

Industry Canada
Research Publications Program

**THE LOCATION OF HIGHER
VALUE-ADDED ACTIVITIES**

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THE LOCATION OF HIGHER VALUE-ADDED ACTIVITIES

*By Steven Globerman
Western Washington University*

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Comments should be addressed to:

Someshwar Rao
Director
Strategic Investment Analysis
Micro-Economic Policy Analysis
Industry Canada
5th Floor, West Tower
235 Queen Street
Ottawa, Ontario
K1A 0H5

Tel.: (613) 941-8187; Fax: (613) 991-1261; e-mail: rao.someshwar@ic.gc.ca

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EXECUTIVE SUMMARY

The primary purpose of this report is to identify and assess the implications of industrial clustering for the future location of technology- or knowledge-intensive activities in North America. A related purpose is to identify and discuss potential initiatives that might be pursued in Canada to blunt or reverse the advantages that specific regions in the United States enjoy as a consequence of hosting already established clusters of innovative firms and skilled and entrepreneurial individuals.

The concern of policymakers in small, developed countries like Canada that trade liberalization will encourage productive resources to migrate to larger economies has been somewhat diminished by evidence showing that trade liberalization increases intra-industry trade and international integration instead of reducing the overall level of economic activity. However, as firms rationalize production across geographic locations to take advantage of the horizontal and vertical value chains, policymakers have become more concerned about the nature of economic activity encouraged by specialization and “agglomeration economies.” Since knowledge-intensive activities draw more heavily upon human capital than physical capital and social infrastructure that can be created anywhere, the challenge for Canada, competing against the inherent size advantage of the United States, is to create attractive opportunities for industrial clusters. The increased ease of doing business across borders might facilitate the relocation of existing technology-intensive activities from Canada to the United States, especially if agglomeration economies in those activities favour locating in the latter country.

Closer economic integration may affect the mix of value-added activities in Canada by altering the size of industries in Canada and the strength of firms with different mixes of value-added activities within industries, or by altering the optimal mix of value added within firms in response to international comparative advantage, competitive pressures and the changing economic environment. That is, firms will alter their geographical location in response to closer economic integration, holding constant their industrial focus, size and so forth. Whether this will reinforce the U.S. advantage in products that are human capital-intensive and the Canadian advantage in resource-intensive industries will depend on the degree to which inter-industry trade patterns are affected by closer economic integration and whether existing industrial clusters are characterized by economies or diseconomies of scale.

The location of clusters is not fixed; they expand and contract geographically, and can emerge in locations distinct from the areas encompassing older clusters. While economists are in disagreement on whether historical accidents or the antecedent conditions of a region play a larger role in determining the geographical location of a cluster, several causes have been suggested to explain the benefits of agglomeration arising through external economies of scale. Firstly, a large industrial centre offers a pooled market to workers with specialized skills, creating liquidity in the labour market, which benefits both workers and firms. Secondly, a large industrial centre provides specialized non-traded inputs in greater variety and at lower cost. Thirdly, clusters promote technological transfers and spillovers as closer geographical proximity improves communication. However, too dense a cluster of economic activity creates congestion and diminishing returns.

As well, more research is required to determine whether a region's institutional characteristics impact on the formation of agglomeration economies, and what role government policy can play in promoting clusters. The evidence on whether clusters benefit more from a large number of small firms, which are more likely to contract out, or from the hub-and-spoke model associated with a small number of large firms, is unclear. What is clear is that vertical disintegration of economic activity contributes to the critical mass of specialized business and technical services required to encourage and sustain industrial clusters. But it is not clear that foreign participation in a local economy discourages the formation of vertical and horizontal linkages locally by centralizing innovative activity in the home country, or that foreign affiliates are increasingly dispersing value-added activities to exploit differences in location advantage and local technical expertise. It may be that the forces influencing clusters are dependent on the type of economic activity and industry involved. Low taxes and generous subsidies are obviously preferable for firms and high-skill workers when choosing a location. Fiscal incentives aimed at individual firms are inefficient; a more promising route is to use tax breaks and subsidies to make a region more attractive to a variety of technology-intensive firms. Of course, a satisfactory level of telecommunications and transportation infrastructure, public utilities and other social infrastructures are necessary to sustain an industrial cluster, but not in and of themselves sufficient.

The strength of local competition, including openness to foreign ownership, and the presence of sophisticated customers in a region might improve the nature and importance of external economies of scale. Public policy can nurture a competitive industrial environment and facilitate the migration of labour and skills. Making knowledge-intensive sectors relatively

free of regulatory barriers should be the starting point of any coordinated set of government policies aimed at making Canadian regions attractive as locations for knowledge-intensive clusters. Secondly, government policies should promote international labour mobility, especially for skilled professional and technical workers, and for Canada's major urban areas in order to attract industrial clusters.

More importantly, the evidence shows a positive relationship between university research, centres-of-excellence, and a region's innovative performance. This relationship is strongest in larger metropolitan centres with a concentration of high-technology production and established linkages between researchers and the business and financial communities. Thus, government policy will be most effective when focused on "pre-competitive" research, as private firms are easily able to draw on non-local experts for specific, codifiable functions.

Finally, it has been hypothesised that electronic commerce will reduce some costs dependent on physical proximity, and thus reduce the importance of clusters, though this outcome is far from clear.

In conclusion, the paper states that governments should focus less on industrial policy, whereby they target "desirable" industries or "national champions," and instead encourage clusters by promoting conditions within regions that contribute to the realization of external economies. Governments may need to be involved in rationalizing the competing claims of regions for public support. It may be ineffective for a small, open economy to encourage more than one cluster to develop in specific industrial areas. Cooperation would mean allowing and encouraging patterns of regional specialization that maximize the nation's welfare, rather than that of individual provinces. The federal government might justifiably see its role as assisting provincial governments to enhance the specific environment of regional clusters in policy areas where the federal government is dominant. It may well be that the effective promotion of knowledge-intensive clusters in Canada requires a substantial reorganization of government responsibilities and financing arrangements.

1. INTRODUCTION

The enduring competitive advantages in a global economy are often heavily local, arising from concentrations of highly specialized skills and knowledge, institutions, rivalry, related businesses and sophisticated customers in a particular nation or region.¹

A traditional concern about trade liberalization is the distribution of capital investment. Specifically, policymakers are concerned about net outward investment being undertaken by businesses as a result of reduced tariff and non-tariff barriers to cross-border trade.² For policymakers of small, developed countries, a particular concern is that production capacity will migrate to larger countries in a regional free trade area given the existence of (incompletely exploited) economies of scale and scope in firms and industries located in the latter. All other things constant, producers would presumably prefer to be located closer to the major markets for their products in order to save on transportation costs.³ Hence, with the reduction, or removal, of trade barriers, there should be a stronger incentive for firms to establish or expand capacity in the relatively large geographical markets they serve, especially if economies of scale at the plant and firm levels can be more fully exploited.

Of course, location preferences are shaped by a host of factors, and proximity to major markets may not be the most important. Indeed, economies of product specialization provide an important rationale for encouraging vertical and horizontal specialization of the value chain across plants and affiliates within a multinational corporate structure.⁴ The prominence of intra-industry trade underscores the empirical importance of vertical and horizontal product specialization. In particular, the overwhelming evidence is that regional and multilateral trade liberalization has been associated with increased intra-industry trade rather than inter-industry trade.⁵

The association of increased intra-industry trade with closer international economic integration substantially mitigates concerns about individual countries or regions suffering (or enjoying) large net losses (or gains) in capital investments (and associated employment) as a consequence of businesses relocating elsewhere. Rather, the major vehicles for carrying out international trade, that is multinational companies (MNCs), appear to exploit reduced barriers to trade by seeking greater specialization of economic activities. In this context, trade liberalization can be seen as augmenting other economic and technological forces, such as outsourcing and contract manufacturing, which are promoting specialization among economic agents.

While the predominance of intra-industry trade should reassure policymakers that economic integration is rarely followed by a giant sucking sound created by capital and jobs fleeing one region for another, there is less conventional wisdom about the nature of specialization associated with trade liberalization. In this regard, concerns about the overall volume of economic activity are being replaced by concerns about the nature of economic activity encouraged, or discouraged, by economic integration. In particular, an emerging policy concern in Canada, and in some other relatively small countries like Sweden, is that higher value-added activities are being relocated within regional trade areas from smaller to larger countries because of agglomeration economies.

The essence of this latter concern is illustrated by the following quote: “Companies move to the United States, not just because it is the world’s biggest market with the lowest taxes and fine golf courses. They move also because globalization is creating groupings or clusters of like-minded companies. Most of the clusters happen to be in the United States and are growing amoeba-like, by the minute. Canada has none, which is why it stands an excellent chance of losing the globalization war.”⁶ It should be acknowledged that the preceding quote is taken out of context. Specifically, the author does not mean to imply that all economic activities are relocating from Canada to the United States. Rather, he is suggesting that technology-intensive activities are predominantly located in specific regions of the United States, and that North American economic integration is continually reinforcing this pattern. To the extent that innovation ultimately underlies the creation of economic value along the value chains of many goods and services, one might talk about technology-intensive activities and higher value-added activities interchangeably.

While an equation between innovation and value-added activities is, at best, misleading, the relevant policy concerns of small, open economies such as Canada certainly feature a desire to attract and retain more *new economy* production activities.⁷ For critical stages of the value-added process in the relevant sectors, such as microelectronics, biotechnology and pharmaceuticals, software design and development, as well as rapidly growing service sectors such as finance, insurance, and business consulting, innovation associated with the application of specialized human capital is crucial. Another way of putting it is that knowledge work underlies the creation of economically valuable output in the *new economy* production activities.

There is abundant and increasing empirical confirmation of the importance of the clustering phenomenon. While clustering characterizes a wide range of economic activities, it is argued to be especially prominent in knowledge-intensive economic activities.⁸ Moreover, technology clusters are also characteristic of sectors that are integrated into the global economy, particularly since these clusters attract foreign direct investment.⁹ The clustering of technology-intensive electronic industries in Silicon Valley and Boston is one prominent example. The clustering of innovative financial services in New York City is another. The agglomeration of biotechnology companies in San Diego and pharmaceutical companies in New Jersey are also good examples.

Given the predominance of the United States as a locus of regional clustering for knowledge-intensive activities across a range of *new economy* sectors, closer economic integration with the United States might raise concerns about a resulting de-skilling and technological downgrading in comparable Canadian sectors. Specifically, the increased ease of doing business across borders might facilitate the relocation of existing technology-intensive activities from Canada to the United States, especially if agglomeration economies in those activities favour locating in the United States, at the margin. Equivalently, it might be more difficult for Canada to attract its proportionate share of new investment in technology-intensive activities if agglomeration economies continue to be important in those activities.

The primary purpose of this report is to identify and assess the implications of industrial clustering for the future location of technology- (or knowledge-) intensive activities in North America. A related purpose is to identify and discuss potential initiatives that might be pursued in Canada to blunt or reverse the advantages that specific regions of the United States enjoy as a consequence of hosting already — established clusters of innovative firms as well as skilled and entrepreneurial individuals.

The report proceeds as follows. Section 2 describes the established motivations for clustering, including the potential influence of regional economic integration. Section 3 discusses the available evidence on the relative importance of different factors that encourage or discourage clustering. Section 4 identifies and evaluates alternative public policy instruments to enhance Canada's attractiveness for locating innovation-intensive activities. Section 5 contains a brief summary and our conclusions.

2. MOTIVATIONS FOR CLUSTERING

Where dynamic industrial clusters locate is part luck and part accident.¹⁰

The key characteristic of industrial districts that leads to geographic clustering is that the firms in an industrial district are closely linked in developing new products and production processes.¹¹

Discussions of the motivations for industrial clustering can be found as far back as the writings of Alfred Marshall. Nevertheless, as the preceding quotations suggest, the origins of observed patterns of industrial clustering remain as contentious as the origins of life on earth. Prominent economists such as Gary Becker and Paul Krugman assign an important role to historical accident as a determinant of where a cluster will originally develop.¹² Others suggest that prime movers of industrial clustering can be systematically identified with sufficient attention to antecedent conditions in a region.¹³ In particular, the recent literature emphasizes a region's underlying capacity to innovate.

External (Agglomeration) Economies

Whatever the original role of luck or accident, several broad economic characteristics of a geographical region may give rise to so-called external economies of scale which, in turn, underlie the advantages of agglomeration. There are three main sources of external economies: 1) A large industrial centre offers a pooled market for workers with specialized skills, which benefits both workers and firms. 2) A large industrial centre provides nontraded inputs specific to an industry in greater variety and at lower cost. 3) An industrial centre generates technological spillovers, because information flows locally more easily than over great distances.¹⁴

With respect to the first source of external economies, the basic notion is that a relatively large market for specialized skills will be a more liquid market. That is, individual buyers and sellers of specialized skills can be relatively confident that they will be able to acquire new workers, or new sources of employment, at prevailing wage rates within a short time period. The subsequent reduced risks of excess supply and demand, in turn, make it effectively cheaper for would-be employers and employees to participate in larger labour markets.

The positive relationship between the size of a market and the degree of economical specialization of factor inputs within that market is well known. As economists from Adam Smith to George Stigler have noted, specialization is a function of the breadth of a market. To the extent that specialized inputs are more productive than non-specialized inputs, productivity levels of input users will be higher in larger markets than in smaller markets, all else constant.

Finally, geographical limitations on the scope for technological spillovers derive from the advantages of face-to-face contact in facilitating technology transfers. In particular, a shared information context with end-users often requires a physical presence near customers.¹⁵ A recent issue is whether the emergence and growth of the Internet has obviated the advantages of geographical proximity in the promotion of technological diffusion. Preliminary evidence on this point will be considered in a later section.

While there is broad acceptance of the relevance of these three factors to patterns of industrial agglomeration, there is much less agreement on how the importance of each factor changes with the growth of an industrial cluster. For example, at what point do decreasing, and even negative, returns to clustering set in? Perhaps the major source of external diseconomies in a regional cluster is congestion in its various guises. For example, limited land space implies that housing costs will increase significantly with the growing density of economic activity in a region. Higher housing costs, in turn, will require higher wages and other forms of compensation to attract and retain skilled labour inputs. Other costs of doing business related to the use of land will also rise with increased intensity of usage. Amenities such as green space, short commuting times, and relatively low crime rates are also likely to be negatively related to geographical clustering, at least beyond some point.¹⁶ At issue is the importance of such external diseconomies of scale at different stages of clustering.

As well, relatively little systematic attention has been paid to environmental and institutional factors that might condition the nature and extent of external economies (or diseconomies) of scale. One potential factor is the size distribution of firms within a region. For example, it is often suggested that external economies of scale are especially significant when a cluster consists of a large number of relatively small firms, as might be exemplified by Silicon Valley. Alternatively, it is sometimes argued that external economies are equally or more significant in regions where a few very large firms dominate the local economy, as might characterize the Puget Sound region.¹⁷

Another potential factor is the industrial composition of the cluster. As noted above, while clustering seems to be a phenomenon that is relevant to a wide range of industrial activities, it is implausible that the forces influencing clustering are equally relevant to all economic activities. For example, local access to specialized technical and scientific skills is unlikely to be equally important to the biotechnology and steel industries.

A third factor potentially conditioning the importance of agglomeration economies is the extent of foreign participation in the local economy. It might be argued that multinational companies (MNCs) derive fewer benefits from clustering than do smaller, domestically owned firms. This is because MNCs might be able to realize many of the benefits of close proximity to specialized inputs and sources of technology by establishing efficient internal markets in order to transfer specialized inputs among their foreign affiliates. As a result, the presence of MNCs in a region may discourage the deepening of vertical and horizontal linkages among firms that could contribute to the realization of external economies of scale. On the other hand, MNCs may locate in a region precisely to participate in the industrial networks that cluster in that region, thereby actively contributing to the agglomeration process and its resulting economic benefits.¹⁸

Yet another potentially important set of conditioning factors is associated with public policies that may promote the emergence and growth of regional clusters. Suggested policies include efforts to improve industrial infrastructures, such as roads, ports and airport facilities, as well as expenditures on social infrastructures such as schools, hospitals, police and fire services, access to courts of law, and so forth. Taxes and government subsidies to business have also been identified as important determinants of the location choices of firms. While most of these factors are discussed in the literature, assessment of their individual importance has been relatively *ad hoc*, and there is some (perhaps unsurprising) inconsistency across the available findings.¹⁹ One possible explanation of some of the inconsistency across studies is that the impact of specific government policies may vary for different economic activities.

Finally, the openness of an economy might condition the nature and importance of external economies of scale. One aspect of openness, as noted above, is the extent to which foreign direct investment is regulated or constrained. A second is the degree to which foreign and domestic competition serve to stimulate and nurture a competitive industrial environment. To the extent that openness to foreign competition is especially important, barriers to

import competition may ultimately discourage the creation of an environment that attracts and sustains clustering. However, the venerable infant industry argument suggests that temporary and measured protection from foreign competition might facilitate the incubation of local industrial clusters. A third aspect of openness is inward and outward migration of skilled professional and technical workers. A current concern of policymakers in Canada is that an increasing number of highly skilled Canadians are migrating to the United States under NAFTA visa arrangements.²⁰ At the same time, there is a substantial flow of skilled workers entering Canada from outside of North America. At issue is whether immigration patterns are, on balance, supportive of or detrimental to the ability of technology-intensive firms to operate in Canada.

Economic Integration and Clustering

As noted above, Canadian policymakers have long been concerned with the issue of whether closer economic integration with the much larger and dynamic U.S. economy contributes to a hollowing out of Canadian industries, especially those involved in technology-intensive activities. While the hollowing out concept is loosely used and, therefore, imprecise, the basic phenomenon it is meant to describe is the movement of value-added activities abroad.²¹

There are a number of direct and indirect potential linkages between closer economic integration and the location of value-added activities. Since most international production is carried out by MNCs, the relevant linkages are, perhaps, most conveniently discussed with reference to the firm-level strategies of MNCs. In this context, closer economic integration can be broadly thought of as easier and/or less costly mobility of goods, services and factors of production across national borders. It is immaterial whether closer integration is the outcome of a formal trade agreement, such as the NAFTA — which reduced barriers to trade, as well as regulatory and legal barriers to the movement of capital and labour within North America — or of technological developments, such as improvements in transportation and communications.

In a stylized manner, we can characterize Canada's industrial sector as a mix of value-added activities distributed across a set of firms. The firms, in turn, are distributed across a set of industries. Conceptually, closer economic integration can alter the mix of value-added activities in Canada in one of three possible ways: 1) It can alter the relative size of different industries, which, in turn, will alter the mix of value-added activities, assuming that mix differs across industries. 2) It can alter the relative size of firms within industries,

which will alter the mix of value-added activities if the mix differs across firms within industries. 3) It can alter the optimal mix of value-added activities within firms, within industries. That is, firms, holding constant their industrial focus, size and so forth, will alter the geographical location of different activities in response to closer economic integration.²²

Consider the first potential link. In theory, freer trade should lead to the expansion of domestic industries that enjoy a comparative advantage, and to the contraction of domestic industries that have a comparative disadvantage, other things constant. In the case of Canada, an overwhelming portion of its trade is carried out with the United States. Empirical studies have documented that the United States enjoys a revealed comparative advantage in products that are human capital-intensive, especially products that intensively utilize scientific and engineering human capital. Canada enjoys a comparative advantage in products that are resource- and physical capital-intensive. The inference one might draw is that closer economic integration with the United States should lead to relatively less technology-intensive activities in Canada, as technology-intensive activities in Canada contract and other activities expand. The practical relevance of this inference ultimately depends upon two factors. First, the degree to which inter-industry trade patterns are affected by closer economic integration, holding other influences constant. As noted in an earlier section, changes in inter-industry trade patterns in Canada and other developed countries have not been a notable outcome of trade liberalization. Second, the degree to which existing industrial clusters are characterized by economies or diseconomies of scale.

With respect to the second potential link, firms that can better adapt to and exploit an environment of freer trade should expand relative to those that, for one reason or another, cannot or do not quickly and readily adapt to the new environment. The ability and willingness to adapt to new opportunities and threats in the economic environment will depend upon a host of organizational factors, including the capabilities of managers and other employees, access to financial capital and other resources, and the physical location of the firm. Location itself may help a firm acquire resources that are critical to responding to the changed economic environment. For example, being located in a centre-of-excellence for a particular activity should enable firms to better exploit the external economies generated within that centre. However, firms located in less economically favourable regions, perhaps originally to take advantage of government grants, should find themselves relatively disadvantaged given the increased competition associated with closer economic integration.

To the extent that certain types of organizations in an industry make a particularly strong contribution to the growth of industrial clusters, economic integration might alter the formation and growth of economic clusters by strengthening or weakening the competitive position of these organizations. As shall be discussed below, there is no consistent evidence that, for example, the size or ownership distribution of organizations influences the likelihood of industrial agglomeration. Rather, the strategies of individual firms seem to be more important.

In this regard, the response of Canadian-owned MNCs and large foreign-owned firms in Canada to closer economic integration (the third potential linkage) would seem to be the critical link between closer economic integration and the mix of value-added activities in a country.²³ This perspective is reinforced by numerous case studies of resource allocation decisions within MNCs that document the growing propensity of global firms to increase the level of specialization of value-adding activities based on the relative strengths and weaknesses of the different regions in which they operate.²⁴ To the extent that existing clusters or agglomerations of efficient and successful firms are important determinants of the attractiveness of a region for a specific value-added activity, it may, therefore, also be an important determinant of geographical specialization patterns undertaken by MNCs in response to the opportunities and threats created by closer economic integration. However, if location attributes are relatively unimportant sources of influence on the relocation of MNC activities, economic integration may neither augment nor mitigate the impact of extant industrial clusters on the location of higher value-added activities.

As noted in an earlier section, specific technology-intensive value-added activities are not randomly distributed in geographical space, but tend to cluster in some specific regions. At the same time, the location of clusters is not immutable over time. Rather, clusters expand and contract geographically, and new clusters emerge in areas that are non-contiguous to those encompassing older clusters. The limitations of the theory discussed in this section therefore focus attention on the empirical question: what factors or set of factors determine the emergence, growth and (possible) demise of regions as attractive locations for clusters of higher value-added activities?

3. EVIDENCE ON THE DETERMINANTS OF CLUSTERING

The short answer to such questions as what is the minimum size and population density of a region and the level of development that will confer external economies, how great are these, and at what point do diseconomies begin to outweigh the advantages of further development? is that we do not know.²⁵

Notwithstanding that the preceding quote is almost 25 years old, it still accurately summarizes the relative dearth of precise information bearing upon the optimal size and (geographical) scope of regional agglomerations of different types of economic activity. At the same time, there is a growing body of research that seeks to identify some broad characteristics of industrial clusters. In this section, an attempt is made to summarize the available evidence on a set of characteristics that have been considered important.

Size Distribution of Firms

In many contemporary discussions of the dynamics of innovative regional clusters, the importance of vertical disintegration and cooperation among small, flexible specialized firms is stressed as a critical feature. The discussants usually have in mind the Silicon Valley model of a high-technology region. As noted earlier, however, other models identify the stimulus to a cluster imparted by a few relatively large firms. In these so-called hub-and-spoke models, large innovative firms contribute to clustering as new firms are created as spin-offs from the hub companies and as specialized service and input providers are attracted to the region by the presence of these hub companies.

On balance, there is little consistent evidence that clustering is associated with a concentration of smaller firms, rather than the hub-and-spoke model. One possible explanation for the inconsistent research findings on the relationship between clustering and the size distribution of firms is that other factors may confound the identification of any simple relationship. For example, one might anticipate a relationship between clustering and vertical disintegration. The contracting out of value-added stages contributes to the creation and growth of specialized skills and knowledge that, in turn, foster innovation. All other things constant, smaller firms are more likely than larger firms to contract-out various stages of the value-chain. However, the size and degree of contracting out are conceptually distinct phenomena, and one would presumably want to identify separately their contributions to industrial clustering. Similarly, a larger average firm (and plant) size in a region may be associated with a larger overall scale of economic activity in the region.

While the latter might reflect significant external economies of scale, larger average plant and firm sizes may not be important contributing factors. Rather, they may be statistical artifacts of the plant's (or firm's) presence in a large metropolitan area.

In studies where attempts have been made to identify separately the contribution of vertical disintegration to the clustering process, there is fairly consistent evidence of a positive relationship between vertical disintegration and clustering.²⁶ Vertical disintegration, in turn, appears to be related, as might be expected, to the overall scale of industrial activity. A larger overall scale of activity creates the pooling effects that sustain the presence of specialized providers of business and technical services. The latter seem to be especially important in motivating and sustaining the viability of industrial clusters.²⁷

There is less consistent evidence regarding the separate relationship between clustering and the size distribution of plants and firms. For example, Kim, Barkley and Henry (2000) find that industries with larger average establishment sizes exhibit greater spatial concentrations of establishments in nonmetropolitan areas. Conversely, Enright (1994) finds that, for state-level employment concentrations, large establishments discourage rather than attract employment.²⁸ Yet another study looks at clustering patterns of producers by size in a major manufacturing state of the southeast United States and concludes that progressively smaller producers do not have a greater tendency to cluster geographically, above and beyond the general tendency of industry to cluster in space.²⁹ Specifically, that study finds that clustering increases up to some size threshold and then starts to decrease.

In summary, the available evidence suggests that the presence of a critical pool of specialized business and technical services promotes vertical disintegration which, in turn, encourages and sustains clustering. However, the size distribution of firms in a region does not seem to have a uniquely identifiable impact on incentives to cluster. Obviously, specialized business and technical services are more likely to locate in a region already characterized by a concentration of substantial economic activity. The issue confronting policymakers who are trying to foster the growth of new clusters in competition with existing clusters is how to attract the requisite specialized services to promote and sustain industrial clustering. As Krugman (1991) notes, relocation of clusters can emerge spontaneously if expectations become widespread that a relatively undeveloped region is becoming more attractive as a location for industrial activity than other developed regions. This perspective

naturally leads to the quest for the Holy Grail of regional developers — the determinants of location advantage. Evidence on those determinants will be considered below.

At this point, one preliminary policy implication might be inferred. Industrial policies that seek to encourage the growth of small and medium-sized enterprises relative to large firms, or the reverse, are unlikely to promote industrial clustering in any systematic way. Rather, it seems more appropriate to favour policies that promote the attractiveness of a region to a broad cross-section of technology-intensive firms.

Foreign Ownership

In Canada, the substantial presence of foreign-owned establishments has long been the focus of policy debates in the context of innovation and industrial development. One long-standing view is that foreign ownership discourages innovation.

As noted above, this controversy has a parallel in the different hypotheses surrounding the linkage between foreign ownership and industrial clustering. Specifically, one hypothesis is that foreign affiliates operate as miniature replicas of their parent affiliates, and acquire the bulk of their technical expertise through transfers from their parent firms. Hence, the presence of foreign affiliates discourages the formation of a critical mass of specialized professional and technical expertise that, in turn, supports vertical disintegration and the associated agglomeration economies. According to another hypothesis, this view of foreign ownership is outdated, and foreign affiliates are increasingly dispersing value-added activities on a global basis to exploit differences in location advantage. In this context, foreign-owned establishments will be no less willing to utilize professional and technical expertise located in Canadian clusters than are Canadian-owned firms. Indeed, if MNCs have superior knowledge about international differences in location advantages for alternative value-added activities, they may be quicker than domestically owned firms to expand within Canadian clusters when the latter enjoy relevant location advantages.³⁰

The balance of evidence on this issue is that foreign ownership, *per se*, is a relatively neutral influence. That is, the dynamism of a cluster in a host country depends upon other industry and country effects.³¹ Moreover, systematic negative effects of outward foreign direct investment on clustering

in home countries are also hard to identify. For example, Fors and Kokko (1998) describe as one of the major concerns regarding the effects of outward foreign direct investment in Sweden in recent years that foreign production will lead to the departure of attractive capital- or skill-intensive jobs.³² They study the operations of 17 Swedish MNCs and conclude that the evidence does not provide strong support for such concerns. Similarly, Lipsey, Ramstetter and Blomstrom (2000) find only a weak relationship between affiliate production of Swedish MNCs and higher blue-collar employment at home, rather than increased supervisory or research activities at home. This finding belies the notion that outward FDI by Swedish MNCs has contributed to a substantial reallocation of capital-intensive and skill-intensive activities outside the home country.³³ The authors also find little indication that Japanese MNCs have reallocated skill-intensive segments of their home operations to foreign locations, whereas U.S. MNCs allocate the more labour-intensive parts of their output to developing countries.

In summary, foreign-owned firms are guided by location advantages, as are domestically owned firms. It is therefore appropriate to consider evidence that bears upon the determinants of location advantage for higher value-added clusters. Such evidence is provided in an eclectic range of studies encompassing case studies of individual industries or regions and econometric studies of the productivity performance of different regions.

Universities and Research Institutions

The experiences of Silicon Valley and Route 128 in Boston point to the importance of having excellent research universities within a region to promote industrial clustering of knowledge-intensive activities. The numerous discussions of the role played by institutions such as Stanford and MIT in the creation and growth of local clusters of microelectronics and computer firms are too well known to dwell upon. What is much less clear, however, is whether the Silicon Valley experience can be replicated in other regions and (possibly) in other industries. Statistical studies, as well as case studies of specific industries provide evidence on this issue.

Statistical Studies

There is abundant evidence documenting a positive relationship between university research and measures of a region's innovation performance, such as patents filed by local firms.³⁴ What is less clear is how general the relationship is across industrial activities and geographic regions.

In a study focusing on 6 two-digit industries located in 25 U.S. metropolitan areas, Bania, Eberts and Fogarty (1993) find a positive and statistically significant relationship between university research and firm births in the electrical and electronic equipment industry. However, no statistically significant relationship is identified for the other technology-intensive industry in their sample, i.e. scientific instruments.³⁵ Similarly, Beeson and Montgomery (1993) find mixed evidence when relating the activities of local colleges and universities to regional economic development, where the latter is measured by different labour market characteristics. For example, area employment growth rates are positively related to changes in local university R&D funding, as well as to the number of nationally rated science and engineering programs at local universities. The percentage of the workforce employed as scientists and engineers is also found to be positively related both to R&D funding and to the portion of bachelor's degrees awarded in science and engineering at local universities. At the same time, there is only weak evidence that university activities affect income levels, overall employment rates or the mix of high-technology and other industries in a region.

Varga (2000) offers a possible explanation for some of the inconsistencies among findings relating university activities to regional economic characteristics.³⁶ He finds that the same university R&D expenditure results in a higher level of innovative activity in large metropolitan areas than in smaller cities. The most influential factor affecting the intensity of local academic knowledge transfers is the concentration of high-technology production in a metropolitan area. Technology spillovers among private firms are influenced primarily by local business service concentrations. Varga finds that innovation activity is linked between metropolitan statistical areas located within a 75-mile distance band of each other.

Varga's evidence suggests that technological spillovers from university research are fairly local, and that technical and business service employment in a region is a strong complement to university R&D. A policy inference that might be drawn is that broad-based funding of university research spread

across regions and institutions in a democratic manner is unlikely to be an efficient way to promote and sustain technology clusters. Rather, funding should be concentrated in research institutions located in metropolitan areas that possess a critical mass of technical and business expertise in the area(s) being funded. To the extent that Canadian research institutions are proximate to U.S. technology clusters, they may be especially robust generators of technology start-ups in Canada.

In summary, the available evidence from econometric studies clearly indicates that university (and related) research activities can, under the proper circumstances, contribute to the growth and maintenance of knowledge-intensive industry clusters. Therefore, there would appear to be good reason for federal and provincial government funding agencies to develop a coherent strategy to allocate funding in order to achieve more systematic clustering benefits. In this regard, the importance of having established local links in place between the university research and the business and financial communities is that much of the necessary knowledge transfer is implicit. That is, face-to-face and often informal interaction among the various stakeholders is needed to harmonize the scientific and commercial foci of university research, as well as to work out plans to coordinate the movement of technology from the laboratory to the marketplace. To be sure, scientists can make useful contributions to local efforts to commercialize technology, even if they are not integrated into the local community. For example, eminent scientists can be brought from a great distance to serve as consultants on a specialized issue, or to serve on corporate boards of directors. In effect, outsiders can be used to perform activities that can be readily codified or that are fairly generic in nature, for example helping raise money from venture capitalists.³⁷ An implication is that government funding of research intended to encourage knowledge-intensive clustering is probably best focused on the pre-competitive stage. Local firms confronting specific technical and commercial issues related to their own corporate ventures are often in a position to recruit such talent on a consulting basis.

Case Studies

A number of case studies of technology-oriented industries also highlight the linkages between university activities and industrial clustering. The linkages encompass both teaching and research activities carried on at universities. For example, a survey of over 350 high-technology establishments in Washington State shows that Washington's high-technology industry has been

primarily locally grown. In many cases, the company's founder had a personal preference to live in the Puget Sound region and attended a local university. Other major academic-establishment relationships were access to library resources, recruitment of graduates, seminars and employee degree programs.³⁸

In another study, Haug and Ness (1993) report the results of interviews conducted with 33 commercial biotechnology firms in Seattle. Again, the overwhelming majority of company founders were from university, research or commercial organizations within the state of Washington. Almost 90 percent reported that proximity to educational institutions was an important influence on their choice of location.³⁹ The ability to attract employees was an equally important factor.

Other Factors

A number of other factors have been suggested as potential sources of contribution or barriers to the emergence and growth of knowledge-intensive industrial clusters. Several relate directly or indirectly to government policies. They include taxes and subsidies, regulation and openness to competition, and transportation and communications infrastructure. More recently, interest has focused on the role that electronic commerce might play in decentralizing economic activity.

Tax Rates and Direct and Indirect Government Grants

The available evidence on these factors is limited, largely anecdotal and, ultimately, inconclusive. For example, there is little reason to doubt that lower corporate tax rates will be preferred by firms in choosing business locations, all else constant. Moreover, highly skilled individuals will prefer to live in jurisdictions with relatively low personal tax rates, all other things constant. The relevant issue is whether equilibrium tax rates can be sustained at a higher level in a well-established cluster than in regions distant from the cluster before business migration away from the cluster occurs. And, if so, how much of a tax differential can be sustained? Similarly, given the costs and risks of individual migration, can clusters sustain higher tax rates without suffering any significant out-migration of its skilled technical and professional workers?

Ireland has been a prominent focus of attention in recent years for its efforts to attract investment by tax policy initiatives. It is well known that

Ireland's rates of economic growth and employment creation in the late 1980s and through the 1990s were markedly above the European and OECD averages. One expert on the Irish economy credits a low corporate profit tax rate as having been a favourable factor.⁴⁰ Grants offered to set up in Ireland using European Union aid were focused on firms specializing in knowledge-intensive activities and were apparently used effectively. Grants and other financial advantages were available for activities such as high value-added manufacturing footloose projects. Few grants or tax breaks were given to captive sectors such as local services. Walsh (2000) also points to the willingness of the Irish government to relax its previous insistence on regional decentralization, allowing cities like Dublin, Cork and Galway to attract significant clusters of firms in certain industries.

Walsh cautions that while the low rate of corporate profit tax and the reductions in personal income tax rates were important factors in Ireland's economic performance, it would be wrong to conclude that changes in the tax system triggered the boom, especially as the corporate profit tax rate actually increased in the 1980s. He also notes that the average skill levels in the high-tech sectors are significantly but not dramatically above the average for all industries. Overall, he warns that simplistic conclusions about the contribution of tax policy to Ireland's economic boom are not warranted.

Competition

Porter (1990) offers an extended theoretical defence of openness to competition as a necessary condition for a region to emerge as a knowledge-based cluster.⁴¹ He also discusses a number of cases studies of regions that have emerged as centres-of-excellence for specific activities, and links their emergence and growth to spirited competition among producers based in the region. The presence of sophisticated customers who are demanding quality also stimulates a climate of innovation in a region. There seems to be little reason to quarrel with Porter's positive assessment of the role of competition in stimulating the growth of knowledge-intensive clusters. Indeed, it is shared by other students of regional economic growth.⁴² To be sure, the preoccupation with preserving competitive domestic markets is not uniquely motivated by a policy concern to promote knowledge-based clustering. Nevertheless, it serves as a useful reminder that policies restricting foreign ownership in certain knowledge-based activities, such as audio-video entertainment products, are likely to benefit only the incumbent domestic producers of those products, at the potential cost of truncating the growth of other organizations and groups of skilled employees.

Infrastructure

It can also be readily accepted that a satisfactory physical infrastructure of telecommunications, transportation facilities and other public utilities is necessary to attract and sustain a cluster of modern, knowledge-based businesses. However, it certainly may not be sufficient. Indeed, there are numerous examples of regional governments that invested substantial funds in developing modern local telecommunications facilities with little success in attracting businesses that rely upon such facilities as an important input. In other cases, businesses did seem to respond to improvements in the local communications infrastructure, although other factors may also have been at work. Again, the point is that the attractiveness of locations for knowledge-intensive activities is a function of various factors that may well be interactive. Unless all are present to some degree, a region will fail to attract (or retain) knowledge-based activities.

Electronic Commerce

There has been substantial speculation about whether and how the emergence of electronic commerce will affect the economics of regional clusters of knowledge-intensive activities. The conventional wisdom might be characterized as stating that physical proximity between market participants will become less important in virtually every economic activity. This is largely because search costs and related transaction costs that are a function of distance should decline with the use of the Internet. Some observers have gone as far as saying that distance will become an irrelevant determinant of the location of economic activity.

In fact, search costs are only one component of transaction costs, and possibly a modest one for many types of goods and services. For example, the quality of many goods and services might be confidently asserted only after they have been used. In such cases, reduced costs of search achievable by using the Internet may be largely immaterial. In other cases, the information to be communicated may be sufficiently uncodifiable that face-to-face communication is necessary for effective information transfer.

In effect, it can be hypothesized that reductions in search costs will mitigate the importance of clustering in several ways. For example, it might expand the effective geographical radius over which technology spillovers occur by reducing local information impactedness. It might also reduce the

advantages of labour market clustering by reducing excess supply and demand conditions through improved information about those conditions in different geographical markets. That is, the Internet might effectively integrate hitherto segmented labour markets. It might also make it easier and less costly for producers located outside of clusters to identify and purchase the services of specialized inputs outside their local labour markets.

Of course, it is also possible to speculate that the primary effect of electronic commerce will be to make it easier for final consumers to identify and purchase the products of knowledge-intensive clusters, thereby increasing the demand for the output of existing clusters. If external economies of scale extend beyond the current sizes of clusters, the electronic commerce phenomenon would, if anything, contribute to an even greater geographical concentration of knowledge-intensive production. The net impact of electronic commerce might well vary depending upon the specific activity in question.

4. POLICY IMPLICATIONS

The available empirical literature points to several relatively uncontroversial directions for public policy. One is to promote and maintain competition in knowledge-intensive sectors. This effort implies policies that allow increased economic integration, including foreign investment in all sectors of the economy. Openness to foreign competition should provide policymakers in small open economies greater opportunity to allow firms in local clusters to engage in alliances and joint ventures. Collaboration among firms in knowledge-intensive sectors is a common phenomenon.⁴³ Indeed, it is becoming more common with the formation of purchasing and selling groups engaged in electronic commerce. A future challenge facing competition policy authorities is to ensure that achieving the private economic benefits of collaboration does not entail greater social costs arising from substantial reductions in effective rivalry. Ensuring that entry into industries such as telecommunications, broadcasting, finance, health care and other knowledge-intensive activities is relatively free of regulatory barriers should be the starting point for any coordinated set of government policies aimed at making Canadian regions attractive as locations for knowledge-intensive clusters.

A second relatively uncontroversial inference is that government policies should promote labour mobility, especially for skilled professional and technical workers. One instrument available to the government is immigration policy. While the considerations surrounding immigration policy are, of course, broader than economic concerns, increasing immigration quotas for skilled technical and professional workers is arguably the most robust tool available to policymakers to deepen Canadian labour markets with the types of workers that attract knowledge-intensive firms. However, policymakers should also be willing to tolerate a concentration of immigration in Canada's major urban areas if one goal of immigration policy is to promote industrial clusters.

A more controversial issue is the emigration of skilled and highly educated Canadians. The growing number of Canadians relocating to the United States, particularly under the NAFTA temporary visa arrangement, has raised concerns about a new Canadian *brain drain* that, in turn, is making Canada a less desirable location for technology-intensive businesses.⁴⁴ Suggestions have been made to implement policies to discourage such emigration. An example would be to require Canadians who acquired technical or professional higher education in Canada to post bonds to cover the cost of their education to taxpayers. Those bonds would be forfeited if they left Canada before some fixed period of time. In fact, we know too little about the effects of emigration on the Canadian economy. For example, it is clear that a

substantial percentage of young Canadians migrate to gain work experience and additional training at leading scientific and technical organizations in the United States. If many of those Canadians return to Canada, it is very likely that there will be net gains for the Canadian economy, as these persons will increase the overall technical and professional skill level of the local workforce — a fundamental condition supporting the growth of knowledge-industry clusters. Even those who do not return might make a unique contribution to Canada's attractiveness as a location for *modern economy* activity by promoting closer technical and business ties between American and Canadian organizations. Until we know more about the long-run economic effects of temporary emigration on the Canadian economy, it is arguably premature to implement policies designed to discourage emigration.

Relatively high marginal personal income tax rates have also been identified as an incentive for highly skilled professionals to leave Canada. There is certainly a basis for concern that high personal income taxes in Canada relative to the United States have induced some (unknown) number of highly educated Canadians to migrate to the United States.⁴⁵ A problem is that the relatively greater level of publicly provided services and amenities that are largely funded by tax revenues are an attraction, at the margin, for *modern economy* workers. While it is quite possible that Canada has gotten the balance wrong from the standpoint of encouraging more rapid growth of a highly educated professional and technical workforce, it is very difficult to identify the optimal tax and expenditure levels required to encourage industrial clustering. Moreover, tax and expenditure policies are guided by a host of other considerations as well.

Even if it is difficult to be unequivocal about whether and to what extent lower marginal tax rates would encourage more industrial clustering in Canada, it does seem fair to argue that tax breaks, or direct and indirect subsidies, targeted at specific firms are inefficient. As discussed earlier, dense networks of small and medium-sized firms characterize many knowledge-intensive industrial clusters. Tax breaks and subsidies that make a region more attractive to a variety of technology-intensive companies are more likely to encourage clustering than similar fiscal policies directed at a few firms, especially if the latter are relatively large, multi-location enterprises. In that case, it seems unlikely that the beneficiary companies will become the locus of an industrial cluster, particularly if these firms were disinclined to expand in Canada absent the subsidy.

Financial support to universities and other institutions carrying out pre-competitive research is clearly an appropriate instrument to encourage industrial clustering. The goal of such support is to create an infrastructure of scientists, engineers, business experts and operating companies integrated into a unique local network of specialized expertise. The focus of network specialization should presumably be related to a broader set of location advantages. As an obvious example, knowledge-intensive clusters of organizations focusing on marine-engineering applications are more likely to thrive on the East or West Coast where large and knowledgeable users of the cluster's output exist. Less obvious, it may be ineffective for a small, open economy to encourage more than one cluster to develop in specific industrial sectors. Geographical concentration can magnify the power of competition and peer group pressure, creating incentives that encourage efficiency and progressiveness. It can also make it easier for firms (and public policymakers) to solve problems associated with the provision of the kinds of public goods required by firms to develop and maintain competitive advantages.⁴⁶

5. SUMMARY AND CONCLUSIONS

This paper provides an overview of the phenomenon of industrial clustering. The motivation for this focus is the growing perception among regional geographers and economists that economic activity in knowledge-intensive sectors is characterized by regional clustering. Thus, if it is a goal of Canadian policymakers to promote and sustain the growth of knowledge-intensive economic activity in Canada, there is reason to focus on the clustering phenomenon. In particular, there is reason to focus on what makes particular locations attractive as nodes of industrial clustering.

In cases where the advantage of a location is largely based on a site-specific natural resource, the issue is relatively uninteresting from a policy perspective. However, knowledge-intensive activities draw more heavily upon human capital than physical and social infrastructure that, at least in principle, can be created anywhere. The challenge for a small open economy is to create attractive opportunities for industrial clusters in competition with larger economies that have an inherent size advantage in this regard.

The literature identifies a set of factors contributing to the external economies of scale that ultimately underlie industrial clusters. The relevant material emphasizes a distinction between *industrial policy* and policies to promote cluster formation and upgrading. For example, Porter (1998b) associates industrial policy with governments targeting their initiatives on desirable industries or national champions. The encouragement of clusters focuses on promoting conditions within regions that contribute to the realization of external economies.⁴⁷ Relevant conditions include an educated workforce, modern and efficient physical infrastructure and workable competition. Porter (1998b) and others also emphasize the importance of collaboration between governments and the private sector to build on the foundations of existing location advantages in order to create specialized niches of expertise, rather than trying to out-compete well-established rival locations. This seems particularly appropriate advice for Canada as it becomes increasingly integrated with the U.S. economy.

The basis for regionally specialized niches of expertise will likely reside in identifiable seeds of existing clusters. In any case, it would be a mistake for governments to try to pre-determine what specific location clusters should be promoted. Nevertheless, governments may need to be involved in rationalizing the competing claims of regions for public support. For example, both British Columbia and the Maritime provinces might have legitimate *a priori* claims to cultivating a successful cluster involved in the design, development

and production of technology to serve the aquaculture industry. That is, they both are likely to have the seeds of a commercial cluster in the form of specialized human capital, specialized programs in colleges and universities, relevant business expertise and physical infrastructure that are complementary inputs to these activities. However, the full exploitation of agglomeration economies may only support the existence of a single cluster. Presumably, market forces would eventually provide appropriate signals as to which location is preferable. Yet, competition between provinces to tilt market support in favour of one or the other region could lead to much wasteful expenditure and even the emergence of two unsustainable clusters.

Ideally, regional governments would avoid wasteful competition to attract and sustain industrial clusters. In practice, policy in this area might be characterized by a *prisoner's dilemma* game in which the dominant strategy of provincial government participants is to compete rather than cooperate. Cooperation here would mean allowing and encouraging patterns of regional specialization that maximize the nation's welfare rather than the welfare of one province at the expense of another. In this context, perhaps the greatest practical challenge facing the federal government is to use its financial (and moral) leverage with the provinces in order to discourage wasteful competition to cultivate industrial clusters. It would take us too far afield to speculate on how the federal government might pursue this role. However, an example might suffice as an illustration. Federal funds used to support the recruitment and retention of outstanding scientific and engineering teaching staff in Canadian colleges and universities might be assigned to the faculty member rather than to the university. Thus, the individual recipient would, in principle, be free to use the funds to work in the Canadian university that is most complementary to his or her human capital.

In other circumstances, individual regions may have sufficiently advanced clusters in specialized areas that wasteful competition among provinces is an unlikely event. In this case, the federal government might justifiably see its role as helping provincial governments enhance the specific environment of regional clusters in policy areas where the federal government plays a dominant role. For example, envelopes of federal government research funding might be created and transferred to the provinces' research funding agencies for ultimate distribution to local research communities. Hence, funding for agricultural technology might form an envelope administered by the Prairie provincial governments.

It may well be that the effective promotion of knowledge-intensive clusters in Canada requires a substantial reorganization of governmental responsibilities and financing arrangements. This could (and, perhaps, should) be the subject of additional investigation. In the interim, the federal government has at its disposal several policy instruments that can potentially modify the environment within which clusters might develop and grow. They include competition policy, laws and regulations surrounding foreign investment, immigration law, federal tax legislation, and funding for research and development. A judicious application of these instruments would work to promote economical clustering across the entire (provincial) spectrum.

NOTES

- 1 Porter, 1998a.
- 2 This concern is especially pronounced in countries that have used import protection to encourage the establishment and growth of tariff factories. The latter may be thought of as production facilities that would not have been established absent the import protection supplied.
- 3 For some basic economic models of the location choices of producers in geographical space, see Krugman, 1991.
- 4 The value chain may be thought of as the set of interrelated activities that an organization undertakes to create value for buyers. It is, in effect, the conceptual set of stages at which commercial value is added to a product, comparable to the economist's notion of value added. For a discussion of the value-chain concept, see Porter, 1990.
- 5 For a summary of evidence and some original empirical results, see Globerman and Dean, 1990.
- 6 See Reguly, 2000.
- 7 This is also an expressed concern of small open economies in Europe, such as Sweden, Holland and Belgium. Indeed, it would be fair to characterize it as a major policy focus of most European governments. See Cheshire, 1995.
- 8 For evidence on this point, see Henderson, Kuncoro and Turner, 1995. See, also, Florida, 1995.
- 9 See Duffield and Munday, 2000.
- 10 Quotation taken from Becker, 2000.
- 11 Taken from Bernat, Jr., 1999.
- 12 See Krugman, 1991. For example, he describes how the concentrated location of the carpet-making industry in Georgia was largely the result of innovations in tufting made by an early resident of Dalton, Georgia. By implication, had that individual been living in another state, the concentrated location of the industry may have evolved elsewhere.

- 13 Such conditions usually include intense competition and flexible labour market practices. See, for example, Pinch and Henry, 1999.
- 14 These sources are discussed in great detail in Krugman, 1991.
- 15 For an assessment of this assertion within the context of the software industry, see Kogut and Turcanu, 2000.
- 16 It is also undoubtedly true that certain amenities are positively related to the size of a cluster, at least over some range of clustering. These might include the local availability of cultural activities, professional sports events and specialized medical and other services.
- 17 These two broad models of clustering are discussed in Gray, Golob and Markusen, 1999.
- 18 These two alternative models of the linkage between MNCs and agglomeration are discussed in Birkinshaw and Hood, 2000.
- 19 Some of the relevant findings will be discussed in a later section of the report.
- 20 This policy concern is identified and evaluated in Globerman (forthcoming).
- 21 This is the basic notion underlying a recent Canadian study. See Feinberg, Keane and Bognanno, 1998.
- 22 There is no need for all firms to respond in exactly the same way or to the same extent.
- 23 In their empirical study, Feinberg, Keane and Bognanno (1998) conclude that unobserved differences across firms within industries explain most of the variance in MNCs' responses to changes in tariff levels.
- 24 For a review of recent literature, see Birkinshaw, 2000.
- 25 Keeble, 1976.
- 26 See, for example, Holmes, 1999, and Kim, Barkley and Henry, 2000.

- 27 See Kim, Barkley and Henry, 2000.
- 28 See Enright, 1994.
- 29 See Sweeney and Feser, 1998.
- 30 In a similar vein, the presence of MNCs in a region might be taken as a signal by other investors that the region does enjoy significant location advantages.
- 31 See, for example, Birkinshaw and Hood, 2000, and Paelinck and Polese, 1999.
- 32 Fors and Kokko, 1998.
- 33 Lipsey, Ramstetter and Blomstrom, 2000.
- 34 For a review of the literature, see Beeson and Montgomery, 1993.
- 35 See Bania, Eberts and Fogarty, 1993. The authors suggest that university research is probably more important for product than for process R&D as a possible explanation for their findings.
- 36 Varga, 2000.
- 37 For evidence on this latter point, see Audretsch and Stephan, 1996.
- 38 See Haug, 1995.
- 39 Haug and Ness, 1993. This result is similar to findings from other studies of U.S. biotechnology firms.
- 40 Walsh, 2000. Walsh also cites a ready supply of well-educated labour and easy shipping and cultural proximity to the United States as other factors.
- 41 Porter, 1990.
- 42 See, for example, Asheim and Dunford, 1997.

- 43 For discussions of the collaboration phenomenon, see Sharp, 1987, and Teece, 1992.
- 44 The CEO of Nortel Networks Corp., among others, has publicly voiced this concern. See Surtees, 1999.
- 45 See Globerman (forthcoming).
- 46 This point is emphasized in Geroski, 1992.
- 47 See Porter, 1998b.

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