chains as well. Most global supply-chain analysts focus on the producer-driven supply chain, in

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5 A similar concept of sharing is behind the creation of the manufacturing centres in the United States that have been set up by the U.S. National Institute of Science and Technology (Sabel 1996).
which the producer is looking for ways to reduce costs, reduce the time it takes to get the product to market, and expand the market for the product(s).

In a different study (Polenske 2004), I differentiate three types of analysts who wrote about restructuring, namely: (1) Italian model, (2) Japanese model, and (3) Global Model. I call those who study the success of multinational corporations in the post-Fordist period the “global-model analysts”, which include Amin and Robbins (1990), Gereffi and Korzeniewicz (1994), Harrison (1992, 1994), MacDuffie and Helper (1999), Martinelli and Schoenberger (1991), and Scott (1993). These global analysts disagree with those who emphasize the role of small firms in the restructuring of production, although they agree that restructuring is occurring and that flexibility is being incorporated into the production and distribution processes. Castells and Hall (1994) assert that networks among all sizes of firms are critical to allow flexible specialization to thrive.

The global firms are adopting supply-chain management techniques, enabling them to push risks and costs along the supply chain by just-in-time (JIT) production. Specifically, rather than to absorb the cost of warehousing or of having extra supplies on hand at the production site, the global analysts indicate that the suppliers and the customers are now having to cover these costs. Five chief characteristics are associated with these firms: (1) an increased internationalisation of capital, (2) more effective corporate integration, (3) increased control over markets and finance, (4) pushing of risks and costs along the supply chain onto small suppliers, and (5) the need for support from both the public and private sectors.

An important forerunner to the global perspective and supply chains is the work by Chandler (1977) on the rise of large firms. The managers of these firms created the hierarchically organized firm to achieve their dominant competitive position. They used producer-driven supply chains, where managers oversaw the entire supply chain from the raw-material supplier to the ultimate consumer. As a result, they were able to use these attributes and scientific-management procedures to reap ‘economies of time’. Such an organizational structure seems to stand in sharp contrast to that proposed by the horizontal structure of the learning-region advocates.

Why is the large firm adopting more flexible production techniques and flourishing? Harrison (1994, pp. 9-10) argued as follows. First, they are downsizing both the number of activities and number of employees, thus reducing costs. Second, the directors of the large firms develop a core-periphery labour relationship. They segment the employees into a core group, who are kept at the headquarters, are paid high salaries, and collaborate in the production decisions, and a periphery group, who are dispersed to other locations or hired in locations distant from the plant, some of which may be overseas. I argue that this is one of several ways in which firms can reap dispersion economies. Third, they network both within their own corporation and with other corporations, through respective intrafirm and interfirm networks. Finally, managers are using computers increasingly both for manufacturing and management information systems to help coordinate and monitor their activities and employees and to increase the flexibility of production and marketing. Thus, firms are working not only to reduce costs, but also to disperse them along the supply chain.
As is the case of Harrison, many of these global analysts deal with regions in terms of the way the corporations develop a network of supplier firms across space and allocate core workers to the urban centres and peripheral workers to the suburbs or elsewhere. By incorporating the regional dimension, these analysts can determine the way the organizational boundary of the firm changes and the way costs are dispersed across regions. Ettlinger (1992) investigates the specific way in which large corporate organizations affect the regional geography. The Gereffi and Korzeniewicz (1994) research on global commodity-chains supports my contention that dispersion economies are helping to maintain a viable supply chain. They develop a global commodity-chain framework to study different segments of the chain, from the core region, where the innovating firms locate, to the peripheral regions, where the low-cost firms locate and employ low-skill workers. Rather than to look at networks of firms in a region, they study the network of large transnational firms and their customers across political boundaries.

Because large transnational producers control the supply chain, they disperse globally and control the way the costs are dispersed along the chain. Thus, they control many of the small firms. As I have stated in another paper (Polenske 2004), these large multinationals do interfirm networking within the large corporation, among other large firms, and between the large and the small firms, mostly through supply chains, with the spatial boundary being extended globally. The organizational boundary extends along the producer-supply chain, with the large producer controlling the market.

3.6 Conclusions

I began this chapter by hypothesizing that two types of economies are affecting regional economic growth, namely, agglomeration economies/diseconomies and dispersion economies/diseconomies. A number of analysts reviewed above show that this may be so. More empirical tests, however, still need to be made. No analyst has tested the hypothesis I put forth, partially perhaps because the concept of dispersion economies is only two-years old (introduced in 2003). I created the concept based on a belief that the economies from dispersing economic activity is an important factor affecting regional development, but regional analysts have not yet systematically examined the effects.

I think that the increasing number of global and regional supply-chain analyses may be a good place to start with the empirical tests. In fact, my own research staff and I have several case studies in the United States and the People’s Republic of China (China) that may provide sources for such tests. We had a different objective for our work on supply chains for the Chicago metalworking sector (Polenske et al. 1996), but the plant surveys we conducted may provide some information we could use.

Likewise, I could glean some empirical data from our six-year environmental and energy study of the coke-making sector in the People’s Republic of China in which we are conducting surveys of coke making township and village enterprises
(TVEs) and state-owned enterprises (SOEs). I can use these data to help determine whether or not dispersal of plants leads to cost savings—at least for the metal- working and coke making sectors.

I did not expect to find studies of dispersion economies, but I think it is important to measure empirically the cost-savings of the agglomeration/dispersion of firms. Fingleton et al. (2002) recently conducted some tests of cluster intensity. They are looking at a different question from mine, but they found that their econometric estimates “support the hypothesis that cluster intensity is a cause of employment growth, although there are important differences of scale at which this effect operates for the two sectors [computing services and research and development] considered” (Fingleton et al. 2002, p. 1).

Many analyses are needed to provide sufficient empirical evidence that will support or not support my hypothesis that both agglomeration and dispersion economies are important for regional economic development. The analyses should be both quantitative and qualitative. There is obviously considerable need for such studies. The results should be fascinating and will help policy makers as they make industrial policies.

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