



The Industrial Geographer

ISSN 1540-1669
VOLUME 1 ISSUE 1 FALL 2003

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Mission

The Industrial Geographer (ISSN 1540-1669) publishes articles and research notes that focus on a broad range of economic issues across all economic sectors and explore issues at all scales from the firm to the globe. The journal encourages submissions that are theoretically driven empirical research, papers with an applied and planning thrust, and papers that explore directions for future research. Individuals interested in organizing a special issue should contact the editors or a member of the editorial board.

Publication Information

The Industrial Geographer (ISSN 1540-1669) is published bi-annually in the Fall (September-October) and Spring (April-May). Additionally, special issues may occasionally be published on an irregular basis. The journal is a collaborative effort between the ISU Cunningham Memorial Library and the Department of Geography, Geology, & Anthropology. The **IG** is also affiliated with the Regional Development & Planning Specialty Group. The journal is available free of charge via the internet [<http://igeographer.lib.indstate.edu>] or vis-à-vis one of many on-line content aggregator services. To contact the publishers, write to *The Industrial Geographer*, 159 Science, GGA, Indiana State University, Terre Haute, IN 47809. (812)237-2256.

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Editorial—A Venue, A Vision, and An Opportunity...

The inaugural issue of the *Industrial Geographer* is an important moment for us the editors and the editorial board. The publication of Volume 1 Issue 1 is an accomplishment that should be positioned within the context of the *IG's* mission, unique format, author opportunities, and delivery mechanisms.

Rationale & Mission

The *Industrial Geographer* is envisioned as a venue for high quality research and writing on industrial geography. We are motivated to do this because the traditional outlets for theoretically-driven empirically-based industrial geography have increasingly focused on social theory, debates in critical human geography, and/or a variety of social theory-case study hybrids. As such, we believe that a demand and readership exists for this new outlet. At the same time, the *IG* intends to serve as an outlet for emerging geographies that identify new directions and prompts conceptual debates. As the mission statement below illustrates, the journal emphasizes the unique nature of industrial geography and its specific context within the discipline.

The Industrial Geographer publishes articles and research notes that focus on a broad range of economic issues across all economic sectors and explore issues at all scales from the firm to the globe. The journal encourages submissions that are theoretically driven empirical research, papers with an applied and planning thrust, and papers that explore directions for future research.

Format

The journal is structured around two independent sections and editorships. The articles section is unique in that shorter articles are encouraged and submissions of any length are accepted. The intent of the articles section is provide an initial venue—perhaps even a developmental venue—for industrial geographers to shape, form, and rethink current and future research. As such, the review time will be kept to a minimum with the primary objective being the development of high quality manuscripts. The research note and discussion section provides an opportunity to engage in semi-structured discussions with colleagues on methods, concepts, new books, pedagogy, and issues in industrial geography. Likewise, the research note will enable researchers to publish initial brief empirical accounts of research findings. Finally, the notes section of Issue 1 for each volume will include a list of selected papers in industrial geography prepared by the section editor with the assistance of the editorial board. This should act as a quick and useful reference guide for faculty and students alike.

Authorship

Unlike traditional journals, the *IG* provides authors expanded opportunities. First, authors will retain all rights to their work. As such, authors are encouraged to expand, develop, and rearticulate their ideas in subsequent research with the understanding that

subsequent works will: (1) represent a reasonable extension beyond the boundaries of the *IG* paper; and (2) the *IG* paper be cited in the bibliography. Second, the electronic format provides new opportunities to be creative. That is, the 'press-ready' electronic format will afford the editors the potential to publish in a variety of styles including posters, wide-format maps, or other creative works. Likewise, authors can publish papers that include multimedia components or links to outside Internet resources.

Delivery

The *IG* will be hosted on a Indiana State University server and freely distributed as a PDF via the web and has been included in many e-journal catalogs, such as the University of Colorado's E-journal Miner. Additionally, the *IG* will be indexed and delivered as content to the thousands of subscribers of EBSCO Host and other derivative bibliographic and full-text products of EBSCO Publishers, Inc. In the future, we expect other content aggregators will also include the *IG* as part of their services. In fact, upon publication of the first issue other prominent e-content providers have agreed to review our content and determine its appropriateness for subsequent inclusion.

In this issue, the papers represent a range from reflective to empirical. In the first paper, Stafford uses his own biography to explore the development of traditional industrial geography in North America with an emphasis on the trajectories established by the quantitative revolution. The second paper, MacPherson & Kalafsky's study

of the machine tool industry, puts a new spin on the industrial geography of heavy industry to understand how industrial renewal occurs. Finally, Oshiro provides an interesting albeit more traditional note on the bubble economy and its implications on the real estate industry in Japan as the pressures of territorial industrialization alter the cost of residential and commercial land.

As the articles in this issue imply, the journal welcomes submissions on all aspects of industrial geography and encourages papers that focus on any region of interest to scholars. Moreover, we would like to emphasize that while the journal is based in North America scholars from around the world are encouraged to submit, nominate potential editorial board members, or propose a special issue.

In closing, we thank you for your support and truly hope the *IG* comes to be a valuable contribution to the discipline. Additionally, we would like to acknowledge the support, feedback, and constructive criticism of the editorial process as they have provided needed insights throughout the development and—now—implementation phases of this project. If you have any questions, suggestions, or comments, please feel free to share them with any member of the editorial board.

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Industrial Geography in the United States, the past half century

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Some immediate reactions when asked to write a review of the past half century of industrial geography were about how well would my memory serve me, how wide a net to cast, and if 50 years is an acceptable time frame. I began by outlining what I remember of my personal experiences in the field. Then I wrote to many industrial geographers, some of my acquaintance and some I knew only by their contributions to the literature or membership in the economic geography group of the Association of American Geographers, and asked for their perspectives and remembrances of the course of industrial geography over the past few decades. Several answered, and their responses have helped shape the narrative that follows. I next consulted a variety of sources, including reviews others have written, and textbooks that could reflect both the changes and the enduring themes.

The half-century time frame seemed comfortable. On a personal level, my first exposure to industrial geography was almost that long ago, when I started graduate school at Iowa in 1955, and had the good fortune to work under H. H. McCarty, a leader in economic geography and in the spatial economic theory, quantitative tech-

niques “revolution” of the period. The 1950s and 1960s were a period of exciting change in industrial geography. It also was a time of much contention. I remember going to my first Association of American Geographers West Lakes Division meeting at the University of Illinois. A leading industrial geographer, Joseph Russell, characterized me as “one of those Iowa numbers boys.” It now seems to me that we are currently in another time of paradigm conflict, with those who focus on the sociology and consumption of production and favor different styles of “theorizing” even while there is a revival of interest in analytical, regional science type research. From my perch it looks a lot like what is old is new again.

As by now obvious, this essay is seriously biased. The net is not cast very far. It is very highly focused on what has happened in industrial geography in North America, and especially in the United States. There is a sprinkling of reference to the important contributions from the United Kingdom and a soupcon of nods to other parts of the world, but it by no means reflects a very broad purview of industrial geography around the world. Also, there is no attempt to provide a literature review. The references cited are merely to

support or illustrate my points. Many more worthy contributions are neglected than cited, so if your favorites are not here attribute it to my poor memory, or the constraints on the length of this piece, or my just running out of time. However, the references in the sources here noted can lead to the much broader industrial geography literature. The focus is on a broad outline; there is insufficient space to provide detail on content, but it is hoped that placing the themes in context will facilitate the reader's subsequent review and evaluation.

INDUSTRIAL GEOGRAPHY, HOW DO WE SEE IT?

The scope of the essay also is restricted in another sense. It is mainly focused on production and production systems and especially on manufacturing. The question of a definition of "industrial geography" was raised by several of the respondents to my invitation to provide their perspectives. J. W. Harrington feels that "industrial geography is now the study of production and production systems across all sectors (whereas) economic geography includes consumption, living standards, and perhaps more of an emphasis on labor (re)production than industrial geography" (Harrington, 2002). H. D. Watts sees the "central question of industrial geography as to why industrial activities grow/decline in particular places. It seems to me that, in the most recent past, this question gets lost in the detailed examination of processes involved, and understanding the process rather than the outcome has become the central question" (Watts, 2003).

Walker sees traditional industrial geography as focused on the making of goods, and an expanded view of the geography of production also includes the production of services. One way he looks at the geography of industries is through the lens of spatial divisions of labor, which also can be sliced by occupation. Another way to view the geography of production is by looking at the sites of plants and firms, and their corporate geography (Walker, 2003). These ideas influenced the organization of the essay.

A PERSONAL PERSPECTIVE

I began by outlining the materials along a rough time-line, by decades. However, as I organized ideas and perceptions, mine and those of others, it became apparent that significant themes occurred time and again. I decided that in addition to noting the new, the persistence of some oscillation around other focal points is significant, and can be better appreciated by organizing around the themes themselves. The research themes are (1) spatial patterns of industries and industrial sectors, (2) geographies of companies, (3) industrial places (spaces), clusters, districts, and regions, (4) process via location theory, old and new, (5) process via company decision-making, (6) process via social context, and the consumption of production. To these are added two other sections. One deals with observations about the communities of scholars which have shaped the field over the past decades. Another looks at applied industrial geography.

A persistent theme has been examinations of the *spatial distributions of industries (industrial sectors)*. The large and visible and “heavy” industries have been especially popular, such as oil, steel and automobiles, but other industries have received attention, including Hoover’s classic study of the shoe and leather industry, and even paperboard containers (e.g., Hoover, 1937, Stafford, 1960, Estall & Buchanan, 1961, Rubenstein, 1992, Lallajainen and Stafford, 1995). Dicken, at the global scale examines two old favorites, textiles & clothing and the automobile industry and adds two newer sectors, electronics and services (Dicken, 1992). The technology sector appears in several other recent studies, but, in fact has been examined for many years (Malecki, 1991, and see Harris, 1954).

Industries are composed of *companies*. Companies make location decisions to open and close facilities of different production capabilities. These create the “geography of the firm.” In the 1960’s there was a concerted move to examine how companies organize space. McNee’s analyses of global oil companies were among the early research on corporate spaces (McNee, 1958, 1960). Research on corporate structures remains strong with examinations of such things as branch plants in relation to headquarters, and company responses to the product cycle, and the influences of corporate culture on the static and dynamic geography of the firm (Norton and Rees, 1979, Massey, 1984, Schoenberger, 2000) Complementing the systematic approaches by sector and by company is

the regional perspective. Substantial spatial concentrations (agglomerations) of manufacturing capacity are variously called, depending on geographic scale, *clusters, industrial districts, or regions*. Industrial *regions* have received much attention, especially large areas of heavy concentration such as the American Manufacturing Belt, the British Midlands, and the German Ruhr. Changes of geographic scale produce the now popular work on *industrial districts* and *industrial clusters*. Of course, *industrial districts* research has been around for many years, but it is perhaps even stronger now than ever, especially since industrial districts (and *clusters*), conceptually at least, fit into regional economic development planning. Early industrial districts examples include studies of jewelry and garment districts. The genre was given a big push by Porter when he argued that national and regional industrial districts convey and are a consequence of the special advantages of specialized manufacturers being close to others in their supply chain (Porter, 1990). The essential arguments also are applied at more local scales. The arguments for clustering in districts revolve around several factors, most notably “Marshallian” localization and urbanization economies of scale, the relative immobility of labor, and face-to-face interactions among creative people in creative companies (Amin, 2003, Markusen, 1996, Saxenian, 1994, Florida, 2000).

Logical and deductive reasoning, especially in relation to “basic” economic factors, may be broadly thought of as *location theory*. Historically, there are several phases in American geography.

Harris neatly illustrates work before 50 years ago: "In 1927 Richard Hartshorne proposed a quantitative method of appraising the relative importance of raw materials, fuel, markets, and labor, and emphasized the key role of relative location or locus. His ideas were similar to those of Weber. Recently George T. Renner noted the effect of agglomerative industries, which he calls conjunctive or disjunctive symbioses, depending on whether or not there is a functional relationship among the areally associated industries. Charles C. Colby recognized centrifugal and centripetal forces affecting industrial location within cities" (Harris, 1954, 299; Hartshorne, 1927; Weber, 1929; Renner, 1947; Colby, 1933). Harris continues by noting the contributions of economists such as Edgar M. Hoover, and concludes with the observation that "much needs to be done to bridge the gap between economic theory and the actual observed distributions" (Harris, 1954, 300; Hoover, 1948).

As Harris was writing, a new and powerful influence on industrial geography was emerging from the writings of regional economists such as Isard and Greenhut (Isard, 1956, Greenhut, 1956). Industrial complex analysis was a major contribution (Isard, Schooler and Vietorisz, 1959). The difficulties of developing microeconomic mathematical models when dealing with imperfect competition resulting from spatial distributions remained. However, a variety of alternative techniques were brought to bear to finesse the problem, including input-output, linear programming and potential modeling, and explicit consideration of the effects of

uncertainty (Isard, 1960, Webber, 1972). Geographers were taking note and contributing, and out of this came the Regional Science Association.

Since then mainstream economics has made progress in dealing with imperfect competition and this has spawned a new surge of formal spatial modeling that tries to derive spatial patterns from "first principles." This is not "pure" (to the neo-classical economist) because it must rely on "tricks" (e.g., game theory), but it is sufficiently well developed to be known by some as a "new economic geography" and have text books written (Fujita, Krugman and Venables, 1999, Krugman, 2000, Fujita and Thisse, 2002). There is still the gap between location theory and actual distributions, but the real values of formal models are not in their reflection of the real world but rather in three other dimensions: like all good deductive reasoning, things hidden are revealed; new hypotheses or lines of inquiry are suggested; and arguments fashioned from other evidence are buttressed by model confirmation. Spatial analytic industrial geographers are not missing the potentials these contributions offer (Hanick, 1999).

As noted above, formal "location theory" is inadequate to totally explain real world locations of manufacturing, for several reasons. It cannot deal adequately with spatial disequilibria and cannot incorporate a sufficient variety factors. Furthermore, the corporate executives that make the location decisions that add up to the geography of the firm, which collectively produce the spatial distributions of sectors and industrial districts, are largely ignorant

of, or do not find formal location theory useful. An alternative approach has been to focus on the *location decision-making* processes of actual corporate executives. I characterized this approach as the “geography of manufacturers,” as distinct from “manufacturing” (Stafford, 1972) and it also is sometimes known as a *behavioral approach*. It relies on in-depth interviews with corporate locators (McNee, 1958; Rees, 1974; Stafford, 1974). Several books focused on the location decision-making process appeared in the 1980’s (Townroe, 1971, Stafford, 1980, Schmenner, 1982). This approach still remains strong. It ranges from asking about the opening or closing of a specific plant to considerations of the working of the local network and of the influence of corporate culture on the structure of the firm (Stafford and Watts, 1990, Schoenberger, 2003).

There is another “new economic geography” which is “located theoretically on the borderlands between geography, economics (typically political economy), cultural studies, and various kinds of sociology” (Barnes, 2001, 559). There appears to be a link back to the political economic geography and Marxist approaches that were a consequence of dissatisfactions with “regional science” research, but the canvas of inquiry is broader (Sheppard and Barnes, 1990). This version of a “new economic geography,” a.k.a. the “cultural turn,” means different things to different people. For some it is a move of focus of interest from production to consumption (Watts, 2003). For others it is a focus on labor, and flexible production, and their interplay within industrial spaces (e.g.,

Scott, 1988). For others it is a shift from “geographies of labor” to “labor geographies,” with the argument that the reason firms exist is to organize labor. Labor market segmentation and gender relations are prominent topics (Martin, 2000). For others it is a shift in ways for theorizing, from “epistemological” to “hermeneutic.” Barnes contends that “epistemological” theorizing characterized the period beginning in the 1950s, while “hermeneutic” theorizing characterizes the “cultural turn” or the “new economic geography.” By epistemological theorizing is meant establishing unambiguous relationships that mirror an independent, real world. Hermeneutic theorizing recognizes that no theoretical vocabulary is perfect and there is constant search for theoretical accounts (Barnes, 2001).

Regarding the “cultural turn” and industrial geography, two things are clear. One is that topics that previously received little attention are now front burner. The second is that industrial geographers of different stripes react very differently to the heightened concern for the “cultural” dimensions. Some think it goes not far enough, where the questions (being asked are) very small, missing big issues like “the mechanics and the politics of international linkages and the relations between people that are embedded in poverty, while the new relations between economic/industrial geography and cultural geography have taken us in exactly the opposite direction to studies of culture in the city of London, to the manners of business people, and such issues, none of which seem to be of a serious kind” (Webber, 2002). Others

worry about loss of important knowledge within industrial geography, for example the literature on branch plant location decisions because such research is now “old fashioned” (Watts, 2003). Another perspective is that the “old industrial geography which focused on the economics of location is more interesting than the new industrial geography that focuses on the sociology of wealth and income” and there are far better employment prospects for students trained as objective analysts (Gibson, 2002). An opinion in a recent review is that bringing the social and cultural into industrial geography is “not necessary a bad thing” and it is good to more pluralistic and less narrowly focused on the economic, but industrial should not lose sight of the economic while “culturalizing” (Yeung, 2001).

At one time the *practical applications* of industrial geography were more apparent than now. Joseph Russell did pioneering work analyzing Ford Motor Company sales. He also recruited Howard Roepke to the University of Illinois, who in turn concentrated on community industrial development, and was very active with the Industrial Research Development Council. Community development also was the theme of Moriarty’s book (Moriarty, 1980). Henry Hunker worked extensively with Chambers of Commerce, and with Alfred Wright authored a practical volume on the factors of industrial location (I leaned on that book, and Roepke’s advice when preparing my own “guidebook” for manufacturers (Hunker and Wright, 1963; Hunker, 1974; Stafford, 1980). There still are geographers in

manufacturing corporations and utilities making or assisting in siting decisions, but they are not as visible as the applied geographers in retailing. With the exceptions of a few people like James Rubenstein who now consults with Ford, and the ongoing activities like those at the University of Arizona Economic Development Research Program, the practical applications of industrial geography are hard to find. This is a missed opportunity (as evidenced by the popularity of a book by a business college professor on making location decisions (Schmenner, 1982)).

Progress in a discipline is facilitated by an active *community of scholars*. Notable in industrial geography have been the industrial geography group within the Association of American Geographers (AAG), and the comparable groups in the Institute of British Geographers (IBG), and International Geographic Union (IGU). The first specialty group within the AAG was industrial geography. It grew out of the desire of several scholars to have time at national meetings for extended discussions on prearranged topics, with invited presenters. This format was not then available at the AAG, so the industrial geographers met in the convention city the day before the formal beginning of the meetings. For many of us, the pre-convention sessions were the best part of going to the AAG annual convention. Obviously the idea had merit and the current forty-nine specialty groups of the AAG are a legacy. The IBG sessions always were both stimulating and fun, and the specialty group retains its vigor with several leading industrial geographers active.

AAG and IBG links also play out on the world scene. The late Ian Hamilton is to be especially remembered for his leadership and just plain hard work in the international arena with the Industrial Commission of the IGU in the 1970s and 1980s. The IGU associations helped forge international perspectives, and they remain critical.

Textbook and Review Reflections

After organizing the above, I wondered how well my personal recollections fit with those of others. I started by looking at the record as revealed in books. Textbooks reflect, with some delay, the focal points of a field. I pulled five books off my shelf that roughly span the past half century, to be reminded of how things have changed, and how they have remained the same. I did the same with recent reviews of industrial/manufacturing geography. The topics covered reveal something of the evolution of the field.

The chapters in Miller's 1962 book are Localization of Manufacturing, Location of World Manufacturing, Anglo-America, Europe, Soviet Union, Far East, The Southern Continents, Iron and Steel Industry, Aluminum Industry, Machine Tool Industry, Motor Vehicle Industry, Merchant Shipbuilding Industry, Agricultural Machinery Industry, Petroleum Refining Industry, Portland Cement Industry, Cotton Textile Industry, and Perspective.

A few years later, Smith (1971, 1981) had a very different agenda as he examined *The Plant Location in Context*, *The Location Factors*, *Approaches to Theory: Spatial Economic Analysis*, *Approaches to Theory: Critique and Re-*

form, *The Variable-Cost Model, Relaxing Some Assumptions*, *Introducing Demand*, *Introducing the Time Dimension*, *Operational Models*, *Elements of Empirical Analysis*, *More Complete Analyses*, *The Impact of Industrial Activity*, *The Spatial Strategy of Industrial Development*, and *Case Studies of Industrial Development Planning*.

The parts and chapters in Watts (1987) are *The Geography of Industrial Change*, Part I: Frameworks (International and Historical), Part II: Firms (The Segmented Economy, The Location Decision), Part III: The Context of Change (Products and Processes, Labour Costs, Capital and Land costs, The Supply and Market Context, the Political Context), Part IV: The Components of Change (New Firms, Movement and Acquisition, In Situ Change: Employment Growth, Employment Decline and Plant Closure), Part V: Policies and Research Priorities (Intervention, Reflections and Directions), and Appendices on how to describe the Geography of Industrial Change and on the Potential Transport Cost and Market Potential models.

The most recent of the four is Hayter's 1997 text. His parts and chapters are Part I: The Problem of Industrial Transformation (Industrial Geography, Manufacturing Change in Historical Perspective, The Geography of Manufacturing), Part II: The Location Factors (Location Conditions and Location factors, Factory Location as Cost-Minimizing Exercise, The Location of Factories as a Decision-Making Process, The Location of Factories as a Strategic Process), Part III: The Manufac-

turing Firm and Its Geography (The Size Distribution of Firms: Geographical Perspectives, Formation and Function of New (and Small) Firms, Medium-Sized Firms, Big Firms Locally, The Growth of Multinational Firms, Corporate Restructuring and Employment Flexibility), Part IV: Production Systems and Local Development (Production Systems and Industrial Districts, Core-Firms-Dominated Production Systems and the Japanese Auto Industry, Production Systems in Home and Host Economies, De-Industrialized Regions: Restructured and Rejuvenating?, and Industrial Transformation and Jobs: Contemporary Dilemmas.

In 1954 nineteen geographers contributed to a short chapter on manufacturing in American Geography Inventory and Prospect (Harris, 1954). After noting that although manufacturing takes relatively little space it is economically important, the discussion proceeds to characterize research on the areal distribution of manufacturing and changes in distributions. The next section is on the availability of statistical materials that locate and measure manufacturing. This is followed by review of work on location theory and location types. Then there are sections on studies of specific industries, studies of specific areas, and on explanation and prediction of industrialization. The chapter ends with consideration of problems needing study, including the significance of industries to regional development and the impact of new technology.

Thirty-three years later eight industrial geographers contributed a chapter to

Geography in America (Beyers, et. al., 1989). Their headings are Locational Shifts in Manufacturing, Research on Producer Services, High Technology and Industrial Innovation, International Trade and Foreign Investment, Labor Markets (and the radical urban critique), Models for Regional Industrial Analysis, and Industrial Geography and Policy Analysis.

A successor chapter in the latest Geography in America appears in 2003. Significantly, the chapter is no longer titled "industrial geography" but rather the industrial is embedded within "Economic geography: Reconceiving the 'economic' and the 'region'" (Harrington, et. al., 2003). The introduction makes clear that the chapter reflects the "cultural turn" in economic geography and that "industrial" is considered too narrow a focus. A section on "reconceiving the economy" discusses four approaches: Spatial Divisions of Labor and Localities; Regulationism, Flexible Specialization and Post Fordism; Institutionalism and Revolutionary Economics; and Spatial Science, Analytical Political Economy and the New Economic Geography. The section continues with overviews of topics that are more subject matter oriented and less methodological or theoretical. The topics are: Labor, Gender and Ethnicity; Economic Geography of the Environment; and Consumption and the New Retailing Geography. A second section focuses on "Reconceiving Regions: Defining 'Local' in a Global Economy." The subdivisions of this section are: Defining Regions by Defining Processes: Agglomeration and Technology-Based Industrial Districts; Defining Regions by Defining Proc-

esses: The Example of Labor; and International Economy and Globalization. The next section is on “Economic Geography Within Public Policy. The chapter ends with concluding comments that note research foci to which economic geographers pay too little attention; additional work on more tradi-

tional industrial geography issues is not among them.

At the risk of miss-characterizing the books and chapters, a simplification might be that the *industrial emphases* of each are:

Topic	AGIP 1954	Miller 1962	Smith 1971	Watts 1987	GinA 1987	Hayter 1997	GinA 2003
Actual locations by area	X	X					
Actual locations by industry	X	X					
Location theory: economic, cultural	X		X	X	X	X	X
Location decision making				X		X	
Change, innovation	X			X	X	X	X
Labor markets, impacts of industry			X		X	X	X

Recent reviews of industrial geography in Progress in Human Geography note many of the same topics. They cover agglomeration and local milieu, new industrial spaces, restructuring and emerging flexibility, corporate and regional structure, office locations, organizing the firms, networks, firms and institutions, firms and regional development, regional systems of innovation and the knowledge-based economy, socio cultural practices in industrial geography, culture and the firm, and labor market processes in relation restructuring and to ethnicity, gender and social practices (Malmberg, A., 1994, 1996, Yeung, 2000, 2001).

There has been a shift of focus away from description of actual location patterns of manufacturing towards theo-

rizing and models (with industrial geography embedded within two “new” economic geographies), decision-making, change, and impacts over the past five decades, but even so the very short 1954 chapter in American Geography Inventory and Prospect was remarkably prescient.

EVOLUTION AND FUTURE

The reviews suggest some major shifts of foci over the past half-century. Within these, however, are continuing themes. As examples, research on the causes and consequences of the uneven spatial distribution of industry, identification of industrial districts, and the threads of location theory have long histories. The progress of industrial geography is kind of jerky evolution.

What is the next phase? There are three forces that I think are important to consider when contemplating the future of industrial geography. One is the strength of “cultural-industrial” geography relative to that of “analytical” industrial geography. The second is the impact of Geographical Information Systems on the students who shape the future of the field. The third is the public and professional fixation on people. I discuss these in reverse order.

There is frequent mention in the popular press on the demise of manufacturing in the advanced economies of the world, and especially in the United States. The decline of manufacturing is real in terms of the number of people employed. However, there is no drop of the importance of manufacturing when measured as percent of gross domestic product. Twenty-five years ago manufacturing accounted for approximately 25% of GDP; twenty-five years later the share remains, manufacturing accounts for 25% of GDP. However, in spite of the continued relevance of industry, and especially to regional economic development, few new students seem to opting for research on manufacturing. The concern for people plays out at a very fundamental level in that the importance of a sector of the economy is too often popularly measured by the number of people employed. An analogy is with agriculture, a sector that has experienced huge declines in number employed, and a corresponding decline in student research topic popularity. The closest research gets to agriculture today is work on rural places and their uphill battle for economic relevance. It would be a shame, and shortsighted, if

manufacturing suffered neglect similar to that which has befallen agricultural geography. However, while the focus on people in terms of share of employment bodes ill for narrowly focused industrial research, in another sense focus on people, via cultural-industrial geography provides new breadth and relevance. It not clear that the “cultural turn” has pushed alternative foci into hiding, but it is clear that the cultural focus geography is a potent force in shaping the discipline, and enhances the scope and versatility of economic geography.

The interests of current students may influence the field in yet another way. A high proportion of students want to link their work to the use of Geographic Information Systems. GIS emphasizes empirical research via counting, data structuring, and spatial patterns. GIS is especially compatible with spatial analysis. Spatial analysis, in turn, draws strength from the advances microeconomics has made in dealing with imperfect competition. Although “regional science” seems to have weakened while the “cultural turn” has gained momentum it is easy to imagine reinvigoration of spatial analytic research.

Manufacturing remains important economically, socially, and academically important. Long-term interest and concern for the where of production, and the consequences of those location decisions will not go away. The vitality of the field is indicated by the amount of production and discussion. The cultural-economic-industrial community of scholars is producing a large number of articles and is sufficiently cohesive to

be able to afford internal debate. The two “new” economic geographies can be complementary. It is perhaps even truer now than it was in 1986 that “industrial geography is alive and well and encouragingly contentious” (Taylor, 1986, 412).

ACKNOWLEDGEMENTS

I appreciate the valuable comments and insights of those who responded to my request for remembrances and perspectives on industrial geography of the past several decades. Special thanks to Bill Beyers, Roger Bolton, Rod Erickson, Jerry Fellmann, Lay Gibson, J. W. Harrington, Henry Hunker, Gunter Krumme, John Rees, Jim Rubenstein, Mike Taylor, Doug Watts and Michael Webber.

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The Technological Revitalization of a Mature US Industry: The Case of Machine Tools

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ABSTRACT

The US machine tool industry enjoyed a period of global dominance between the early 1900s and the late 1970s. In the final quarter of the last century, however, almost every major US producer lost domestic market share as a result of import competition. By the early 1990s, several segments of the US machine tool industry appeared poised on the edge of market exit. This paper argues that US producers have achieved a rebound in recent years. This rebound has been driven by a variety of innovation-related efforts, including improved machine design, increased R&D, a renewed emphasis upon export markets, and greater customization. Evidence comes from a national survey of 104 machine tool producers. A major finding is that recent employment growth has been concentrated among younger firms, especially those that have made strategic commitments to increased R&D spending, faster cycle times, and improved customer support. In contrast, the incidence of zero or negative employment growth is more pronounced among older firms, many of whom primarily serve local customers. The paper concludes with a brief discussion of possible futures for the US machine tool sector.

Keywords: US machine tool industry; competitive problems; techno-market recovery; import competition; export development.

INTRODUCTION

Mature industrial sectors that are exposed to severe import competition rarely exhibit positive employment growth, export expansion, or fast rates of new product development (Malecki, 1991). Many of these sectors are positioned toward the tail end of the product-life-cycle (PLC), where cost reduc-

tion tends to dominate strategic thinking at the corporate level (Vernon 1979). Conventional wisdom holds that advanced industrial economies no longer enjoy a comparative advantage in basic sectors such as steel, textiles, or apparel, if only because international competition at the mature end of the

PLC is overwhelmingly cost-based. In the United States, however, specialized production within many of the so-called twilight industries has resulted in positive employment growth in recent years (Florida 1996). Notable examples include apparel (e.g. New York City's garment district), steel (e.g. the mini-mill phenomenon), and machine tools (e.g. computer numerically controlled [CNC] machining centers). The machine tool (MT) industry is a particularly interesting example, in that this sector was poised on the threshold of extinction only a decade ago (Graham 1993). Beginning in the mid-1990s, however, the MT industry started to rebound in a number of unexpected ways. Since 1994, employment levels have stabilized, exports have expanded, and overall output has recovered dramatically (Aronson 1996; Robinson 1996).

Although the MT sector is not the only mature US industry to have experienced a commercial turnaround in recent years, we argue that this particular case is instructive in at least two ways. First, the United States lost its technological and market leadership in this industry more than 20 years ago (coincident with the rise of Japan and Germany as dominant international suppliers). Second, the industry remains geographically concentrated in the traditional manufacturing belt that fringes the Great Lakes. Thus, we are talking about an import-competing sector that remains rooted in the nation's oldest industrial region. On the face of it, these two factors alone suggest that the MT sector's recent revival has been noteworthy. After all, external competi-

tion comes mainly from the world's premier suppliers in terms of product quality (Germany and Japan). Further, over 60% of US employment in the MT sector is concentrated in core manufacturing-belt states such as Ohio, Michigan, and New York (most of which have been growing slower than the national average for many years).

The purpose of this paper is to examine the main organizational and technological factors that have contributed to the recent revival of the MT industry. Our evidence comes from a sample of 104 companies that participated in a national survey in the summer of 2000. Additional evidence comes from a series of follow-up inquiries, including 52 telephone interviews and 14 site visits. Before presenting our results, however, a brief research context is in order. Why is the machine tool industry worth looking at? Why did the industry start to decline in the first place? And, how did the industry manage to position itself on a recovery path?

RESEARCH CONTEXT

A machine tool is essentially a piece of equipment found on a factory floor that manipulates metal, often forming it into new machines or machine parts. Such tools come in a variety of sizes and types, ranging from relatively small CNC lathes to the enormous industrial presses that are used by automotive stamping plants. Placing a date on the emergence of the MT sector is still a matter of debate (see Nivin, 2000), though most scholars agree that the industry originally evolved as a spin-off from the armories in the second

half of the nineteenth century. The US government's demand for interchangeable parts in weapons in the early 1800s is widely credited as the first stimulus behind the industry's birth (Rosenberg, 1963). Also playing important roles on the demand side were the sewing machine, textile, bicycle, and automotive industries. According to Ashburn (1988), the sewing machine industry was the first to build on the manufacturing system developed by the arms makers. Specifically, machine tools were deployed to create standardized and interchangeable parts on a mass-production basis.

Despite the importance of the MT sector to firms in the various metalworking industries (notably automotive and aerospace companies), the strategic significance of this sector can ultimately be traced to its origins. Bluntly speaking, MT products are critical to weapons production. The first known example of this took place in 1813, when Simeon North was awarded a US government contract to produce interchangeable parts for guns (Nivin, 2000). Today, the MT sector remains pivotal to the interests of the US defense establishment (sophisticated weapons cannot be produced without the help of high-end machine tools). In this regard, the process of new product development within the MT industry typically entails the creation of faster and/or more flexible machines. While the fundamental principles that govern machine design have not changed very much over the last 100 years, the speed, accuracy, and versatility of such machines continues to improve. From the outset, then, it should be empha-

sized that 'innovation' within the MT sector usually entails a mix of software development (e.g. better control systems) and hardware enhancement (e.g. high-speed linear motors). The goal is to achieve faster machining speeds, along with improved accuracy and increased flexibility. Faster machining speeds flow from the use of more efficient electric motors; greater accuracy comes from improved fixtures and better software; while increased flexibility comes from the development of multi-axis machines.

From the outset, however, it should be stressed that machine tools are not generally in household use. Aside from the fact that industrial MT products are typically too large to fit into the average home, such products are also very expensive. To give a sense of price scale, a low-end tool such as a simple CNC lathe might cost anywhere between \$5,000 to \$50,000, whereas a high-end milling machine could cost as much as \$8 million. Regardless of price, a notable characteristic of most MT products is that they last a long time (20 years or more). For example, most of the automated fastening machines that are currently used to rivet the wings for Boeing 747 aircraft were delivered to Boeing in the 1970s (Pritchard 2002). Machine longevity is both a drawback and an asset for the MT industry. On the negative side, the durability of well-engineered machines means that it might take an established customer many years to place a new order. On the positive side, machines with extended lifespans are coveted by clients. For MT suppliers, however, a critical problem is that demand

is structured by the unpredictable re-tooling requirements of customers that themselves face cyclical markets (e.g. firms in the automotive and aerospace sectors).

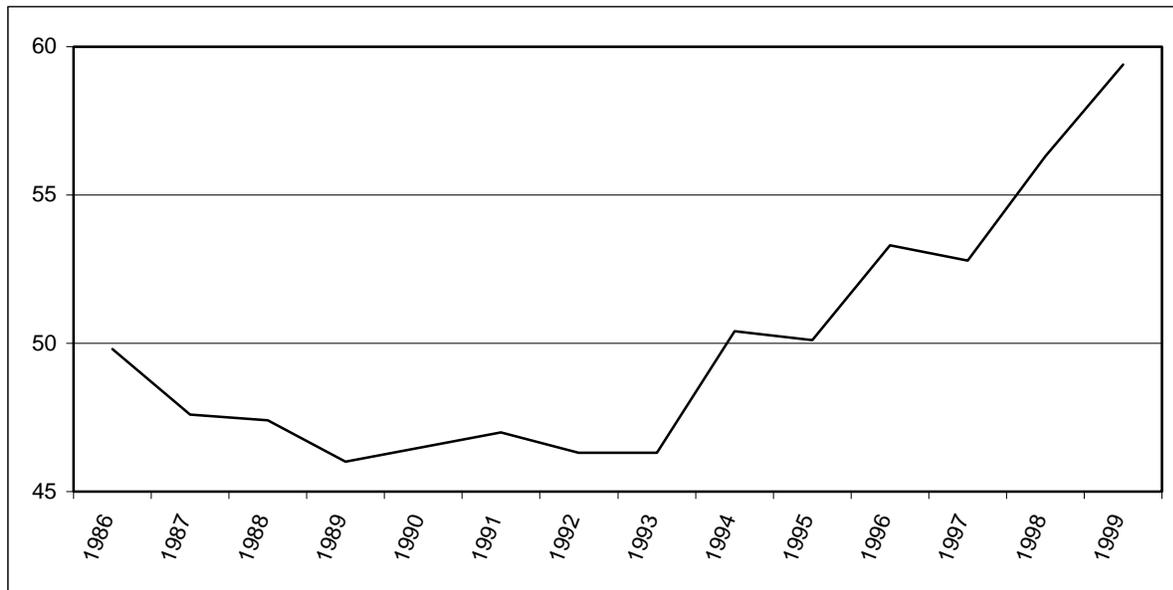
To counter this problem, US producers have long backlogged their orders to insulate themselves against cyclical downswings in demand (Finegold *et al.* 1994). We contend that this practice, though initially quite successful, laid part of the foundations for the industry's post-1975 slide toward diminished competitiveness. When Germany and Japan entered the global MT market on a large scale in the late 1970s, US consumers of MT products quickly realized that foreign equipment could be purchased with minimal delivery delays (and at lower prices).

From a strategic perspective, there is a general consensus in the literature that US producers relied for too long upon obsolete modes of business organization (e.g. backlogging, minimal customization, and poor after-sales service). The critical error was that the possibility of serious foreign competition was not factored into the business strategy equation (Dertouzos *et al.* 1989). Beginning in 1978 (which was the last time the US enjoyed a trade surplus in MT products), imports started to enter the US market on a significant scale. Today, imports account for over 60% of total domestic consumption, compared to only 20% in 1970 (US Department of Commerce 2000). The ability of foreign producers to dominate the US market so quickly exposed a number of underlying structural problems that persist

within the US MT sector today (albeit in weaker forms). Specifically, the industry: (1) relied for too long upon US military procurement contracts; (2) produced over-engineered equipment for government clients (products that remain hard to sell to commercial manufacturers); (3) resisted or ignored the global trend toward closer supplier/client interaction; (4) failed to establish inter-firm partnerships for product development and/or marketing purposes; and (5) allowed itself to become integrated with multinational conglomerates that had no long-term interest in MT production (Finegold *et al.* 1994; Nivin 2000). In short, the industry had positioned itself (with government help) to perform as a second rate competitor by the time that global MT marketing took off in the late 1970s (Graham 1993).

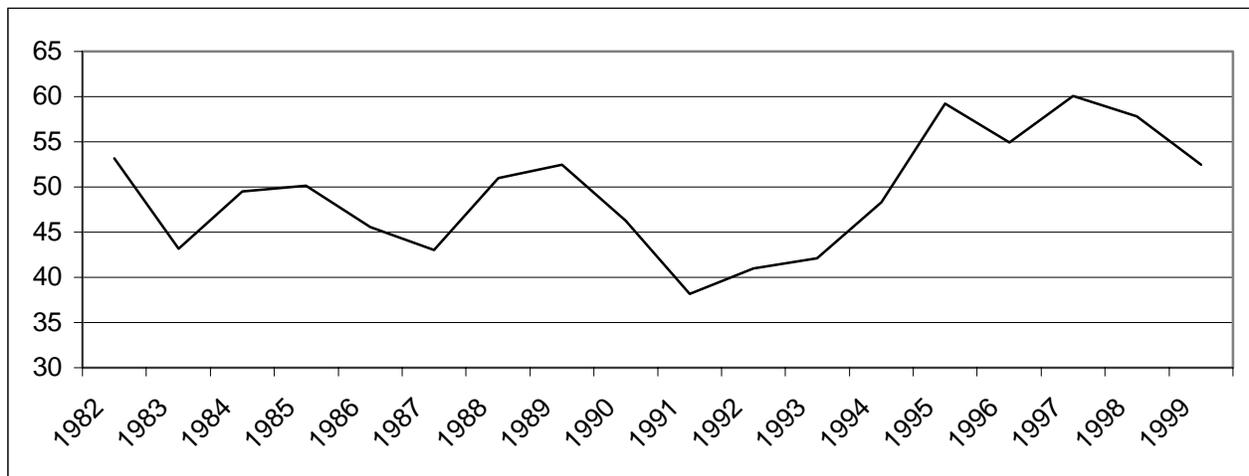
But none of this is fresh news. By now, in fact, there is little debate regarding the causes of the industry's decline. For example, few scholars would deny that the US government inadvertently played a key role by locking many producers into a technologically advanced but commercially doubtful trajectory of machine development (DiFilippo 1986). When the import gates opened in the 1980s, not even voluntary export restraint agreements could dissuade US buyers from purchasing foreign machines. Not surprisingly, then, several scholars writing in the early 1990s expressed concern that a US MT industry might not exist in the 2000s (e.g. Graham, 1993, Finegold *et al.*, 1994).

Figure 1. Imports as a Percentage of US Machine Tool Consumption



Sources: Association for Manufacturing Technology, US Department of Commerce

Figure 2. US Machine Tool Shipments (in thousands of units)



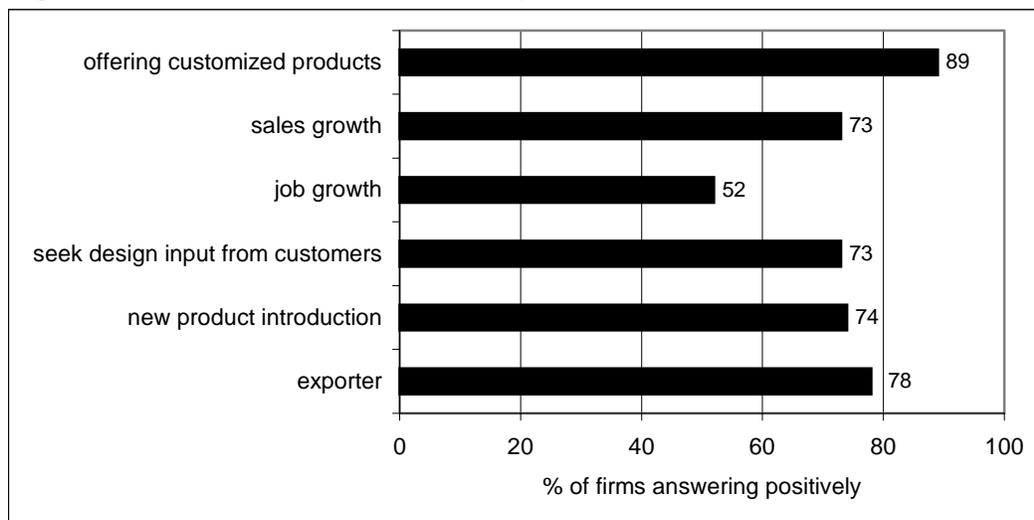
Sources: Association for Manufacturing Technology, US Department of Commerce

Figure 3. *Distribution of US Machine Tool Employment*



Sources: Association for Manufacturing Technology, US Bureau of the Census (2000)

Figure 4. *Firm Distribution for Key Variables*



To an extent, of course, many of these earlier projections have turned out to be true (Prestowitz 1988), especially with regard to import penetration and shipment levels (see Figures 1 and 2). This said, close to 10,000 new jobs were added to the US MT sector between 1993 and 1999, and exports as a percentage of total sales increased from around 15% in the mid-1980s to 30% in 2001 (AMT 2000). Although the industry is still dominated by small-and-medium-sized enterprises (SMEs) that employ fewer than 50 workers, average employment levels have recently been growing as a result of mergers and acquisitions (US Department of Commerce 2000). Still, the industry remains spatially concentrated in the nation's traditional manufacturing belt (Figure 3). Close to 65% of total MT employment is located within a seven state region that fringes the Great Lakes (Wisconsin, Michigan, Illinois, Indiana, Pennsylvania, Ohio, and New York). Although a gradual decentralization of MT employment has taken place since 1970 (see Kalafsky and MacPherson, 2002), the traditional manufacturing belt still contains a dominant share of national MT activity.

Set against this context, the remainder of this paper offers a firm-level perspective on the MT sector's recent commercial rebound. Despite counterproductive or nonexistent policy initiatives at the federal and state levels (discussed later), many US producers have become increasingly export active, while others have solidified their hold over key domestic customers. The question thus arises: how was this achieved?

SURVEY METHOD

In a first attempt to answer this question, self-administered surveys were mailed to a sample of 284 MT manufacturers in the summer of 2000. A four-page questionnaire was distributed to obtain firm-level information on R&D activity, employment levels, exports, competitive problems, recent growth performance, product policy (innovation and design issues), and technical aspects of production (e.g. cycle times, unit cost trends, average batch sizes). The sampling frame was drawn from the AMT's 1999 membership directory, which accounts for close to 90% of total US employment in the MT sector. Of the 480 firms listed in this directory, 196 were rejected from the final sampling frame (193 were found to be suppliers of accessories rather than machine tools, 1 was found to be a multi-product firm with only a minor MT focus, while 2 had ceased production since the 1999 directory was published). Given that our inquiry was designed to focus on MT producers only, the 'population' dropped from 480 to 284. After three rounds of contact (i.e. the initial mailing of the questionnaire, a postcard reminder 30 days later, and follow-up telephone calls thereafter), 104 valid returns were received (giving a final response rate of 36.6%).

Several approaches were employed in an effort to estimate nonresponse bias. First, t-tests and/or chi-square tests were applied to early and late respondents across several variables, including employment size, plant status (single versus multiplant), ownership (foreign versus domestic), export-intensity (proportion of sales from export mar-

kets), and firm age (number of years in the MT business). According to Babbie (1990), late respondents are thought to have more in common with nonrespondents than early respondents. Although the logic surrounding this approach is questionable, the fact that no significant contrasts emerged should be noted (early respondents were defined as within 30 days). A second test involved a comparison of the known characteristics of respondents and nonrespondents. Here, three attributes were tested (employment, plant status, and product focus), reflecting data availability. Again, no significant contrasts emerged. Last, we compared the geographic distribution of the sampling frame with the pattern of sample responses across several levels of regional aggregation. Chi-square tests did not point to significant differences between the sample distribution and the target population. In short, we believe that we have a sample that is spatially and structurally representative of the industry.¹

EMPIRICAL RESULTS

As a starting point in the analysis, Table 1 provides a descriptive snapshot of the main characteristics of the sample. While some of these characteristics are suggestive of a mature industry, others are not. For instance, most of the survey firms have been in business for at least 50 years. There are few young companies in the sample, suggesting a

low rate of new firm entry across the industry as a whole. Nevertheless, a majority of the survey firms introduced at least one new product over the study period (1995-1999). On average, newly developed products accounted for over 30% of the sample's recent outputs. This is a high proportion by almost any yardstick, especially for a mature sector (Malecki, 1991). In addition, the data indicate that most firms offer customized products, which was almost unheard of 20 years ago except among job-shops.

Further descriptive material is shown in Figure 4, which gives frequency distributions for a number of key variables. Of the 104 establishments in the sample, fully 82 (78%) serve foreign export markets; 77 (74%) introduced at least one new product between 1995 and 1999; 73 (70%) design their machines in close association with customers; while 52 (50%) created new jobs over the study period. All told, these characteristics are not suggestive of a mature industry.

This said, the recent revival of the industry can be traced to the efforts of certain types of firms rather than to the efforts of the population as a whole. To illustrate this point, Table 2 crosstabulates three categories of employment change (negative, zero, and positive) alongside the incidence of new product development (products introduced within the past five years) and export

Table 1. General Characteristics of the Sample

Characteristics	Mean	Median	High	Low
Employment	128.4	60	1200	4
R&D spending	5.8	5	25	0
Age	53	45	154	2
Innovation count	3.3	2	20	0
Innovation share	35.9	30	100	0
Customization	36.3	20	100	0
Export-intensity	14.9	10	70	0

-
1. Total employment in 1999
 2. R&D spending as a proportion of sales
 3. Number of years in the machine tool business
 4. Number of new products introduced between 1995 and 1999
 5. New products (1995-1999) as a proportion of 1999 sales
 6. Percentage of 1999 output from customized products
 7. Export sales as a percentage of total sales
-

Table 2. Employment Change (1995-1999) by Innovation and Exports

<i>Employment change</i>		<i>negative</i>	<i>zero</i>	<i>positive</i>	<i>total</i>
innovation	yes	18	15	44	77
	no	13	4	10	27
exports	yes	20	16	46	82
	no	11	3	8	22

Chi-square for growth by:	innovation	5.90	(p= 0.052)
	exports	5.44	(p= 0.065)

Table 3. *Employment change by commercial problems (ANOVA)*

Problem	negative	zero	positive	p-value
labor availability	3.85	3.65	3.21	0.536
cyclical of demand	3.51	3.15	3.03	0.121
import competition	3.90	3.21	2.83	0.004
product liability laws	3.38	2.78	2.71	0.162
declining local markets	3.33	2.47	2.32	0.003
federal taxes	2.77	2.57	2.38	0.350
local/state taxes	2.64	2.47	2.35	0.535
worker compensation	2.56	2.42	2.30	0.592
domestic competition	2.51	2.47	2.79	0.397
government regulations	2.63	2.38	2.26	0.365
customer relocation	2.54	1.89	1.86	0.044
electricity prices	2.25	1.94	1.88	0.316
ISO certification	2.03	1.68	1.86	0.456
US export restrictions	1.87	2.10	2.01	0.725
access to export finance	1.71	2.21	2.05	0.211

mean score along a five-point scale, ranging from 1 (not a problem) to 5 (critical problem).

involvement. Although the chi-square tests fail to meet the usual 95% confidence level, they come remarkably close in both cases ($p = 0.065$). Of the 77 innovators in the sample, for instance, 57% ($n = 44$) created new jobs over the study period, compared to only 37% ($n = 10$) among non-innovators. More interesting, perhaps, is the fact that 48% of the non-innovators lost jobs over the study period, compared to 23% among innovators ($p = 0.052$). Similar distributions are evident with regard to export activity, in that firms that serve foreign markets are more likely to belong to the job-growth category than firms that serve home markets only ($p = 0.065$). At first blush, then, it would appear that the revival of the MT sector has been powered mainly by innovative firms that market their wares to foreign clients.

Keeping this point in mind, Table 3 collates our three categories of employment change alongside 15 competitive irritants that have been identified in the academic and trade literature as significant obstacles to growth among MT companies (Dertouzos *et al.* 1989; Finegold *et al.* 1994; Suzik 1999). Respondents were asked to rate the importance of each factor along a 5-point scale, ranging from 1 (not a problem in our competitiveness) to 5 (a critical problem). One-way analysis of variance (ANOVA) was employed to probe for differences among the three categories of employment change. While few of the contrasts are statistically significant, some of the results warrant brief mention. For a start, problems associated with finding and/or retaining skilled workers emerged as the top-ranked problem across all three categories of employment change (mean score = 3.57). As shall be shown later, this is a

rather complex problem that portends a deceleration of the sector's rebound over the long run. A second point is that the top-5 rankings are broadly similar across all three employment categories, with considerable mixing beyond that. In short, the chief problems facing the sector as a whole apply to shrinking, stable, and growing firms. Aside from labor availability, these problems most notably include cyclical demand, import competition, product liability claims, and declining local markets. A third point is that significant contrasts are evident for three potentially interconnected variables, including import competition, the relocation of longstanding customers, and declining local markets.

With regard to imports, firms that lost jobs over the study period cited foreign competition as the single most pressing issue (mean score = 3.90). While static and growing firms also rated import competition as being a serious problem (with respective mean scores of 3.21 and 2.83), the ANOVA results suggest that declining firms have been hit harder ($p = 0.004$). Declining firms have also been hit harder by customer relocations ($p = 0.044$) and local market shrinkage ($p = 0.003$). One possible interpretation of these findings is that imports have induced local market shrinkage (an external competition effect), while the relocation of longstanding customers has presumably added to the problem of operating on a local basis. Further, most of the firms that lost jobs over the study period were significantly older than the sample average, significantly smaller, and less likely to

introduce new products than their counterparts in the other two groups.

As a further step in the analysis, respondents were asked to indicate whether or not they believed that the MT industry had experienced a techno-market rebound since the mid-1990s. Seventy-eight respondents (76%) answered 'yes'. Those answering 'yes' were then asked to rate the importance of various firm-level factors to the rebound process (those answering 'no' were evenly distributed across the three categories of employment change). A 5-point scale was again employed, ranging from 1 (not an important factor in our recent performance) to 5 (a critically important factor). As with Table 3, our 15 factors (Table 4) were identified on the basis of recent contributions to the academic and trade literature (e.g. Aronson 1996; Robinson 1996). The one-way ANOVA results are remarkable in several respects. First, the mean score gradient runs from low to high across the groups for 13 of the 15 factors listed. Second, significant group differences ($p = < 0.05$) emerged for 11 of the 15 factors. Third, the top-ranked factors represent producer-level responses to some of the key explanations for the MT sector's post-1980 decline. Specifically, firms in the positive growth category identified reduced cycle times, better customer support, improved machine design, and the use of fewer parts as major factors in their competitive rebound. While firms from the other two categories also ranked these factors as being important, the relative degree of emphasis is striking. For example, firms in the negative growth category rated 'cycle times' with

a mean score of 2.16, compared to a mean score of 3.52 among firms in the positive growth class ($p = 0.007$). As a further example, firms in the positive growth class rated the importance of increased R&D with a mean score of

3.19, compared to only 1.83 among firms that lost jobs over the study period.

Table 4. *Employment Change by Rebound Factors (ANOVA)*

Factor	negative	zero	positive	p-value
shorter cycle times	2.16	2.89	3.52	0.007
fewer machine parts	1.86	3.16	3.05	0.005
improved machines	2.13	3.21	3.62	0.003
better customer support	2.20	3.05	3.65	0.004
greater customization	1.93	2.89	3.94	0.280
supplier improvements	2.03	3.00	3.36	0.003
strategic alliances	1.80	2.89	3.19	0.003
better technical data	2.13	3.21	3.44	0.007
use of the internet	2.26	3.05	3.23	0.068
better export access	1.73	2.61	2.88	0.011
government assistance	1.46	2.11	2.09	0.135
ISO compliance	1.83	2.68	2.80	0.054
increased R&D	1.83	2.68	3.19	0.002
better production methods	2.03	2.94	3.53	0.001
unit cost reduction	2.16	2.84	3.34	0.016

mean score along a five-point scale, ranging from 1 (not a factor) to 5 (critical factor).

It would, of course, be tedious to wade through all of the contrasts that are shown in Table 4. After all, the general picture is fairly clear. Specifically, firms in the positive growth category have placed stronger emphasis upon factors that pertain to delivery speeds, customer support, R&D, communications (e.g. use of the internet), machine design, the establishment of technical and/or marketing partnerships with complementary firms, and the use of new production methods (in this case, the use of flexible CNC workstations that are themselves used to produce similar types of machines). In essence, then, successful MT firms have been responding to many of the popular pre-

scriptions listed in the recent management literature on industrial competitiveness (for a comprehensive overview, see Daniels and Radebaugh 1998).

An additional point worth noting is that firms that lost jobs over the study period turned out to be more locally oriented than their counterparts that retained or expanded employment. On average, firms that lost jobs obtained over 24% of their sales from customers located within the same metropolitan area, compared to an average of only 9% among firms in the other two groups (ANOVA; $p = 0.019$). In short, the incidence of job-loss is concentrated among old SMEs that rely heavily upon

geographically localized markets. An implication is that local orientation detracts from growth potential, and confirms previous findings that firms that rely on longtime local customers run the risk of no longer innovating for larger markets (Grabher 1993). Significantly, a substantial majority (85%) of the firms that belong to this particular category are located in the traditional manufacturing belt shown in Figure 3. In short, employment losses have been heaviest among firms located in the nation's oldest industrial regions.²

A final point concerns the extent to which US firms in the MT industry have forged supply contracts with foreign-owned durable goods producers that operate branch facilities inside the US. Recent evidence suggests that foreign manufacturing plants in the various metalworking sectors have tended to pull their longstanding (foreign) suppliers toward the US as part of a supply-chain maintenance strategy (i.e. retain key suppliers on a geographically proximate basis) (Banerji and Sambharya 1996; Shaver 2000). While there is good evidence that this practice is common, it should be noted that most of the survey firms that generated new jobs over the study period earned at least 10% of their 1999 revenues from sales to foreign subsidiaries inside the US (mean = 21%), compared to 6% among firms that lost jobs (3-group ANOVA $p = 0.008$). In short, MT firms in the positive growth category have managed to capture markets within the foreign-owned segment of the US manufacturing base. This can be regarded as a major achievement from a technological and marketing perspec-

tive, if only because foreign-owned manufacturing plants in the US typically operate with state-of-the-art facilities (Nivin 2000). In other words, the ability to serve a foreign-owned client located inside the US represents a vote of confidence in the US machine tool sector.

DISCUSSION

Despite the optimistic picture painted above, it should be remembered that import penetration now stands at approximately 60%, and there are few signs that US-based establishments will ever regain domestic market share unless foreign direct investment (FDI) in MT production increases dramatically. Further, the recent slowdown of the US economy portends a new phase of consolidation, rationalization, and/or downscaling across the MT sector as a whole. At present, the MT sector is now dominated by such large industrial groups as Yamazaki-Mazak, ThyssenKrupp, and UNOVA (parent of Cincinnati Machine, the largest US producer). Moreover, many MT companies are confronted with labor shortages (i.e. a general lack of skilled mechanical engineers and machine operators), and many have been forced toward highly specialized production in areas where future growth potential is uncertain (e.g. waterjet cutting, laser welding). On this note, we would characterize the US machinery sector as a trichotomy that includes: (1) a small number ($n = 10$) of large-scale producers that can offer a full range of flexible workstations (these are the high-end producers in terms of unit selling prices); (2) a secondary core of roughly 50 firms that

specialize in niche-markets (e.g. dry cutting, aircraft fuselage riveting); and (3) a larger mass of job-shops that specializes in tailor-made products (over 300 firms). Though it is widely recognized in the trade literature that job-shops are a major part of the MT industry in terms of growth potential (Oakey and O'Farrell 1992), we would argue that this is the sub-sector most at risk in terms of both domestic and foreign competition.

Lest we be misunderstood, it should be emphasized that job-shops are unlikely to disappear any time soon. Instead, the intent is to suggest that the days of the small machine shop are limited in light of increasing standardization. We expect to see a substantial rationalization of the industry at the SME scale within the next few years. On the other hand, some job-shops are likely to survive for a long time, if only because large producers are unlikely to manufacture specialized 'bits and pieces' on a tailor-ordered basis if they can help it.

With regard to first-division companies (i.e. major producers that offer diverse product lines), 6 of the 10 largest players in our sample are foreign-owned. Of the latter, 5 established branch facilities in the US during or immediately after the last export restraint agreement which was implemented in 1986.³ Given that recent employment growth has been concentrated among larger firms, it is safe to suggest that many of the new MT jobs that were created over the mid-to-late 1990s were the result of capacity expansions among foreign subsidiaries. Although we do not have hard numbers to bolster this claim, we sus-

pect that part of the MT sector's turnaround must reflect an FDI effect.

In this regard, follow-up interviews with some 66 companies (14 site visits and 52 telephone inquiries) yielded qualitative impressions that merit brief mention. Though we are not concentrating upon the details of these follow-ups in this paper, several findings ought to be flagged. First, high-end production is often concentrated within the foreign-owned segment of the industry. Although several US-owned firms successfully manufacture at the top end of the market (e.g. Cincinnati Machine, Haas), these producers are facing increased competition from firms that are either branch plants or were purchased by major transnational corporations headquartered in nations such as Japan, Germany, the UK, or Switzerland. Our interviews revealed that many of these high-end plants (and purchases) were established primarily to avoid potential access restrictions such as voluntary export restraint agreements. To an extent, then, US trade policy during the 1980s encouraged inflows of FDI within the MT sector. Further, these policy initiatives created a geography of inbound investment that closely matched the existing distribution of other metalworking plants (key MT customers) inside the US (for details, see Kalafsky 2002).

A further impression that was gleaned from our interviews concerns second-division firms, almost all of which are wholly US-owned. These firms produce mid-level products in terms of selling prices (typically less than \$1 million per unit), and have experienced modest

employment growth as a result of specialization, customization, and niche-dominance. Interviewees in this group almost invariably indicated that they do not compete with first-division companies, and that constant innovation (e.g. the anticipation of customer needs) lies at the heart of their competitive strategy. Another common thread is that these firms are expected to 'turnkey' their products to meet the needs of potential and current customers. With only a handful of exceptions, customization is becoming a common customer demand throughout the industry, along with increased expectations of training and extensive after-installation support. The turnkey trend is important to note, as it causes additional burdens for already-challenged MT producers in that it has often led to increased retooling and customer support costs. Basically, many established manufacturers were forced to change design and production processes in order to survive.

With regard to third-division firms, however, our interview results revealed a more mixed picture. At the top-end within this group, several specialty producers have cornered the global market for machines that few first or second division firms would ever consider producing. While we are unable to offer specific examples without compromising the nondisclosure rules that guided our survey, we can state that most of these firms compete on the basis of unique products that are manufactured in small batches for global rather than national or regional markets. This particular subgroup within the third-division consists of approximately 40 firms (13% of the group to-

tal). Elsewhere within the third-division, however, the long-run outlook is not so good. Here, our evidence points to a number of strategies and practices that seem out of place in the 21st century, including order backlogging, the use of outmoded software control systems, reliance upon local customers (minimal interest or little capability in export development), and weak or zero investment in worker training. In many ways, these are the same competitive problems that caused the loss of market share to international producers in the early days of the domestic industry's decline. Old, family-owned, locally focused, and heavily oriented toward job-shop activity, these are the types of firms that typically populate the negative growth class shown in Table 2. To make matters worse, firms within this particular group have found that clients increasingly want flexible machines rather than dedicated equipment. While the need for customization is unlikely to disappear over the foreseeable future, it would seem that the market wants customized machines that are flexible rather than MT products that can only be deployed on a limited basis. Put another way, customers that formerly demanded job-specific machines now want multi-task products. A final issue is that these producers often compete on a price basis with low-cost rivals. This is a critical problem, as our initial research shows a growing group of customers (often subcontractors) taking a short-term approach to MT purchases, looking only at the life of their contract (and price) rather than choosing a machine with longevity. If this conjecture is correct across the demand side as a whole,

then the days of the typical job-shop are surely numbered.

CONCLUSION

The US machine tool industry has been described as a sunset sector by many scholars. While there is a good deal of truth to this perspective, notably with regard to import penetration, a residual core of technological competence remains inside the US. Firms belonging to the 'core' have recently created new jobs, expanded their export share, found new markets within the US itself, and initiated commercial partnerships with complementary firms (both foreign and domestic). Such firms have also emphasized a variety of useful initiatives to support future growth, including increased spending on applied R&D, sustained efforts to reduce cycle times, and improved customer support (i.e. better after-sales service). Despite frequent claims to the contrary, our evidence suggests that several key segments of the MT industry will remain intact for some time. The likely survivors with future growth potential include the small number of large producers that manufacture flexible workstations, several medium-sized producers that offer customized products, and a variety of job-shop producers that offer unique outputs (often aimed at specific industries). On the negative side, import competition (as well as domestic competition) threatens to eliminate many of the nation's older SMEs, many of whom are market-tied to local buyers that are either 'on the way out' or 'moving forward'. The strategic challenge for many of these producers is to keep pace with clients that want flexible equip-

ment rather than dedicated machines. A further challenge is to cultivate distant markets as a counterbalance to weak or declining industrial demand at the local scale.

Looking to the future, it would seem that specialization and customization offer the best prospects for competitive survival at the firm level. Rather few US companies can manufacture CNC workstations for mass markets. Fewer still can export CNC products that can be installed, calibrated, and integrated with pre-existing systems *without* extensive technical support. There is little doubt that German, Japanese, and European producers have cornered the global market for high quality machines that can be purchased off-the-shelf. At the bottom end of the market, moreover, there is widespread agreement that low-end machines can be produced at highly competitive prices by manufacturers in nations such as Taiwan and South Korea. So, where does this leave the US MT sector? According to industry analysts (e.g. Haas, 2000), the answer lies in niche-based product innovation, custom work, and systems integration. Under systems integration, machines are designed by US firms – but critical items of hardware and software are sourced externally (i.e. imported). Here, the opinions of industry experts mesh closely with the findings from our follow-up interviews. An important implication is that domestic suppliers of accessories and parts will be increasingly threatened, as will a major US supplier of software controllers. A further implication is that US intra-industry trade in the machine tool sector will continue to ex-

pand. This suggests, among other things, that the foreign content of US MT exports will increase substantially over the 2000s.

Finally, it should be emphasized that our survey was conducted fully one year prior to the global economic slowdown that started in early 2001. Ongoing tracking studies by the authors suggest that recent job losses and plant closures have been overwhelmingly concentrated among third-division producers. As mentioned earlier, these producers are typically very small, very old, family-owned, locally-oriented, and apt to produce tailor-made equipment of a dedicated nature. Further, such producers are disproportionately represented in older industrial cities such as Buffalo, Cleveland, Cincinnati, and Detroit. While some of these cities have created new specializations in other sectors, the fact remains that virtually all of the major industrial centers that fringe the Great Lakes retain an above average proportion of total employment in basic metalworking activities (e.g. steel, auto parts, construction equipment). These cities also contain the bulk of the nation's 'high-risk' SMEs in terms of our survival prognoses.

ENDNOTES

1. The AMT membership directory does not capture the entire population of machine tool companies. This is because many of the nation's smallest MT firms are not AMT members. One possible reason for this is that AMT member services may not be terribly relevant to small firms that operate on a job-shop basis.

2. By itself, the incidence of negative employment growth does not necessarily imply poor business performance. After all, companies can often expand their sales while simultaneously cutting jobs via process automation. For this particular sample, however, the incidence of negative employment growth goes hand in hand with reduced output and/or a loss of market share. In short, firms that lost jobs over the study period also experienced declining sales.

3. A systematic assessment of the differences between foreign versus domestic MT establishments is planned for a separate paper. For now, however, it should be noted that foreign subsidiaries differ significantly from their US counterparts in terms of several variables, including: (1) market range (foreign establishments serve wider domestic markets than US companies); (2) import sourcing (foreign subsidiaries import a higher percentage of their inputs than US companies), and (3) establishment age (foreign subsidiaries are significantly younger than their US counterparts). No statistically significant differences were detected for performance-related variables such as employment growth, sales growth, or product innovation.

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Land Price Changes in Sendai and Sapporo, Japan 1993-1998

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ABSTRACT

The rapid rise of land prices in Japan from the mid-1980s to the early 1990s and their subsequent collapse followed monetary responses by the Government to yen appreciation and later efforts to control the “bubble economy.” Land price changes from 1993 to 1998 indicated a lag between the regional (local) and domestic (national) levels. Examination of data from the *Chika Koji Yoran* (Benchmark Land Price Survey) indicated three zones of local price changes in the study locations of Sendai and Sapporo. The largest reduction in prices occurred in city cores and moderated toward the periphery. Commercial lots declined the most because of higher prices from speculative buying, used as collateral for loans, and a drop in demand. Residential lot prices experienced a large drop in the core area because of potential conversion to other uses and high valuation of land. In the intermediate zone, drops in prices were smaller since residential lots dominated and not used for loan guarantees or speculation. In the periphery, in-migration caused growth of population and households which led to demand for residential lots as well as for commercial lots. Generally, prices were higher or remained stable at the periphery.

Keywords: Land Prices, Residential Land, Commercial Land, Internationalization Impact, Localized Factors, Territorial Industrialization, Japan.

INTRODUCTION

The concentration and growth of industry and population in certain regions of Japan since the end of World War II has increased the demand for land and contributed to a rise in land prices. This rise in land prices began about 1955, coinciding with the end of postwar recovery period, and continued during the high growth period of the economy in the 1960s (Takenaka 1991, 110). Land prices surged nationwide from the mid-1980s to the early 1990s during the period of the “bubble economy”.

Price increases ranged from 2.4 percent in 1985 to 21.7 percent in 1988 for all types of land and exceeded the previous high of 10 percent in 1980 (Zenkoku Shichokai 1992, 292). This national pattern changed to a downward trend from the early 1990s.

Selected aspects of the land price changes between 1993 and 1998 at the national and regional levels will be the main foci of this study. The average prices for all land uses nationally increased up to 1990 and dropped in 1991, but the regional pattern showed

the beginning of a downward shift about 1992 (Zenkoku Shichokai 1992, 272). These differences suggest that the regional patterns are reflective of the national pattern though delayed by the geographic transmission of price behavior. The interconnected nature of land prices at the national and regional (local) levels is clear; the differences between the two levels indicate that different kinds of factors were operative and are, thus, critical determinants of price behavior.

A Framework for Study of Land Prices

A method for the examination of land rent and location of activities was formulated by Johann H. von Thunen through a study of agricultural land use in Germany (von Thunen, 1966). In 1960, Alonso presented a theory of urban land markets as an extension of the agricultural model (Alonso 1960, 149-157). The Alonso paper recognizes differences in markets for business locations (profits) and residential locations (satisfaction) (Alonso 1960, 153-155).

Land markets in a city must recognize other factors as determinants of values and prices along with the location/or accessibility. The determination of urban land prices must incorporate the accounting for multiple factors associated with the parcel of land (Wendt 1965, 240). At the local level, the introduction of a new transportation mode will play an important role in shifting the center of accessibility, relocating a market

center and be a continuing influence on land use and values. Intermingling of uses of lots within an area or district is certainly an element in the formation of prices of parcels because of the coexistence of incompatible social, economic and environmental conditions that will detract from its value. Further, the existence of incompatible conditions in an area may portend future land use changes to attain higher returns. Such elements as proximity to different activities, a transportation system which connects a location to different activities, and historical conditions determine the value associated with a parcel of land (Brigham 1965, 334). Also, a factor such as topography may affect land values by the impact it may have on the supply of easily accessible land, but can also provide premium locations by including scenic vistas for residents. Factors such as government policy, laws, and speculators' actions are also part of the determinants of land values in cities (Mills and Ohta 1976, 704). Thus, changes in local land prices in a city are influenced by the location of the land unit relative to other landscape elements and will be reflective of its uses such as commercial and residential land within the larger framework of a geographic area.

The intent of the "Isolated State" framework was to analyze regional or local patterns of land values and prices by excluding external factors. The interrelated nature of economies

or internationalization necessitates the incorporation of external factors within a framework of examining land prices. An increase in demand for building space in a section of a large city by externally-based multinational businesses is one such situation. Government monetary actions in response to international conditions by an economically dominant country will affect its land prices. The role of internationalization of the economy must be examined in the study of changes in land prices at the national level in Japan.

The movements of land price in Japan in this study will be considered at two levels. *First*, the consideration of contributory factors to land price changes at the national or domestic level, especially the rapid rise during the “bubble” economy and the subsequent period of decline, will provide insights into the effects of internationalization on land prices. *Second*, the examination of land prices at the local level in the two selected cities will reveal the effects of several additional factors on land price changes.

STUDY LOCATIONS AND DATA

The study locations selected are the cities of Sendai in Miyagi Prefecture, and Sapporo on Hokkaido. Criterion for their selection was the “regional nature” of these cities. Regional cities

were selected to reduce possible direct distortions in prices and uses induced by proximity to a large metropolitan area. However, the effects of large metropolitan areas are virtually impossible to eliminate completely as demonstrated by the diffusion effect of prices from metropolitan areas to regional cities in the latter part of the 1980s. An additional criterion for the selection of the study locations was based on their population sizes. Another reason for the selection was to attain insights into effects on land prices when the core of a city shifts from one location to another.

The cities selected for this study have different origins. The initial impetus for growth of Sapporo was by its selection as the capital city in 1869 by the *Kaitakushi* (Colonial Office) for the settlement of Hokkaido. The city began to function as the capital with the movement of government offices from Hakodate in 1871 and continues to serve as the capital city of the *Do* (prefecture). The City of Sendai developed from its selection as the site of the castle town by the *Daimyo* (Lord) Date Masamune in 1601 (Toyoda 1976, 93). Currently, Sendai serves as the capital of Miyagi Prefecture and functions as the regional center for the Tohoku region. The geographic characteristics and locations of the selected cities are shown on Table 1 and Figure 1.

Table 1. Characteristics of Selected Cities

City	Incorporation Date	Population (1995)	Area (sq. km.)	Population Density (/sq. km.)
Sapporo	1899	1,757,025	1,121.12	1,567
Sendai	1889	971,297	783.5	1,240

Sources: Zenkoku Shichokai (ed.). *Nihon toshi nekan (Heisei 4-nenhan) (Japan city yearbook, 1992 Edition)*. Tokyo: Dai-ichi Hoki Shuppan Kabushiki Kaisha. Somucho Tokeikyoku. *Kokusei chosa hokoku (1980, 1990, 1995 Population census of Japan)*. Tokyo: Somucho Tokeikyoku.

Table 2. Range of Land Price Changes in Percent

City	Zone 1		Zone 2		Zone 3	
	Commercial	Residential	Commercial	Residential	Commercial	Residential
Sapporo	-78 to -17	-44 to -6	-49 to -7	-36 to +4	-30 to +20	-37 to +15
Sendai	-70 to -7	-38 to -2	-22 to +3	-26 to +8	-14 to +14	-4 to +14

Source: Computed from land values in Chika Koji Yoran, 1993 and 1998.

The Chika Koji Yoran (Benchmark Land Price Survey) is the data source for this study. It is compiled annually on January 1 by the Kokudocho (National Land Agency; currently a part of Ministry of Land, Infrastructure and Transportation) to achieve the administrative objectives of the National Land Use Act of 1974. Among the purposes of the Benchmark Land Price Survey is to announce the prices of representative types of land yearly to provide an index of prices for land transactions (Chika Koji Kenkyukai 1993, Preface).

The formulation of an index price for a parcel of land begins with the classification of land into residential, potential residential, business, semi-

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industrial, industrial, forested land for conversion-renewal and residential land for renewal (Kokudocho Tochi Kantei Iinkai 1993, Preface). Parcels of similar land uses as well as displaying similar quality in natural and social conditions, in an area are aggregated into districts such as residential district, business district, industrial district and potential residential district. Within each district, a parcel is selected as the foundation ("base land") for price comparison. A value for the "District Factor" of a parcel is developed by assessing 25 specific items in five major categories such as street, transportation and proximity, environmental conditions, etc. A value for "Individual Parcel Factors" is

established by using the same five major categories with 34 specific items (Chika Chosa Kenkyukai 1992, 6). The index price is a product of: the price of the “foundation” (base) parcel in a district multiplied by “Differences in Quality Rate of District Factors” multiplied by “Differences in Quality Rate of Individual Parcel Factors” (Chika Chosa Kenkyukai 1992, 9).

Questions have been raised about the usefulness of benchmark prices. Some have considered these prices to be unacceptable because they do not

reflect the actual transaction prices. Still others indicate that it is “virtually useless” because land is “illiquid” during a period of economic stagnation or depressed market (Wood 1992, 51). Although benchmark prices may cause concerns from certain perspectives, they do provide a means for assessing the changes over time from a single source of government statistics. Also, a perusal of the methodology for deriving the index prices indicates a consistent and firm basis for each type of land use.

Figure 1. Study Locations



The pattern of land price distribution was established by plotting of data points from the Chika Koji Yoran on a city map according to the address of the parcel. Only data points which appeared in both 1993 and 1998 surveys were used in the study. The year, 1993, was selected as the base year since price decline had begun in regional cities (Kokudocho 1993, 100). The second year, 1998, was chosen because there is a continuation of price drop, with sufficient lapse of time to show variations in price changes. The number of data points mapped for the two cities were: Sendai, 252 locations, and Sapporo, 350 locations. After plotting the locations and recording the data for each, the distance from the central point to each point was measured and added to the data set.

Responses to International Conditions and Its Impact on Land Prices

Analysis of the data suggests adjustments in domestic policies to external pressures have an impact on changes in land prices. Responses to internationalization of the Japanese economy also appear to have contributed to the rise in land prices between 1986 and 1992, and its subsequent decline. It is also clear that Japan has had to take into account its impact on other countries as well as respond to the potential effects of actions taken by other countries.

Monetary measures undertaken by the government to cope with the effects of yen appreciation affected land prices domestically. Beginning with pressures to correct the trade imbalances between the United States and Japan, the Plaza Agreement, signed at the G-5 meeting in 1985, led a rapid appreciation of the yen (Nihon Keizai Shimbun, Inc. 1986, 7). The deflationary impact of *endaka* (yen crunch) resulted in the deployment of pump-priming measures as well as four discount rate cuts by the Bank of Japan (BOJ) in 1986 to slow the rise of the yen and to stimulate domestic demand for goods and services (Nihon Keizai Shimbun, Inc. 1987, 12). These monetary measures led to an increase in money supply, stimulated a monetary flow into the real estate and stock markets, especially by enterprises and financial institutions, and subsequently pushed the prices of land and stock prices to higher levels (asset inflation) (Nihon Keizai Shimbun, Inc., 1986, 14).

The demand for office space, especially the need for space by international financial firms, also contributed to the initial surge in prices. Land prices in the major cities began to rise in 1985 and 1986; for example, it rose as much as 54 percent in Central Tokyo in 1986 (Nihon Keizai Shimbun, Inc. 1987, 193). The ripple effect of this surge caused price rises in other large metropolitan regions and, eventually, diffused to regional cities (Oizumi, 1994).

Subsequent actions of the BOJ in reaction to domestic and international conditions reversed the upward trend of land prices. The BOJ changed its monetary policy on May 31, 1989 by raising the discount rate to 3.25 percent, the first such increase in nine years, and followed with two additional increases in the same year and one in early 1990 (Nihon Keizai Shimbun, Inc. 1990,8). The objectives of these increases were threefold: to bring the Japanese discount rate closer to the level charged in the United States; to shore-up the weakening yen as well as to ease inflationary pressures because of higher wage costs and a tightening of the supply-demand situation; and to help in slowing the rapid rise of land prices (Nihon Keizai Shimbun, Inc. 1990, 24-25). These moves on the part of the BOJ resulted in achieving the desired effect of slowing the rise of land prices and in some instances, reducing them.

General Land Price Distribution in Cities

The general pattern of land prices in cities selected for the study was established by computing the average price of land per square meter, and was computed for each one kilometer (band) distance from the main railroad station. These price-distance relationships for the two cities are graphically represented in Figures 2 and 3.

The expected spatial distribution of land prices in a city is a drop with distance from the core and is demonstrated in the distribution of land values from the “cores” selected for Sendai and Sapporo. In this study, the core or center of the city was determined on the basis of the clustering of highest land prices. In both of the two study cities, the clustering occurred around the main railroad station. Thus, the railroad station was selected as the central point, though no price was published for this point.

The railroad station became the core area of Sendai during the early Modernization Period (1867-1945). The original core was the castle. The ease of access provided by the railroad increased flows of passengers, especially from local hinterlands to the city, as well as interregional passengers and freight. Additionally, the main railroad station became the point of high accessibility because it also is the junction with other forms of transportation within that city. Accordingly, the importance of siting such a point of transportation convergence in close proximity to their establishments was not lost on local merchants. They mounted a vigorous lobbying effort in 1886 to influence the railroad company to move the location of a station from a previously selected site to one located much closer to their establishments (Miyagi Kenshi Hensan Iinaki 1954-1987,5, 649). Their successful lobbying resulted in establishing the core of Sendai

through the attraction of businesses and related activities around the station.

After the establishment of the railroad station, some of the business-related sections of this castle town became part of the core area continuing with similar functions. Land values around the former castle area did not exhibit noticeable changes because of limited land area and preservation of historical land uses.

As expected, the overall land price distributions in the selected cities showed a pattern of high prices in the core area and a decline toward the periphery. However, the comparison of prices between the two years selected, 1993 and 1998, indicates a pattern of a large drop in prices in the center and smaller one toward the edge. These noted differences in land price changes from the center to the periphery between the two years demanded an examination of potential factors which contribute to these variations.

Patterns of Local Variations, 1993-1998

Changes in land prices were determined by computing the differences in land prices for lots which were listed in the 1993 Benchmark Survey and again in the 1998 Benchmark Survey. These differences were then converted to percentage changes. The original data of seven land use categories was

reduced to two: **residential** and **commercial**, representing the six other land use classifications identified earlier. This consolidation of several land uses into two use categories reduced the complexity of examining differences in land types.

The distribution of percent changes in land prices by location is shown graphically for the two cities (Figures 4 and 5). On these scatter diagrams, the zero percent line represents the value of land units (square meters) in 1993 as the base line. The price - distance plots, below or above the base line, represents the direction of percentage change in the prices for each parcel observed in 1998. Figures 4 and 5 clearly reveal the general trend of smaller land price changes with increasing distance from the central core of each of the cities. A large decline in land prices are particularly noticeable in a zone extending five kilometers from the main railroad station of Sendai (Figure 4) and Sapporo (Figure 5). In this first zone, both commercial and residential land use prices experienced significant declines from 1993 to 1998 in each of these regional centers. Additionally, the percentage decline in commercial land prices was larger in comparison to that of residential land. In the second zone, extending from five to ten kilometers from the main railroad stations of these cities, price drops over this time period were much less severe and some price increases are evident. In the third zone, extending beyond ten kilometers from

the central core, positive changes in land prices are indicated; however, negative anomalies did occur. The ranges of land price changes are shown on Table 2.

Factors in Land Price Changes

Contributory factors to price changes are different in each zone. In the first zone of zero to five kilometers from the main railroad station, the dominant type of land use is commercial (businesses). The drop in prices in this use category from 1993 to 1998 in the two selected cities was similar to those of large metropolitan regions in Japan (Chika Koji Kenkyukai 1993 and 1998 editions). During the period of rising land prices, the higher increase in prices was pushed by the demand for more commercial space as the economy continued to grow during the 1980s. Also, the land was used as collateral for capital borrowing by corporations which lead to higher valuations, especially for land in the core areas of the cities (Kokudocho 1997, 109). Another factor was the increase in prices for speculative purchases. These three factors raised the land prices to very high levels in the core area. Eventually, downward pressure on prices was exerted by the slowing of the economy and the resultant decline in demand for commercial space. Further, enforcement of the land policy through financing procedures, adjusting the tax system, and regulation of land transactions led to still lower demand

for space in the commercial sector (Kokudocho 1993, 102).

The occurrence of a price anomaly around the main railroad station demonstrates the role of localized factors in influencing land prices. Commercial location prices were higher in the “front” than in the “back” of the main railroad station. For example, in Sendai the price for a commercial location at about 450 meters from the station was about 28 percent less in the “back” than the “front” of the station. This phenomenon seems to continue, with the exception of one or two sites, to approximately two kilometers from the station. Such anomalies are attributable to the initial development pattern of commercial areas and investments in associated infrastructure in “front” of the station. Most people who come to the city to work or shop have used the “front” of the station to enter and leave; therefore, commercial activities tended to be concentrated in the areas of heavier foot traffic. Also, the “back” did not receive the same attention regarding construction of roads for access during the early years when the “front” of the railroad station was developing in response to increasing number of commuters and shoppers. Thus, the front developed more rapidly which translated into higher land prices over time. The difference in land prices between the “front” and “back” demonstrates the significance of the historical pattern of

development and its lasting effects over long period of time.

The decline in residential land prices was not as great as those of commercial land prices. In comparison to other zones, however, the decline in residential land prices in the first zone was larger. The association with nearby commercial land prices is reflected in higher residential land prices in this zone in 1993. As a result, lots in the first zone sustained greater drops in prices unlike residential lots in the other zones during the period of decline. Further, residential lots in the first zone that were classified as "general" residential districts intermixed with other uses such as "mansions" (condominiums), "apato"(apartments) and commercial activities tended to decline more than those districts designated as "general residences". Though intermixed districts are not uncommon in Japanese cities (81 percent of the sample in Sapporo and 61 percent in Sendai), such areas have the potential for being converted to more profitable land uses. In Sendai, all of the lots classified as being located in "intermixed" districts incurred very large price drop ranges (42 percent to two percent), while those lots in the "general" residences district category had smaller price drop ranges (30 percent to three percent). Similarly, in Sapporo all of the lots in "intermixed" districts experienced large price changes (44 percent to seven percent); while the other lots in "general" residence

districts had a drop of 43 percent to six percent. The 43 percent drop in Sapporo represented a single lot that was listed as being in a "high class" district and appears to be an exceptional case.

The trend in price changes moderates in the region from 5 to 10 kilometers or Zone 2 in the selected cities during the same period. Three factors are identified as contributing to the variations in prices among residential lots. The *first* is similar to the large drop in prices of "residential" lots associated with "intermixed" land use in Zone 1. In this zone, the sample included 27 percent of the "residential" lots with "intermixed" land uses in Sapporo and 14 percent in Sendai. For example, one intermixed "residential district" lot experienced a larger drop of 28 percent, but the decline in a district of mainly "general" residences was only 2 percent. Yet, both districts were located approximately six kilometers from the core region but in different sections of the City of Sapporo (Chika Koji Kenkyukai 1993 and 1998 editions). The *second* is a "corridor effect of transportation;" larger drops in prices were noticed among lots in districts intermixed with stores, offices and operations offices located along major roads. The *third* aspect is prices among lots which were described mainly as general residences and middle class residences sustained smaller drops or remained unchanged. The relatively small decline or stability in prices in such districts is

explained by the fact that most owners were interested in keeping their houses and had not used them as collateral for loans as in the case of commercial buildings. Consequently, the prices of these lots did not reflect the fluctuations in economic activities or the commercial change in demand that occurred during the high activity period.

Commercial lots in Zone 2 showed a relatively smaller decline in prices than Zone 1, but they are larger in comparison to residential lots. The reason for the noticed decline in prices is the same as in Zone 1. The common characteristics shared by commercial lots sustaining larger declines were locations in which there were retail stores along a road. Another was those locations with offices and banks. Still another was those locations with a combination of stores, mansions, "apato" and other living accommodations. Lots which were in areas associated with distribution centers, trucking operations and related activities also experienced price drops.

The third zone beyond ten kilometers from the city core generally experienced an increase in prices, though there were some exceptions. The rise in prices between the years 1993-1998 reflected the demand for new residences a result of the outward movement to and/or growth of the population in the periphery. The population figures for both Sapporo and Sendai showed a similar pattern

of population change. For example, there was a five percent population increase in Sapporo between 1990 and 1995; but the population increase in peripheral wards of the city was as high as 17 percent while wards toward the center showed about 3 percent decrease. Also, the growth of private households in Sapporo showed an increase of 23 percent in a peripheral ward, while it was as low as six percent in the core area between 1990 and 1995. In Sendai, one of the peripheral wards increased in population by 17 percent while wards near or close to the center experienced smaller increases or actual decreases (Somucho Tokeikyoku 1990 and 1995 editions). In Sendai, between 1990 and 1995 the increase in private households in one of the peripheral wards was 29 percent compared to only 9 percent in the inner wards (Somucho Tokeikyoku 1990 and 1995 editions).

Another element in the demand for residential lots in the peripheries involved families which had previously purchased residences within the inner zones and completed or almost completed the repayment of their loans. Such families had the option of either remodeling their current homes or purchasing a newer house and lot at the periphery. Additionally, the expanding economy provided these families higher income which made it possible to undertake the option to buy a new home at the periphery using the first residence as the financial foundation for such action.

Therefore, residential lot prices in new subdivisions in the periphery maintained their value or increased in value in 1998.

The extension of a commuter transportation system into smaller towns at the periphery of a large city affected land prices. In one of the northern suburbs of Sendai, one site, located about seven kilometers from the core, was appraised at a level comparable to prices within a one to 1.9 kilometer radius from the main railroad station. In this case, the ease of commuting by the completion of a subway line was the basis for higher price. Also, prices for residential lots closer to the subway station were much higher than in the surrounding areas.

Commercial lots in Zone 3 show some price increases. These increases were connected to the rise in residential lot prices. As the population moved to the periphery, businesses saw opportunities to fulfill new family needs for goods and services; thus, they moved in to buy land in appropriate locations, putting pressure on land prices. Similar to Zone 2, drops in prices for commercial lots such as semi-industrial, industrial and transportation parks reflected the slowing of economic activities.

CONCLUSIONS

The importance of the linkage among national economies or internationalization is demonstrated by the

experience of Japan regarding the rapid rise of land prices in the 1980s and a subsequent decline in the 1990s. The Plaza Agreement to reduce trade imbalances led to yen appreciation and, in reaction, monetary responses affected its domestic money supply, causing a flow of money into the asset market and inflation of stocks and real estate. Eventually, the Government raised interest rates to control the "overstimulated" economy and in the process achieved the goal of slowing the rising prices of stocks and land. Responses to external pressures were significant in creating the conditions for an increase in land prices and its subsequent decline.

When the drop in land prices occurred it was not uniform, suggesting there were other forces at work at the local level. The general pattern of land prices in the study cities revealed a pattern of decreases with increases in distance from the core of the city, a pattern of change similar to that found in Western cities. A closer examination of local land prices indicated that price drop of commercial land in the core area of these cities was much greater than residential land during the study period. The large reduction in prices was a reflection of high prices associated with commercial land speculation by 1980s, and the use of commercial land as collateral for loans. An anomaly in land prices was the differences between the "front" and "back" of the main railroad station, demonstrating the effects of

local factors. Also, the shift of the core of the city from the castle to railroad station led to the organization of overall land prices based on the main railroad station as the core of the city in the case of Sendai.

The prices for residential lots dropped greatly in districts closer to the core areas of the cities and lost less toward the periphery. The larger reduction in prices of residential lots close to the core was very noticeable in districts where residential land use was mixed with other uses such as mansions, apartments, and other types of rental buildings. Toward the periphery, the residential lots experienced smaller price declines and even some increases. Land in these areas was not

being used for the purpose of loan guarantees and did not have the potential of conversion to other uses. Thus, the stability of land use for residences contributed to a smaller decline in prices. Further, increases in land prices for some lots reflected a demand for new residential lots where an increase in population occurred through migration to or growth in the suburbs. Local price variations in this study are indicative of the impact of socio-economic forces over space and time; thus, they are, though linked, different from variations experienced at the national level. The factors for changes in land prices considered in this study are by no means exhaustive and at best they are the beginning point for further inquiry.

Figure 2. Land Price Changes, Sendai

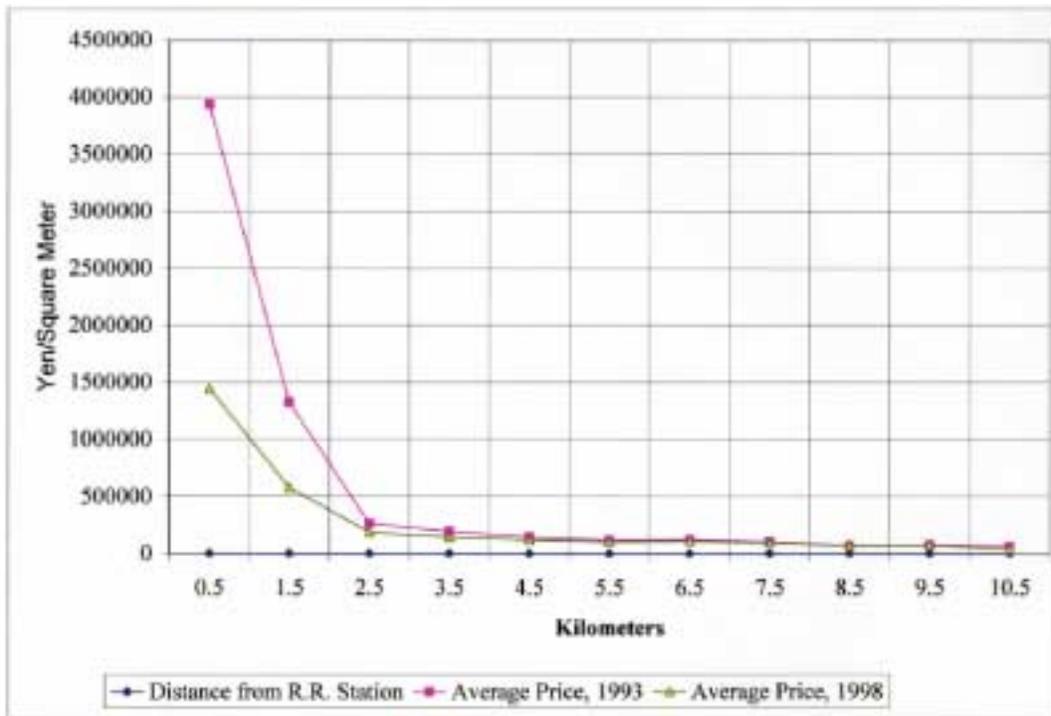


Figure 3. Land Price Changes, Sapporo

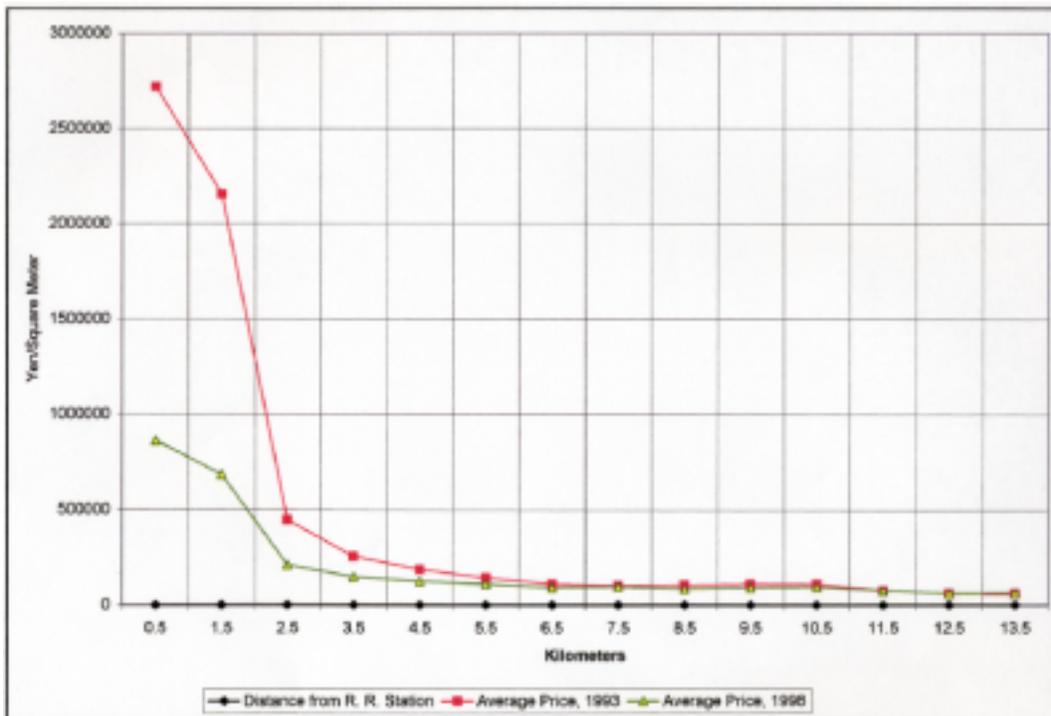


Figure 4. Percent change of residential and commercial land, Sendai

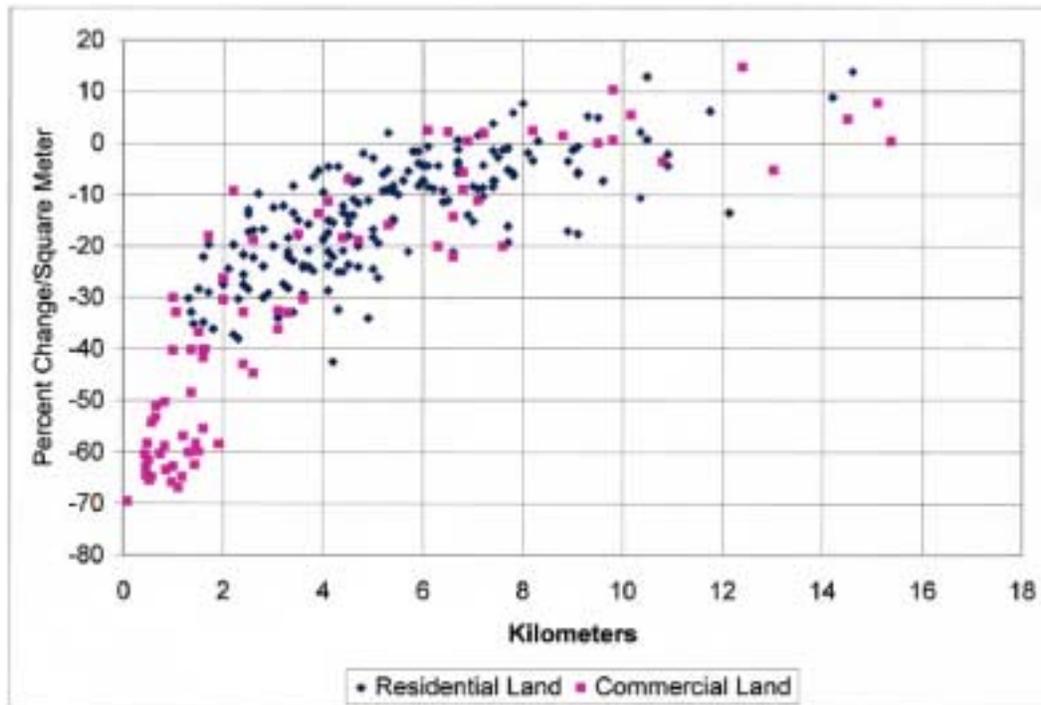
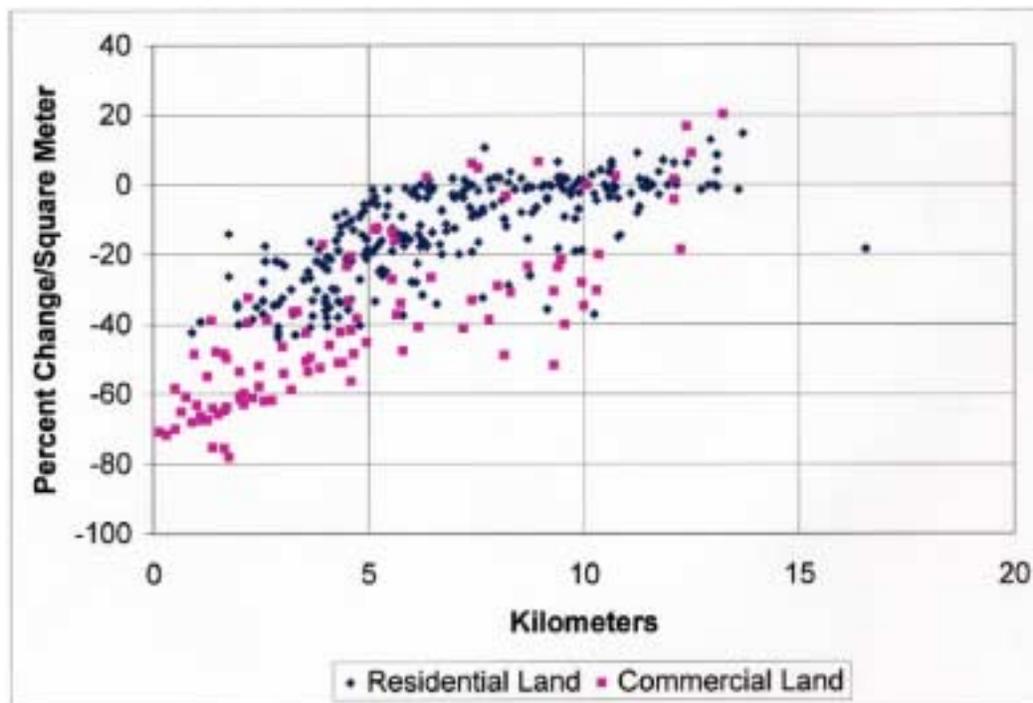


Figure 5. Percent change of residential and commercial land, Sapporo



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Acknowledgments

The author would like to acknowledge the generous assistance of Mr. and Mrs. Tohoru Takahashi, Ms. Taeko Takahashi, and Mr. and Mrs. Yukio Yamaki of Sendai, Miyagi Prefecture in the preparation of the paper. Further, the author would like to express his thanks to Dr. John R. Ray for his comments on an earlier version of the manuscript. Additionally, the comments of the reviewers and editors of the journal were appreciated in revising the paper.

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**Compiled by Jay D. Gatrell with assistance from the Editorial Board.*

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Graves, W. 1997 Mapping the new economy: Estimating intellectual capital distributions form [sic] balance sheet data. Presented at the Southeast Division of the American Association of Geographers (SEDAAG).

4. Books

Illeris, S. 1996 *The Service Economy: A Geographical Approach*. New York: Wiley.

5. Working Papers or Other Resources

Atchison, S. 1993 Care and feeding of lone eagles. *Business Week*, November 15, p. 58.
DeVol, R. 1999 America's High-Tech Economy: Growth, Development, and Risks for Metropolitan Areas. Milken Institute, Santa Monica, CA.
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