The North American Manufacturing Belt in 1880: A Cluster of Regional Industrial Systems or One Large Industrial District?

Gordon M. Winder

Department of Geography, The University of Auckland, Auckland, New Zealand

Abstract: As a supply region for manufacturers, the nineteenth-century North American Manufacturing Belt can be conceived as a series of regional industrial systems, as one large industrial district, or as a chaotic conception, since industries built their own industrial networks without reference to the belt. Analysis of the supply linkages of two 1870s manufacturers reveals extensive disintegrated supply networks within the belt. The manufacturers functioned within the belt as a whole, and long-distance linkages were central to their activities, even when they located their operation within an "industrial district." By 1880, manufacturers' supply networks spilled over regional industrial system boundaries. Metropolitan centers did not dominate linkage behavior. These findings indicate that perhaps the belt as a whole functioned as an innovative milieu for manufacturers.

Key words: North American Manufacturing Belt, supply linkages, industrial districts.

Were local industrial districts the spatial frames of reference for nineteenth-century manufacturers' supply linkages? In this paper I argue that nineteenth-century manufacturers operated disintegrated networks which extended over wide regions within the North American Manufacturing Belt, which itself operated as a milieu for manufacturers and workers. I examine the ways manufacturers coordinated long-distance linkages and the importance of distant suppliers in production. I establish benchmarks for local versus extralocal linkages among foundries and machine shops and analyze the linkages of two machine shop and foundry enterprises in the context of three competing models of supply linkages within the belt. The firms' supply linkages offer manufacturers'-eye views of the belt as industrial context, in terms of raw material and components supply and technical and business arrangements. Records from the 1870s and 1880s—the height of machinofacture and the key period of specialization within the belt—are used. Both firms used many distant suppliers, and their extensive network arrangements challenge conceptions of the belt and early industrial districts. The paper outlines the social organization of linkages and the institutions, networks, and practices held in common by machine shops and foundries that made distant linkage relations possible, and thus revisits the Manufacturing Belt concept.

The early Manufacturing Belt can be conceived either as a series of city-centered regional industrial systems, as one large industrial district, or as a descriptive device that obscures the networks of individual industries, each of which built their own
industrial systems. The issue is one of appropriate generalization. Did manufacturers operate most of their supply linkages at the scale of their local industrial district, metro-centered region, or the belt as a whole? The answers are not obvious from the literature. Existing interpretations highlight the belt’s diverse locales, industrial forms, and networks, its dynamic growth and spatial integration. They leave the nature of manufacturing linkages out of their analysis. Amid the diversity of spatial arrangements and periods, what coherence can we find for the Manufacturing Belt as a functional space? Let us consider the alternatives.

Models of the Manufacturing Belt

An Array of Regional Industrial Systems

Meyer (1983, 1987, 1989, 1990a) offers the most coherent account of the belt’s formation. He defines the belt as an array of distinct industrial regions comprising outer-ring cities and industrial towns clustered around metropolitan centers. A spatially differentiated process of cumulative causation, operating at a continental scale, produced local and regional specializations on the back of initial advantages. Between 1860 and 1880 manufacturers within the belt began to serve multiregional and national markets, and discrete regional systems (in terms of demand linkages) became integrated into a continental economy. By 1880, 15 regional metropolises dominated U.S. manufacturing, and clear signs of manufacturing specialization were discernible (Meyer 1987). Metropolitan centers provided finance, wholesale, warehouse, and transport services for manufacturers and served as innovation centers and information nodes. Between 1830 and 1860 the belt grew from small industrial beginnings in Atlantic coast states to cover an area marked by Minneapolis and St. Louis in the west, Toronto and Montreal in the north, and Louisville and Cincinnati in the south. Migration and urbanization, westward frontier expansion, and railroad and telegraph construction fueled industrial development within a westward-expanding industrial belt. Initially, growth processes generated discrete regional industrial systems, as replica industrial facilities were built in new locations, producing a generic urban industrial landscape despite the belt’s apparent diversity (Meyer 1990b). In the period 1860–80, however, discrete regional industrial systems were functionally integrated into a continental geography of market and resource supply regions. By 1880 the belt integrated a continentwide set of periphery regions. The dynamics of these interregional core-periphery relationships are controversial (Earle 1992; Earle and Hoffman 1976, 1980; Meyer 1988; McCann 1983; Inwood 1991; Kerr 1987; Laxer 1989), but, because of them, the processes generating the belt were spatially confined. Beginning in the 1880s, a second industrial revolution associated with steel, electrical energy, and university-trained engineers altered the spatial dynamics of North American industry, but by 1880 we can expect interregional trade on a large scale.

In this interpretation, the relationship between urban and industrial form within the belt remains poorly theorized, and the nature and spatial extent of supply linkages remain unknown. The belt comprised diverse industrial and urban locales set in a “dominant landscape of farms and forests” (Meyer 1990b, 251). Industrial landscapes included various industrial districts within metropolitan centers (Muller and Groves 1979; Hiebert 1990; Pupud 1983; Scranton 1983, 1989; Muller 1989) but also satellite industrial towns, company towns (Mosher 1995), single-industry resource towns with processing industries, and industrial countrysides of small factory villages (Vance 1990; Prude 1983; McCann 1988; Wynn 1987). Workshops remained important even with the development of factory organization, machinofacture, and wage work.
The belt’s internal diversity complicates the metro-centered region model. So far, manufacturers’ supply linkages have not been studied to confirm these city-centered regional industrial systems. Analysis focuses on the proximity of plants to each other and to transport lines, power sites, and labor sheds, or on indicators of urban importance: population size, headquarters locations, news sources, and bank correspondence. Connections among these urban functions and the manufacturing establishments themselves tend to be neglected (but see McCann 1994). Firms located within industrial cities may have enjoyed urbanization economies, but perhaps agglomeration economies were more elusive. The many establishments dispersed across the countryside (Pudup 1987) must have managed regional and extraregional linkages, yet their own communities offered few suppliers. Establishments located outside metropolitan centers and outside the integrated networks of industrial corporations have received little attention, because they are said to have been rendered obsolete by the corporation and mass production. Long-distance trade predates industrialization and made the industrial revolution’s ramifications more significant (Braudel 1984; Wallerstein 1979). That early manufacturing was part of local economies that were unified and somehow escaped external influences is at odds with these findings.

Perhaps manufacturers’ supplies came chiefly from firms in metropolitan centers, but the jury is out. There is no verdict for either the period of westward industrial expansion to 1880 or the subsequent period of continental market integration. In the absence of a manufacturer’s-eye view of connectivity, research has revealed many types of regional and local groupings of manufacturers, but it has left the rationales for them assumed. Specialized manufacturing suppliers may have emerged with national or beltwide markets. Alternatively, did the belt comprise a series of metro-centered “industrial districts,” each with its own agglomeration economies, local linkages, governance systems, regulatory regime, milieu of innovation and trust, and work culture? The idea that discrete regional industrial systems operated around each metropolitan center needs to be tested in these terms.

### One Large Industrial District

It is hard to conceive of the belt as one large industrial district. The idea plays havoc with our ideas about globalization, the slow pace at which businesses became vertically integrated and multinational in scope, and the gradual annihilation of space by time. In terms of regulation, each state and province had its own industrial policies (Jarrell 1988; McCurdy 1978). The belt is subdivided by international and linguistic borders. Both U.S. and Canadian government jurisdictions extended over wide territories beyond the belt, and neither developed many truly national institutions by 1880. Production costs were not uniform over the belt’s large territory (Bater and Walker 1970; Kerr 1987). Strike activity and unionization were localized within the belt (Earle 1992), and wage rates varied across the United States (Earle and Hoffman 1976, 1980). Manufacturing involved few blueprints or detailed engineering specifications, and neither transnational corporations nor university-trained mechanical engineers coordinated transfers of designs, machine tools, and practices among establishments (Noble 1977). Moreover, it is difficult to conceive of the belt as a whole functioning as an innovative milieu or offering external agglomeration economies and the face-to-face contacts and institutions which are thought to guarantee trust within industrial districts.

“Milieu” can apply at the scale of the belt. Milieu comprises networks beyond the firm’s ownership, associated social relationships of production and management, common instrumental goals, a shared work culture, and a high level of organizational synergy (Castells 1989, 72). But “in principle, the diffusion of science and technology do not require spatial proximity,” so that
“milieu” is not necessarily defined by spatial proximity. However, “in the case of information technology industries, spatial proximity is a necessary material condition for the existence of such milieux, because of the nature of interaction in the innovation process” (Castells 1989, 82–83). Outside the context of late-twentieth-century information technology industries, spatial proximity might not be a defining characteristic of innovative milieus. Indeed, many aspects of industrial practice, trust, work culture, and innovation were widely shared among manufacturers by 1860. Robert Allen coined the term “collective innovation” to describe the ways nineteenth-century firms “collectively invent in the course of routine production and then make available to their competitors the results of their new designs and techniques” (Newell 1986, 5). Generally inventors found it difficult to hide their technical advantage from would-be copiers. Through combinations of learning-by-doing, copying, licensing, and patent purchase, manufacturers accessed technology with or without the permission of competitors. Through combinations of learning-by-doing, copying, licensing, and patent purchase, manufacturers accessed technology with or without the permission of competitors. Long-distance linkages involved license agreements, subcontracting, branch plants, strategic alliances, and credit relationships among manufacturers. Firms transferred patterns and drawings among factories, and many went much further. In the 1840s, for example, the Baldwin Locomotive Works operated around a 60-day production schedule, with materials shipped to Philadelphia from subcontracted specialist firms under “a rudimentary just-in-time inventory system,” “with bills of lading arriving in advance of the shipments” to facilitate production planning, and with payment by notes of credit with terms of up to four months (Brown 1995, 14–16). Subcontractors held Baldwin’s drawings and specifications on file and made finished parts to order. Baldwin ordered parts and materials from across Pennsylvania and from New York State, Baltimore, Boston, Connecticut, and the United Kingdom. “Baldwin’s ties to this constellation of companies had both a technical basis, dependent upon the quality of their products, and a financial aspect, and the two became intertwined” (Brown 1995, 14). Thus, simple governance structures covered early, long-distance supply relationships, and perhaps, if the belt comprised an innovative milieu, then it could have functioned as a vast supply region for manufacturers.

Industries Built Their Own Networks

If each industry built its own network of suppliers, then the belt may well be a nonsense that should be abandoned. Walker (1988) proposes that economic geography be reconceived as the study of a variety of locales integrated in networks of both dispersed and localized establishments. New industries create their own geography by making factors of production come to them. Industrial establishments can be treated as territorial complexes, ranging from the workplace, itself a geographic cluster, through to the vertically disintegrated production complex and territorial growth centers, from which established industries are dispersed to capture new markets (Storper and Walker 1989). This approach might make sense of the panoply of industrial districts within the belt, but it leaves open the question of what role region and district played in manufacturing. Clusters of networked establishments may have emerged as industries pulled suppliers to them (Storper and Walker 1989). Alternatively, a metropolis might develop its own vast resource and market region (Cronon 1991).

Manufacturers’ Supply Linkages and the Belt

All three models are untested in terms of supply-side linkages. Did manufacturers develop local, regional, beltwide, or international networks, and if they enjoyed many long-distance linkages, how were they managed? In this paper I analyze the relative importance of local and long-dis-
transcend linkages to two nineteenth-century manufacturers and thus establish spatial frames of reference for supply linkages. First, however, expectations about the geography of firm supply linkages need to be established.

Strong, complex, or reliable linkage ties have long been assumed "to operate only over limited distances" (Wood 1969, 34), partly because reliable long-distance linkages are thought to have developed only with the rise of vertically integrated corporations, which also made industrial agglomerations more or less redundant; and partly because, to be significant, linkage analysis must explain a distinctive locational pattern or trend. On these grounds explanations for industrial agglomerations are usually thought to lie in the nature of local linkages as opposed to extralocal ones (Taylor and Wood 1973). However, defining an industrial district on the basis of local versus extralocal linkages is a difficult proposition. Having noted several approaches for formulating systematic taxonomies of geographic production systems (input-output structure, governance mechanisms, and territorial forms), Gertler (1992, 263–64) finds "no real consensus" on what constitutes an industrial district. Trust may be a defining characteristic of industrial districts, but Brusco (1986) and Harrison (1992) offer different ideas about the role of trust in industrial districts than those offered by Scott (1991). There have been many types of industrial districts, and they are not simply associated with post-Fordism (Scott and Storper 1992; Storper and Walker 1989). Gertler (1992) asks: When is a district a "district"? How big can it be? What proportion of the transactions must be local? And what relations among producers constitute the necessarily unique behavior? This paper confronts these issues by using the company records of two enterprises located in specialized industrial towns.

From company records, we can establish the value of each supply link, the number, nature, and location of suppliers, and thus the relative importance of local suppliers. Company correspondence can reveal the governance relations associated with these linkages. Individual firms, rather than industry aggregates, are the units of analysis. By selecting enterprises located in specialized industrial towns rather than in metropolitan centers we can test the spatial extent and localization of linkages. The most easily tested of the three competing models is the city-centered industrial region model. Meyer (1987) maps city-centered industrial regions in the belt, and we might expect a firm's supply linkages to be localized within these regions. By the 1870s and 1880s, perhaps 70 percent of the supplies and suppliers of establishments located in industrial towns might be sourced from the immediate industrial region and the metropolitan center should figure prominently, especially in terms of business services. Alternatively, if the belt is the supply region, we could expect 50 percent of the supplies or suppliers to be sourced from outside the city-centered industrial region. Supplies should be drawn from many parts of the belt, and the metropolitan center should be a relatively unimportant source. Clear signs that industries built their own regions might be the presence of suppliers from outside the belt, different spatial patterns by industry, and increasing localization of suppliers around the manufacturer as the industry drew suppliers to it.

Enterprises must be chosen carefully, since early linkage studies reveal dramatic differences in linkage patterns among metals fabrication industries clustered in the same industrial region (Wood 1969; Taylor 1970; Taylor and Wood 1973; Johnson 1958). Machine shops and foundries were generic elements of the belt (Meyer 1987), but some built complex capital equipment, industrial machinery, and tools, while others manufactured consumer products, repaired equipment, did jobbing work, or made parts. Machine shops and foundries were both widely scattered in urban and rural locations and concentrated in special urban districts. Some were dedicated to national markets, others to local jobbing
work. Each firm used a variety of shops, skills, and materials and resorted to filing, fitting, and building to make wide ranges of products. Firms also strove for interchangeability of parts and subcontracted component production. To avoid these diverse situations, two firms producing large quantities of standardized capital equipment for national markets are analyzed here. In order to clarify the precorporate supply linkage geography of North American manufacturers, I examine the 1870s and 1880s supply arrangements of a harvesting machinery manufacturer and a stove manufacturer, each located in an industrial town.

**A. Harris, Son and Co., Brantford, Ontario**

Nestled in a small industrial complex, A. Harris, Son and Co. purchased designs, materials, energy, and finished components from widely scattered suppliers. In 1872, having acquired a license for a new reaper design, and with financial backing from a Hamilton, Ontario, merchant, Harris moved his reaper firm to Brantford. Other Brantford firms, notably I.G. Cockshutt, J.O. Wisner and Son, Verity Plow, and Patterson Brothers, built farm implements, and were all subsequently merged into the two major Canadian agricultural implements corporations: Massey-Harris and Cockshutt. By 1891 Brant County was one of four main county concentrations of implement production in Ontario (Gilmour 1972, 175–76). The Harris company thrived, with sales mushrooming from Canadian $111,299 in 1875 to $401,269 in 1885 (Winder 1991, 204–9). Before its merger into Massey-Harris in 1891, Harris was the leading producer of harvesting machinery in Canada.

When measured by the number of linkages, Harris’s enterprise appears to be a localized activity. In 1875, 64.4 percent of linkages were to other establishments in Ontario, including firms in Brantford (11.9% of linkages) and in neighboring villages and towns (13.6%). Ten years later, Ontario suppliers again contributed 64.4 percent of the firm’s linkages, with Brantford firms making up 20.1 percent and neighboring towns and villages another 16.1 percent. Most of the firm’s local linkages involved only small transactions. Purchases of cordwood comprised the largest number of linkages. When measured by the value of each transaction, the long-distance nature of the Harris company’s linkages is revealed.

At first, Harris relied upon American (67.1% of inputs by value), especially New York State (62%) supplies (Fig. 1). Rochester and Buffalo supplied pig iron (18.5%), and steel bars came from Jersey City (2.3%), but payments for harvester parts (22.4% of inputs) and royalty fees (10% of expenses) to D.M. Osborne and Co. made Auburn the largest single supply town. Paint, a small amount of coal, and nuts, bolts, and rivets were largely sourced in the United States. Montreal supplied mostly manufactured goods (10.1%), tools, and varnish, making it the third most important single source of all inputs (12.1%), far ahead of Toronto, Hamilton, and London (together 2.9%). Six establishments in Brantford, including plow manufacturer I.G. Cockshutt, and six others in nearby towns supplied 6 percent of inputs by value. Ontario contributed all of the lumber (5.8%). There was no separate freight account, but in addition to the $28,555 Harris spent on materials, parts, patents, and services, $18,995 went on wages in Brantford, $5,981 on sales commissions and salaries, and, in a separate account, a further $15,528 went in royalties to D.M. Osborne and Co. The *Account Books* do not disclose the sources or costs of the new Brantford factory opened in 1872, but New York and New England connections must have been pronounced. Together, these procurement patterns for 1875 reflect both the nascent character of Ontario manufacturing. Harris’s orientation to New York State (using Hamilton, the Grand Trunk Railway, the Great Lakes, and canals), and reliance on a local network
Figure 1. A. Harris, Son and Co., purchases of materials and parts, 1875. Source: A. Harris, Son and Co. (1872-87).
of workshops in Brantford and surrounding hamlets. Harris drew heavily upon the New York foundry hearth for designs, materials, and parts, and probably machinery, workers, technical skills, and advice as well.

In the next decade, however, Harris took advantage of his location in Canada's emerging core industrial region (Fig. 2). By 1885 Harris's inputs came largely from Ontario and Montreal sources, though supplies arrived from right across the northern tier of the Manufacturing Belt. The firm's growth entailed both a widening geography of interfirm connections and a concentration of activity within nearby workshops. Inputs from Ontario rose to 66.3 percent in 1885 from a meagre 20.3 percent in 1875. Cordwood from diverse, unknown, Ontario locations (23.6% of inputs by value) and cutter bar parts from St. Catharines (19.8% of inputs) were the two most important inputs. Hamilton manufacturers supplied 9.5 percent of inputs, mostly iron and steel but also nails and emery wheels. Oshawa's Malleable Iron Works supplied 3.6 percent of inputs, but the Cleveland Malleable Iron Co. supplied a similar amount. Increased Ontario sourcing did not translate into orders for Toronto or Brantford firms. From Toronto 19 suppliers contributed just 1.7 percent of inputs. Thirty different suppliers in Brantford contributed just 3.9 percent in 1885, up from 3.5 percent in 1875. Another 19 suppliers, scattered in 16 towns and hamlets located within a 75 kilometer radius of Brantford, contributed 2.2 percent of inputs. These industrial countryside suppliers included a steam engine builder, three implement makers, a threshing machine maker, a stove company, two machine shops, a wagon factory, and numerous artisans. On average the 49 Brantford area suppliers furnished just $304 of manufactured goods each, and none supplied more than $1,200. The outsourcing around Brantford supplied just a little more inputs by value than Nova Scotia, which sent binder twine and steel (4.2% of inputs). Purchases from the United States (9.6%) and Quebec (19.6%) dwarfed those from the Brantford area.

Inputs from the United States tended to be high value added and design related. Harris made $6,034 (2.4%) in patent-related payments to implement companies in New York and Illinois. Twenty-six American enterprises supplied manufactured goods (6.9% of inputs), including wrenches, tools, and springs. Harris split office supply and advertising budgets between Buffalo and Toronto. In 1883 Harris invested $22,074 in machinery, plant, and tools. The orders were probably made to U.S. machine tool manufacturers, but Montreal, Dundas, and Galt now boasted competitive suppliers, largely producing U.S. designs under license.

Ontario thus became the primary source region, but neither Montreal, Toronto, Hamilton, or Brantford captured the linkages. The Brantford factory, itself a cluster of workshops, did source castings and machined articles from enterprises scattered through the city and in neighboring towns, but it also developed an extensive network of suppliers in the Manufacturing Belt. Harris was never an isolated manufacturer, producing all parts and assemblies in its own factory. Nor did outsourcing grow or shrink substantially in relation to in-house production from 1875 to 1885. Harris's obligations to Osborne fell from 15 percent of sales value in 1875 to less than 1 percent ($2,782) in 1885. At the same time, the number of suppliers (not counting cordwood suppliers) more than doubled from 58 to 159 and outsourcing of materials, parts, and services ballooned to $245,822. Harris continued to buy cutter bar parts ($48,956 worth in 1885) despite factory expansion and a mounting wage bill ($82,915). In 1885 freight cost $11,835 and customs charges a further $4,325.

The precise nature of the transactions can only be guessed at from these records. Most purchases consisted of orders to manufacturers on short-term credit. In his dealings with Osborne, Harris will have had legal documents covering his patent rights and obligations but perhaps also his purchases of factory equipment, technical advice, and parts. Local purchases may
A. Harris, Son & Co., Brantford
1885
Total Purchases $245,822

Figure 2. A. Harris, Son and Co., purchases of materials and parts, 1885. Source: A. Harris, Son and Co. (1872–87).
have been done on a casual basis, with Harris supplying patterns or specifications and paying on credit. Certainly, Harris shared design and technical information with numerous suppliers. For example, Whitman and Barnes’s *Canadian Catalogue* (1892) lists the cutter bars of virtually every Ontario harvesting machinery manufacturer for sale from their plant. Most of Whitman and Barnes’s trade comprised large lots for manufacturers, and sections were sold in boxes of 50, enough to fit up, or assemble, at least 3 knives. Whitman and Barnes, an 1877 merger of a New York and a Massachusetts firm, made a comprehensive range of standard shapes: their *Canadian Catalogue* lists 752 different types of sickle knives used by Ontario manufacturers, including 44 for Harris-made machines, as well as numerous malleable iron guards and a range of spring keys, riveted flat keys, and cotter pins. In 1884 their St. Catharines works claimed to have made 60,000 knives, 15,000 cutter bars, 300,000 extra sections, and 500,000 guard plates (*Canadian Manufacturer* 1885). Farmers and manufacturers could send a telegram quoting the numbers of sections and knives and the cipher specified in the catalogue for the type of apparatus desired. Indeed, a mailed tracing of the part was deemed sufficient guidance. Knowledge sharing made this kind of ordering practice possible. By 1882 Whitman and Barnes had 18 years’ experience in knife manufacture, was well connected, and operated factories in Ohio (Akron, Canton), New York (Syracuse), and Ontario (St. Catharines) and branches in New York, Boston, Philadelphia, Cincinnati, Chicago, and Kansas City (Whitman and Barnes 1948).

The chief story here is the shift in location of suppliers. The initial dependence upon New York State suppliers collapsed. In its place emerged a complex array of linkages: local casting and machined part supplies from Brantford and its industrial countryside; iron and steel from Cleveland, Hamilton, Oshawa, and Nova Scotia; patent, tool, and other purchases in small lots from the United States; heavy purchases of manufactured goods in Montreal; cutter bar parts from St. Catharines; cordwood from southern Ontario. It was not just that transport and communication improvements made this new pattern possible. By 1885 foundries, machine shops, and associated services, often replicas of New York and Ohio practice, were established in Ontario and ready to supply, but Harris’s interests now ranged over most of the northern tier of the U.S. Manufacturing Belt states, throughout central and west southern Ontario, and into Quebec and Nova Scotia. This indicates both the rapid integration of Ontario into the Manufacturing Belt and a hierarchy of inputs, with neighboring firms supplying castings and components while distant firms supplied molding sand, paint and equipment, iron, steel, coal, and fastenings. Toronto does not figure as a supplier, and Montreal, the metropolitan center for Ontario at the time, never captured more than 15 percent of supplies by value. It seems that southern Ontario’s manufacturing complex grew out of New York State as existing practices were replicated for a new market region and as manufacturers drew suppliers to the region. For Harris, this process coincided with a proliferation of distant suppliers within the belt: in 1875 he ordered supplies from four of the U.S. industrial regions identified by Meyer (1987) and two Canadian regions; by 1885 suppliers ranged across seven U.S. and three Canadian industrial regions, with one supplier in the United Kingdom.

**Marcus L. Filley Stove Co., Troy, New York**

Marcus Filley’s modest stove company nestled in the Albany-Troy industrial agglomeration, which boasted iron, stove, shirt, and collar specializations (Walker 1988; Walkowitz 1978). Troy stove making showed signs of flexible specialization, linkages based upon trust, and agglomeration into local districts, and, not surprisingly,
Filley had strongly localized linkages within the Hudson-Mohawk area. In 1875 Albany and Troy had 32 stove foundries, together turning out over US $5.8 million of cast-iron products, including 450,000 stoves (Groft 1984, 16). At least 240 Albany and Troy stove firms operated at one time or another in the nineteenth century, and others located in neighboring districts (Groft 1984). Enterprises shared just a few foundries, and companies moved from foundry to foundry. Companies maintained commercial buildings on Troy’s River Street or Albany’s Green Street and contracted the use of cupola furnaces and molding rooms; finishing and mounting rooms; cleaning rooms; machine, blacksmith, tinsmith, hollow ware, fire iron, and enameling shops; galvanizing works; and fire brick and stove-lining works. Pattern shops supplied wooden patterns to both local and out-of-town stove makers. Inmates of Sing Sing Prison in Westchester County assembled stoves for Perry Stove Co. (Groft 1984, 21). Molders subcontracted for stove making and were responsible for the size of the work force. Some stove companies manufactured hollow ware, steam engines, architectural iron, plows, and other iron products in addition to stoves (Waite and Waite 1973). The cities’ largest stove maker, with 550 workers in 1880 and 1,200 in 1885, turned out 200 different models of stoves in the mid-1870s. By 1880 the two cities employed 34,200 manufacturing workers, including many women, but with 13.5 percent of workers making foundry and machine shop products and another 12.7 percent turning out iron and steel (Meyer 1987). By the 1880s the Burden iron mills employed 1,000 workers in bolt, rivet, railroad spike, and wrought iron bar production, while Corning and Winslow employed 1,500 workers in bar and sheet iron manufacture (Walkowitz 1978). Ostensibly, these enterprises had a large local market among stove makers, as did clothing manufacturers, and Albany and Troy made up a large, functionally integrated, industrial agglomeration.

Both the Hudson-Mohawk agglomeration and the New York–centered industrial region figure prominently in Filley Stove’s linkages (Fig. 3). Troy accounted for 66 percent of suppliers and 58 percent of supplies by value, the Hudson-Mohawk area for 76 percent and 74 percent respectively, and the industrial region for 93 percent and 96 percent (Filley 1871). Filley purchased stoves, stove parts, hollow ware, and patterns from 24 Albany, Troy, and Schenectady firms (Table 1), but Filley also placed orders with firms in Massachusetts and Connecticut. Altogether, these 27 firms shared product knowledge with Filley Stove. Invoices indicate the number of pieces required and assume prior knowledge of the product and its production, but do not divulge the ways in which knowledge, practices, and designs were shared. Filley sold stoves, castings, and brick to 18 Hudson-Mohawk area stove and tinware manufacturers (Table 2). Filley ordered fastenings (stove bolts, stone pins, and nails) from suppliers in Troy, Saratoga Springs, and Cohoes, but also from firms in Massachusetts and Connecticut. Galvanizing, tool purchase, and repair were done locally. Numerous as these local linkages were, however, Filley’s local dealings were insignificant in monetary terms. At $0.07 per pound ($0.15 per kilogram) for castings and with discounts, Filley’s stove parts and pattern purchases totaled only $6,137, or 9 percent of purchases by value (Table 1), and Sanford and Clute of Schenectady, the largest local area parts supplier, received orders worth only $2,220.

Pig iron purchases comprised 74 percent of Filley’s 1871 invoices by value. These purchases were made through three New York ($12,046), one Philadelphia ($990), and one Troy ($15,349) agent as well as directly from the Hudson Iron Co. ($21,730) and Coleraine Iron Co. ($900). Filley corresponded with a number of manufacturers’ agents and compared prices and service. Agents shipped pig iron from Pennsylvania, New York, and U.K. furnaces to New York City and up the Hudson River, in 30 and 50 ton (27 and 45
Figure 3. Marcus L. Filley Stove Co., purchases of materials and parts, 1871. Source: Marcus L. Filley Stove Co. (1868–1912).
### Table 1

**Suppliers of Goods and Services to Filley Stove Co., 1871**

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<tr>
<th>Goods and Services Supplied</th>
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<th>Hudson-Mohawk Value ($)</th>
<th>Supplies</th>
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<td>23.63</td>
<td>100.0</td>
</tr>
<tr>
<td>Other goods</td>
<td>26</td>
<td>92.3</td>
<td>1,220.78</td>
<td>88.3</td>
</tr>
<tr>
<td>Finance</td>
<td>1</td>
<td>100.0</td>
<td>3,265.61</td>
<td>100.0</td>
</tr>
<tr>
<td>Freight</td>
<td>1</td>
<td>0</td>
<td>8.00</td>
<td>0</td>
</tr>
<tr>
<td>Insurance</td>
<td>2</td>
<td>100.0</td>
<td>194.97</td>
<td>100.0</td>
</tr>
<tr>
<td>Information</td>
<td>6</td>
<td>66.7</td>
<td>40.91</td>
<td>31.6</td>
</tr>
<tr>
<td>Taxes</td>
<td>2</td>
<td>100.0</td>
<td>377.39</td>
<td>100.0</td>
</tr>
<tr>
<td>Societies</td>
<td>3</td>
<td>100.0</td>
<td>18.50</td>
<td>100.0</td>
</tr>
<tr>
<td>Totals</td>
<td>131</td>
<td>79.4</td>
<td>68,831.41</td>
<td>51.4</td>
</tr>
</tbody>
</table>

Source: Marcus L. Filley Stove Co. (1868–1912).

<sup>a</sup> Includes Albany, Cohoes, Hudson, North Troy, Saratoga Springs, Schenectady, Troy, and West Troy.

<sup>b</sup> Filley purchased $21,730 of pig iron from the Hudson Iron Co. The remaining pig iron was bought—through agents in Troy, New York, and Philadelphia or directly—from Pennsylvania and New York furnaces, all located outside the Hudson-Mohawk area.

### Table 2

**Filley Stove Co.’s Sales Linkages to Stove Dealers and Manufacturers, 1871**

<table>
<thead>
<tr>
<th>Region</th>
<th>To Agents and Dealers (N)</th>
<th>To Stove and Tinware Makers (N)</th>
<th>Total Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hudson-Mohawk&lt;sup&gt;a&lt;/sup&gt;</td>
<td>33</td>
<td>18</td>
<td>51</td>
</tr>
<tr>
<td>Rest of New York State</td>
<td>79</td>
<td>3</td>
<td>82</td>
</tr>
<tr>
<td>Rest of Manufacturing Belt&lt;sup&gt;b&lt;/sup&gt;</td>
<td>118</td>
<td>6</td>
<td>124</td>
</tr>
<tr>
<td>South</td>
<td>39</td>
<td>1</td>
<td>40</td>
</tr>
<tr>
<td>Pacific Coast</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Unknown</td>
<td>14</td>
<td>0</td>
<td>14</td>
</tr>
<tr>
<td>Totals</td>
<td>284</td>
<td>28</td>
<td>312</td>
</tr>
</tbody>
</table>

Source: Marcus L. Filley Stove Co. (1868–1912).

<sup>a</sup> Includes Troy, West Troy, Albany, Amsterdam, Ballston Spa, Canajohai, Cobleskill, Cohoes, Fort Edward, Glens Falls, Hudson, Saratoga Springs, Schenectady, Stuyvesant Falls, and Whitehall.

<sup>b</sup> Includes Quebec and New Brunswick.
Table 3

<table>
<thead>
<tr>
<th>Region</th>
<th>Iron Tonnes</th>
<th>%</th>
<th>Horse Shoes and Rivets Kegs</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mohawk-Hudson Area</td>
<td>2,571.2</td>
<td>35.19</td>
<td>7142</td>
<td>2.04</td>
</tr>
<tr>
<td>New York City</td>
<td>3,430.0</td>
<td>46.94</td>
<td>59,033</td>
<td>16.86</td>
</tr>
<tr>
<td>Rest of New York State</td>
<td>0.9</td>
<td>0.02</td>
<td>22,555</td>
<td>6.44</td>
</tr>
<tr>
<td>Rest of Manufacturing Belt b</td>
<td>1,262.5</td>
<td>17.27</td>
<td>188,232</td>
<td>53.76</td>
</tr>
<tr>
<td>Other sales</td>
<td>42.6</td>
<td>0.58</td>
<td>73,190</td>
<td>20.90</td>
</tr>
<tr>
<td>Total sales</td>
<td>7,307.2</td>
<td>100.00</td>
<td>350,152</td>
<td>100.00</td>
</tr>
</tbody>
</table>


a Includes Troy, West Troy, Albany, Johnstown, Schenectady, Ballston Spa, and Hudson.
b Includes Ontario.

tonne) lots at $30–35 per ton ($33–39 per tonne). Some of the iron purchased from the Troy agent was sourced at the Corning works, but most came from farther afield. If this pig iron and the Hudson supply are discounted from the Hudson-Mohawk area total, then virtually all of Filley’s pig iron was sourced from outside the local industrial agglomeration, leaving 75 percent of suppliers inside the Hudson-Mohawk area supplying only 20 percent of all inputs by value. Local iron mills did not make large sales to local stove makers. By 1880, the Burden Iron Co. enjoyed national markets for rivets and horse shoes, and its iron production sold across the Manufacturing Belt (Table 3). New York City was Burden’s largest market and, apart from a half tonne of iron, none of its local sales were to stove companies. Filley Stove took advantage of the Hudson River, Erie Canal, and railroads to access Pennsylvania, New York, and New England pig iron at the same time that Hudson-Mohawk area firms provided crucial local linkages and national profile.

Final processors figured prominently in Filley’s activities. He sold stoves and stove parts to ten manufacturers located outside the Hudson-Mohawk area, including one in the South (Table 2). His main partner oversaw a stove warehouse in New York City. In 1871 stoves were shipped to 312 dealers, agents, and manufacturers, each of whom assembled and installed the stoves. Filley’s roving agent, Ira Wood, arranged for delivery of products, sales commissions, and tallies of sales during his lengthy journeys around the United States. These forward linkages were vital to Filley’s operations. When Filley’s San Francisco dealer settled his account for 1868 to 1870, payment came in the form of a sight draft on New York for $1,319 and four notes totaling $10,363 at 12 months dated in November and December 1870 (Locke and Montague to Marcus Filley, 25 March 1871). Filley’s sales to dealers, agents, and manufacturers constituted forward manufacturing linkages, and their number and spatial extent sorely test the idea of Troy and Albany as a coherent industrial district.

Albany-Troy constituted a cultural hearth for iron, steel, and foundry practice, and the cities’ transport corridors diffused practices and institutions. Local stove makers, molders, and pattern makers diffused wooden patterns, stove licenses, trained apprentices, even stove enterprises, and participated in the definition of manufacturers’ practices, working-class lifestyles, and modes of resistance in the Manufacturing Belt. Stove companies traded wooden patterns to distant foundries, a trade bound up in the licensing agreements they bought and sold. Canadian and U.S. stove trade catalogues reveal the Troy, Albany, Philadelphia, Cincinnati, and Chicago origins of many of the stove designs. Stove enterprises often began by selling stoves, then entered man-
 manufacture by buying stove licenses, patterns, molding sand, coal, and pig iron. By the end of the century each North American stove maker advertised full ranges of standard stove, range, and heater types, some of their own design and others licensed from or subcontracted to other manufacturers (Giedion 1975 [1948], 533–36). Collective innovation characterized North American stove making, facilitating widespread production of standard product types and cartel activities.

Albany and Troy played key roles in wider social organizations. The cities' iron, steel, and foundry company owners comprised a “formidable interlocking directorate of financial power and social prestige” with influence beyond Albany and Troy (Walkowitz 1978, 28). Based in city foundries, the Iron Molders' International Union's (IMIU) Local 2 was the “largest, most powerful molders local” in the United States (Walkowitz 1978, 6). Its members shaped work conditions, wages, and product design. Troy molders built their own cooperative foundry, and this idea diffused to other industrial cities through the labor movement (Groft 1984, 19). Founded in 1823-24, Rensselaer Polytechnic Institute was the first engineering school in the United States (Noble 1977, 22). Mechanical engineers trained in the institute and with experience in the iron mills migrated to other Manufacturing Belt locations. The institute shaped engineering education in the belt. In these and other ways, workers and manufacturers far from Albany and Troy linked into the cities' industrial practice and culture.

Troy and Albany stove makers became uncompetitive in the 1880s. Competitors in Pittsburgh, Cleveland, and especially Chicago took advantage of new iron and steel industry innovation, less-powerful union locals, easier access to Midwest markets, Mesabi Range iron ore, and the Midwest steel industry. New York producers of iron, stove, and steel products found it difficult to adapt to bituminous coal from western Pennsylvania and Ohio and to the conversion from charcoal to coke in steel making (Walkowitz 1978). The cities' strong unions hampered the intensification of work processes. Developments in the heating industry called for much greater use of steel in ranges and central furnaces. Troy's small stove foundries, operating out of old shops, could not capitalize these innovations, especially while the owners confronted militant molders in pitched battles between contending police forces in the “reign of terror” of the late 1870s and early 1880s. Nor could their New York–centered industrial region suppliers offer competitive materials. Solutions were found in amalgamation, bankruptcy, or departure for new locations. By 1920 only two stove companies remained. Clearly, Troy and Albany fortunes hinged upon relations with manufacturers in other parts of the belt.

Filley Stove relied heavily upon suppliers within the Hudson-Mohawk area and the New York–centered industrial region, but drew upon manufacturing suppliers in five regional industrial systems and coordinated forward processing linkages with dealers and manufacturers throughout North America, but especially in the Manufacturing Belt. Furnaces in Pennsylvania and New York supplied pig iron, the most important input. New York City figures prominently in supply relations. The Filley records offer much clearer evidence than the Harris records of city-centered industrial regions framing supply linkages, but the enterprise's long-distance linkages must not be underestimated.

**Toward a Geography of Nineteenth-Century Supply Linkages**

The two firms studied here display remarkable arrays of long- and short-distance linkages. Iron, steel, castings, and finished components were sourced from well outside the firms' immediate regional industrial systems. Both firms ordered parts, repairs, materials, goods, and ser-
vices from many local suppliers, but such suppliers accounted for a low proportion of the total value of supplies. Many distant suppliers shared Harris and Filley’s technical and design knowledge. The two firms’ supply regions covered broad subregions of the Manufacturing Belt. By 1885 Harris obtained 60 percent of his supplies by value from Ontario, but suppliers ranged over seven U.S. and three Canadian regional industrial systems. Despite his heavy reliance on the New York-centered industrial region, Filley drew supplies from five of the U.S. regional industrial systems. Metropolitan centers did not dominate these companies’ supply linkages. Neither Harris nor Filley sourced more than 20 percent of their manufacturing linkages by value from their respective metropolitan centers. Their supply linkages were largely to firms in widely scattered industrial cities, villages, and towns. Both Harris and Filley shared product technology with dozens of distant manufacturers. Together, these patterns indicate the importance of the Manufacturing Belt, or at least broad regions within it, as a context for firm behavior over and above industrial regions, districts, or locales.

The Harris case offers evidence for the spatial extension of the belt as a process of frontier replication. Harris’s changing geography of suppliers indicates both a shift away from New York State as the focus of his network, localization of sources inside Ontario, and an extension of the overall supply region to include states and provinces right across the northern part of the belt. Manufacturers in new industrial regions initially relied on long-distance linkages to firms located in industrial culture hearths. Subsequently, they pulled to their own region replica suppliers, but also developed further supply relationships outside their immediate region. Perhaps firms that did not take advantage of new specialized suppliers located beyond their metro-centered industrial system risked becoming mired in uncompetitive supply relations. A new and distinctive geography of networks probably supported firms adopting second industrial revolution technology and in the process rendered obsolete many industries and regions within the belt.

The spatial extent of the Harris and Filley supply networks seems at odds with concepts of milieu, governance, regulation, embeddedness, and trust developed for late-twentieth-century manufacturing contexts (Zucker 1986). These economic geography terms do not translate well into nineteenth-century contexts. Nineteenth-century licenses, subcontracts, and orders took a great deal for granted, especially the specifications of the goods themselves. Firms depended upon a common repertoire of skills, techniques, materials, and designs and had to possess basic process technology, but they could produce various designs using purchased components. Collective innovation involved learning by doing and copying from other machines, but also apprenticeships and transfers of technology from master to apprentice and among kin; searches of Scientific American and the Patent Office Recorder; employing consultant mechanics, pattern makers, or patent agents; relying on machine tool and parts suppliers for innovations; taking out licenses; and establishing spin-off plants. Licensing was far more common than in the United Kingdom (Macleod 1992). Collective innovation and recourse to fitting obviated the need for precise specifications and strict interchangeability for most foundries and machine shops. Customary work practices, like production for seasonal markets and seasonal works closures, meant that firms ordered in anticipation of demand and resorted to stockpiles. This situation is a far cry from “production subcontracting” (Walker 1988, 389–91), but it did facilitate long-distance supply in manufacturing.

Practices were developed, diffused, unpacked, and tinkered with across the continent and were backed by governance and regulatory structures that have been obscured in most accounts. Key regulatory institutions included patent offices and departments of agriculture. In both
Canada and the United States the patent office and census bureau were initially part of the department of agriculture, and all three agencies provided services for manufacturers. They stimulated and registered innovation, educated and trained workers, protected and enumerated manufacturers, arranged exhibitions of manufactured goods, and offered prizes to manufacturers (Winder 1995). Patent offices granted and enforced patent rights, oversaw transfers of technology under licenses, and advertised innovations through office journals (Cooper 1991).

By the 1870s manufacturers shared business services, institutional and social networks, and informal credit networks. Business services, like Dunn and Bradstreet’s creditworthiness appraisals and railroad, postal, and telegraph services, operated widely throughout the belt from an early date. Family networks and alliances provided trust for enterprises and coordinated production in distant establishments through separate firms, branch plants, partnerships, or licensed enterprises. Owners mobilized as a class (Veblen 1953 [1899]; Kirkland 1956). While each town had one or more circles of business people (Ingham 1991), owners also networked at regional levels and had national aspirations and interests. Manufacturers’ associations emerged as early as the 1860s (Clark 1939), and cartels tried to set prices and allocate market territories and production at national conventions. Metropolitan finance houses provided credit, but manufacturers relied upon financial interdependence with suppliers and purchasers.

Machine tool manufacturers transferred innovations across industries and pushed for standardization of industrial practices. The U.S. armories stimulated machine tool development and diffused the “American system of manufactures” (Rosenberg 1982; Hounshell 1981, 1984), but the significance of these transfers is sometimes exaggerated (Best 1990, 29–45). Hoke (1990) has warned that this was not the only way in which interchangeability was achieved, and Brown (1995) shows how one influential capital equipment builder achieved interchangeability without recourse to the armories. Systematic diffusion routes may have emerged for machine tool technology, and some machine tool producers—for instance, William Sellers (Table 4)—had widespread influence. Standardization proceeded despite the early dearth and later proliferation of engineering institutions. The Franklin Institute and the American Society of Civil Engineers (ASCE) pushed for national standards in engineering, for instance through an investigation into steam boiler explosions and tests of iron and steel strength and screw threads (Sinclair 1969). The proliferation of local scientific and engineering institutes facilitated rather than precluded collective adoption of standards across the continent before the U.S. Bureau of Standards was established in 1911.

Skilled workers registered in international trades unions and schooled in practical science underpinned manufacturing production. Migration, featuring frequent moves and return migration, created permanent links between sending and receiving communities, so that “In the extreme

<p>| Table 4 |
| William Sellers and Co., Visitors’ Register, 1865 |</p>
<table>
<thead>
<tr>
<th>Region</th>
<th>Places</th>
<th>Visitors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Philadelphia</td>
<td>1</td>
<td>1.6</td>
</tr>
<tr>
<td>Middle Atlantic</td>
<td>13</td>
<td>20.3</td>
</tr>
<tr>
<td>New England</td>
<td>8</td>
<td>12.5</td>
</tr>
<tr>
<td>Quebec and Ontario</td>
<td>2</td>
<td>3.1</td>
</tr>
<tr>
<td>Great Lakes</td>
<td>7</td>
<td>10.9</td>
</tr>
<tr>
<td>West North Central</td>
<td>1</td>
<td>1.6</td>
</tr>
<tr>
<td>South Atlantic</td>
<td>2</td>
<td>3.1</td>
</tr>
<tr>
<td><strong>Manufacturing Belt</strong></td>
<td><strong>34</strong></td>
<td><strong>53.1</strong></td>
</tr>
<tr>
<td>South</td>
<td>15</td>
<td>23.4</td>
</tr>
<tr>
<td>West</td>
<td>1</td>
<td>1.6</td>
</tr>
<tr>
<td>Europe</td>
<td>6</td>
<td>9.4</td>
</tr>
<tr>
<td>Latin America</td>
<td>2</td>
<td>3.1</td>
</tr>
<tr>
<td>Africa</td>
<td>1</td>
<td>1.6</td>
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<tr>
<td>Unknown</td>
<td>5</td>
<td>7.8</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>64</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

case, a craft became an ‘invisible college,’ occupational ties dominating those of proximity” (Southall 1989, 167; also Southall 1989; Cumbler 1980; Berthoff 1968 [1953]). Trades unions fought for wages, conditions, shopfloor control, and status on both sides of the Canada-U.S. border (Montgomery 1979; Palmer 1979; Kealey 1980; Heron 1980). International unions set out a common vocabulary and structure of unionism, making possible the synchronization of strike action (Earle 1992, 346–445). Divided, with different strengths from one town to the next, and with ethnic tensions cutting across their attempts to organize within and beyond the factory (Davis 1980), U.S. skilled workers nevertheless achieved a ten-hour work day norm by 1880 (Atack and Bateman 1992) and pushed on for the eight-hour day. Skilled workers dominated innovation and production until product development concentrated in the hands of engineers in the second industrial revolution (Noble 1977). Despite a proliferation of local engineering societies, as early as 1870, two national engineering organizations dominated the U.S. scene: the New York–based ASCE and the American Institute of Mining Engineers (Layton 1986; Reynolds 1991).

While these phenomena mark an era of capitalist production, they also mark a geographic organization of manufacturing effort. Perhaps two broad geographies of innovation and diffusion can be identified with this evolving milieu. First, as the center of industrial activities shifted westward and the boundaries of the belt were set through processes of specialization and localization, a foundry frontier operated (Winder 1995). Equipped with the product rights, technical backing, and expertise of the firm from which they came, entrepreneurs established new factories named after local proprietors as branch plants or spin-off firms. Innovation on the frontier, industrial hearths, the diffusion of innovations, the migration of factors of production, and windows of opportunity for locales characterized this frontier process (Storper and Walker 1989, 70–71). Second, Midwest producers organized new resources and innovations and in some industries outcompeted eastern firms (Page and Walker 1991). Midwest industries created their own geography by making factors of production come to them. In these ways replication of the social relations of production across the belt mitigated the friction of distance and enabled both expansion of the belt and concentration and specialization within it. Thus, Troy became a design center and cultural hearth in stove making, but this occurred on the back of expansion of stove making to foundries elsewhere, not through the creation of an enormous concentration of stove making in Troy to serve all national markets. Yet Troy stove makers did serve the entire continental market with semifinished stoves and stove designs.

By the 1870s the learning process of the firm took place within a broad industrial milieu. North American manufacturers operated through networks of locales, whose geographic spread corresponded with, but were not identical to, Manufacturing Belt boundaries. Each firm used both long and short range connections, many of them not covered by any formal or ownership governance structures. However hard they are to trace, long-distance interfirm linkages are central to explanations of the competitiveness and organization of nineteenth-century industry. Machine shop and foundry owners engaged far-flung manufacturers in support of their local production in the 1860s or even earlier, altogether producing dense networks of supply linkages which certainly transcended the confines of regional industrial systems and may be taken as constituting the Manufacturing Belt.

This paper has concentrated upon machine shops and foundries, but other industries betray long-distance linkages. Textile mills in Georgia or New Brunswick were designed by Massachusetts engineers, fitted with cotton textile machinery from Lowell, and staffed by New England managers. The resulting mill towns shared technology and management structures as
scaled-down approximations of Lowell, with its dozens of mills. Future research may well reveal connections among inner-city garment districts in New York, Philadelphia, San Francisco, Montreal, or Toronto. For firms in the metal-processing industries examined here, the increasing complexity of manufacturing linkages, their proliferation and their intensification within the belt all suggest that the belt as a whole, or very large subregions within it, functioned as key frames of reference for manufacturers' supply networks.

When conceived as a container of manufacturing, the North American Manufacturing Belt remains a chaotic conception. While it was a denser mat of manufacturing establishments and rail lines than found in the rest of the continent, the belt was at once a manufacturing landscape and a farm landscape. It can be subdivided into regional industrial districts with metropolitan centers, and, through processes of localization and specialization, the belt is riven by local, regional, and national variations. As a geographic outcome, the belt does not itself reveal the nature of manufacturers' interactions. They can only be captured through analysis of the linkages developed by indicative companies at particular moments. Such analysis supports the idea of the belt as a functioning industrial region: by 1870 manufacturers shared network, regulatory, and governance structures at the scale of the belt.

However, the canon of early “industrial district” names emerging in the debates over new industrial districts and flexible manufacturing systems (Piore and Sabel 1984 versus Scott and Storper 1992) cannot stand as summaries of old modes of industrial organization on their own. When new work (Amin and Robins 1990) demythologizes the currently emerging geography of flexible accumulation, the mythology of a more cozy, local, and communitarian industrial past persists, indeed is generated (Gertler 1992). Propinquity can foster the trust, regular meetings, and socialization which are vital to disintegrated networks and can generate agglomeration economies, but propinquity is not a necessary condition for linkage relationships. Local and distant industrial interactions were mutually constitutive. Some studies cast disintegrated networks over large territories (Christopherson and Storper 1986), and besides, proximity may lead to competition as well as to cooperation. Town settings may be divided by conflict, leading to desires for escape, resistance, repression, or control. While the nature of and context for proximate connections are important objects of economic geography inquiry, current research narrowly focuses on clusters of establishments. Before the rise of the vertically integrated industrial corporation, manufacturers built and participated in extensive, disintegrated supply networks. If it is to be useful as a geographic metaphor, the North American Manufacturing Belt is best conceived as a manifestation of these early linkages.

References


Economic Geography


Scott, A. 1991. The role of large producers in industrial districts: A case study of high-technology systems houses in Southern


——. 1948. The First 100 Years of Whitman and Barnes, Makers of Fine Tools Since 1848. Detroit: Whitman and Barnes, A Division of United Drill and Tool Corp. Hagley Museum and Library, Wilmington, Delaware.


