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The changing Canadian inventive spatial economic pattern: An urban and regional analysis between 1881 and 1986

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THE CHANGING CANADIAN INVENTIVE SPATIAL ECONOMIC PATTERN: AN URBAN AND REGIONAL ANALYSIS BETWEEN 1881 AND 1986

BY

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ABSTRACT

Canadian urban and regional patent and trademark data was analysed between 1881 and 1986 in an attempt to distinguish spatial inventive patterns in Canada over time. Inventive activity, as a pre-condition for economic development, is a viable indicator for predicting future economic growth in an inventive spatial economy. As such, it will be possible to extend the description of spatial inventive patterns in Canada after 1986.

The percentage and relative level of inventive activity in urban centers and regions in Canada will help distinguish spatial inventive patterns in Canada over time. This information was based on a 25 percent systematic sample of registered Canadian patents and trademarks between 1881 and 1986. Inventive activity was also compared to population growth and unemployment levels in an attempt to discern the relationship between inventive activity and urban growth. This analysis compared the number of inventions per 10,000 population in 1981 to the percentage of population growth between 1981 and 1986 and unemployment levels in 1986 for twenty-four major Census Metropolitan Areas in Canada.

It was found that the Canadian inventive spatial economy is very dynamic. However, an overall pattern of concentration was detected. For example, inventive impulses in the Maritime region was lacking after 1911. In the West, impulses of varying intensity were evident over time and space. Most of Canada's healthy inventive activity was found in Central Canada. Further, the core region lost some of its inventive importance during the post-war years, however, between 1981 and 1986, this region experienced traditionally high levels of inventive activity. Also, there was a noticeable pattern of inventive concentration towards higher ordered places in the Canadian urban hierarchy, and a rationalization of Canada's core region from a Quebec City to Windsor axis to a Toronto to Kitchener-Waterloo axis with a trunk line towards Hamilton and two island impulses in Montreal and Ottawa. Lastly, there was a positive and significant relationship between inventive activity and urban growth, lending support to the notion that recent inventive concentration in the core region of Canada can be expected to continue well into the next decade.

TABLE OF CONTENTS

LIST OF FIGURES AND TABLES

1.0 INTRODUCTION

1.1 TOPIC OF RESEARCH

The purpose of this thesis is to determine the spatial economic inventive pattern in Canada between 1881 and 1986. In essence, the question to be answered is: "Is Canada's inventive space economy becoming more concentrated or more dispersed through time. This question will be answered by examining registered patents and trademarks from 1881 to 1986 on an urban and regional basis. Registered patents and trademarks are a viable indicator for distinguishing spatial inventive economic areas, because they represent new or modified economic activities which are unique or entrepreneurial in nature. In effect, inventive is a pre-condition for economic development.

By examining inventive areas in Canada over time, it will be possible to determine if the Canadian inventive space economy has become more rationalized between 1881 and 1986. In effect, it will be possible to suggest which inventive areas in Canada are growing or declining. Further, since it can be argued that inventive activity is a pre-condition for economic development, it will be possible to determine the extent of future disparities in the Canadian inventive space economy. Since there have been a few examples of research utilizing registered patents and trademarks as a measure for determining inventive in Canada's space economy, this thesis will add to the limited amount of research.

Five basic procedures will be examined in an attempt to answer the above question. First, the percentage of inventive activity in urban places with greater than one-percent of the Canadian total (concentrated inventive impulses) for any one period between 1881 and 1986 will be examined. Second, the percentage of all Canadian inventive activity in the core region of Canada (Quebec City to Windsor) for any one period between 1881 and 1986 will be determined. Third, the cumulative percentage of inventive activity in concentrated urban inventive places for any one period between 1881 and 1986 will be examined. Fourth, the number of inventions per 10,000 population in urban places which had greater than one-percent of the Canadian total for any one period between 1881 and 1986 will be determined. Lastly, Canadian relative inventive activity in 1981 will be compared to the percentage of population growth between 1981 and 1986 and unemployment levels in 1986 for major Census Metropolitan Areas in Canada.

In this thesis, it should be kept in mind that Patent and trademark data, as recorded for different communities over space, are surrogate measurements of present and future economic well-being. Secondly, patent and trademark data are surrogates of industrial development. Lastly, inventive activity, as measured by patents and trademarks, will be assumed to have been created in the general location of their registry.

But before the above assumptions and procedures are explored more fully in this thesis, three facets of the literature concerning inventive and innovative activity will be discussed. First, an understanding of the spatial distribution of inventive activity will be

discussed. Second, the benefits and deficiencies of patent and trademark data will be reviewed. Lastly, this thesis will examine the notion that inventive and innovative activity is a pre-requisite for economic development.

1.2 PERTINENCE OF RESEARCH

There appears to be a limited number of studies which examined the spatial distribution of patents in the literature, nor has a thorough examination of patents over time in Canada been done. The lack of concern by geographers in this area of research is further evident when one considers there are no spatial studies involving trademarks either. The benefits of using registered patent and trademark data by geographers is that they provide us with the geographic location of the inventor. This generates a data-set capable of explaining the spatial distribution of economic wealth if the notion that inventive activity is a pre-condition for economic development is held true. In this thesis, the spatial distribution of patent and trademark data between 1881 and 1986 is examined. This research shed light on the general notion held in Canada that inventive activity is becoming increasingly concentrated over geographic space. Further, the location of presently registered patents and trademarks might tell us something about where future economic growth will take place in Canada.

1.3 PROCEDURAL ANALYSIS

To facilitate the temporal and geographic understanding of industrial creativity in Canada, patent data was collected from 1881 to 1971. Specifically, each census year, ie; 1881, 1891, 1901, through to 1971 will be analysed. Trademark data for 1981 and 1986 completed the analysis. The rationale for switching from registered patents to registered trademarks is linked to the fact that the geographic location of inventors was absent from registered patents after 1976, but was available for trademark data. Since it can be argued that patents and trademarks are correlated, it is assumed that trademark data will also reflect patent location data. Both data sources will be collected from weekly publications by the Ministry of Consumer and Corporate Affairs and Canadian Patent and Trademark Records. Once the data is collected, the place of residence of the patentee or trademarkee will be classified according to the appropriate urban center, providing a geographic base of this data. In addition, only Canadian patent and trademark data is examined. It should also be noted, that a twenty-five percent systematic sample of registered Canadian patents and trademarks were examined for each of the years mentioned above.

In an attempt to inter-relate patent and trademark data, both sources will be collected for six overlapping years to determine the extent of similarities in geographic location and intensity of

registry. Secondly, any possible time lags between the two data sources were determined.

In an attempt to simplify the analysis, inventive activity, as measured by the percentage of patents and trademarks in urban centers and regions in Canada, will be recorded. Most of this information will be diagrammatically displayed on maps and in table form. For each city, the number of inventions per 10,000 population will be determined. Most of this information will also be displayed in table form. Lastly, traditional indicators of economic activity, ie; population growth and unemployment levels for major census metropolitan regions in Canada, will be correlated with the number of inventions per 10,000 population for the same centers.

2.0 AN UNDERSTANDING OF THE LITERATURE

2.1 INTRODUCTION TO THE LITERATURE

It has been suggested that patents and trademarks are viable indicators of present and future economic activities. However, there is controversy surrounding the use of patent and trademark data as a surrogate for economic wealth. Therefore, this chapter will provide support from the literature for two basic areas concerning inventive and innovative activity. First, a spatial understanding of inventive activity will be provided in an attempt to explain why some regions are more successful than others with respect to inventive activity. Secondly, the use of registered patents and trademarks (inventive activity) as a pre-condition for economic wealth, will be reviewed.

2.2 A SPATIAL UNDERSTANDING OF INVENTIVE ACTIVITY

Before a spatial understanding of inventive activity can be discussed, some important concepts and notions need clarification. Technical inventions are a new combination of existing knowledge designed for practical use in production. Innovations are the practical use of technical inventions on a commercial scale. Innovations are not the discovery of knowledge, but the application of new knowledge (Lee, 1972, p.10). Emerging technologies are defined by new or modified products, techniques and processes that are rapidly diffusing through the economy (Ministry of Skills and Development, 1987, p.14).

A patent is an official right to be the sole maker or user of an invention or process (Oxford Dictionary, 1981, p.366). A trademark is a word, mark or design used by an individual or firm to distinguish a good (Winston Dictionary, 1970, p.492). A trademark is not a legal monopoly like that of a copyright or patent, but is to distinguish between products of competitors (Diamond, 1973, pp.1-3). A trademark protects a product and its logo for 17 years in Canada. The conceptualization of that product is also protected by a patent for 17 years in Canada. With patent and trademark protection, innovators are more likely to disclose their product and make the necessary investment to bring their product to market (Scherer, 1977, pp. 9-10). Therefore, if inventors are encouraged to patent, there should be a correlation between a particular geographic area's level of patent and/or trademark activity and its industrial strength.

The amount as well as the quality of research dealing with the locational attributes of inventive and innovative activity has been limited in geography. Pred (1966, p.86) documented the fact that **geographers have shown a lack of concern toward the spatial attributes of industrial inventions and innovations. The link from inventions to manifestations on the landscape has not been analysed and is even believed by some to be a locational accident.** As Schumpeter (1964, p.75) observed, innovations are not distributed over economic space randomly.

Pred (1966, pp,106-107) undertook a study on patent data for sixteen major U.S. cities in an attempt to quantify the relationship between inventive and innovative activity and urban growth. His

methodology involved a comparison between crude data, ie; population size, for selected American cities from 1860 to 1900 and patents per 10,000 capita for the same places. He found that those centers which had a stronger manufacturing base experienced higher levels of urban growth and inventive and innovative activity than those that did not. In essence, the metropolitan environment was more conducive to innovations due to a large labour force and substantial local market (pp. 99-100). Pred (1966, pp.132-133) also examined immigration as a factor in promoting inventive and innovative activity. The results showed a slight positive relationship between immigration and inventive activity. In his summary, he also pointed out that regions or centers with well developed economies were more likely to experience economic growth due to their ability to capitalize on initial advantages, ie; superior infrastructure.

In an earlier study, Ullman (1958, pp.179-98) also tried to link inventive activity to the concentration process of industrial and urban development across the U.S.. It was accomplished by mapping the number of patents for each region and the number of patents per-person. Ullman found the North-East and California to be strong regions of inventiveness. This geographic pattern was attributed to rapid urban growth in the North-East and California, which was linked to a growth in new manufacturing activities in these regions. This according to Pred (1960, p. 117), is conducive to industrial inventions and innovations. In an attempt to further understand the geographic location of inventive activity, Haug (1986 pp.26-27) linked the location of scientific, engineering and skilled labour to inventive

activity. Haug interviewed 25 executives at fourteen U.S. owned electronic plants in Silicone Glen to determine the needs of high-technology industries. The results indicated that labour skills, and technical and educational support were very important in attracting new high technology. Therefore, those areas that possess a highly skilled labour force are more likely to attract high technology, and ultimately, experience greater than average inventive activity.

Howells (1984, pp.26-27) showed that larger urban centers were more likely to create unequal levels of inventive activity across the space economy due to their superior interaction and information flows which reinforce the concentration of inventive activity. Howells was able to reach this conclusion based on a spatial examination of R&D activity in Great Britain. This study was based on unpublished employment records relating to R&D activity. He found that R&D activity was concentrated in the South-East where it could take advantage of superior information flows, infrastructure and labour. Similarly, Pred (1960, p.129) pointed out the importance of information as far back as the late nineteenth century when it promoted technological progress through a complex network of communication flows, particularly, inter-personal communication. Most importantly, from a geographic standpoint, it is the larger cities which possess the most favourable levels and types of information flows which are conducive to inventive activity, particularly, short distance information flows.

There has been little research examining the locational bias of inventive activity in high ordered centers which are favourable to this type of activity. In an attempt to meet this gap in the literature,

Antonelli (1986, pp.85-91) examined not the spatial distribution of patents in a region or country, but within a metropolitan area. This spatial understanding was achieved by mapping 1,197 registered patents in the province of Turin, Italy. The findings suggested a stronger level of patent activity further away from the Central Business District. Therefore, although inventive activity favours well developed urban centers, in some cases this activity is locating beyond the inner city of these well developed centers. In essence, the "regional city" concept was evident when registered patents were mapped for Turin, Italy.

The type of inventive activity within large firms is also important in understanding the spatial distribution of inventive activity (Howells, 1984, pp.20-24). For example, if research is **basic**, then proximity to the head office is important. If research is **applied**, it will be more decentralized and production location oriented, thereby, meeting the needs of a particular manufacturer's sub-division. Thus, the most important and fruitful patents are frequently found in the large metropolitan areas. Also found, was detectable "discriminant decentralized activity" by large firms. In other words, the likelihood of important innovations reaching other branches of an organization decreases with distance, especially if political boundaries are involved. When a large percentage of corporate headquarters are located in large urban centers (in the core region), the likelihood of decentralized inventive and innovative activity is reduced. For example, by 1975, decentralized inventive and innovative activity in Great Britain occurred in a South Easterly direction from London. In

essence, as corporate headquarters moved in this direction, so did inventive and innovative activity (Howells, 1984, PP.25-26; Hall and Ritchie, 1975, PP.243-45).

If the above findings are held true, it can be expected that inventive and innovative activity in Canada should be centralized based on the findings of Semple and Green (1981, PP.398-406). They examined corporate headquarter relocations between 1970 and 1981 in Canada. Their findings suggested that Canada experienced a strong concentration of corporate headquarters. In particular, Toronto increased its share of corporate headquarters, while Montreal decreased its share between 1970 and 1981.

In a study of West German cities, Meyer-Krahmer (1985, pp.520-527) examined the indigenous potential of West German regions and found that urban agglomerated areas were more likely to enhance inventive activity. This finding was based on data collected from 8,200 small to medium sized firms. In effect, regional inequalities in innovative potential and behaviour does exist. For example, more than half of innovating firms in Meyer-Krahmer's study were found in large agglomerations. In densely populated areas, every fifth firm was innovating compared to every tenth firm in rural areas (1982, pp.527-530).

In an attempt to determine the impact of population size on inventive activity, Simon (1984) utilized a similar "learning by doing" model by Arrow (1962) for two different fictitious worlds. One world had a larger population, but otherwise, both worlds were similar in every respect. With respect to the world with a larger population,

Simon (1984, pp.181-182) discovered that population growth, and more importantly, population size, did have a positive relationship upon the rate of economic growth stemming from inventive and innovative progress. This finding contradicts that of Arrow's. He found that population size did not create substantial economic growth. Arrow's finding was different because he incorporated capital stock in the model rather than cumulative output. As such, populations in Arrow's model did not learn by doing as quickly as those in Simon's model.

Spatial differences in inventive activity can be linked to the spatially selective process of innovation adoption. In other words, larger cities in general, enjoy larger population and income growth rates than smaller ones. This arrangement can perpetuate the existing economic space and resource distribution of a region. In essence, the diffusion of new technology can create a further concentration in the urban hierarchy, and thereby, increase the concentration of necessary infrastructure needed for inventive and innovative activity to take place (Meir, 1981, p.114; Lausen, 1973, pp.163-188, and; Berry, 1972). In essence, due to the spatially selective process of innovation diffusion, which is an outcome of spatial variations in the pre-requisites needed for adoption (which is most favourable in the larger urban places), the effects of diffusion are more intense for larger urban centers (Meir, 1980, p.104).

The geography of innovations can also be viewed by examining the spatial disequilibrium of potential venture capital. In the U.S., venture capital was found to be concentrated in unique areas, as documented by Leinbach and Amrhein (1987). They reported that between

1980-1982, New York and Massachusetts accounted for 71 percent of venture capital in the east, and California and New York accounted for 42 percent of the national total. In their view, the uniqueness of these regions can be found in their superior labour, educational and technical infrastructure and information flows (pp.149-151).

Hale (1987, p.21) believes that access to capital and information is essential for firm formation and this in turn is frequently related to inventions and innovations. It has also been suggested that regional economic development is biased towards a locational specific investment process (McNaughton and Green, 1987, p.20). This is evident when examining the spatial distribution of venture capital firms in Canada. Mc Naughton and Green (1987, p.20) gathered information on Canadian venture capital from Venture (1986), The Sources of Funds Index, and the Association of Canadian Venture Capital Companies Membership List. A total of 43 firms were incorporated into the final analysis. It was found that Toronto had 40 percent of all venture capital firms. In comparison, Calgary and Montreal were only secondary centers of venture capital firms. Of the provinces, Ontario possessed 54 percent of existing venture capital firms that had survived for more than 15 years (McNaughton and Green, 1987, pp.21-24).

The above suggests that inventive and innovative activity is not a locational accident process. A self-reinforcing mechanism favours well developed regions in terms of inventive and innovative activity. Further, the locational specific nature of inventive and innovative activity complements traditional theories of self-propelling urban

growth, and therefore, reinforce, and even perpetuate, the existing urban-hierarchy.

2.3 LITERATURE ON INNOVATIONS AND ECONOMIC GROWTH

2.4 INTRODUCTION TO LITERATURE ON INNOVATIONS AND ECONOMIC GROWTH

An underlying assumption in this thesis is that patents and trademarks are valid measures of present and future economic well-being. Consequently, registered patents and trademarks have the virtue of complementing traditional indicators of economic activities and growth. This section will examine the schism between the demand-push theory and the demand-pull theory in an attempt to show that the demand-push theory, which advocates that inventive activity is a precondition for economic growth, is more appropriate. Also, the role inventive activity plays in the business cycle will be discussed.

2.5 INVENTIONS, INNOVATIONS AND THE PRODUCT CYCLE

Before one can examine the effects inventive activity may have in a nation's economy, it is important to explain some basic features of technological change. In essence, technological change in Western development since the start of the Industrial Revolution has created our modern society of today (Ministry of Skills and Development, 1987, p.6). This process of technological change registered as patents and trademarks can facilitate the creation of new technology. Further, technological change can be described as going through four stages: invention, innovation, imitation and decline. At the invention stage a new product is tested. At the innovation stage the entrepreneur

develops a product and introduces it into the market. At the imitation phase other firms watch the success of the product and attempt to capitalize on this process. This imitation phase leads to market saturation and eventual product decline (Brozen, 1959, p.239).

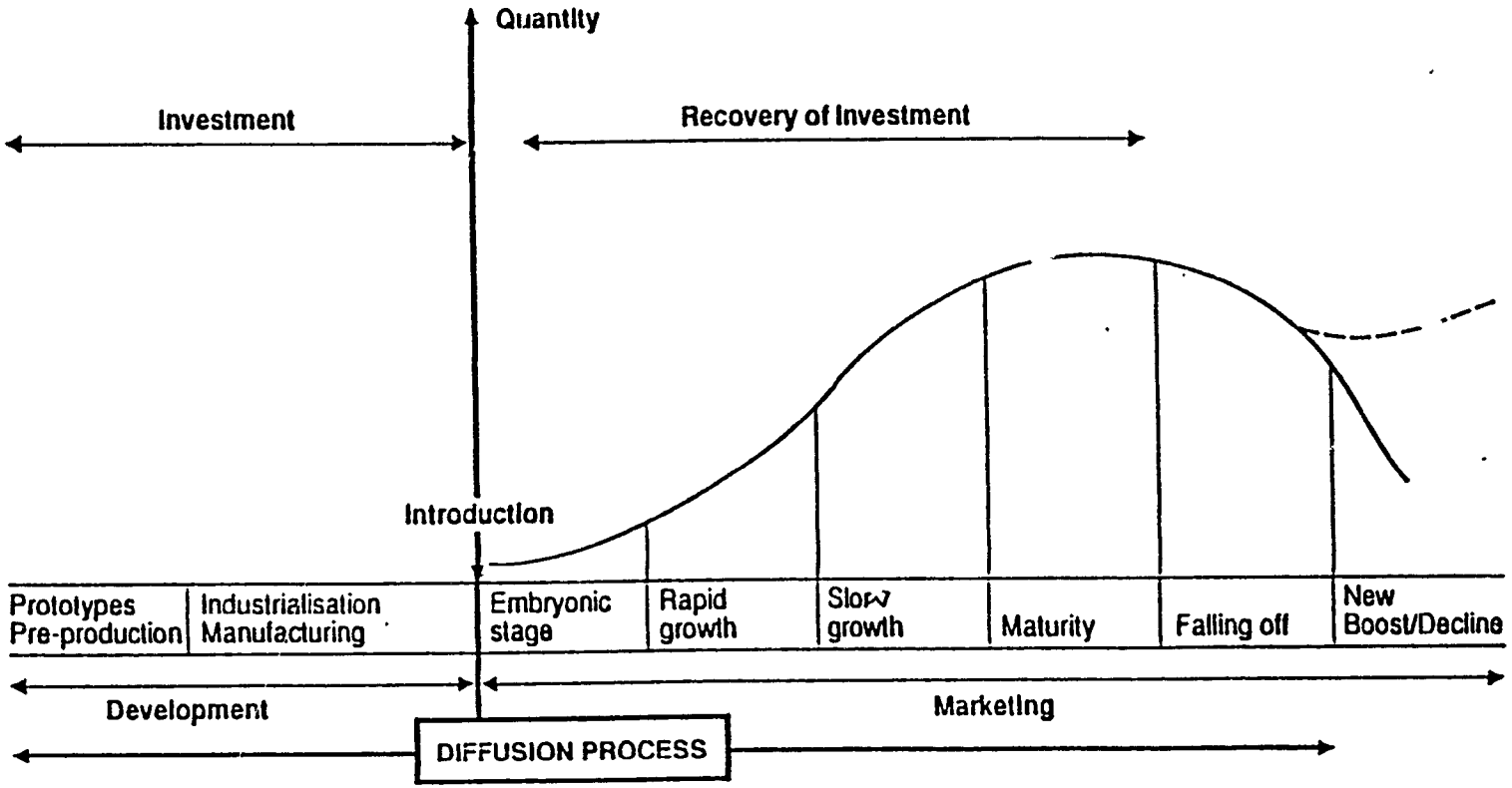
In essence, patents and trademarks are valuable in detecting early inventive activity (the invention and innovation stage) in the product cycle. This is conceptualized in Figure 1. Patents are generally applied during the investment period, whereas, trademarks protect a new product shortly before or at the introduction stage of the product life cycle. Therefore, if a cluster of important patents or trademarks occurs at some point in time, the future impact of this clustering on economic development and technological change can be significant.

2.6 INVENTIVE ACTIVITY AS A PRECONDITION FOR ECONOMIC GROWTH

Inventive activity, also described as indigenous activity, is necessary for economic growth. A good way to understand the importance of indigenous activity is to examine past inventive initiatives, as was done by Jacobs (1970, pp.3-48)). In a quest to discover the importance of the urban-economic development process, Jacobs examined the discovery of an ancient village (Catul Huyuk) in the fertile crescent in the Middle-East, in 1966. Although the village was established in the Neolithic Age, it serves as a good example in illustrating the importance of indigenous activity as a means of providing economic growth. The relevance of the discovery was that this particular village was more advanced then neighboring villages. Furtner, contrary to the expectation that the village would be younger than other villages, it

FIGURE 1.

Diffusion Process and the Product Life Cycle



SOURCE: Adapted from PIATIER, A., Barriers to Innovation Frances Pinter, 1984.

was in fact older. Jacobs accounted for this anomaly of an older, and yet more advanced village, by suggesting that this village (Catul Huyuk) had a more creative local indigenous population. The creative nature of this population was evident from artifacts discovered, ie; superior woven materials, weapons and crafts. The inventive economy of this village allowed it to advance beyond that of other villages since it possessed higher levels of quality goods for trade.

Kao (1984, p.186) has suggested that creativity, entrepreneurship and inventions are linked, and therefore, will be limited to centers which exhibit these virtues. Creativity and not new capital is responsible for economic progress. As Schumpeter viewed it, entrepreneurs are agents responsible for introducing new innovations that lead to the creation of new industries which ultimately induce economic progress. These innovations create changes (economic and non-economic) which in turn reinforce their growth (Van Duijn, 1983, p.99). In essence, since entrepreneurs are responsible for economic progress and are a good indicator of creative efforts, the use of registered patents and trademarks are a valuable source for identifying entrepreneurial efforts.

The growth of industrialized economies can be examined according to the inventions responsible at each stage of its growth. According to Raymond (1986, pp. 17-18), as the fourth wave (Toffler's wave) approaches, companies will have to become more flexible and human oriented. In retrospect, the first wave developed under agriculture and technology; the second wave switched to industrial organization, and; the third wave was created by the micro-chip. The importance of

individual acts of creativity is clear when examining the case of Japan as it moved from the second to third wave. If one were to observe Japan, it would become clear that this nation was able to switch to the third-wave easily due to its ability to adopt new innovations. The consequence of this has been high economic growth in a nation without abundant natural resources.

In an exploratory analysis, Ceh (1988) tried to determine if inventive activity was an indicator of economic wealth in Canadian urban centers between 1981 and 1986. The analysis involved 550 Canadian registered trademarks for 1981 and 1986. The trademarks were classified into urban centers according to the location of the inventor(s). Subsequently, when the data was compared to population, manufacturing growth and unemployment levels for those urban centers which had greater than one-percent of Canadian inventive activity, it was confirmed that there is a positive relationship between inventive activity and economic growth. Those urban centers which had higher levels of inventive activity also had higher levels of population and manufacturing growth and lower levels of unemployment. Therefore, trademark data is a valid source for measuring future economic growth.

In an attempt to determine if growth of a firm is related to the number of patents it has, Firestone (1971) undertook a study of 10 percent of all firms with patents granted in Canada in 1957, 1960 and 1963. In depth interviews of senior executives and patent specialists in 15 companies operating in Canada confirmed the importance of patents as a source for determining economic and firm growth (pp. 9-10). For example, the majority of companies responded that the patent system was

important for their economic growth. When large, medium and small firms were examined (based on sales; 436 million, 360 million and 85 million dollars, respectively), it was found that those firms which had average annual sales of 436 million dollars, held a 28 percent utilization rate of patents compared to 10 percent for those firms with an average annual sale of 85 million dollars (Firestone, 1971, p.149). Patent utilization was defined as working patents which created employment and income through the manufacturing of new or improved products. It was also found, that large firms utilized 348 patents compared to 547 for medium and 165 for small sized firms. In effect, medium sized firms had the most number of patents, but large firms had a higher proportion of sales per patent. Therefore, larger firms tend to be more efficient in making patents productive and profitable. Overall, four firms indicated that patents had decreased in importance in the past ten years, wnereas, seven firms indicated that patents had increased in importance and contributed to firm growth (p.149).

2.6.1 INVENTIVE ACTIVITY AND LONG WAVE THEORY IN PERSPECTIVE

According to Mansfield (1983, p.141), there has been a renewed interest in long waves. Basically, the long wave perspective views economic growth as occurring in cycles of 45 to 60 years intervals. Much of the original interest stems from Schumpeter's (1939) research on development cycles. In essence, Schumpeter forwarded the demand-push theory of development. In this theory, inventive impulses were followed by economic growth. Schumpeter demonstrated his theory from a four-phase cycle model (1939, chapter 3 and 4). Schumpeter's findings can be

summarized as follows: innovations are the fundamental impulses which keep the capitalist engine in motion. Also, innovations occur in swarms, therefore, economic development is a cyclical process (Van Duijn, 1983, p.102). Schumpeter also found that inventive cycles proceeded business cycles.

Contrary to Schumpeter's view, the demand-pull theory (neo-classical in nature), as postulated by Kondratieff (1935), placed the peak of investment prior to the peak of patent activity. Kondratieff based his long wave theory on observations on nineteenth century price and value series which were defined by interest rates, wages and foreign trade (Van Duijn, 1983, p.65). In essence, Kondratieff believed that technology was a consequence of investment in new physical capital which was responsible for economic growth. Schmookler (1966, pp.87-100) contended that innovations would increase during growth periods. It is for this reason Schmookler is also associated with the demand-pull theory. Schmookler based his finding and assumption on important inventions in the World since 1800 in petroleum refining, paper making, railroading and agriculture. Schmookler (1966, pp. 119-120) reported that railroad patents when compared to economic indicators, in this case, stock prices and gross capital formation, experienced its peaks near the same time as the peaks experienced by the economic indicators. However, the patent peaks fell slightly behind the peaks of stock prices and gross capital formation.

Van Duijn (1983, p.105) forwarded two reasons for the recent renewed interest of the Schumpeterian theory. First, there is a growing dis-satisfaction with the demand-pull approach to technological change.

Second, Schumpeter's notion of clustering has been incorporated in modern long wave theories. The Schumpeterian model awards a major role to the concept of innovation and imitation. In Schumpeter's view, innovations are the cause of cyclical instability and economic growth (Rosenberg, 1986, p.7). A clustering of innovations, referred to as the "neighborhood of equilibrium", is responsible for new economic growth. Schumpeter also introduced the term "creative destruction", in which innovations that threaten the existing structure are introduced by a few new entrepreneurs and then diffuse throughout the economy. These innovations create new activities, thereby, undermining the position of older sectors and technologies when introduced mainly during the trough of a Kondratieff wave (Schumpeter, 1961, pp.232-236). Encel (1966, p.517) suggested that there may be evidence of an increase in inventive activity during an economic crisis. The old folk saying "necessity is the mother of invention" undergirds this concept. In effect, Schumpeter's theory lends support to this thesis with respect to the role given to entrepreneurs and inventive activity. That is, inventive activity is necessary for economic development and well-being.

Schumpeter's theory of economic development can be summarized as follows. First, innovations are responsible for maintaining capitalist economies. Secondly, innovations occur in clusters. Thirdly, innovation clusters lead to cyclical economic development. Lastly, innovations have different impacts. These characteristics have led Rosenberg (1986, p.15) to suggest that innovation clusters must have two features in order for them to have a significant economic impact. First, innovations should have strong backward linkages in terms of

expenditures for infrastructure, new material and machinery. Secondly, there should be strong forward linkages, ie; lower prices, increased capital accumulation and increased technical progress. The importance of addressing forward and backward linkages is that it can help explain why some regions are more successful than others in terms of generating and sustaining inventive activity. In effect, well-developed economies which have strong forward and backward linkages are more likely to experience greater inventive activity (Pred, 1960, p.117).

Like Schumpeter, Mensch (1979) discovered a clustering of innovations during the troughs of Kondratieff waves (Kleinknecht, 1987, p.87). Mensch based his finding on data collected on basic innovations in the electronic and chemical industry from 1746 to 1900. Kleinknecht (1987, p.87) explained this clustering as follows: When economic periods are prosperous, firms tend to allocate R&D efforts into product improvement. As the market approaches saturation and distress, new products become attractive. During this technological stalemate, a wealth of new knowledge is waiting to be introduced. If the economic crises is serious enough, new capital is not likely to be invested in traditional lines of production. Mansfield (1983, p.144) also suggested, that when industry operates at high levels of capacity utilization there is reluctance to innovate, because it may interfere with production schedules. Therefore, Mensch's finding re-confirm Schumpeter's concept of "neighborhood of equilibrium" and the notion that inventive activity is a pre-condition for economic growth.

In an attempt to resolve the differences in findings between the demand-pull and demand-push theories, Kleinknecht (1987) attempted to

produce an empirically sound and thorough analysis involving patent data to determine if the Schumpeterian or Schmookler school of thought was more reliable. Kleinknecht's initial results supported both Mensch's and Freeman's opposing views on inventive activity. Therefore, Kleinknecht proceeded to incorporate Baker's (1976) data, which consisted of key patents (and is one of the more reliable indicators of technology). Baker sampled 1,000 key and master patents in Great Britain from 1640 to 1971. This data was then graphed to determine if patterns existed. The relevance of this data is that it examined only important and significant patents, therefore, it is an extremely reliable source for determining if inventive activity truly does have economic significance. The data clearly indicated a slowdown of radical innovations during long wave upswings (Kleinknecht, 1987, p.117). This finding clearly contradicts that of Freeman's (1982, p.70). In short, Kleinknecht's analysis strongly supports Schumpeter's hypothesis about long waves; there is an uneven distribution of innovations over time and these innovations proceed the economic upswing in the Kondratieff wave (Kleinknecht, 1987, p.197). Therefore, Kuznet's (1940, p.262) criticism of Schumpeter's lack of logic for explaining inventive clustering has been answered by Kleinknecht. That is, the "depression trigger effect" allows new products to emerge, and during periods of growth incentives are to develop existing technology and not new knowledge.

Despite criticism in the literature, the Schumpeterian school of thought on the role of inventions in economic growth cycles (demand-push hypothesis) seems to be re-affirmed. That is, economic growth has

major links to inventive clusters. This relationship between inventive activity and economic growth is an outcome of a clustering of innovations at some point in time (usually during the trough of a Kondratieff wave) which leads to the "creative destruction" of the existing structure, thereby, making it possible for entrepreneurs to introduce radical innovations into society.

2.7 SUMMARY OF LITERATURE

In summary, three important findings were found in the literature. First, inventive and innovative activity is locational specific. Inventive activity tended to favour larger urban centers which possessed favourable forward and backward linkages. Further, the diffusion of technology can influence the urban hierarchy in such a way to become more rationalized towards the higher ordered places. In essence, due to a spatially selective process of innovation diffusion, which is an outcome of spatial variations in the pre-requisites needed for adoption, the effects of diffusion were more intense for larger urban c· ters.

Second, it was found that the notion of inventive activity as a pre-condition for economic development, is reliable. In essence, previous research examining key patents has suggested that clusters of innovations can be responsible for technological change and development in society. As such, registered patents and trademarks were found to be a valuable source of information to decipher this relationship between inventive activity and economic development.

3.0 METHODOLOGY

3.1 INTRODUCTION TO DATA AND PROCEDURAL ANALYSIS

The main purpose of this chapter is to provide an account of the data sources incorporated in this thesis and how they were evaluated. For example, the method of collection, problems encountered collecting the data, problems inherent in the data and the different analyses used in this thesis, will be discussed. Therefore, the advantages and weaknesses of patent and trademark data and their potential as surrogates for economic and inventive activity, will be addressed.

3.2 STRENGTH OF REGISTERED PATENTS AND TRADEMARKS

Since registered patents and trademarks are the main sources of data in this thesis, it is important that each of these measurements of inventive activity be analysed. As such, it was found that one strength of patent and trademark data is that it has existed for a long period of time in great abundance and in a dis-aggregate form (Comanor and Scherer, 1969, p.392). Secondly, the national and municipal residence of an inventor is recorded. Thirdly, patent and trademark statistics allow for a more detailed analysis of science and technology than other relevant sources such as production levels, because they describe entrepreneurial or unique economic activities which have long lasting

economic effects. This enables researchers to examine the subject from many directions (Dulude, 1985, p.12). The usefulness of registered patents and trademarks was confirmed by Antonelli (1986, p.85) and Bond (1979) as being rich in detailed information, such as the geographic location of inventors, thereby, generating a data-set capable of explaining the spatial distribution of economic wealth.

The standards applied to patent and trademark registries by the Government have ensured that entries remained highly accurate (Dulude, 1985, p.13; Kitch, 1977, pp.276-279). The concept that a new idea has been perfected beyond the previous "art" is shown through the registry of patents and trademarks (Schiffel, 1978, p.327; Campbell, 1986, p.6). The consequence of this, is that patents and trademarks are an indicator of technological growth. Further, the use of patents and trademarks for forecasting economic growth is practical.

3.3 DEFICIENCIES OF REGISTERED PATENTS AND TRADEMARKS

Two major shortcomings of patents and trademarks, is that not all inventions are patented and subsequently trademarked. In other words, an inventor may feel that not disclosing his/her idea is best, because there is the possibility of losing that idea to a competitor through patent publication. Therefore, there are new products in the market which do not have patent protection, and yet, yield economic benefits. In effect, it is not possible to detect these inventions from registered patent and trademark publications.

Secondly, some products are major innovations and others are minor improvements (Pakes, 1985, p.391; Dulude, 1985, p.15; Comanor and

Scherer 1969, p.393). It was also found, that the propensity to patent varies from one industry to another (Comanor, 1965, p.393). For example, the propensity of government sponsored R&D firms to patent is lower compared to private firms initiating their own inventive activity. As such, these deficiencies can be expected to exist in the data-set utilized in this thesis.

3.4 DATA SOURCE

As indicated earlier, the two main sources of data collected for this thesis consisted of registered patents and trademarks. These sources were collected from 1881 to 1971 for patents and 1981 to 1986 for trademarks. The data originated from weekly publications by the federal Ministry of Consumer and Corporate Affairs and Canadian Patent and Trademark Records (vol. 8-29, 39,...99 for patents and volume 20 and 24 for trademarks). For example, in 1881, there were 125 patents collected (25 percent systematic sample). The twenty-five percent systematic sample was achieved by selecting a given number of patents or trademarks each week from the registry. For example, in 1901, the

first two or three Canadian patents encountered in the registry on a weekly basis were selected until 186 cases were collected over 52 weeks. In 1891, 151; 1901, 186; 1911, 312; 1921, 411; 1931, 279; 1941, 152; 1951, 157; 1961, 313, and; 1971, 467 patents were collected. In 1981, 1,971 trademarks, and in 1986, 1,802 trademarks were collected.

There were substantially more trademarks in 1981 and 1986 compared to patents. This difference can be attributed to the fact that trademarks are not only used for product protection, but for new logos of firms and enterprises. Secondly, trademarks have become more popular over the years. In essence, as new firms and products crowd the market, the need for increased protection of new ideals and logos becomes attractive. It should be noted, that the difference in proportion between patents and trademarks in the registry by 1981 does create difficulties in this thesis, which will be discussed later.

One of the problems encountered using Canadian patent data was that the place of residence of the patentee was not collected after 1976. Therefore, in an attempt to compiete the analysis, trademark data was incorporated for the years 1981 and 1986. It is believed that since trademarks are issued after patents in the product cycle, there would be a lag between one and three years. Further, trademarks are a valuable indicator of economic performance in an economy since they occur later in the product cycle, thereby, signifying a definite new product in the market and not some prototype in the development stage.

In an attempt to determine the extent of this lag, which is estimated to be one to three years, a temporal analysis of peaks and ebbs in patents and trademark activity between 1964 and 1968 was

performed (Appendix A). In essence, a ten-percent systematic sample (based on the same procedure as the twenty-five percent systematic sample) was drawn from each source (patent and trademark). Major municipalities which consistently had inventive activity throughout this comparative analysis are shown in Table 1. The peak and trough year for each center, in terms of patents and trademarks, is given in an attempt to determine the lag between these two measures and aspects of the product cycle.

Table 1: A COMPARISON OF PATENTS AND TRADEMARKS IN THE BUSINESS CYCLE

CITY	PATENTS PEAK YEAR	TRADEMARKS PEAK YEAR	PATENTS LOW YEAR	TRADEMARKS LOW YEAR
MONTREAL	1965	1966	1967	1967
TORONTO	1966	1968	1965	1967
VANCOUVER	1968	1968	1965	1965
OTTAWA	1965	1968	1964	1965
LONDON	1965	1967	1968	-
HAMILTON	1965	1968	1968	-
EDMONTON	1967	-	1968	-
WINNIPEG	1967	1967	1968	-
SCARBOROUGH	1966	1966	1965	1967

It was found, that in 5 out of 13 cases the peak or low year in trademark activity occurred within the same peak or trough year patent activity did (table 1). In comparison, the lag within one year was 2 cases; in two years, 4 cases; in three years, 2 cases; thereafter, 0 cases. Therefore, the lag between patent and trademark registries seems to vary from zero to three years. In many cases, trademarks were granted within the same year patents had been granted. Overall, the lag between patent and trademark peaks and troughs is approximately twelve

months. Therefore, the substitution of trademarks for patents should not pose a major problem.

In 1981 and 1986, Canadian trademarks were incorporated into this thesis. The difficulty involved with using trademark data was that it was not completely compatible with patent data. There was a substantially larger number of Canadian trademarks in 1981 (7,884) compared to patents (1,526) This made it unrealistic to include the trademark data in the analysis of invention per 10,000 population in 1981 and 1986, because a decline in inventive activity (when observing patents) by 1981 did not reveal itself with the trademark data. In effect, because there were so many Canadian trademarks in 1981, the number of inventions per 10,000 population jumped dramatically from 1971 (based on Canadian patents). To resolve this problem, the total number of Canadian patents (1526) in 1981 was divided by the total number of Canadian trademarks (approximately 7884) in 1981 to produce a ratio of .193. Since it is assumed that trademarks are a surrogate of patents, the value of .193 was then multiplied by the total number of trademarks in each urban center to produce an estimated number of inventions (as if patents were used). Subsequently, it was then possible to perform a more compatible analysis between the years 1971 and 1981 for the number inventions per 10,000 population in urban places. The same basic procedure was performed for 1986. The percentage of inventive activity based on trademark data for urban places in 1981 and 1986 did not need to be modified. Therefore, trademarks in this paper have been classified as either modified or unmodified in the procedural analysis. In summary, the modified trademarks used in 1981

and 1986 closely represents the number of inventions which would exist as if patents were used.

It should be noted, that only Canadian patent and trademarks were examined from the registry. By separating Canadian inventions from foreign ones, locally generated inventive activity, particularly entrepreneurial activity, can be distinguished from inventive activity not necessarily indigenous to Canada. Since it can be argued that the importance of economic growth in Canada due to entrepreneurial and small firm activities has increased substantially in the past decade, registered patents and trademarks indigenous to Canada should detect this economic growth.

The second difficulty involved in this thesis dealt with classifying patentees. That is, in some cases an individual inventor or firm may have transferred their idea to another person or company. In such cases, the patent records indicated this dual relationship. There was a problem of deciding to classify the original patentee, or the individual or firm which received it. It was decided that both sources and their geographic location would be recorded. The logic behind this decision is two-fold. First, this study is concerned with entrepreneurial activity, which is inherent in registered patents and trademarks. Although a particular patentee may have transferred their patent, they have not directly created economic growth within his/her or its geographic area. However, it is safe to assume that this individual or firm represents entrepreneurial activity, and the likelihood of this individual or firm to patent in the future is strong. Secondly, the individual or firm receiving the patent is

included in this study, because they directly benefit from the patent. It should be noted, that this double counting tended to favour the larger centers, particularly Toronto and Montreal, and to a lesser degree Vancouver. However, this double counting did not account for a significant percentage of patent activity.

A third problem in this thesis involved the change in boundaries of census regions in Canada. For example, the data collected stemmed from 1881 to 1986, however, the census boundaries changed over these years. In dealing with this problem, the geographic location of inventions was collected and classified into the appropriate urban centers from 1881 to 1941. However, from 1951 to 1986 the data was classified into larger census divisions. Specifically, those defined by Census Canada in 1981. Therefore, 1951 to 1971 boundaries were reorganized to fit the 1981 and 1986 boundaries. This guaranteed comparability, especially when population data was collected. This did not provide a major difficulty, since it was mainly Ontario which tended to change its census boundaries over the years. The reason for classifying the data from urban center to census regions was related to the high level of urban growth associated with cities after 1941. In essence, cities outgrew their boundaries in the post-war years and became regional. Therefore, it was felt that regional census divisions were more effective in capturing this larger urban system.

It was also difficult to capture the overall importance of Toronto within its census division. Therefore, the outer limit of the greater Toronto economic region was defined by Oshawa to Richmond Hill; Kitchener-Waterloo; Brantford, and; Niagara Falls, and their respective

census divisions. It should also be noted, that those census division closer to Toronto were also included in the greater Toronto economic region (Appendix C). This thesis also analysed individual census regions within and outside the Toronto economic area. In comparison, this thesis has defined Montreal by two census divisions: Ile de Jesus and Ile de Montreal. Since it can be argued that Montreal has experienced a smaller degree of decentralized urban-economic activity, it was felt that the two census divisions, defined above, adequately captured the Montreal economic region.

Lastly, the other sources incorporated in this thesis were population and unemployment data. The number of trademarks per 10,000 population in 1981 was separately compared to these simple indicators of economic performance in an attempt to provide evidence that they are related and show a positive or negative relationship with inventive activity. In effect, 1986 unemployment data was compared to the number of trademarks per 10,000 population in 1981 for major Census Metropolitan Areas in Canada. Also, the percentage change in population between 1981 and 1986 was compared to the number of trademarks per 10,000 population for major Census Metropolitan centers in 1981.

3.5 PROCEDURAL ANALYSIS

This thesis incorporated three basic procedures in an attempt to determine if Canada's inventive space economy is concentrating. The first procedure examined the percentage of concentrated inventive activity in Canadian urban centers between 1881 and 1986. The term "concentrated" refers to the fact that only urban places with greater

than one-percent of Canadian inventive activity were examined. This requirement meant that the data would be more accurate since those centers which could be considered suspicious, because they may not be significant at a twenty-five percent sample size, were dropped. Second, in particular sample years, ie 1881, 1891, 1901, 1941 and 1951, if less-than one percent of patents were taken in these cases, less than two patents) every center would have to be analysed. It would be unrealistic to analyse every case which had one patent. However, when determining the level of inventive activity in Canada's core region (Quebec City to Windsor), every center was examined between 1911 and 1986. Lastly, the accumulative percentage of concentrated inventive impulses was compared to the accumulative percentage of less concentrated inventive impulses (less than one-percent of Canadian inventive activity) for any one period between 1881 and 1986 in an attempt to determine if Canada's inventive space economy has become more rationalized. The three percentage procedures were then displayed in table form. Maps were also included for the first procedure.

The second major procedure in this thesis examined the number of inventions per 10,000 population for urban centers which had greater than one-percent of the Canadian total. This procedure had taken population size into account, thereby, providing us with a more realistic observation of indigenous activity in urban centers between 1881 and 1986. For 1981 and 1986, modified trademarks (converted to patents) were created in an attempt to perform a comparative analysis with the number of inventions per 10,000 population in 1971 (based on

patents). The findings of the above procedure have also been diagrammatically displayed in table form.

The third significant procedure in this thesis involved a separate comparison between the number of trademarks (unmodified) per 10,000 population and the percentage of population growth between 1981 and 1986 and unemployment levels in 1986 for major Census Metropolitan Areas in Canada. This comparison was achieved using a regression analysis. The purpose of this comparison was to determine if there is a relationship between inventive activity and urban growth. A more detailed description of the above procedures is given below.

1) A twenty-five percent systematic sample of registered patents and trademarks was based on the first few Canadian patents or trademarks encountered in the registry on a weekly basis (varied according to sample year) for the entire sampled year. This information was collected from 1881 to 1971 for patents, and for 1981 and 1986 in the case of trademarks. Specifically, the data was collected from 1881, 1891, 1901 to 1986 (Appendix B), and was used in both the percentage and the number of inventions per 10,000 population analyses.

2) Also, sleeping patents (those patents with the least economic significance) were not collected from the weekly publications of registered patents and trademarks by the Ministry of Consumer and Corporate Affairs and Canadian Patent and Trademark Office Records. Sleeping patents were identified according to the description offered by the registry for each patent or trademark granted. When registered patents or trademarks had similar descriptions in the registry,

signifying multiple patents or trademarks of a particular product and variations of it, they were not included in the data-set.

3) The geographic location of patentees was recorded, ie; place of residence or firms location, thereby, providing a spatial pattern of inventive impulses in Canada.

4) Registered patents and trademarks were collected for urban centers from 1881 to 1941 and for census regions (represented by the 1981 boundaries) from 1951 to 1986. This procedure was performed in both the percentage and the number of inventions per 10,000 populat on analyses.

5) Those centers with greater than one percent of Canadian inventive activity were selected in an attempt to define concentrated inventive centers. This classification was used in both the percentage and number of inventions per 10,000 population analyses.

6) In the percentage analysis, all inventive centers collected from the registry were classified as belonging in either the core or periphery region. This classification was performed from 1911 to 1986.

7) Also, the cumulative percentage of concentrated inventive impulses (bottom of Table 2) was compared to the cumulative percentage of less concentrated inventive impulses (less than one-percent of Canadian inventive activity) in any one period betw-- 1881 and 1986. This comparison helped determine the degree of inventive ncentration in Canada's inventive space economy over time (table 3).

8) The number of inventions per 10,000 population analysis was characterized by modified trademark activity. The modified trademarks represented the number of patents which would have existed in 1981 and 1986. This modified analysis allowed for temporal comparability with

the number of inventions per 10,000 population in 1971 (which was represented by patents). In effect, the number of trademarks in a particular urban place or region was divided by that place or region's population to produce a ratio of the number of inventions per 10,000 population. This figure was then multiplied by a ratio of .193 (number of trademarks in 1981 divided by the number of patents in 1981) to produce a final figure (ratio) which represented the approximate number of inventions in 1981 as if patents were used. This same basic procedure was used for 1986 trademark data as well.

9) On the other hand, unmodified trademarks were incorporated into the comparative analysis with traditional indicators of performance, in this case, the percentage of population change between 1981 and 1986 and unemployment levels in 1986 for major Census Metropolitan Areas in Canada. These indicators were separately compared to the number of inventions per 10,000 population in 1981 for the same Census Metropolitan Areas in Canada (Appendix C). This comparison was achieved using a regression analysis in which trademarks per 10,000 population was the independent variable.

4.0 THE SPATIAL COMPONENT OF INVENTIVE IMPULSES IN CANADA

4.1 INTRODUCTION TO INVENTIVE IMPULSES IN CANADA

The Canadian space economy can be described as dynamic. That is, it would be expected that early Canadian economic activity, prior to 1900, was located mainly in the eastern half of this nation. However, the early 1900's witnessed economic expansion into interior Canada. During the "dirty thirties" economic activity was mainly concentrated in Central Canada. It was this region which had the most stable economy in Canada at this time. In the post-war years, the West rebounded economically and competed with Central Canada. However, the recession in the early 1980's dampened economic growth in the West, East and to a lesser degree, in Central Canada. By 1985, only Central Canada exhibited healthy economic activity while the remainder of the nation continued to recover from an earlier recession. The purpose of this synopsis of the Canadian space economy is that spatial patterns of inventive activity over time are expected to reflect these same patterns. Further, it is expected that the shifting degrees of inventive concentration in Canada over time can be determined through the use of surrogate variables such as patent and trademark data.

In an attempt to determine varying degrees of inventive and economic concentration in Canada over time and space, this chapter will examine three facets of inventive activity in Canada. First, the spatial component of concentrated urban inventive impulses in Canada between 1881 and 1986 will be examined. Second, the process of inventive concentration occurring in the Canadian urban hierarchy

between 1881 and 1986 will be analysed. Third, inventive activity in the core and peripheral regions of Canada between 1911 and 1986 will be examined. These three procedures will involve an examination of percentages of inventive activity in Canadian urban centers or regions.

4.2 INVENTIVE ACTIVITY IN CANADIAN URBAN CENTERS: 1881-1986

Two of the underlying assumptions in this thesis are that inventive activity is location specific and is associated with industrial development. Therefore, in an attempt to substantiate these two assumptions the percentage of inventive activity in Canadian urban centers from 1881 to 1986 will be examined. The Maritime region will be discussed first, followed by Central Canada (Ontario and Quebec) and then the West. Those urban centers which had greater than one-percent of Canadian inventive activity in any one period between 1881 and 1986 are displayed in Figure 2 and Table 2 . It should be noted, that some of this information has been displayed in maps. When examining the proportional circle on these maps, it should be kept in mind that the greater Toronto economic region is centered on the base map of Canada and the remaining centers in Southern Ontario are centered on a sub-set of this region on the map.

FIGURE 2

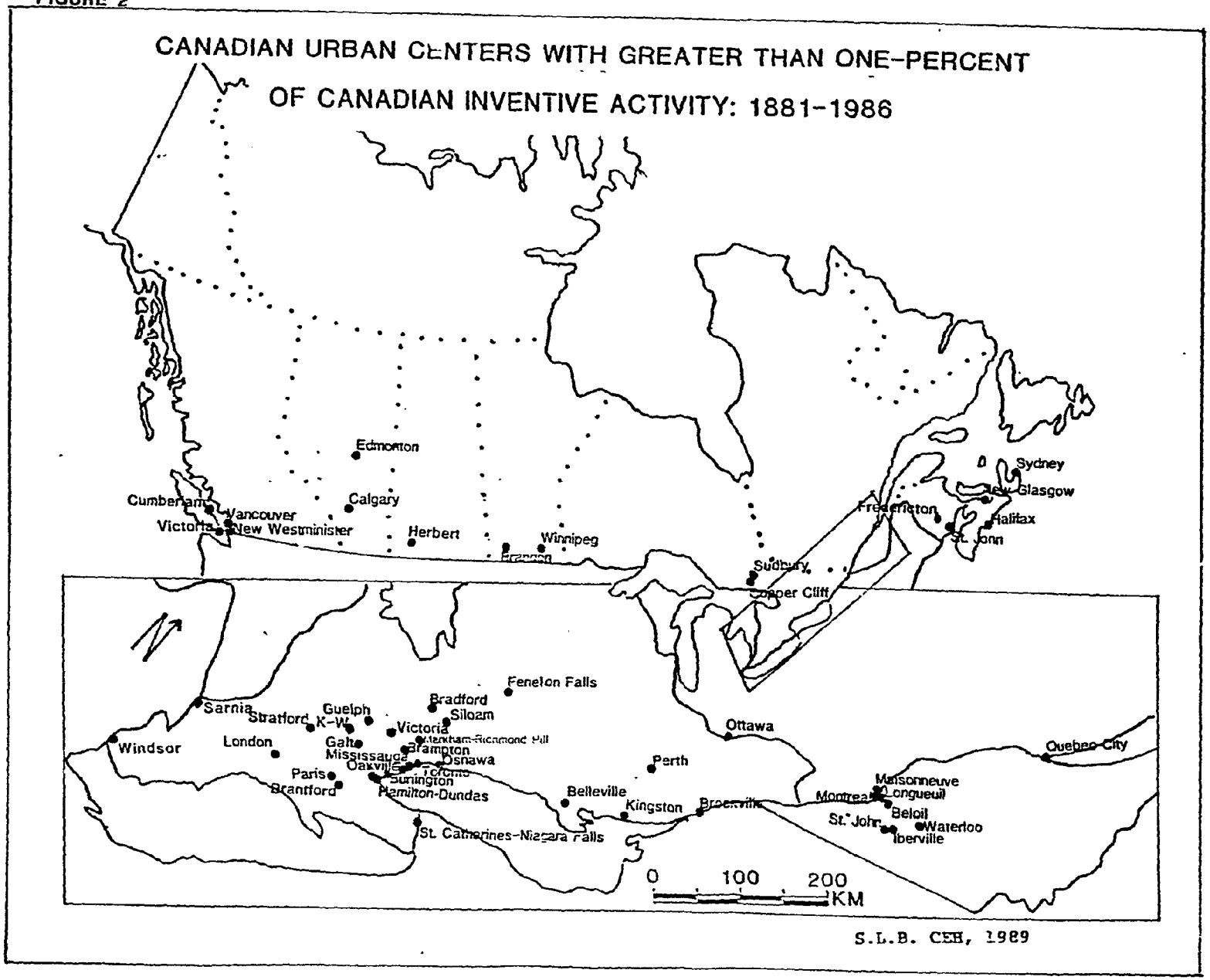

CANADIAN URBAN CENTERS WITH GREATER THAN ONE-PERCENT
OF CANADIAN INVENTIVE ACTIVITY: 1881-1986
Edmonton
Calgary
Cumberland
Vancouver
Victoria
New Westminister
Herbert
Winnipeg
Sydney
New Glasgow
Fredericton
Halifax
St. John
Sudbury
Copper Cliff
Fenelon Falls
Bradford
Sarnia
Stratford
Guelph
K-W
Siloam
Victoria
Windsor
London
Galt
Brampton
Mississauga
Oshawa
Paris
Brantford
Sunlington
Hamilton-Dundas
Belleville
Kingston
Perth
Ottawa
Quebec City
Montreal
Beloil
St. John
Waterloo
St. Catherines-Niagara Falls
0
100
200
KM
S.L.B. CEH, 1989

TABLE 2: PERCENTAGE OF INVENTIVE ACTIVITY IN CANADIAN URBAN CENTERS: 1881-1986

REGION AND CITY	PERCENTAGE OF INVENTIONS: 1881-1986											
MARITIME	1881	1891	1901	1911	1921	1931	1941	1951	1961	1971	1981	1986
HALIFAX	4.0			1.0								
SYDNEY		1.3										
ST JOHN		1.3	1.6									
FREDERICTON			1.6									
NEW GLASGOW				1.3								
CENTRAL CANADA												
QUEBEC												
MONTREAL	16.0	18.5	8.60	15.4	15.8	23.3	26.3	13.4	23.0	22.9	13.3	22.8
QUEBEC CITY	1.6							1.3				
IBERVILLE	4.0											
ST JOHN	1.6											
LONGUEUIL		1.3										
BELOIL			1.1									
WATERLOO			1.1									
MAISONNEUVE					1.5							
WESTMOUNT				1.3								
ONTARIO												
TORONTO	8.0	20.5	22.6	21.2	22.4	23.0	23.7	39.5	24.6	27.6	28.4	28.9
G.T.E.R.								50.3	42.3	41.5	45.2	41.3
HAMILTON	5.6	7.3	2.2	4.5	4.6	10.4	16.4	4.5	3.2	1.7	2.0	
OTTAWA		4.0	2.2	4.5	3.2	4.0	1.3	4.5	8.9	5.4	2.3	2.7
OSHAWA	3.2	1.3					1.3	1.3				1.0
LONDON	1.6		1.1					1.9		1.5	1.5	
K-W	1.6	1.3		1.6							1.6	2.1
ST.CATH.-*N.F.	1.6		*1.1			1.1		2.5	3.5		1.0	
SILOAM	1.6											
BROCKVILLE	1.6											
PARIS	4.0											
BELLEVILLE		2.0										
KINGSTON			2.2							1.0		
FENELON FALLS			1.1									
BRADFORD			1.1									
WINDSOR		1.3	1.6									
VICTORIA			1.1									
PERTH			1.1									
SUDBURY			1.1									
DUNDAS					1.0							
GALT						2.5						
BRANTFORD						1.4			1.0			
COPPER CLIFF								1.3	2.6			
OAKVILLE-BURLINGTON									7.3	5.6	1.5	1.3
SARNIA									1.3	1.5		
STRATFORD									1.0			
GUELPH										1.5		
MISSISSAUGA-BRAMPTON											6.7	4.6
MARKHAM-RICHMOND HILL											1.8	2.6
WESTERN CANADA												
WINNIPEG	1.6		1.6	4.8	3.6	2.2	2.0	3.2	1.0	1.5	2.3	2.6
VANCOUVER			4.3	4.5	6.3	2.2	3.3	3.2	2.6	4.3	4.4	8.3
EDMONTON				1.6	1.2	1.1		2.5	1.3	1.8	1.9	2.6
CALGARY					2.7					2.6	3.0	2.2
NEW WESTMINISTER			1.6		1.0							
CUMBERLAND			1.1									
BRANDON			1.1									
VICTORIA					1.5							
HERBERT				1.0								
TOTAL	57.6	60.1	62.2	62.7	64.8	71.2	74.3	79.1	81.3	78.9	72.7	81.2

* G.T.E.R. = GREATER TORONTO ECONOMIC REGION (OSHAWA TO KITCHENER TO NIAGARA FALLS)

4.2.1 INVENTIVE IMPULSES IN THE MARITIME'S

At one time, the Maritime region was an economically independent and productive region. However, the introduction of the trans-continental rail and protectionist policies between 1870 and 1895 inhibited this region's continued economic growth. These two factors allowed Central Canada to "dump" its goods by rail in an once protected market. (Easterbrooke, 1956, pp.336-37; McCann, 1982, p.41, and; Myers, 1974, pp.150-67). If these claims are true, then one can expect that the Maritime region will have performed adequately in terms of inventive activity before 1900, but will have performed less significantly after this date.

A quick glance at the number of patents registered in Canada by major centers in 1881, showed that only one Maritime center had more than one-percent of Canadian urban inventive activity (Table 2, Figure 3), that center was Halifax. At this time, the Maritime had just been connected with the rest of Canada by the completion of the trans-continental railway, and secondly, the steamship had just been introduced as the new major ocean transport mode (Putnum, 1979, p.98). Both these factors were subsequently detrimental to the Maritime region. The trans-continental railway deprived Halifax of the opportunity to continue to exploit its previously closed market. Steamships now tended to by-pass Halifax in favour of ports further inland. In addition, the days of wooden ship-building (which was a major industry in Halifax) had come to an end. But the above drawbacks had not yet affected Halifax significantly by 1881, for four-percent of

Canadian urban inventive activity was a substantial share at this time. Only Montreal, Toronto and Hamilton had greater values.

By 1891, Halifax had less than one-percent of Canadian urban inventive activity (Table 2). The above mentioned problems in the Maritime region appeared to have become evident. However, it should be noted that two other important inventive centers had replaced Halifax. St. John and Sydney each managed to capture 1.32 percent of Canadian inventive activity. This is closely associated with the fact that the Maritime region had moved away from traditional industrial activities to more modern ones, ie; coal, iron and steel. Acheson (1984, p.10) documented the growth of St. John as being so significant that industrial capital, average wages and manufacturing output at this time surpassed that of Hamilton. By 1901, Nova Scotia failed to produce a concentrated inventive impulse (Table 2). However, New-Brunswick managed to replace Nova Scotia with two of its own inventive impulses, St John (1,61%) and Fredericton (1.61%). New Brunswick, compared to Nova-Scotia, managed to change its industrial base more easily. In addition, St John and Fredericton were more manufacturing oriented than Halifax (Acheson, 1984, p.115). It has been suggested that centers with a healthy manufacturing economy tend to be more conducive to entrepreneurial activity. At this time, positive local leadership in St. John did not extend into the hinterland. In essence, economic spin-offs were confined to the local center (Acheson, 1984, p.115). In Fredericton for example, an important local leader by the name of Alexander Gibson founded cotton mills, timber-lands, saw mills and lath mills (Royal commission on the Relation of Labour and Capital, in

Acheson, 1984, p.117). It was local leaders like this that were important for inventive activity, and ultimately, economic growth.

Previously, New Brunswick had a greater percentage of output per-worker in manufacturing. However, by 1911, Nova Scotia made significant advances in manufacturing output per-worker within its economy (61.4 % of total value output in 1891 t, 74.9% in 1911) (Marr, 1980, p.431). This is reflected by two concentrated inventive impulses in Nova-Scotia - New Glasgow, 1.28% and, Halifax, .96% (Table 2, Figure 4). At this time, New Glasgow's main industrial activity was coal and iron extraction and iron fabrication. In fact, New Glasgow produced a substantial share of Canada's primary steel (Acheson, 1984, p.117). However, despite this finding, overall inventive activity in the Maritime region, with regards to concentrated inventive impulses, had fallen from 4% in 1881; 3.22% in 1901; 2.24% in 1911, to; 0% in 1921.

In retrospect, the decline in inventive activity in the Maritime region can be attributed to geography and a lack of entrepreneurial leadership (Acheson, 1984, p.125). The high level of industrial activity in the early 1880's was the last generation of staple-oriented industrialists. They failed to act as a link between Central Canada and Europe and were faced by the dominance of active local leaders in Montreal who were trying to take over financial and industrial resources in the Maritime's (Nader, 1976, p.35). In addition, the Maritime's failed to produce industrial elites as time progressed. Also, lacking a strong regional center for financial leadership did not help the situation much (Acheson, 1984, pp.125-33). In essence, the eventual take-over of the Maritime economy by Central Canada and the

inability of this region to continue to produce local leadership over time, resulted in inventive decline after 1911.

4.2.2 INVENTIVE IMPULSES IN CENTRAL CANADA

Much of the inventive activity occurring in Canada in 1881 was in Ontario and Quebec. Thirteen of the fifteen concentrated inventive impulses in Canada were in these two provinces (Table 2 and Figure 3) Together, these thirteen centers accounted for 52 percent of Canadian inventive activity, and Ontario and Quebec had 76 percent of Canada's population (Marr, 1980, p.175). It is worth noting, that Montreal was the dominant inventive center, accounting for 16 percent of inventive activity. Montreal's inventive dominance at this time was complemented by its strong manufacturing base. In fact, in 1880 Montreal's manufacturing output was about two and half times that of Toronto's (Nader, 1976, p.129) Further, the completion of the trans-continental railway in 1885, in which Montreal was the focal point in the system, allowed Montreal to assert its metropolitan and economic influence over an extensive area. In fact, Montreal had stronger links to the West then did Toronto (Nader, 1976, p.291).

In Quebec, a healthy cluster of inventive impulses occurred around Montreal, ie; Iberville (4%) and St. John (1.6%). Quebec City also performed well (1.6%). Many of the smaller centers around Montreal and Quebec City had increased their proportion of employment in manufacturing. By 1890, two-thirds of Quebec City's work force was in manufacturing. In addition, much of this activity was labour intensive, ie; shoe-making and textile (Nader, 1976, pp.85-90). Therefore, a

strong manufacturing base in centers located in Quebec complemented this region's ability to produce inventive impulses.

In Ontario, Toronto (8%), Hamilton (5.6%), Paris (4%), Oshawa (3.2%), London (1.6%), Kitchener (1.6%), Siloam (1.6%), St. Catharines (1.6%) and Brockville (1.6%) accounted for 29.6% of Canadian urban inventive activity. This large cluster of innovative centers in Southern Ontario in the early 1880's was complemented by initial advantages unique to this economic region, such as being a closely settled and productive farming region, located centrally within Canada and close to the U.S. manufacturing belt (Bloomfield, 1986, p.7). These initial advantages encouraged and provided the opportunity for Southern Ontario centers to become more productive and innovative earlier compared to other centers in Canada. In addition, once these initial advantages were recognized by local leaders and entrepreneurs, they took advantage of this situation to further their economic lead. Already by 1870, Ontario accounted for 51.8 percent of Canada's industrial production (Bloomfield, 1986, p.31.). It is interesting to note, that inventive impulses at this time were not very dominant. This was due to a more decentralized space economy. Since agriculture was an important industry, this would explain why some small centers in agricultural areas like Paris and Siloam registered a substantial number of patents. The larger centers in this period were busy expanding their manufacturing economies. Yet, the level of inventive activity in a particular center could be linked to its level of urbanization and industrial development (Lee, 1972, p.75). Putnum (1979, p.48) showed that economic growth in 1881 was located in the

same areas as inventive impulses found in this study. That is, Toronto, which had a large population, strong manufacturing base and significant political-economic status in the province; Hamilton, which was ideally located on lake Ontario for metal production, and; towns such a Kitchener and Paris, which are located in the Grand River basin, were "liberated" by the rail-line, and could therefore, develop manufacturing industries. The presence of Brockville as a concentrated inventive impulse in Eastern Ontario would suggest that this region was capable of sustaining inventive activity at this time.

The above pattern remained basically the same in 1891, with the exception that Toronto superceded Montreal in terms of inventive activity (20.62% and 18.54%, respectively) and that there were fewer inventive impulses (table 2). It can be argued that Toronto's larger percentage of inventive activity is even more significant when one considers its population in 1891 was 207,450 compared to 277,525 for Montreal (Marr, 1980, pp. 126, 203). A decline in the number of concentrated inventive impulses in 1901 paralleled the growing trend at this time towards urbanization and industrial concentration. The inventive growth of towns such as Sudbury (1.05%) and Fenelon Falls (1.05%) would suggest the emerging importance of mining and forestry in Ontario. By 1901, the gap between Montreal and Toronto widened in terms of inventive activity (8.6% and 22.58%, respectively). It can be argued, that the inventive difference between Montreal and Toronto at this time, was complemented by faster population growth in Ontario, a westward shift in the Canadian population and a growing importance of American investment in manufacturing activity located in Toronto.

The changing inventive space economy in Canada was more apparent by 1911 (Table 2 and Figure 4). Toronto held 21.15 percent of Canadian urban inventive activity in 1911, which was a slight decline since 1901. Montreal on the other hand, possessed 15.38 percent of Canadian urban inventive activity. Further, only six inventive impulses were noticeable in 1911, compared to fifteen in 1901. The movement towards inventive concentration was even more obvious in Quebec. Only Montreal and neighbouring Westmount showed concentrated inventive activity in 1901. This trend can be traced to the use of increased tariff protection in Canada which induced foreign investment and the beginnings of a branch plant economy (Firestone, 1958, p.58). In essence, this phenomena helped re-organize the spatial industrial and inventive structure in Canada. As such, tariff policies, new markets and new supplies of industrial development shaped Central Canada's economy at this time (Spelt, 1955, p.132).

In Quebec, aside from the Montreal area, it can be contended that its economy resembled that of the Maritime's. For instance, in 1911 Ontario accounted for 49 percent of concentrated inventive impulses compared to 22 percent in Quebec. According to Francis (1988, p.153), Toronto and Montreal were the only two economically independent regions in Canada in 1911. However, aside from these two centers, Ontario possessed a greater number of concentrated inventive impulses at this time.

Quebec's poorer performance could be linked to its uncompetitive advantage with regards to markets, rail-lines, natural resources, labour force, industrial structure and new migrants. In essence, French

FIGURE 3

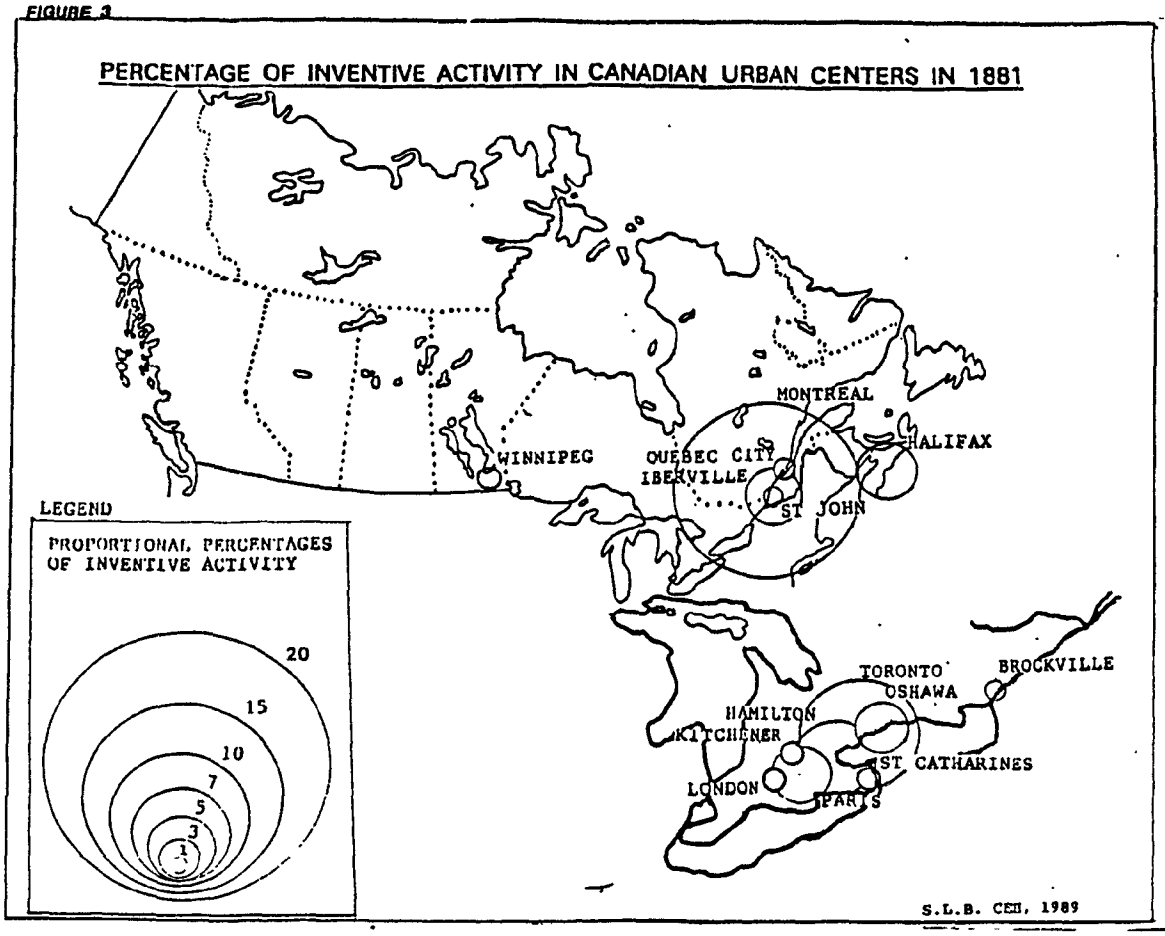
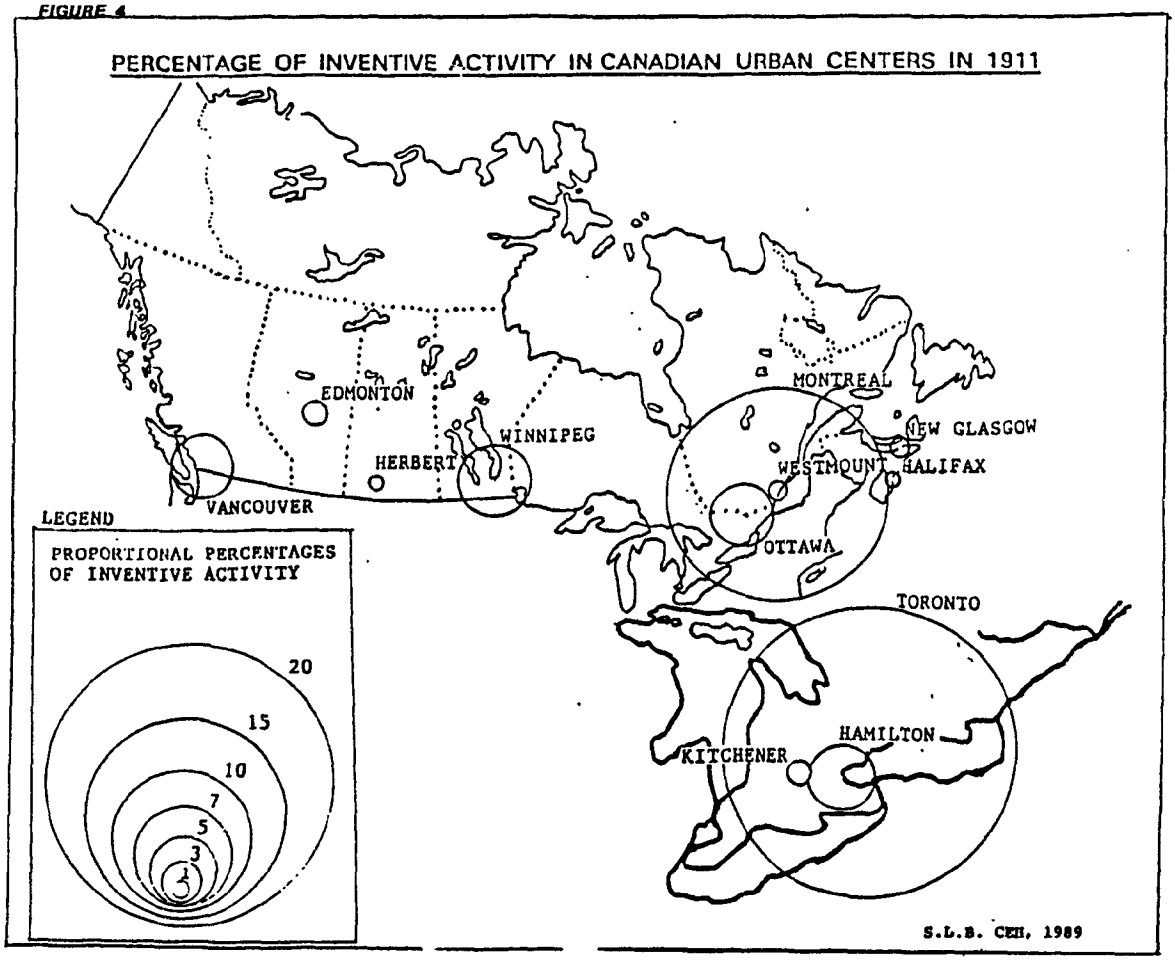


FIGURE 4



Canadians were busy "assembling" rather than "thinking" (Francis, 1988, p.157). In many cases, they were not the owners of manufacturing firms and were too dependent on others for their prosperity. In comparison to Ontario, Quebec had less favourable industrial location factors. In fact, Ontario was a more logical place for entrepreneurs to locate. Investors who came from the U.S. tended to move into Ontario. As Ontario switched to modern industries at this time, the relative importance of traditional ones declined. Quebec on the other hand, encouraged traditional industries. This gave Quebec a comparative advantage with regards to cheap labour. Unfortunately, increasing competition from abroad hurt industries in Quebec more-so than in Ontario (Walker, 1980, p.108). It can also be assumed, that much of Quebec's economic potential was, and perhaps still is, hindered by cultural factors such as language. The outcome of Quebec's disadvantaged position was complemented by lower levels of inventiveness in 1921 (Table 2). Toronto had 22.38 percent of inventive activity compared to 15.8 percent for Montreal. Two other concentrated inventive impulses were Hamilton (4.62%) and Ottawa (3.16%).

The dichotomous inventive performance of Montreal and Toronto ceased to exist by 1931. In fact, Montreal had a slightly higher level of inventive activity (23.29%) compared to Toronto (22.93%) (Table 2 and Figure 5). However, this more equitable performance had more to do with the decentralizing trend occurring within the greater Toronto economic region. For example, Montreal and Toronto accounted for 30 percent of manufactured goods by 1930, but only 20 percent by 1955 (Carrie, 963, p.157). In addition, this decline was related to the

growth of the aluminum, steel and automobile industry, which were mainly located in satellite towns around Toronto. This is clearly evident in the case of Hamilton, which became the steel capital of Canada. Montreal on the other hand, had fewer, if no neighbouring centers which were involved in metal fabrication or auto assembly. In essence, the above industries were accompanied by concentrated inventive impulses in Hamilton (10.39%), Galt (8.5%) and Brantford (1.07%). The importance of metal fabrication at this time was revealed by Ceh (1987, pp. 100-130) and Osborne (1980, chapter 4); it was found that the economies of Galt and Brantford were heavily dependent on metal fabrication. In summary, Toronto maintained its inventive importance since 1921, and its neighbouring centers increased their importance.

Montreal's inventive growth was related to its period in time, that is, it was in the midst of an industrializing era which started in 1900 and finished in 1950. In these years, geographic factors played in Quebec's favour (Marr, 1980, p.441). This was attributed to natural resources, hydro-electricity and expanding markets in the U.S.. In fact, the industrial structure of Montreal, and that of the province of Quebec, had become more balanced relative to that of Ontario (Walker, 1980, p.108). However, it should be noted, that despite Montreal's increase in inventive activity, Quebec failed to produce a second concentrated inventive impulse. By 1951, the greater Toronto economic region had 38.32 percent of urban inventive activity in Canada compared to 22.29 percent in Montreal. No doubt, inventive activity in greater Montreal was substantially lower than in the greater Toronto region.

Central Canada's urban inventive capacity increased from 48.39 percent in 1921 to 65.1 percent in 1931. This trend carried through to 1941 when 69 percent of concentrated inventive impulses in Canada were accounted for by Central Canada (Table 2). Further, the findings in 1931 had magnified themselves by 1941. Montreal increased its inventive role to 26.31 percent, while Toronto captured only 23.68 percent of Canadian urban inventive activity. Further, metal and automobile oriented centers performed well, ie; Hamilton (16.49%) and Oshawa (1.31% of inventive activity).

Montreal's growth of Canadian urban inventive activity ended in 1951 when it only accounted for 13.37 percent of inventions in this year (Table 2 and Figure 6). This inventive decline complements the fact that Montreal's economic growth compared to Toronto, since 1945, was substantially slower. The cause of this less than favourable economic growth was attributed to the declining growth rate of Quebec's population relative to that of Ontario, the growth of Pacific Rim countries, the opening of the St. Lawrence seaway, a decline in rail transport and a shift from manufacturing to service oriented industries (Nader, 1976, p.130). In effect, these factors shifted the focal point of Canada away from Quebec and more towards Ontario. Toronto on the other hand, continued to grow inventively, capturing 39.49 percent of Canadian urban inventive activity. Further, the greater Toronto economic region accounted for 47.75 percent of urban inventive activity in Canada. This growing inequality in inventive activity between Ontario and Quebec can be traced back to 1940, when the Second World War fostered uneven development in Canada (Francis, 1980, p.300). In

FIGURE 5

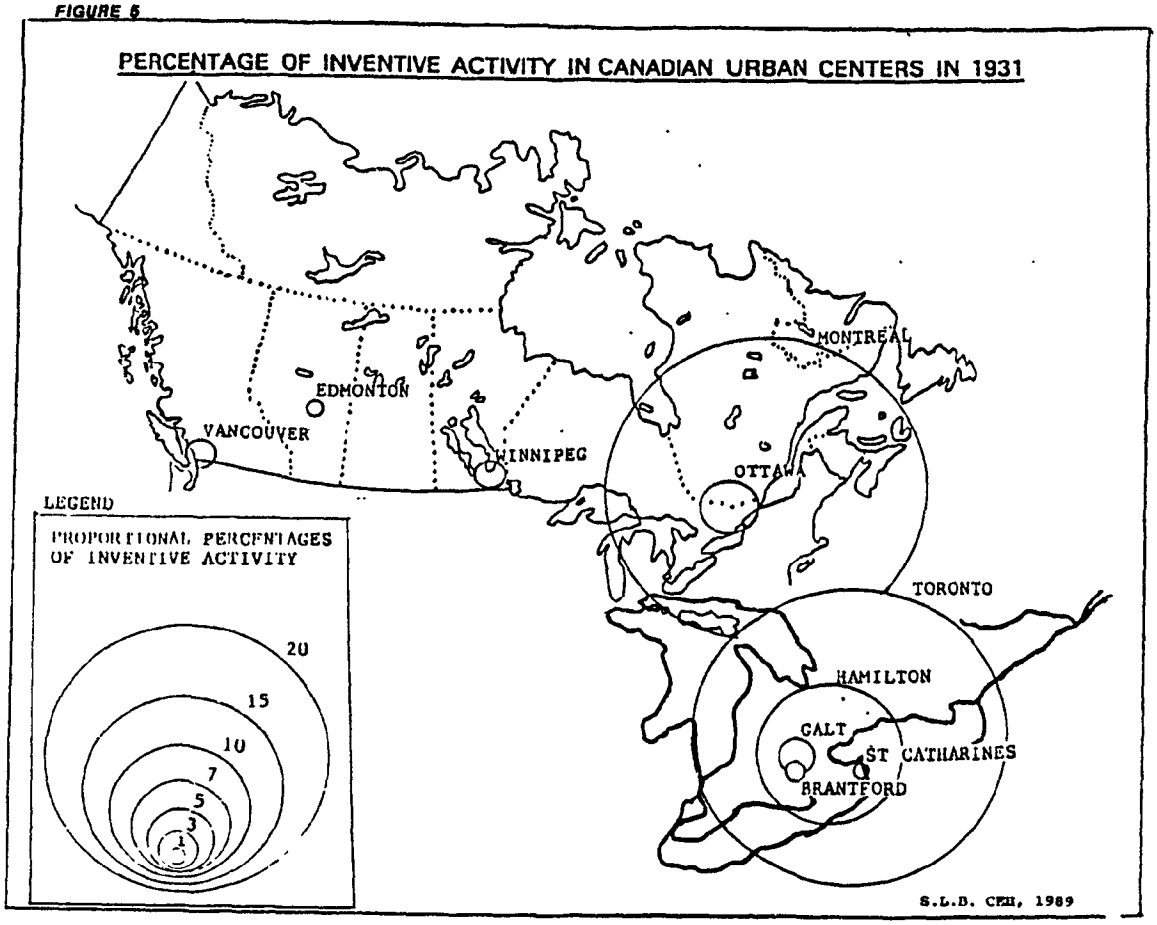
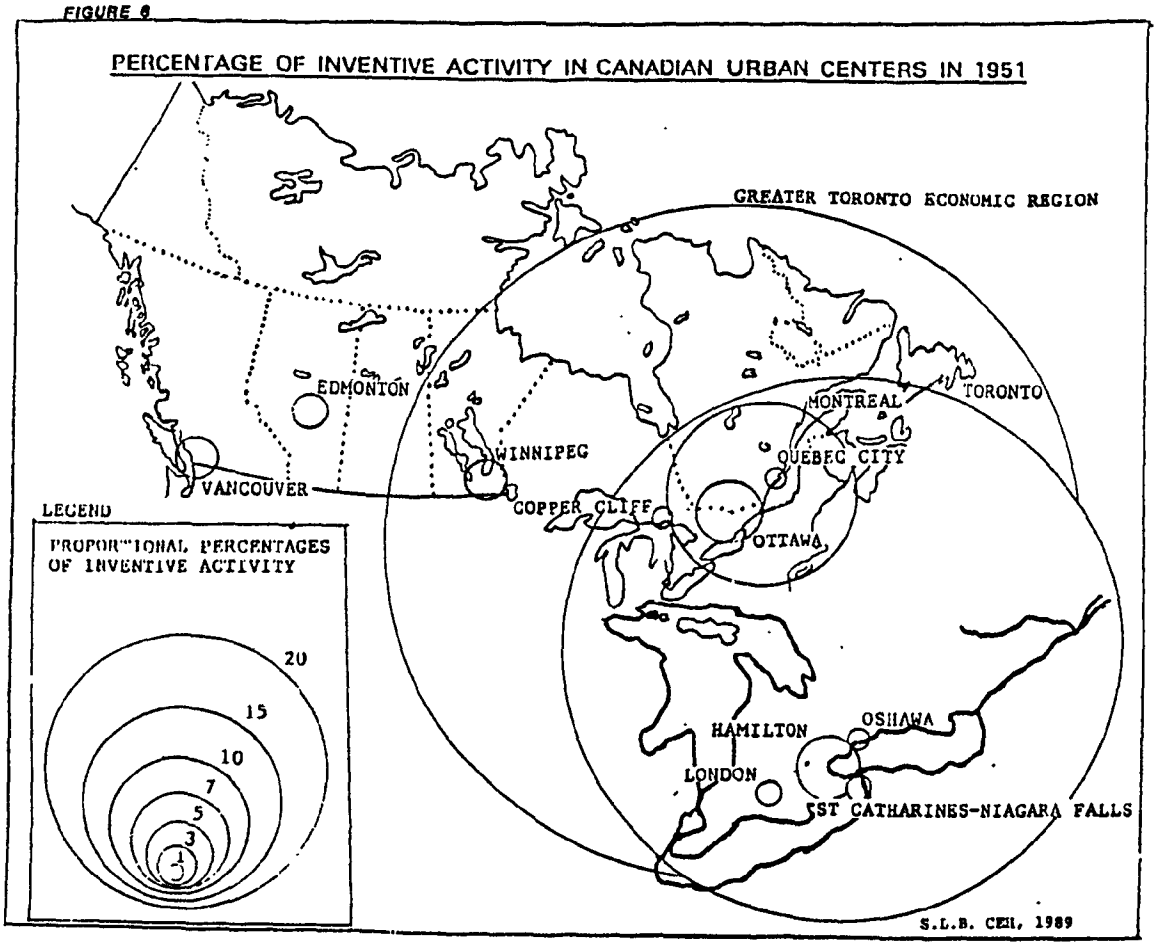


FIGURE 6



1951, urban economies which had a strong manufacturing base performed well inventively, as seen in Hamilton (4.45%), London (1.91%), St. Catharines-Niagara Falls (2.54%) and Oshawa (1.27%). The importance of mining in the province of Ontario was evident in the case of Copper Cliff (Sudbury). This center accounted for 1.27 percent of Canadian urban inventive activity. Overall, Ontario had a greater number and level of concentrated inventive impulses compared to Quebec (55.78% and 14.64%, respectively). Lastly, Ottawa captured 4.45 percent of Canadian urban inventive activity in 1951. Some of this inventive growth can be attributed to Ottawa's higher than national urban growth between 1941 and 1951 (Nader, 1976, p.168).

Montreal managed to increase its percentage of Canadian urban inventive activity to 23 percent by 1961 (Table 2). This increase may be attributed to the realization by the Provincial Government that education and technical training had to be improved. The City of Montreal was in the progress of developing an industrial park in Pointe-Claire, which provided jobs for many blue-collar workers (Putnum, 1979, p.165). Further, the majority of manufacturing activity in Quebec was located in Montreal and its neighbouring suburbs (Putnum, 1979, p.135). This economic concentration around Montreal corresponded to a lack of other concentrated inventive impulses in Quebec in 1961.

Despite a decline in inventive activity in Toronto in 1961, other concentrated inventive impulses within the Toronto economic region and in Southern Ontario performed well, specifically, one must mention Oakville (7.34%), St. Catharines- Niagara Falls (3.51%), Hamilton (3.19%), Sarnia (1.27%), Stratford (.95%) and Brantford (.95%). These

inventive impulses emerged from oil refinering, automobile manufacturing and metal fabrication urban economies. Also, Toronto continued to have a healthy percentage of Canadian urban inventive activity (24.6%) in 1961. Lastly, Ottawa and Copper Cliff continued to grow in importance by accounting for 8.94% and 2.55% of Canadian urban inventive activity, respectively.

Montreal maintained its percentage of Canadian urban inventive activity in 1971 (22.91%) (Table 2 and Figure 7). Montreal's dominance in the province of Quebec, in terms of manufacturing output, was 68 percent at this time (Putnum, 1979, p. 135). It is not surprising that inventive activity was also very concentrated. This complemented the trend between 1962 and 1972 for manufacturing employment in Quebec; it increased in concentration towards Montreal (Putnum, 1979, p.136). Attempts by the provincial government to decentralize economic activity away from Montreal had not proven themselves, at least not in terms of inventive impulses elsewhere in the province.

By 1971, Toronto increased its share of Canadian urban inventive activity to 27.6 percent. On the other hand, inventiveness in the greater Toronto economic region had declined. It fell from 47.75 percent in 1951 to 36.40 percent in 1971. There also appeared to be a shift towards new inventive centers, such as Ottawa (5.35%), Hamilton (1.71%), London (1.49%), Sarnia (1.49%), Guelph (1.49%) and Kingston (1.07%). It has been suggested that aside from Toronto, the other major important manufacturing centers in Ontario at this time were Sarnia, Windsor, London and Kitchener-Waterloo (Putnum, 1970, p.205). Since it has been suggested that manufacturing activity is associated with

inventive activity, it is not surprising that the above mentioned manufacturing centers had healthy percentages of inventive activity in 1971. The decline in inventive activity in metal producing and fabricating centers like Hamilton, was associated with a specialized industrial structure. The absence of Windsor, Oshawa and Oakville as major inventive centers, reconfirm this finding. Lastly, significant impulses in Central Canada were confined to a corridor along the 401 highway, with Ottawa being the exception.

The recently changing inventive spatial pattern in Central Canada, noticed first in 1971, had made itself more clear by 1981 (Table 2 and Figure 8). This change was further accentuated by the "Quebec crisis". This "crisis" was started by Quebec's growing desire to maintain its uniqueness within Canada. This was achieved by enforcing stricter laws such as the language Bill, 101, which enforced French only signs and schooling for example. The provincial government was also in favour of "separation" from Canada. The outcome of the "Quebec crises" was an exodus of economic activity from the Montreal to the Toronto region. Semple and Green (1983, pp.398-406) documented the relocation of corporate headquarters for Canadian cities between 1971 and 1981. The findings, not surprisingly, indicated that Montreal was the major net loser of headquarters, whereas, Toronto was the major net recipient of headquarters by 1981. Further, Clement (1975) documented the dominance of Toronto over Montreal with regards to the number of important corporate elites and headquarters. This phenomenon was accompanied by a decline in inventive activity in Montreal since 1971. In effect, Montreal only accounted for 13.29 percent of Canadian urban inventive

FIGURE 7

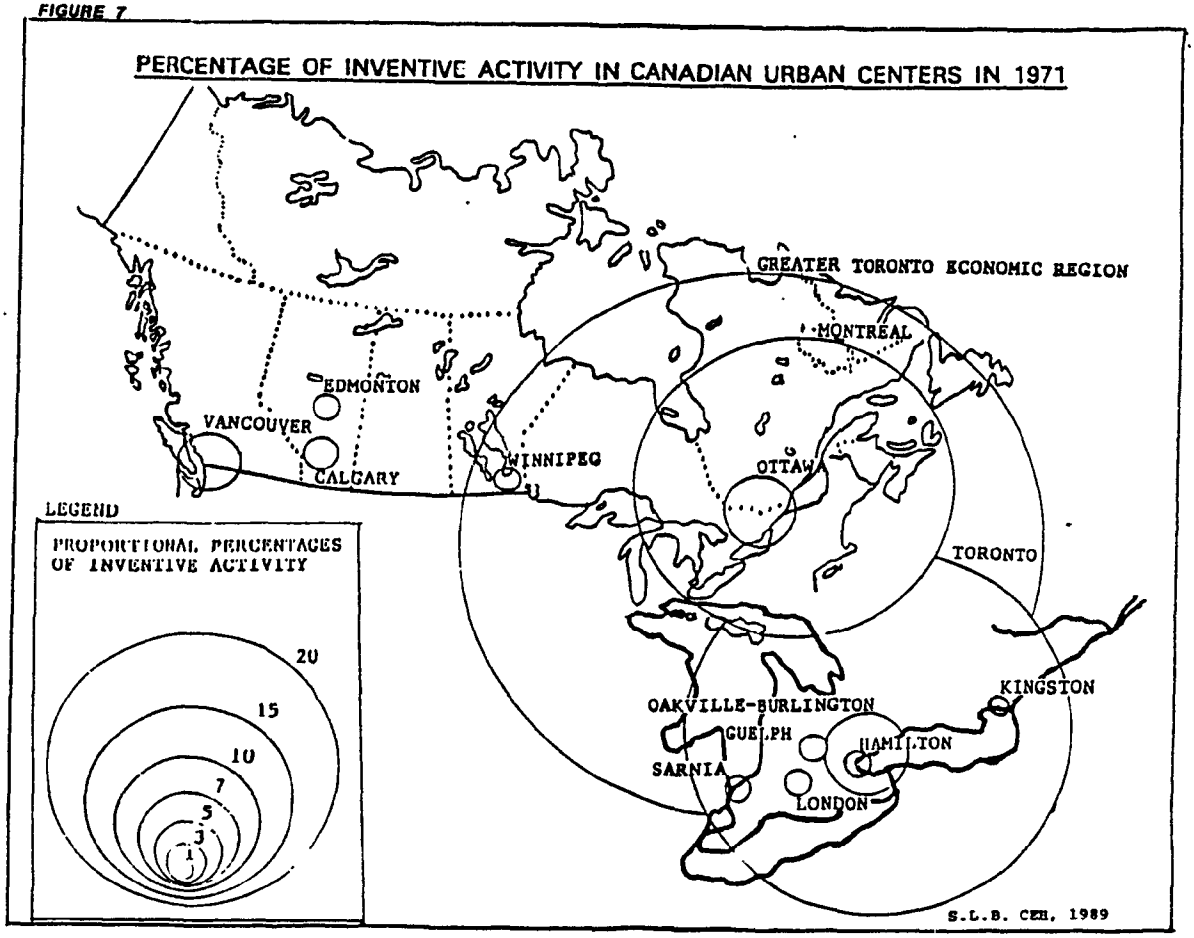
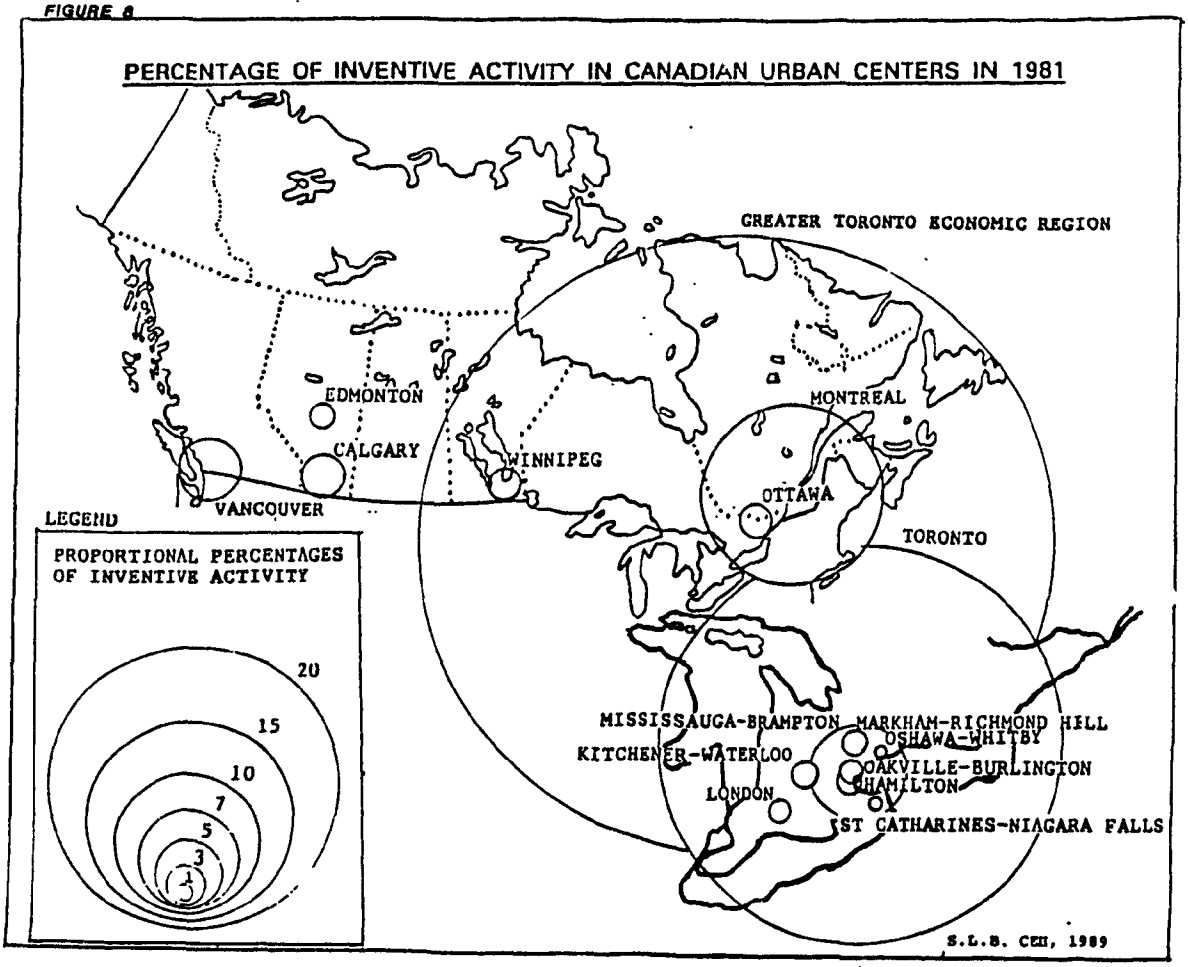


FIGURE 8

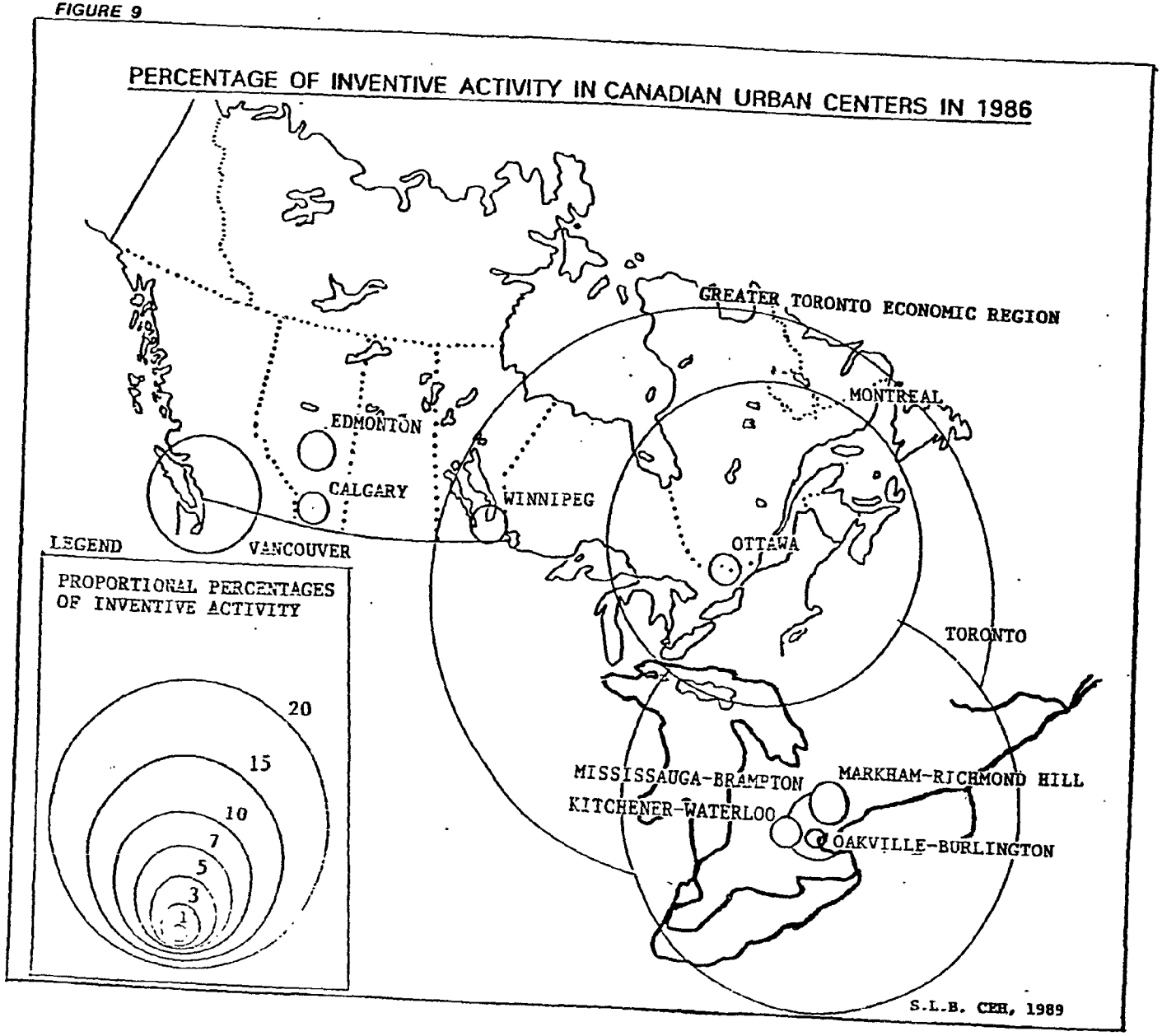


activity in 1981 compared to 22.91 percent in 1971. Toronto on the other hand, increased its inventive activity to 28.41 percent in 1981. Further, the Toronto economic region accounted for 45.20 percent of Canadian urban inventive activity.

Another major trend at this time was the growth in the number and level of concentrated inventive impulses within the Toronto economic region, ie; Mississauga-Brampton (6.74%), Hamilton (1.97%), Markham-Richmond Hill (1.82%), Kitchener-Waterloo (1.57%), Oakville-Burlington (1.47%), St. Catharines-Niagara Falls (1.01%) and Oshawa-Whitby (.96%). It can be suggested, that the growth of inventive activity around Toronto was closely associated with manufacturing and hi-technology activity immediately east, north, and south-west of it, thereby, creating a large, distinct and highly integrated urban-economic region. Further, the geographic boundary of Canada's core region appeared to be much more concentrated with respect to inventive activity by 1981. In essence, the boundary was defined by a Oshawa to London axis with a trunk line to Hamilton and two island impulses in the case of Montreal and Ottawa.

The dynamic spatial adjustments of inventive activity between 1971 and 1981 were matched by the adjustments made between 1981 and 1986. Oshawa, London and Hamilton provided less than one-percent of Canadian inventive activity in 1986 (Table 2 and Figure 9). This reduced the core region (defined by important inventive impulses) to a Toronto to Kitchener-Waterloo axis with a trunk line towards Hamilton and a stronger island impulse in the case of Montreal and a weaker one in the case of Ottawa. This geographic adjustment in inventive activity was

FIGURE 9


PERCENTAGE OF INVENTIVE ACTIVITY IN CANADIAN URBAN CENTERS IN 1986
GREATER TORONTO ECONOMIC REGION
MONTREAL
EDMONTON
CALGARY
WINNIPEG
OTTAWA
VANCOUVER
TORONTO
MISSISSAUGA-BRAMPTON
MARKHAM-RICHMOND HILL
KITCHENER-WATERLOO
OAKVILLE-BURLINGTON
LEGEND
PROPORTIONAL PERCENTAGES OF INVENTIVE ACTIVITY
20
15
10
7
5
3
1
S.L.B. CEH, 1989

accompanied by a decline in inventive activity in the Toronto economic region (from 45.2% in 1981 to 41.2% in 1986). However, Toronto managed to maintain its inventive percentage at 28.85 percent in 1986. Further, only Kitchener-Waterloo and Markham-Richmond Hill experienced a slight increase in inventive activity. In summary, the Southern Ontario and Central Canadian inventive spatial economy had become more geographically rationalized by 1986.

Another significant change in inventive activity in Central Canada was the resurgence of Montreal as an important inventive center (from 13.2% in 1981, to 22.8% in 1986). The political ramifications which started in the late 1970's had subsided by 1983, providing Montreal with the opportunity to manage an economic agenda, rather than a political one. However, Montreal did not challenge Toronto and its economic region in terms of inventive activity. McNaughton and Green (1988, p.19) found that Montreal played a secondary role to Toronto in terms of the percentage of captured venture capital in Canada. Further, the Toronto economic region had 41.28 percent of Canadian urban inventive activity compared to 22.8 percent in Montreal.

It should be noted, that Ottawa consistently appeared strong in terms of its percentage of Canadian urban inventive activity throughout this study. However, Ottawa did experience a general decline in inventive activity since 1951-61. Ottawa's inventive percentage of Canadian urban inventive activity fell from 8.94 percent in 1961 to 2.21 percent in 1986. Four possibilities for this decline, and deserving of further study, are:

1) Government spending in the high-technology park is declining.
2) Government funding is less efficiently utilized, ie; an exercise in wealth consumption and not creation.
3) Entrepreneurial activity is declining.
4) Ottawa is less attractive for high technology activity compared to other centers, in particular, Toronto.

4.2.3 INVENTIVE IMPULSES IN WESTERN CANADA

First, it should be noted that Western Canada in this study refers to the provinces of Manitoba, Saskatchewan, Alberta and British Columbia. Second, it should be kept in mind that Saskatchewan and Alberta were omitted from discussion for the years 1881 and 1891, because they were not provinces at the time.

Prior to 1891, the West was a rather undeveloped region in Canada, because there was only one concentrated inventive center in the West in 1881 (Winnipeg- 1.6%) and no concentrated inventive centers in 1891 (Table 2 and Figure 3). Winnipeg was the only Western center prior to 1900 to consolidate its position as a governmental, financial and commercial center (Nader, 1976, p.271). Also, this period was one of commercial agriculture, in which the prairie pioneer was an agricultural industrialist engaged in commercial trading (Artibise, 1984, p.140). This was the first sign of real local inventiveness in the West. However, much of this inventive activity was very dispersed across the Prairie space economy and only Winnipeg was large enough to provide a concentrated inventive impulse. Prior to 1891, the rate of urbanization and population growth in the West was significantly lower compared to Central Canada. In terms of labour output, even the Maritime's out-performed the West (Pomfret, 1981, p.190). However, the

rapid settlement of the American West placed pressure on Canada to develop its Western frontier.

The sluggish growth in the West changed after 1896. A large influx of homesteaders in the prairie provinces provided a much needed economic stimulus to this region. Further, innovations and diffusion of technology, particularly in agriculture, was limited before 1900. However, after this date, innovations diffused much more rapidly (Norrie, 1987, p.169). This need for new innovations in the West was evident in the number of concentrated inventive impulses by 1901 (Table 2). Vancouver was the major inventive center and accounted for 4.3 percent of Canadian urban inventive activity, followed by Winnipeg, 1.61 percent; New Westminister, 1.61 percent; Cumberland (B.C.), 1.05 percent, and; Brandon, 1.05 percent. Together, these inventive centers accounted for 9.6 percent of Canadian urban inventive activity, and of this percentage, British Columbia accounted for 7.2 percent. At this time, Vancouver was dramatically increasing its importance in the West as an urban center. Much of Vancouver's economic role was one of commercial distribution due to its location on the trans-continental railway system and its port facilities (Nader, 1976, p.380).

Economic growth in Western Canada provided Winnipeg with the opportunity to become a gateway city. This was noticeable in 1911 when Winnipeg accounted for 4.87 percent of Canadian urban inventive activity, followed by Vancouver, 4.48 percent; Edmonton, 1.6 percent, and ; Herbert (Saskatchewan), .96 percent (Table 2 and Figure 4). Winnipeg's population grew from 42,340 people in 1901 to 136,035 people in 1911 (Artibise, 1977, p.201). On the whole, the years between 1900

and 1914 were one of economic growth and expansion in the West (Artibise, 1984, p.150). The role of the larger centers in the West (Vancouver, Calgary, Edmonton and Winnipeg) was that of shipping and distribution, professional and commercial services. These centers were also increasing their manufacturing base and employed skilled and unskilled labour (Artibise, 1984, p.158). Similarly, other Western cities and towns experienced significant population growth. However, Winnipeg remained the largest urban populated center. An increase in inventive activity, particularly in Winnipeg, was also tied to an increase in manufacturing activity. Winnipeg's manufacturing valued output increased 279 percent from 1901 to 1911 (Artibise, 1977, p.199). Lastly, the role of agriculture as a source for inventive activity was evident in the case of Herbert, Saskatchewan.

By 1921, Vancouver and nearby New Westminister were major inventive centers and accounted for 7.29 percent of Canadian urban inventive activity, followed by Winnipeg, 3.64 percent; Calgary, 2.67 percent, and; Edmonton, 1.21 percent (Table 2). It was during the 1920's that Vancouver emerged as the primary metropolitan center in the West (Nader, 1976, p.381). Winnipeg's status as a gateway city was threatened by these other developing urban centers. Comparatively, Winnipeg lost its inventive edge in the West, yet increased its manufacturing output by 129 percent since 1911 (Artibise, 1977, p.199). However, Winnipeg's percentage of labour force in manufacturing dropped from 24.2 percent in 1881 to 16.9 percent in 1921 (Artibise, 1977, p.206).

Wheat production reached its peak between 1925 and 1929. An economic depression and drought in the early 1930's hampered further economic growth in the West. In 1931, only three inventive centers remained in the West (Winnipeg-2.15%, Vancouver-2.15% and Edmonton-1.01%), and each had experienced inventive decline since 1921 (Table 2 and Figure 5); in part due to their ties to primary activities in the West. Also, slow urban growth during the 1920's (.5%) was less than sufficient for increased inventive activity to take place (Artibise, 1984, p.159). In essence, these three urban centers were most suited to support the West through the economic depression. By 1931, Vancouver overtook Winnipeg in terms of population size and Edmonton was a distant third (Roy, 1980, p.19).

Inventive activity in the West declined through the 1930's and continued in the early 1940's. Only Vancouver and Winnipeg had significant inventive activity (3.28% and 1.97%, respectively) in 1941. (Table 2). As Artibise (1984, p.162) described it, Western centers by the mid 1930's were concentrating not on growth, but survival. The Second World War however, provided a boost to British Columbia's economy which complemented a slight increase in Vancouver's inventiveness in 1941. On the other hand, Winnipeg continued to exhibit inventive decline and Edmonton disappeared from the an sis.

The post-war period in Canada was one of general economic growth. However, from 1951 to 1961 the West experienced positive and negative inventive growth. Although the three major Western cities increased their percentage of Canadian urban inventive activity (Vancouver, 3.18%; Winnipeg, 3.18% , and; Edmonton, 2.54%) in 1951, it decreased in

1961 (Vancouver, 2.55%; Edmonton, 1.27%, and; Winnipeg, .95%) (Table 2 and Figure 6). In Winnipeg, the percentage of labour in manufacturing fell from 25.2 percent in 1951 to 20.2 percent in 1961 (Artibise, 1977, p.206). In essence, Winnipeg was transforming into a business and services oriented economy. Saskatchewan failed to be productive in terms of inventive activity due to its low level of urbanization (only 43 percent in 1961) (Lower, 1983, p.317). The Western wheat economy was no longer an area for inventive activity since much of the new technology concerning farming equipment was located in Central Canada. A decline in inventive activity in Vancouver represented the fluctuating demand for Western resources, and subsequently, the instability of the Western economy and its inventive capability.

It was not until the mid 1960's that the demand for Western resources (mineral and energy) increased. This demand was accompanied by inventive growth in major Western centers like Vancouver, 4.28%; Calgary, 2.56%; Edmonton, 1.71%, and; Winnipeg 1.49%, by 1971 (Table 2 and Figure 7). Two noticeable features of the Western inventive space economy was the growth of Calgary and Vancouver. Growth in the oil and gas industry in Alberta was accompanied by a movement of corporate headquarters to Calgary (Semple and Green, 1981, pp.401-403). In addition, the rapid increase in Calgary's population size between 1951 and 1971 (129,060 to 403,319) helped this center increase its percentage of Canadian urban inventive activity (Lower, 1983, p.518). Inventive growth in Vancouver was likely attributed to an increased demand for natural resources in British Columbia- minerals and timber. On the other hand, Winnipeg's inventive decline was complemented by a

general decline in its economy relative to other Western centers. This slow growth was attributed to Winnipeg's declining share of the prairie market, specialized manufacturing industries which had grown at a rate below the national average and its declining proportion of Western labour; which fell from 25.4 percent in 1951 to 18.2 percent in 1971 (Nader, 1976, p.273).

Economic and inventive growth in the West through the 1970's was more evident by 1981. The major inventive impulses were Vancouver, 4.36%; Calgary, 2.94%; Winnipeg, 2.23%, and; Edmonton, 1.87% (Table 2 and Figure 8). All four centers had increased their inventive capacity since 1971. Together, these four centers accounted for 11.45 percent of Canadian urban inventive activity. Vancouver's higher level of inventive activity (in terms of percentage) is related to its larger population. Economic prosperity during this era permitted the West to have the lowest level of unemployment in Canada (Lower, 1983, p.241). British Columbia was the fastest growing province in the West, and Calgary was the fastest growing city (population and economy) (Lower, 1983, p.258).

Economic prosperity in the West was stiffened in the early 1980's. A world-wide economic recession, a decline in world oil prices and a decline in demand for natural resources in the West was the major culprit in slowing Western economic growth. The major loser in terms of inventive activity was Calgary. All three other major centers continued to increase their percentage of Canadian urban inventive activity. Vancouver experienced the highest growth of inventive activity in the West by accounting for 8.32 percent of Canadian urban inventive

activity in 1986 (compared to 4.36 percent in 1981) (Table 2 and Figure 9). Edmonton and Winnipeg slightly increased their share of Canadian urban inventive activity to 2.55 percent and 2.6 percent, respectively. Together, these four inventive centers continued to grow and accounted for 15.68 percent of Canadian urban inventive activity.

This finding was surprising, considering the West had not completely recovered from the economic recession of the early 1930's. It can be hypothesized, that since the labour force had been freed from the natural resource and energy sectors, it had managed to redirect its energy towards new enterprising activities. If this is the case, economic progress in the West, based on locally generated inventive activity, will become more stable. If this is true, a renewed demand for Western resources could negate this beneficial effect of enterprising activity.

4.3 AGGREGATE INVENTIVE CONCENTRATION IN CANADA: 1881-1986

4.4 INTRODUCTION TO INVENTIVE CONCENTRATION IN CANADA

The early 1900's witnessed a trend towards increased urban concentration in the Canadian space economy and urban hierarchy. Small urban places were overlooked by manufactures in favour of larger ones. High levels of mergers and acquisitions around 1911 and 1930 complemented this process of urban-economic concentration. It can be said, that inventive activity in Canada complemented this process of urban-economic concentration, and that certain region(s) are more favourable to this process. Therefore, inventive concentration in this thesis will be examined in two ways. The first understanding of

inventive concentration will involve an examination of inventive concentration in the Canadian urban hierarchy and inventive space economy. That is, has inventive activity become concentrated to a few centers? The second perspective will involve an understanding of inventive activity within the core (an area from Quebec City to Windsor) and peripheral regions of Canada. In essence, has Canada's inventive space economy become more concentrated?

4.4.1 INVENTIVE CONCENTRATION IN CANADIAN URBAN CENTERS AND REGIONS

It would be expected, that as urban-economic concentration increased during the 1900's, inventive activity would have complemented this trend. The degree of inventive concentration in urban centers in Canada is evident in Table 3. In 1881, concentrated inventive impulses accounted for 57.6 percent of Canadian inventive activity. This percentage indicates that the Canadian inventive space economy was somewhat dispersed in 1881. In essence, all inventive impulses with less than one-percent of Canadian inventive activity accounted for 42 percent of the total. However, urbanization and industrial concentration favoured a centralizing trend in inventive activity. Gilmour (1972, p.119) documented this trend for as early as 1880 to 1900. This early trend had ramifications well into the future, ultimately, nourishing core-periphery differences. Therefore, as urban and industrial concentration occurred, the importance of inventive impulses with less than one-percent of the Canadian inventive activity, subsequently decreased.

TABLE 3: PERCENTAGE OF URBAN INVENTIVE IMPULSES*:1881-1986

YEAR	PERCENTAGE	YEAR	PERCENTAGE
1881	57.6	1941	74.3
1891	60.1	1951	79.1
1901	62.2	1961	81.3
1911	62.7	1971	78.9
1921	64.8	1981	72.7
1931	71.2	1986	81.2

* Centers with inventive impulses greater than one-percent of the Canadian total

Inventive urban concentration became most significant between 1921 and 1931. This period was one of Canada's most intense era's of mergers, incorporations and acquisitions (Marr, 1980, p.415). A second important trend to occur concerning inventive urban concentration occurred between 1971 and 1981. In these years, concentrated urban inventive impulses decreased in importance (78.9 percent in 1971 and 72.7 percent in 1981). This complemented a trend towards decentralized inventive activity, not only at the metropolitan level, but at the sub-national and national level as well. This was reconfirmed in Figure 8, in which the growth of inventive impulses around Toronto and outside of Central Canada, increased. It can further be suggested that this decentralizing trend manifested itself into less important inventive impulses (less than one-percent), thereby, increasing their accumulative importance from 21 percent in 1971 to 27 percent in 1981.

The final significant finding in this analysis was the resurgence of inventive urban concentration by 1986. Concentrated urban inventive centers increased their proportion of Canadian urban inventive activity from 72.7 percent in 1981 to 81.2 percent in 1986. In essence, the inventive spatial economy of Canada became more rationalized, favouring the larger urban centers. However, concentrated urban inventive impulses within the Toronto economic region decreased somewhat in number and importance. Their cumulative importance decreased from 27.3 percent of Canadian urban inventive activity in 1981 to 19.8 percent in 1986. On the other hand, Toronto maintained its inventive importance and Montreal increased its pe- -ntage.

The above defined process of inventive concentration in Canada over time has manifested itself in the urban hierarchy. For example, in 1881 there were fifteen concentrated inventive centers which accounted for 57.6 percent of Canadian urban inventive activity. By 1986, there were twelve concentrated inventive centers which accounted for 81.2 percent of Canadian urban inventive activity. Clearly, there has been a trend of increased inventive activity towards fewer and higher ordered urban places in Canada.

In an attempt to further analyse the level of inventive concentration in Canada, a grouping of inventions into two distinct geographic regions was performed, that is, Central Canada, also known as Canada's core (Quebec City to Windsor) region, and the remaining periphery region. The findings from 1911 to 1986 are given in Table 4.

TABLE 4: **INVENTIONS IN THE QUEBEC CITY-WINDSOR AXIS**

YEAR	% OF TOTAL	YEAR	% OF TOTAL	YEAR	% OF TOTAL
1911	66.6	1941	86.4	1971	82.6
1921	70.3	1951	77.7	1981	71.2
1931	82.8	1961	82.5	1986	77.1

In 1911, Central Canada, as defined by a Quebec City to Windsor axis, accounted for 66.6 percent of all inventive activity in Canada. Although this was moderately important, especially in that time period, it was not as significant as the degree of inventive concentration within this region between 1921 and 1941. Central Canada accounted for 86.4 percent of Canadian inventive activity in 1941. This strong performance of inventive activity in Central Canada in 1941 was likely a response to three factors. First, Central Canada's economy had experienced high levels of merger and acquisition activity throughout the 1930's, thereby, accompanying and promoting inventive concentration. Secondly, Central Canada progressed through the "dirty thirties" comparatively better than the periphery. Lastly, in comparison to other regions, the war-effort increased manufacturing production significantly in Central Canada.

The post-war period was one of economic expansion, especially in the early 1950's. This coincided with the periphery's ability to increase its inventive capability. This growth was accompanied by economic expansion in the periphery based on natural resources. Subsequently, Central Canada experienced a decrease in Canadian inventive activity from 86.4 percent in 1941 to 77.7 percent in 1951.

This finding was complemented by an increase in inventive activity in dominant inventive centers in the West in 1951 (Table 2). Yet by 1961, Central Canada again captured nearly 82.5% of Canadian urban inventive activity. This complemented Central Canada's strong manufacturing base, ie; the growth of the automobile industry and the implementation of the Auto Pact in 1965.

Steady economic growth in the periphery from 1965 to 1982 can be traced to an increase in demand for mineral and energy resource in this region and period. Subsequently, increasing population levels in the periphery allowed this region to capture a greater percentage of Canadian inventive activity by 1981. However, this trend had altered by 1986. The economic recession in Canada in the early 1980's and a drop in world oil prices reduced the periphery's traditional level of economic growth. It was not surprising therefore, to find that Central Canada accounted for 77.1 percent of Canadian inventive activity in 1986, an increase from 71.2 percent in 1981.

The growing difference between the core and periphery in Canada was more noticeable in the 1980's. While Central Canada experienced an economic boom, the periphery was staggering out of a recession. Considering the continued sluggishness of the peripheral economy into the late 1980's and the persistent growth of Central Canada's economy, the percentage difference between these two regions, with respect to Canadian inventive activity, can be exp· ced to increase further after 1986.

It should be noted, that population growth is not always a good indicator of inventive activity. As Gilmour (1972, p.119) found,

traditional industrial locations tend to reinforce themselves, thereby, making locational attributes as important as population size. Therefore, initial advantages in the core region may not have been completely lost to a growing Western population. This can be better explained by examining the U.S. space economy. Continued population growth beyond the north-eastern industrial core region since the early 1900's has not debilitated this region of economic growth and importance. Today, a substantial proportion of inventive, innovative and R&D activity takes place in this region. This was confirmed by Leinbach and Amrhein (1987), in which the proportion of captured venture capital in the U.S. was concentrated in unique areas. For example, between 1980-82, New York and Massachusetts accounted for 81 percent of venture capital in the east, and California and New York accounted for 42 percent of the national total.

Relating this phenomena to Canada, it can be expected that Central Canada will continue to capture a large proportion of Canadian inventive activity. This can be attributed to its advanced urban and industrial structure. Therefore, two urban centers with the same population levels, one in the periphery and one in the core, will not always have similar levels of inventive activity. Initial advantages in Central Canada, with regards to an advanced urban system, will allow the Central Canadian city to perform better with respect to inventive activity. This is evident in the case of Kitchener-Waterloo. It had a much smaller population in 1986 compared to that of major Western cities, yet performed almost as well as Calgary in terms of its percentage of Canadian urban inventive activity. Further, when

population size is taken into effect, the enterprising nature of Kitchener-Waterloo's economy becomes even more apparent.

4.5 REGIONAL AND URBAN INVENTIVE PATTERNS IN CANADA: SUMMARY

Early Canadian inventive activity, as measured by the number of Canadian patents and trademarks registered, was mainly located in Central Canada and to a lesser degree, in the peripheries, both east and west. Further, early inventive activity was predominantly more dispersed across the Canadian inventive space economy. Many small towns and cities were major contributors of inventive activity. This is not surprising, considering economic activities at this time were less dependent on the benefits derived from urban economies of scale. However, the early 1900's witnessed a trend towards manufacturing and urban concentration, which was complimented by inventive concentration. This phenomenon tended to favour Central Canada, and by 1941 the core region had a substantial proportion of Canadian inventive activity.

Overall, Toronto consistently increased its percentage of Canadian urban inventive activity throughout this study. Montreal on the other hand, played a secondary role to Toronto (with the exception in 1881 and 1931) and exhibited variable proportions of total Canadian urban inventive activity. This secondary role in relation to Toronto was even more evident when the Toronto economic region was considered. Lastly, the core region, in terms of concentrated inventive impulses, had become more rationalized by 1986. A Kitchener to Toronto axis with a trunk line towards Hamilton and an island impulse in the case of Montreal and Ottawa defined this region.

On the other hand, Inventive activity in the Maritime region had diminished and in the West was characterized by erratic impulses. In post-war Canada, the Maritime's failed to produce an important inventive impulses. On the other hand, the West reached its inventive peak in the early 1900's and in 1986. Although the traditional inventive centers in the West increased their proportion of inventive activity (Vancouver, Winnipeg, Calgary and Edmonton), the periphery exhibited inventive decline. The importance of urban size is reduced somewhat for those urban centers which are located within the Central Canadian urban system since they possess favourable industrial attributes which conducive to inventive activity. In other words, inventive activity is more likely to germinate in an advanced urban system, and thereby, create unequal levels of inventiveness in a spatial economy.

5.0 RELATIVE INVENTIVE IMPULSES IN CANADIAN REGIONS AND CENTERS

5.1 INTRODUCTION TO RELATIVE INVENTIVE IMPULSES IN CANADA: 1881-1986

The purpose of this chapter is to examine urban inventive activity in Canada when standardized per 10,000 people. Chapter four helped define the spatial context of inventive activity in Canada by urban center. It did not however, measure creativity per person. In other words, centers which were larger tended to also register larger inventive activity. Creativity per person will provide another perspective on concentrated inventive impulses in Canada. Secondly, this chapter will examine the relationship between inventive activity and population growth and unemployment levels in Canadian metropolitan areas.

5.1.1 RELATIVE INVENTIVE PATTERNS IN THE MARITIME REGION

Although the Maritime's failed to produce an inventive impulse after 1911 with a percentage higher than one, the number of inventions per 10,000 people was calculated for Halifax from 1951 to 1986. The values were: 0.0 in 1951; .17 in 1961; .15 in 1971; .38 in 1981, and; .23 in 1986 (Appendix B). When each of these samples was compared to those of other urban centers in similar years, it became apparent that Halifax ranked last in each year. This, coupled with a similar low rank in 1911, showed that Halifax had poor inventive capabilities after 1891. (Table 5). Only in 1881 did Halifax have a moderately healthy inventive climate (Table 5). It would appear that Halifax, as the Maritime's overall strongest impulse, had performed poorly compared to

TABLE 5: RELATIVE INVENTIVENESS IN CANADIAN URBAN CENTERS: 1881-1986

REGION AND CITY	NUMBER OF INVENTIONS PER 10,000 POPULATION											
MARITIME	1881	1891	1901	1911	1921	1931	1941	1951	1961	1971	1981	1986
HALIFAX	6.3			2.6								
SYDNEY		33.0										
ST JOHN		3.3	2.3									
FREDERICTON			16.9									
NEW GLASGOW				26.1								
CENTRAL CANADA												
QUEBEC												
MONTREAL	5.7	6.1	3.2	4.0	4.2	3.2	1.8	0.6	1.8	2.0	1.0	1.5
IBERVILLE	13.8											
QUEBEC CITY	1.3							0.3				
ST JOHN	6.5											
LONGUEUIL		29.0										
BELOIL			48.2									
WATERLOO			44.5									
MAISONNEUVE					5.9							
WESTMOUNT				10.9								
ONTARIO												
TORONTO	4.6	8.6	10.8	6.9	7.1	4.1	2.2	2.4	1.8	2.6	2.0	1.8
G.T.E.R.								1.5	1.7	1.9	1.4	1.1
HAMILTON	2.8	9.3	3.0	6.8	6.7	7.5	6.0	1.1	1.1	.77	.68	
OTTAWA		6.4	2.7	6.4	4.0	3.5	.51	1.2	3.2	2.2	.78	.46
OSHAWA	40.1	19.7					.30	.68			.56	
KITCHENER	19.7	10.3		13.2							.78	.85
ST CATH.-*N.F.	8.3		*18.9			4.8		.75	1.5		.43	
BROCKVILLE	6.4											
PARIS	6.3											
LONDON	4.1		3.2					.74		.99	.75	
SILOAM	N.A.											
BELLEVILLE		12.1										
WINDSOR		3.8	32.3									
BRADFORD			81.3									
FENELON FALLS			70.7									
KINGSTON			50.4							2.0		
SUDBURY			39.5									
PERTH			22.2									
VICTORIA			N.A.									
DUNDAS					32.1							
GALT						9.3						
BRANTFORD						5.0			1.4			
COPPER CLIFF								.72	1.9			
OAKVILLE-									8.6	5.5	.94	.58
BURLINGTON									2.1			
STRATFORD									1.6	2.4		
SARNIA										2.6		
GUELPH												
MISSISSAUGA-											2.1	1.0
BRAMPTON												
MARKHAM-											1.1	1.0
RICHMOND HILL												
WESTERN CANADA												
WINNIPEG	10.0		2.8	4.4	3.4	1.2	.54	.60	.25	.51	.56	.60
VANCOUVER			11.8	5.6	8.9	.97	.72	.30	.35	.73	.58	.88
EDMONTON				7.0	3.4	1.5		.70	.38	.57	.36	.39
CALGARY					2.0					1.1	.65	.39
BRANDON			14.2									
CUMBERLAND			N.A.									
VICTORIA					6.2							
HERBERT				N.A.								
NEW-WESTMINESTER			5.0		11.0							

* G.T.E.R = GREATER TORONTO ECONOMIC REGION (OSHAWA TO KITCHENER TO NIAGARA FALLS)

other inventive urban centers in Canada. This would complement the findings in the percentage analysis. It should be noted, that Halifax's ability to increase its number of inventions per 10,000 people from zero in 1951 to .38 in 1981, might be a sign of inventive recovery. Despite Halifax's inventive increase in the post-war years, be it small, other inventive impulses in the Maritime's have performed less significantly, if not at all. It would appear that entrepreneurial and economic leadership in the Maritime's was less than significant after 1911.

5.1.2 RELATIVE INVENTIVE PATTERNS IN CENTRAL CANADA

In 1881, it was not the large urban centers in Central Canada which had a high number of invention per 10,000 people, but the smaller to medium sized centers like Oshawa, Kitchener, Iberville and St. Catharines (Table 5). This trend continued until 1911. Toronto made moderate gains compared to other urban centers at this time, and Montreal performed less favourably. As mentioned in the percentage analysis, Quebec's economy had several weaknesses which developed at this time. This was due to a labour force based on traditional industries which was busy "producing" rather than "thinking". (Francis, 1988, p.157). In effect, an abundant labour force and low wages produced labour intensive industries which were less conducive to economic growth, especially since they would be declining in importance more quickly. It can also be suggested that cultural factors alienated foreign investment to a degree. Lastly, it should be mentioned that merger and acquisition activity in the early 1900's was partially responsible for Toronto's inventive growth. As high levels of

urbanization and industrial concentration occurred, so did inventive activity.

From 1881 to 1931, those urban centers which had a healthy manufacturing base, and produced important goods, performed well, ie; Oshawa and Kitchener in 1881; Fenelon Falls and Kingston in 1901; Kitchener in 1911, and; Galt and Hamilton in 1931 (Table 6). The fact that Belleville and Kingston in 1891 and 1901 possessed an inventive population, indicates that Eastern Ontario at this time was suitable for economic growth.

By 1951, Toronto had the most significant level of relative inventive activity in the country (Table 5). Hamilton also performed well in 1951, as it did in 1931. This was closely associated with the growth of the iron and steel industry in this city. Also, Brantford and St. Catharines had healthy inventive activity in 1951. It should be noted, that Montreal and Quebec City performed poorly compared to Ontario centers in 1951. Prior to 1950, Montreal's inventive growth was complemented by an industrializing era which started in 1900 and ended in 1950. After these years, geographic factors were not as favourable for Quebec (Marr, 1980, p.441).

The inventive growth of Copper Cliff (a center within Sudbury's regional boundary) from 1951 to 1961 indicated the importance of mining in Ontario (Table 5). Further, Ottawa performed well in 1961, as it did in 1951. On the other hand, Toronto did experience some inventive decline by 1961. The decentralizing trend occurring at this time could explain this decline. This is evident in the case of Oakville and Burlington. These two centers, which are located just outside of

Toronto, had the most inventive economies in Canada in 1961. While Montreal failed to decentralize its economic activity at this time, it performed similarly to Toronto. Lastly, the decline of Hamilton's inventive economy, along with that of St. Catharines, would indicate the declining importance of economies based on iron and steel and/or metal fabrication, as was the case of Brantford. This complimented similar findings found in the percentage analysis.

In 1971, the most important and healthy inventive economies were located in Ontario (Table 5). Although Oakville and Burlington had experienced relative inventive decline since 1961, they continued to possess the most inventive economies in Canada. Further, the inventive growth of Guelph, Sarnia and Ottawa signified the importance of inventive impulses at a distance from Toronto. In addition, the Toronto economic region had increased its proportion of inventions per 10,000 people from 1.46 in 1951 to 1.93 in 1971.

By 1981, the Toronto economic region declined in inventive importance. Further, the significant inventive decline of Oakville-Burlington since 1961 had crowded out the real gains made by Markham-Richmond Hill and Mississauga (Table 5). Of further interest, was the significant decline of Montreal's inventive economy since 1971. However, Montreal increased its position relative to that other urban centers in Central Canada. This was due primarily to the fact that Montreal had never really decentralized its economic activity, and therefore, had spread less of its wealth. Overall, the Toronto economic region had a higher level of inventive activity compared to Montreal.

Toronto increased its relative inventive position in 1986 along with Montreal (Table 5). In fact, these two urban centers had the most important and healthy inventive economies in Canada. Although Toronto had a higher inventive index than Montreal, the number of inventions per 10,000 people for the Toronto economic region was lower. Montreal possessed a population which had become more receptive to entrepreneurial activity since 1951. In essence, Montreal had become a viable economic region, despite its secondary role as suggested in the percentage analysis. However, Montreal continued to lack an extensive economic region compared to Toronto, and therefore, Quebec can be explained as possessing too much inventive activity within a small geographic area. In fact, one can argue that Ontario will always hold this advantage over Quebec, because Southern Ontario urban centers developed a strong economic base as far back as 1900. These centers have initial advantages due to their historical development, in particular, a more advanced urban system compared to that around Montreal. It is likely that economic reinforcing mechanisms will allow Southern Ontario, in particular, the Toronto economic region, to maintain its economic lead in Central Canada and the nation. Lastly, it should be noted that Ottawa experienced relative inventive decline since 1981. This complimented the findings and suggestions in the percentage analysis.

5.1.3 RELATIVE INVENTIVE PATTERNS IN WESTERN CANADA

An examination of inventive activity per 10,000 population for centers in Western Canada revealed that in 1881 Winnipeg was the only strong inventive impulse in the West. This center had ten inventions per 10,000 population. This enabled Winnipeg to compete effectively with other centers at this time (Table 5). It was not until 1911 that Winnipeg reappeared in the study, but with a comparatively lower level of inventive activity. In 1901, Vancouver and New Westminister were the only inventive centers in the West. Further, they had somewhat respectable level of inventive activity compared to other centers in this study. Like Winnipeg, Vancouver's population was slightly less inventive in 1911. Although the percentage analysis indicated a growth in inventive activity, it is obviously related to population growth and not inventive attributes within the population. However, it is surprising to see that in 1911 Edmonton performed better than Winnipeg and Vancouver. Unfortunately, Edmonton, like Winnipeg had one of the lowest levels of inventive activity in 1921, whereas, Vancouver and New Westminister performed well. At this point, it becomes apparent that inventive impulses in the West varied in importance over time. This was likely due to the economic and industrial structure of major centers in this region. That is, each had a small manufacturing base and economy that was strongly linked to primary activities. Therefore, fluctuating demands for different resources was accompanied by variations in intensity of inventive impulses in the West. This erratic shift in inventive activity among Western centers is most evident by 1931.

Vancouver performed well in 1921 (8.87) and poorly in 1931 (1.09) (Table 5).

The post-war years can best be explained by lower levels of relative inventiveness in the West (compared to other centers in the study) (Table 5). With variations over the years, Vancouver, Edmonton, Calgary and Winnipeg exhibited comparatively poorer levels of inventive activity. Vancouver performed poorly from 1951 to 1971, and moderately better between 1971 and 1981. This trend would suggest that Vancouver had developed a less resource dependent economy, and by 1986 was the West's strongest inventive center. From 1961 to 1986, Winnipeg revealed similar, but slightly less significant inventive growth, compared to Vancouver. Like Vancouver, this center is developing a stable economic base, and is becoming an important manufacturing and financial center in the West. Edmonton on the other hand, continually declined in inventive importance between 1951 and 1986. Similarly, Calgary exhibited the same pattern between 1971 and 1986. These two centers developed their economies during the oil and gas bonanza in the sixties and seventies Consequently, the decline of this industry in the early eighties had unfavourably affected these two centers. Although the percentage analysis indicated a growing inventive impulse in the case of Edmonton, it is was not as significant as appeared, since this growth was due mainly to population increases. Therefore, the postulation that the labour force was more entrepreneurial in Edmonton and Calgary in 1986, is less true according to this analysis. However, the growth of Vancouver's and Winnipeg's inventiveness in the

percentage analysis is attributed not only to population growth, but unique inventive qualities in each of the mentioned populations.

5.1.4 RELATIVE INVENTIVE PATTERNS IN CANADIAN REGIONS

When two populations of equal size are examined, ideally there should be an equal level of inventive activity in each population. However, in reality certain populations tend to be more indigenous, as such, this analysis will attempt to distinguish inventive healthiness in three Canadian regions by examining the overall performance of inventive impulses identified in Table 5. In an attempt to first develop an overall understanding of inventive activity in the Maritime, Central Canada and West regions of Canada, the number of inventions per 10,000 people for urban centers identified in Table 5 were classified as being important, moderately important or non-important. This was achieved by ranking a list of standardized inventive centers (number of inventions per 10,000 population) for any one period from highest to lowest. The top five standardized centers were classified as important, the bottom five were classified as non-important and those in between were classified as neutral or moderately important (except in 1941, the top and bottom three were selected). Lastly, since the Maritime's only had a limited presence in this analysis, the number of inventions per 10,000 people in Halifax was performed for the sample years 1951 to 1986 in an attempt to provide a better understanding of this region's indigenous potential. The results of the above procedure have been displayed in Table 6.

Of all the centers examined over the 1881 to 1986 time period, the Maritime's possessed only two cases that in any one decade had a high number of inventions per 10,000 people (Table 6). On the other hand, there were eight examples of centers which had a low number of invention per 10,000 people. The West also performed poorly considering there were six examples from 1881 to 1986 in which urban centers had a high number of inventions per 10,000 people and twenty-two cases in which urban centers had a low number of inventions per 10,000 people (Table 6). Even when the moderately important cases were added to the important cases, both the Maritime's and the West had a higher number of non-important cases. Central Canada appeared to be the most capable region of providing an environment suitable for inventive activity. This was evident by the fact that there were forty-eight cases throughout this study which had a high number of inventions per 10,000 people. On the other hand, there were thirty-two cases which had a low number of inventions per 10,000 people.

TABLE 6: **CLASSIFICATION OF STANDARDIZED INVENTIVE ACTIVITY IN CANADA**

	NUMBER OF IMPORTANT STANDARDIZED CASES*	NUMBER OF MODERATE STANDARDIZED CASES*	NUMBER OF NON-IMPORTANT STANDARDIZED CASES*
MARITIME CENTERS	2	2	8
WESTERN CENTERS	6	8	23
CENTRAL CANADIAN CENTERS	48	21	32

* the number of times the same and/or different urban centers had a high or low number of inventions per 10,000 people between 1881 and 1986

In summary, Central Canada's ability to produce healthy inventive centers is likely attributed to many factors ie; geography, politics, economics, demography and industry. This finding complements that found in Table 5. Basically, urban centers which were located within the Quebec City to Windsor axis benefited from their location within this urban system, and therefore, experienced higher levels of inventiveness.

5.1.5 TRENDS IN THE RELATIVE INVENTIVE ANALYSIS

Of the concentrated inventive impulses analysed, the most significant trend from 1881 to 1986 has been the overall decline in inventive activity per 10,000 population (Table 5). The peaks of inventive activity, when examining inventive activity per 10,000 population for concentrated urban impulses, occurred in 1901 and 1961-71; in which the second peak was less

significant. This decline in inventive activity would suggest that Stafford's (1952, pp.593-45) postulation, that inventive activity in North America as a whole is declining, is accurate. However, it might be suggested that inventive activity has not declined. This can be explained by the quality of patents over time. A greater number of patents in 1901 may have been non-important compared to those in 1961. In 1900, practically any concept could be patented, whereas today, a new concept must be significant enough before it is accepted by the patent registry. In effect, the decline in inventive activity found in this study probably reflects this tougher standard applied to modern-day patents. Also, in 1900 much of the inventive activity that did take place usually served the inventor within his geographic region and had less impact in the national economy. By 1961, patents tended to be more basic and served a larger geographic area.

As urban and industrial concentration developed, inventive concentration followed, especially in the latter years of this study. It can also be suggested, that the most important patents are made close to corporate headquarters, which are usually located within large urban centers, therefore, the relative importance of Toronto should have also increased throughout this study. This appeared to have occurred, and to a lesser degree, in Montreal. Since 1881, their relative inventiveness appears to have increased in importance. In essence, they were the two most inventive centers by 1986. Further, Vancouver appeared to be taking the same path since 1951.

5.1.6 SUMMARY OF RELATIVE INVENTIVE PATTERNS

Those centers which possessed indigenous qualities favourable to inventive activity prior to 1921, were located in all three geographic regions. That is, the Maritime's had significant inventive activity from 1881 to 1911; the West, from 1881 to 1921, and; Central Canada, from 1881 to 1921. Therefore, all three regions possessed qualities capable of nourishing inventive activity. However, since 1941 Central Canada appeared to be the only geographic region that generated above average inventive activity. The increasingly competitive nature of modern industries probably requires special needs which only an advanced urban system can provide. Therefore, it is not surprising to see that Toronto and Montreal made comparatively significant inventive gains during this time period. Vancouver also appears to be taking the same path. However, due to its peripheral location and characteristics it is difficult to determine at what point Vancouver will compete effectively with Toronto and Montreal.

5.2 INVENTIVE ACTIVITY AND NATIONAL GROWTH

The purpose of this section is to examine traditional indicators of economic healthiness with that of inventive activity. Population , growth and unemployment levels are hypothesized to be caused by inventive activity. The data collected was for major Census Metropolitan Areas as defined by Statistics Canada. It will be expected, that those urban centers which had higher levels of relative inventive activity in 1981 will have experienced lower levels of unemployment and higher levels of population growth.

5.2.1 INVENTIVENESS AND POPULATION GROWTH

In an attempt to determine an overall pattern between inventive activity and urban growth, the number of trademarks per 10,000 population in 1981 was regressed to the percentage of population growth between 1981 and 1986 for 24 major Census Metropolitan Areas in Canada. A brief glance at Appendix D would indicate that those urban centers which were less inventive in 1981 were more likely to experience slower population growth between 1981 and 1986.

To explain why some centers experienced greater or less than the expected levels of population growth between 1981 and 1986 when compared to inventive activity in 1981, a regression analysis was performed using the same data in Appendix D. The number of trademarks per 10,000 population was the independent variable and the percentage of population growth between 1981 and 1986 was the dependent variable (Appendix E). There were 24 cases representing the major Census Metropolitan Areas in Canada.

The regression model held that one-quarter (R square = .259) of a community's future population growth can be accounted for by inventive activity. It should be noted, that patent transfer and imitations will create economic benefits elsewhere. It can also be held that inventive activity and urban growth are symbiotic in nature. Therefore, it is not surprising to find that inventive activity could only accounted for one-quarter of a centers population growth. In addition, the model found this relationship to be positive and significant; a Beta value of .508 (the value is positive) and a Significant level of the T value of .011 (T value = 2.77) was produced.

In addition, the regression model found ten centers which had significantly higher or lower levels of population growth between 1981 and 1986 when compared to inventive activity for 24 census cases. In essence, the model subtracted the actual percentages of population growth from the predicted values (taking inventive activity into consideration). These value differences were defined by the model as residuals. The model than standardized these values to produce Z residuals. Those centers which deviated significantly from what the regression model had predicted are given in Table 7.

TABLE 7: OUTLIERS IN REGRESSION ANALYSIS: INVENTIVE ACTIVITY (X) COMPARED TO POPULATION GROWTH (Y) FOR MAJOR C.M.A.'S IN CANADA

C.M.A.	Z Residual	C.M.A.	Z Residual
Saskatoon	2.28	Vancouver	1.05
Sudbury	-1.78	Montreal	-1.05
Oshawa	1.38	Thunder Bay	-1.03
Ottawa	1.36	Hamilton	-.69
St Catharines	-1.14	Regina	.93

In short, of the ten major outliers identified in the regression model, five were positive and five were negative. The positive outliers or residuals in the regression model were: Saskatoon, Oshawa, Ottawa, Vancouver and Regina. It is not surprising that three of the five positive outliers were from the West. Much of this pattern is due to the fact that the regression equation under-predicted this growth. Much of the growth was not due to inventive activity alone, but to economic activities in the natural resource sector. Although this population growth levelled-off by the mid-1980's, it was not enough to off-set the gains made in the early 1980's. In addition to an active economy, Oshawa's higher then expected population growth may be explained by migrants from Toronto looking for a less expensive and congested place to live. Lastly, Ottawa's population growth was higher then expected, because this center serves an important political function as the nation's capital which may have encouraged higher then expected levels of population growth.

Those urban centers which had lower then expected levels of population growth when inventive activity was taken into consideration were Sudbury, St Catharines, Montreal, Thunder Bay and Hamilton. Sudbury, St Catharines, Thunder Bay and Hamilton experienced lower then expected population growth due to their local economic structures,ie; each had a specialized industrial base. Thunder Bay's economy is based on shipping; Hamilton and St Catharines are steel producing and fabricating centers, and; Sudbury is a mining community. For example, Hamilton's specialized industrial structure in metal production and fabrication may continue to be a viable area for producing entrepreneurial activities, however, its population growth has been stiffened due to its degree of industrial concentration in one manufacturing sector. In

the case of Thunder Bay and Sudbury, they both experienced low levels of inventive activity anyway. This could have compounded itself to make population growth even less significant. Montreal's dilemma lies in the fact that population growth was not as significant as it could have been. The fact that Quebec experienced political problems in the early 1980's, which was compounded by an economic recession, also in the early 1980's, could explain slow population growth in this center. This is also complemented by the fact that Quebec experienced negative net-migration by 1985-1986 (Hecht, 1986, p.29). As economic activity left Montreal in the early 1980's, population growth was slower than what it could have been. The regression model also found the remaining urban centers, identified in Appendix D, as possessing close to the expected percentages of population growth between 1981 and 1986 when inventive activity in 1981 was taken into consideration.

Lastly, a scatter-diagram of the above variables and centers (found in Appendix D) shows a positive relationship between inventive activity and population growth (figure 10). As expected those urban centers which were classified as major outliers in the above regression model tended to be located further away from the line of best fit, ie; Saskatoon, Sudbury, Ottawa, Oshawa, Thunder Bay, St. Catharines-Niagara Falls and Vancouver. Those centers which were identified as positive outliers (or residuals) in the regression model can be found above the line of best fit in figure 10. On the other hand, those centers which were identified as negative outliers can be found below the line of best fit.

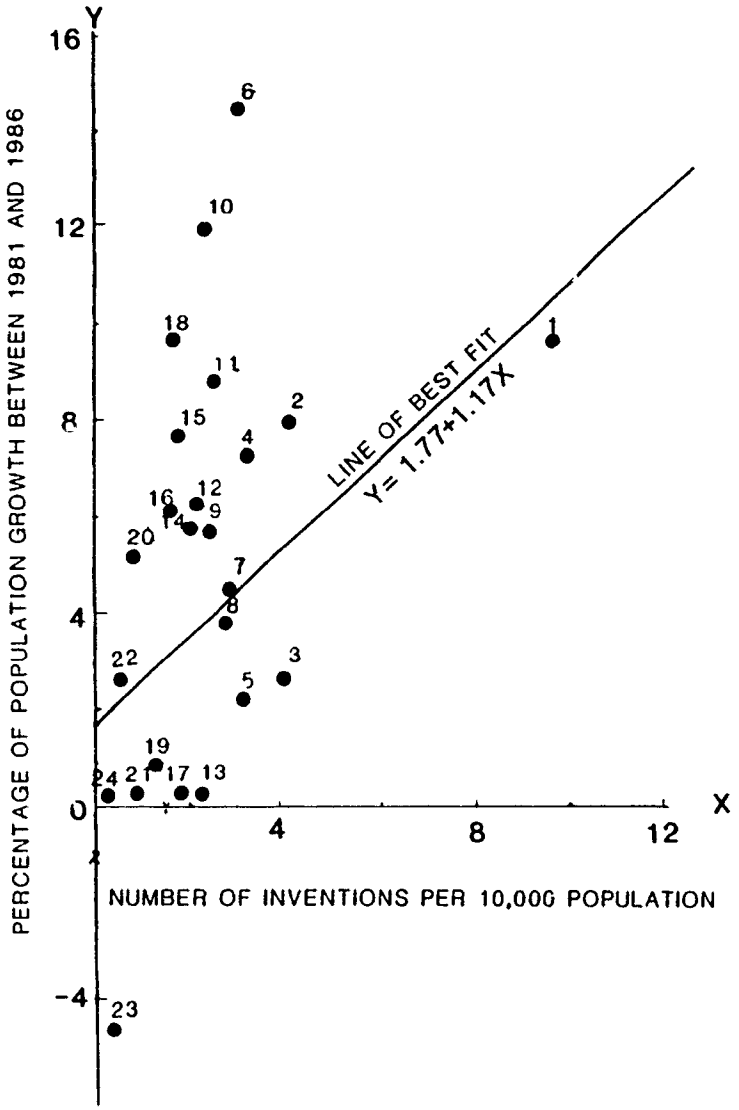
FIGURE 10: SCATTER-DIAGRAM OF INVENTIVE ACTIVITY (X) COMPARED

TO POPULATION GROWTH (Y) FOR MAJOR C.M.A.'S IN CANADA

LEGEND

C.M.A.

1 Toronto
2 Kitchener
3 Hamilton
4 Calgary
5 Montreal
6 Saskatoon
7 London
8 Sherebrooke
9 Winnipeg
10 Ottawa
11 Vancouver
12 Halifax
13 St. Catharines-Niagara Falls
14 Victoria
15 Regina
16 Edmonton
17 Thunder Bay
18 Oshawa
19 Windsor
20 St John's
21 Saint John
22 Trois-Rivieres
23 Sudbury
24 Chicoutimi



5.2.2 INVENTIVENESS AND UNEMPLOYMENT CONDITIONS

In a second attempt to reveal the relationship between inventive activity and urban growth, inventive activity was compared to future unemployment data (Appendix D). A brief glance of Appendix D would suggest that those urban centers which had lower levels of inventive activity in 1981 were more likely to experience greater levels of unemployment in 1986 (unemployment in this case, represents the number of unemployed persons as a percent of the labour force fifteen years of age and over). In an attempt to understand the above relationship more clearly, a regression analysis between the number of inventions per 10,000 population (independent variable) in 1981 and unemployment levels (dependent variable) in 1986 (July) for major Census Metropolitan Areas in Canada was produced (Appendix F).

The regression model revealed that thirty percent (R square = .307) of a community's future level of unemployment can be traced to past inventive activity. As noted earlier, the R square value will not be significant because patented innovations can be imitated and transferred.
As expected, this relationship was negative and significant. That is, the Beta value was -.55 and the Significant level of the T value was .006 (T value = 3.05).

In addition, the regression model again identified ten outliers; three were positive and seven were negative (Table 8). In summary, three urban centers had higher then expected levels of unemployment in 1986, and seven urban centers had lower then expected levels of unemployment in 1986, when

inventive activity in 1981 for 24 major Census Metropolitan Areas was taken into consideration. The outliers found in the regression model are in Table 8.

TABLE 8: OUTLIERS IN THE REGRESSION MODEL: INVENTIVE ACTIVITY (X) AND UNEMPLOYMENT LEVELS (Y) FOR MAJOR C.M.A.'s IN CANADA

C.M.A.	Z Residual	C.M.A.	Z Residual
Oshawa	-1.42	Chicoutimi	-1.20
Regina	-1.37	Winnipeg	-1.11
Halifax	1.33	London	-1.07
Thunder Bay	-1.25	Trois Rivieres	1.03
ST John's	1.22	Kitchener	-1.02

Those urban centers which had higher then expected levels of unemployment in 1986 were Halifax, St. John's and Trois Rivieres.

It can be suggested that Halifax, St. John's and Trois-Rivieres are located in eastern part of Canada, and as such, have not developed strong diversified industrial economies. Further, these centers have been slow in recovering from the economic recession in the early 1980's.

Those urban centers which had lower then predicted levels of unemployment in 1986 were Oshawa, Regina, Thunder Bay, Chicoutimi, Winnipeg, London and Kitchener. Oshawa likely had a lower then expected unemployment rate since its economy benefited from a healthy demand for finished automobiles and parts; which is a major economic activity in this center. As well, it can be argued that the cities of London and Kitchener have strong industrial economies which rebounded after the economic recession in the early 1980's. It can be said, that Winnipeg has benefited from its closer ties to Toronto and has developed a strong financial, insurance, real-estate and administrative employment base. Regina is an anomaly in this study,

because one would expect it to have a higher unemployment rate. However, its relatively low unemployment rate in 1986 may be linked to its importance in administration as the provincial capital. Chicoutimi and Thunder Bay's lower then expected unemployment rate may be linked to an adequate industrial base capable of employing the local population, but as the previous analysis indicated, not very capable of encouraging significant population growth. The remaining urban centers in Appendix D have been identified by the regression model as possessing the expected levels of unemployment in 1986 when inventive activity was taken into consideration.

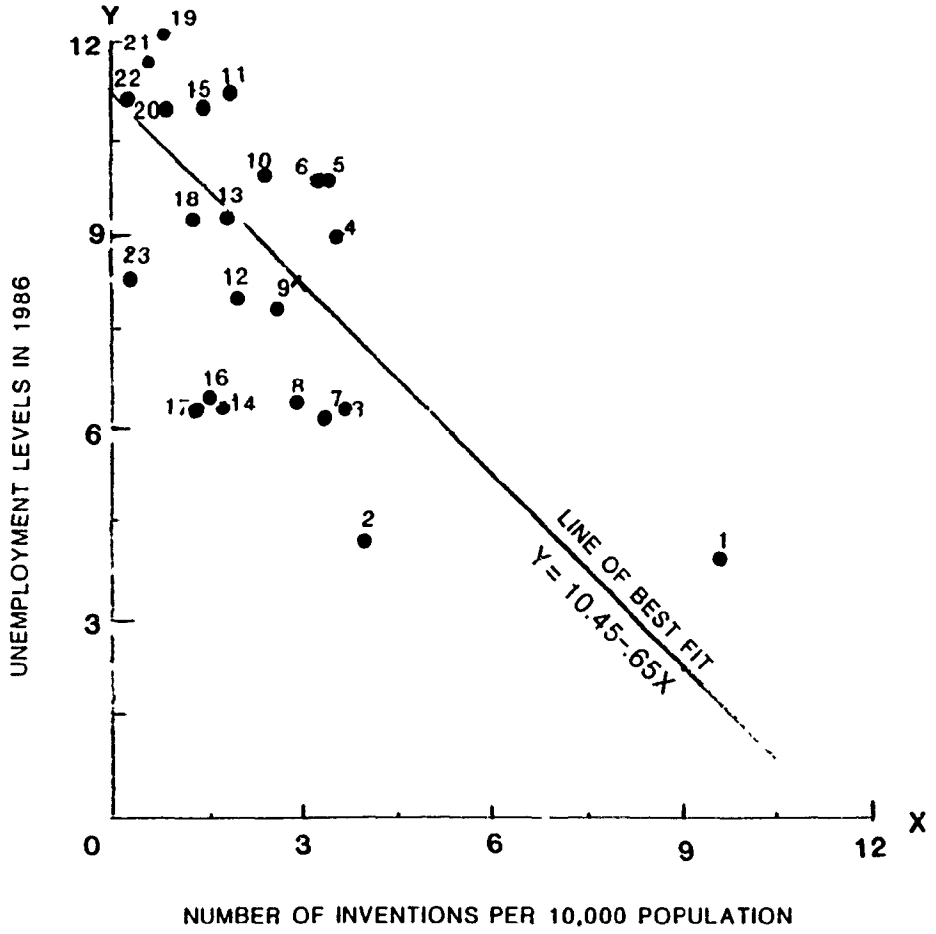
A scatter-diagram of the above variables and centers shows an expected negative relationship between inventive activity and unemployment levels (figure 11). The fit between these two variables is more tight compared to population growth data. This is also complemented by a higher R square value. As expected, many of those centers which were identified by the regression model as major outliers were further away from the line of best fit.

In summary, it was found that when inventive activity was compared separately to population growth and unemployment levels for major centers in Canada, one-quarter to one-third of the performance of these variables could be accounted for by inventive activity. Imitations of patented innovations and the symbiotic relationship between inventive activity and urban growth would explain why population growth and unemployment levels cannot be completely explained by inventive activity. Despite this, the continued economic growth of Central Canada when examining future population growth and unemployment levels due partially to inventive activity, would suggest that Central Canada can expect to maintain it's role as Canada's economic engine well into the next decade.

FIGURE 11: SCATTER-DIAGRAM OF INVENTIVE ACTIVITY (X) COMPARED TO UNEMPLOYMENT LEVELS (Y) FOR MAJOR C.M.A.'S IN CANADA

LEGEND

C.M.A.	
1	Toronto
2	Kitchener
3	Hamilton
4	Calgary
5	Montreal
6	Saskatoon
7	London
8	Winnipeg
9	Ottawa
10	Vancouver
11	Halifax
12	St. Catharines-Niagara Falls
13	Victoria
14	Regina
15	Edmonton
16	Thunder Bay
17	Oshawa
18	Windsor
19	St John's
20	Saint John
21	Trois-Rivieres
22	Sudbury
23	Chicoutimi



6.1 CONCLUSION

An analysis and description of the spatial aspect of Canadian inventions shows it to be very dynamic. However, an overall pattern of concentration towards the core region of Canada's inventive space economy exists. That is, early inventive activity in Canada, prior to 1900, was located mainly in Eastern and Central Canada. Between 1900 and 1930, indigenous activity was found mainly in Central and Western Canada. However, Central Canada appeared to be the only region capable of nourishing healthy levels of inventive activity between 1930 and 1950. The post-war years witnessed healthy levels of inventive activity in Central and Western Canada, and to a much lesser degree, in the Maritime region. Unfortunately, the economic recession in Canada in the early 1980's was accompanied by traditionally high levels of inventive activity only in Central Canada.

When examining concentrated inventive activity in these three regions, it was found that the Maritime region lacked concentrated inventive urban centers after 1911. The West on the other hand, was characterized by erratic inventive impulses between 1881 and 1986. This unstable inventive pattern was likely linked to urban economies which were too dependent on natural resource activities and/or lacked a strong manufacturing base. Lastly, Central Canada can be described by two very strong inventive centers, Toronto and Montreal, with the former being stronger than the later. The political and economic

problems in Quebec in the early 1980's did not help Montreal's position. Further, Quebec has much of its inventive activity concentrated only within the Montreal area. Ontario on the other hand, has many inventive centers plus one large one in the case of Toronto. The importance of nearby inventive impulses around Toronto had increased over the post-war years. In 1951, Oshawa was the only concentrated inventive impulse close to Toronto. By 1986, Mississauga-Brampton, Markham-Richmond Hill, Oakville and Oshawa-Whitby had emerged as new clusters of inventive concentration.

The degree of inventive concentration in the Maritime, Central Canada and the West was even more evident when the total number of important, neutral and non-important standardized cases (invention per 10,000 population by urban center) of inventive activity were analysed, it was found that Central Canada was the only region that continuously produced high levels of inventive activity.

Early Canadian inventive activity was found to be more ubiquitous across the Canadian space economy, than it is today . Between 1880 and 1900, small towns were found to be important contributors of Canadian inventive activity. In one sense, this is not surprising considering economic activities at this time were less dependent on the benefits derived from urban economies of scale. However, the twentieth century witnessed large manufacturing and urban concentrations. This process was also complemented by inventive concentration. Secondly, periods of high increases in inventive concentration occurred at roughly the same time as periods of high levels of mergers and acquisitions. Since Central Canada was seemingly the most suitable region in Canada to

accommodate urban-economic concentration, inventive activity was naturally better represented in this region. The outcome of this process of inventive concentration was evident by the fact that there were fewer concentrated urban inventive centers in the Canadian inventive space economy by 1941. Also, these fewer centers accounted for a larger percentage of Canadian urban inventive activity.

Inventive Canada decreased in size over the post-wa years. At f st, in 1951-61 the core region was defined by inventive impulses from Quebec City to Sarnia. By 1. ., this economic region had decreased in size to an Oshawa to London axis with a trunk line to Hamilton and two island impulses in Ottawa and Montreal. By 1986, this regicn had again shrunk, this time to a Toronto to Kitchener axis with a trunk line towards Hamilton and a stronger island impulse in the Montreal area and a weaker one in Ottawa.

Lastly, it was found that when inventive activity was compared separately to population growth and unemployment levels for major urban centers in Canada, one-quarter to one-third of these variables could be accounted for by inventive activity. This, coupled with the earlier findings, would suggest that Central Canada can expect to maintain its role as Canada's economic engine well into the next decade.

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APPENDIX A: COMPARATIVE DATA FOR PATENT AND TRADEMARKS: 1964-1968.

SOURCE: DEPARTMENT OF CONSUMER AND CORPORATE AFFAIRS: ANNUAL REPORT ON PATENTS AND TRADEMARKS, 1964-1968.

NUMBER AND PERCENTAGE OF TRADEMARKS IN URBAN CENTERS IN 1964

CITY-TOWN-PROV.	NO.	TRDMKS	%
TORONTO ONT		76	31.53526
MONTREAL QUE		70	29.04564
WINNIPEG MAN		15	6.224066
CALGARY ALB		6	2.489626
VANCOUVER BC		6	2.489626
OTTAWA ONT		5	2.074688
SCARBOROUGH ONT		4	1.659751
BRAMPTON ONT		3	1.244813
ST LAUREL QUE		3	1.244813
ST CATHARINES ONT		3	1.244813
QUEBEC CITY QUE		3	1.244813
DON MILLS ONT		3	1.244813
CLARKSON ONT		3	1.244813
ST LAMBERT QUE		2	0.829875
ETOBICOKE ONT		2	0.829875
ORANGEVILLE ONT		2	0.829875
HALIFAX NS		2	0.829875
WINDSOR ONT		2	0.829875
WALKERVILLE ONT		2	0.829875
LACHINE QUE		2	0.829875
OAKVILLE ONT		2	0.829875
BURNABY BC		1	0.414937
PETERBOROUGH ONT		1	0.414937
BEAUCE QUE		1	0.414937
TILLSONBURG ONT		1	0.414937
HAMILTON ONT		1	0.414937
NIAGARA FALLS ONT		1	0.414937
BARRIE ONT		1	0.414937
LEVI QUE		1	0.414937
LONDON ONT		1	0.414937
WOODSTOCK ONT		1	0.414937
PRINCE ALBERT SASK		1	0.414937
ISLINGTON ONT		1	0.414937
LONGUEUIL QQUE		1	0.414937
MEDICINE HAT ALB		1	0.414937
WILLOWDALE ONT		1	0.414937
LEASIDE ONT		1	0.414937
REXDALE ONT		1	0.414937
WESTMOUNT QUE		1	0.414937
DRUMMONDVILLE QUE		1	0.414937
COBOURG ONT		1	0.414937
EDMONTON ALB		1	0.414937
PEMBROKE ONT		1	0.414937
GUELPH ONT		1	0.414937
VERDUN QUE		1	0.414937
KIRKLAND LAKE ONT		1	0.414937

241

NUMBER AND PERCENTAGE OF TRADEMARKS IN URBAN CENTERS IN 1965

CITY-TOWN-PROVINCE	NO.	TRDMKS	%
TORONTO ONT		76	29.92125
MONTREAL QUE		67	26.37795
CALGARY ALB		7	2.755905
REXDALE ONT		5	1.968503
WINNIPEG MAN		5	1.968503
BURNABY BC		5	1.968503
VANCOUVER BC		5	1.968503
LONDON ONT		5	1.968503
HAMILTON ONT		4	1.574803
KITCHENER ONT		4	1.574803
BRANTFORD ONT		4	1.574803
BARRIE ONT		3	1.181102
ETOBICOKE ONT		3	1.181102
DON MILLS ONT		3	1.181102
EDMONTON ALB		2	0.787401
WOODSTOCK ONT		2	0.787401
CHATHAM ONT		2	0.787401
QUEBEC CITY QUE		2	0.787401
ST LAURENT QUE		2	0.787401
POINTE CLAIRE QUE		2	0.787401
SCARBOROUGH ONT		2	0.787401
OUTREMONT QUE		2	0.787401
WESTON ONT		2	0.787401
PETERBOROUGH ONT		2	0.787401
COOKSVILLE ONT		2	0.787401
AJAX ONT		2	0.787401
BURLINGTON ONT		2	0.787401
ST JEROME QUE		2	0.787401
REGINA SASK		2	0.787401
MOOSE JAW SASK		2	0.787401
LACHINE QUE		1	0.393700
LONGUEUIL QUE		1	0.393700
SACKVILLE NB		1	0.393700
OTTAWA ONT		1	0.393700
CALT ONT		1	0.393700
KELOWNA BC		1	0.393700
TRURO NS		1	0.393700
KINGSTON ONT		1	0.393700
FREDERICTON NB		1	0.393700
HANTSPORT NS		1	0.393700
BRAMALEA ONT		1	0.393700
ST LAMBERT QUE		1	0.393700
BROCKVILLE ONT		1	0.393700
ST CATHARINES ONT		1	0.393700
AURORA ONT		1	0.393700
PRESTON ONT		1	0.393700
ACTON VALE QUE		1	0.393700
HULL QUE		1	0.393700
WATERLOO ONT		1	0.393700
GUELPH ONT		1	0.393700

NUMBER AND PERCENTAGE OF TRADEMARKS IN URBAN CENTERS IN 1966

CITY-TOWN-PROVINCE	TRDMKS.	%
MONTREAL QUE	81	28.42105
TORONTO ONT	70	24.56140
SCARBOROUGH ONT	9	3.157894
EDMONTON ALB	8	2.807017
VANCOUVER BC	8	2.807017
CALGARY ALB	7	2.456140
DON MILLS ONT	7	2.456140
DOWNSVIEW ONT	5	1.754385
REXDALE ONT	5	1.754385
WINNIPEG MAN	5	1.754385
OTTAWA ONT	4	1.403508
KITCHENER ONT	4	1.403508
BURNABY BC	4	1.403508
WINDSOR ONT	4	1.403508
WESTON ONT	3	1.052631
LONDON ONT	3	1.052631
QUEBEC CITY QUE	3	1.052631
SHERBROOKE QUE	3	1.052631
HAMILTON ONT	3	1.052631
ST LAURENT QUE	3	1.052631
BRANTFORD ONT	3	1.052631
ST CATHARINES ONT	2	0.701754
SASKATOON SASK	2	0.701754
HENSALL ONT	2	0.701754
PETERBOROUGH ONT	2	0.701754
CLARKSON ONT	2	0.701754
NEW WESTMINISTER BC	1	0.350877
STRATFORD ONT	1	0.350877
MOUNT ROYAL QUE	1	0.350877
BRAMALEA ONT	1	0.350877
BEDFORD ONT	1	0.350877
POINTE CLAIRE QUE	1	0.350877
FREDERICTON NB	1	0.350877
RICHMOND HILL ONT	1	0.350877
SAULT STE MARIE ONT	1	0.350877
AURORA ONT	1	0.350877
WHITBY ONT	1	0.350877
LONGUEUIL QUE	1	0.350877
THOROLD ONT	1	0.350877
PORT PERRY ONT	1	0.350877
BATAWA ONT	1	0.350877
WOODSTOCK ONT	1	0.350877
LEASIDE ONT	1	0.350877
CORNWALL ONT	1	0.350877
ETOBICOKE ONT	1	0.350877
WESTOCK ONT	1	0.350877
MONTAMAGNY QUE	1	0.350877
BATTLEFORD SASK	1	0.350877
ST JEAN QUE	1	0.350877
LAVAL QUE	1	0.350877

101

VICTORIA BC	1	0.393700
PORT CREDIT ONT	1	0.393700
OSHAWA ONT	1	0.393700
GRANBY QUE	1	0.393700
ALDERGROVE BC	1	0.393700
INDLEWOOD ONT	1	0.393700

254

SARNIA ONT	1	0.350877
PROTON ONT	1	0.350877
SIDNEY NS	1	0.350877
PORTAGE LA PRAIRIE MAN	1	0.350877
OWEN SOUND ONT	1	0.350877
DORVAL QUE	1	0.350877
BRAMPTON ONT	1	0.350877
ST JOHN'S NF	1	0.350877
GUELPH ONT	1	0.350877

285

NUMBER AND PERCENTAGE OF TRADEMARKS IN URBAN CENTERS IN 1967

CITY-TOWN-PROV.	NO. TRDMKS	%
TORONTO ONT	78	24.14860
MONTREAL QUE	78	24.14860
WINNIPEG MAN	22	6.811145
LONDON ONT	15	4.643962
VANCOUVER BC	15	4.643962
CALGARY ALB	9	2.786377
REXDALE ONT	6	1.857585
OTTAWA ONT	6	1.857585
QUEBEC CITY QUE	5	1.547987
HAMILTON ONT	4	1.238390
POINTE CLAIRE QUE	3	0.928792
EDMONTON ALB	3	0.928792
WILLOWDALE ONT	3	0.928792
KITCHENER ONT	3	0.928792
BATAWA ONT	3	0.928792
SASKATOON SASK	3	0.928792
VICTORIAVILLE QUE	3	0.928792
ISLINGTON ONT	3	0.928792
ST HYACINTHE QUE	3	0.928792
COOKSVILLE ONT	3	0.928792
SELKIRK MAN	3	0.928792
SHERBROOKE QUE	3	0.928792
MOUNT ROYAL QUE	2	0.619195
STE FOY QUE	2	0.619195
CORNWALL ONT	2	0.619195
ST JOHN'S NF	2	0 619195
BRANTFORD ONT	2	0.619195
RICHMOND QUE	2	0.619195
MIDLAND ONT	2	0.619195
WESTON ONT	2	0.619195
DON MILLS ONT	2	0.619195
PORT COLBORNE ONT	2	0.619195
ST LAURENT QUE	2	0.619195
DOWNSVIEW ONT	2	0.619195
BARRIE ONT	2	0.619195
SITTSVILLE ONT	1	0.309597
KAMPLOOPS BC	1	0.309597
PARIS ONT	1	0.309597
LAVAL QUE	1	0.309597
DAUPHIN MAN	1	0.309597
DUNCAN BC	1	0.309597
PORT CREDIT ONT	1	0.309597
THETFORD MINES	1	0.309597
WELLAND ONT	1	0.309597
MIMICO ONT	1	0.309597
SAINT JOHN NB	1	0.309597
HALIFAX NS	1	0.309597
GALT ONT	1	0.309597
TILLBURY ONT	1	0.309597
ST BONIFACE MAN	1	0.309597

NUMBER AND PERCENTAGE OF TRADEMARKS IN URBAN CENTERS IN 1968

CITY-TOWN-PROVINCE	NO. TRDMKS	%
TORONTO ONT	81	27.18120
MONTREAL QUE	72	24.16107
VANCOUVER BC	15	5.033557
WINNIPEG MAN	12	4.026845
OTTAWA ONT	9	3.020134
SCARBOROUGH ONT	6	2.013422
HAMILTON ONT	6	2.013422
DORVAL QUE	6	2.013422
LACHINE QUE	5	1.677852
LONDON ONT	5	1.677852
QUEBEC CITY QUE	4	1.342281
CALGARY ALB	4	1.342281
DON MILLS ONT	4	1.342281
BURNABY BC	3	1.006711
PRESTON ONT	3	1.006711
WILLOWDALE ONT	3	1.006711
LAVAL QUE	3	1.006711
WESTON ONT	2	0.671140
BURLINGTON ONT	2	0.671140
OAKVILLE ONT	2	0.671140
SHERBROOKE ONT	2	0.671140
KELOWNA BC	2	0.671140
VICTORIA BC	2	0.671140
REXDALE ONT	2	0.671140
MONCTON NB	2	0.671140
EDMONTON ALB	2	0.671140
DOWNSVIEW ONT	1	0.335570
WILLIAMS LAKE BC	1	0.335570
MOUNT ROYAL QUE	1	0.335570
ST PIERRE QUE	1	0.335570
RICHMOND HILL ONT	1	0.335570
MONTMAGNY UE	1	0.335570
BEAUCE QUE	1	0.335570
KINGSVILLE ONT	1	0.335570
HULL QUE	1	0.335570
POINTE CLAIRE QUE	1	0.335570
WOODBRIDGE ONT	1	0.335570
ETOBICOKE ONT	1	0.335570
ST HYACINTHE QUE	1	0.335570
MILLTOWN NB	1	0.335570
LA SALLE QUE	1	0.335570
ACTON ONT	1	0.335570
CHICOUTIMI QUE	1	0.335570
MONTAGNES QUE	1	0.335570
RICHMOND BC	1	0.335570
WINDSOR ONT	1	0.335570
SAULT STE MARIE ONT	1	0.335570
BRANTFORD ONT	1	0.335570
SARNIA ONT	1	0.335570

NEW WESTMINISTER BC	1	0.309597
JASPER ALB	1	0.309597
LONGUEUIL QUE	1	0.309597
COLLINGWOOD ONT	1	0.309597
PENTICTON ONT	1	0.309597
SARNIA ONT	1	0.309597
LACHINE QUE	1	0.309597
ST JEROME QUE	1	0.309597
	323	

KINGSTON ONT	1	0.335570
VICTORIA BC	1	0.335570
BRAMPTON ONT	1	0.335570
ST CATHARINES ONT	1	0.335570
PERTH ONT	1	0.335570
ST JOSEPH ONT	1	0.335570
WESTMOUNT QUE	1	0.335570
ST LAURENT QUE	1	0.335570
PETERBOROUGH ONT	1	0.335570
SOREL QUE	1	0.335570
WATERLOO ONT	1	0.335570
CENTERVILLE NB	1	0.335570
BURLINGTON ONT	1	0.335570
VALCOURT QUE	1	0.335570
MARIEVILLE ONT	1	0.335570
BELLEVILLE ONT	1	0.335570
	298	

NUMBER AND PERCENTAGE OF PATENTS IN URBAN CENTERS IN 1964

CITY-TOWN-PROVINCE	NO. PATENTS	%
[illegible]AL QUE	35	20.23121
TORONTO ONT	34	19.65317
VANCOUVER BC	7	4.046242
OTTAWA ONT	6	3.468208
SCARBOROUGH ONT	6	3.468208
OAKVILLE ONT	5	2.890173
PETERBOROUGH ONT	5	2.890173
LONDON ONT	4	2.312138
BRAMPTON ONT	4	2.312138
SARNIA ONT	3	1.734104
ST CATHARINES ONT	3	1.734104
LACHINE QUE	3	1.734104
OSHAWA ONT	3	1.734104
ST HILAIRE QUE	3	1.734104
HAMILTON ONT	3	1.734104
CALGARY ALB	2	1.156069
WESTMOUNT QUE	2	1.156069
EDMONTON ALB	2	1.156069
SURREY BC	2	1.156069
WILLOWDALE ONT	2	1.156069
QUEBEC CITY QUE	2	1.156069
GUELPH ONT	1	0.578034
NEWMARKET ONT	1	0.578034
WHITE ROCK BC	1	0.578034
ORILLIA ONT	1	0.578034
WESTON ONT	1	0.578034
BURLINGTON ONT	1	0.578034
ST LAMBERT QUE	1	0.578034
PREVILLE QUE	1	0.578034
ST ALBERT ALB	1	0.578034
OTTAWA ONT	1	0.578034
LINDER ALB	1	0.578034
LA SALLE QUE	1	0.578034
ST LAURENT QUE	1	0.578034
MIDLAND ONT	1	0.578034
BOWMANVILLE ONT	1	0.578034
ABBOTSFORD BC	1	0.578034
THETFORD MINES QUE	1	0.578034
RED DEER ALB	1	0.578034
BENDALE ONT	1	0.578034
HULL QUE	1	0.578034
KINGSTON ONT	1	0.578034
SCHEFFERVILLE QUE	1	0.578034
RICHMOND BC	1	0.578034
COOKSVILLE ONT	1	0.578034
WOODBRIDGE ONT	1	0.578034
VERDUN QUE	1	0.578034
WINNIPEG ONT	1	0.578034
TROIS RIVIERES QUE	1	0.578034
ISLINGTON ONT	1	0.578034

NUMBER AND PERCENTAGE OF PATENTS IN URBAN CENTERS IN CANADA IN 1965

CITY-TOWN-PROVINCE	NO. PATENTS	%
MONTREAL QUE	50	24.63054
TORONTO ONT	29	14.28571
OTTAWA ONT	14	6.896551
OAKVILLE ONT	9	4.433497
HAMILTON ONT	8	3.940886
LONDON ONT	6	2.955665
DON MILLS ONT	4	1.970443
CALGARY ALB	4	1.970443
LACHINE QUE	4	1.970443
VANCOUVER BC	4	1.970443
SCARBOROUGH ONT	4	1.970443
EDMONTON ALB	3	1.477832
ST LAURENT QUE	3	1.477832
DOWNSVIEW ONT	3	1.477832
WILLOWDALE ONT	2	0.985221
COPPERCLIFFF ONT	2	0.985221
FALCONBRIDGE ONT	2	0.985221
LA SALLE QUE	2	0.985221
WINNIPEG MAN	2	0.985221
NIAGARA FALLS ONT	2	0.985221
ST CATHARINES ONT	2	0.985221
WILLOWDALE ONT	2	0.985221
MOUNT ROYAL QUE	2	0.985221
VILLE LE MOGNE QUE	1	0.492610
ETOBICOKE ONT	1	0.492610
FABERVILLE QUE	1	0.492610
STRATFORD ONT	1	0.492610
CANDIAC QUE	1	0.492610
QUEBEC CITY QUE	1	0.492610
GALT ONT	1	0.492610
BEACONSFIELD QUE	1	0.492610
SUDBURY ONT	1	0.492610
DEEP RIVER ONT	1	0.492610
BURLINGTON ONT	1	0.492610
OUTREMONT QUE	1	0.492610
BLEHEIM ONT	1	0.492610
CATIERVILLE QUE	1	0.492610
WINDSOR ONT	1	0.492610
POINTE CLAIRE QUE	1	0.492610
SAULT STE MARIE ONT	1	0.492610
ARVIDA QUE	1	0.492610
PICKERING ONT	1	0.492610
CORNWALL ONT	1	0.492610
SCHEFFEVILLE QUE	1	0.492610
BELLEVILLE ONT	1	0.492610
BRAMPTON ONT	1	0.492610
OSHAWA ONT	1	0.492610
VERDUN QUE	1	0.492610
SAINT LUC QUE	1	0.492610
CAP DE LA MADELEINE QUE	1	0.492610

NUMBER AND PERCENTAGE OF PATENTS IN URBAN CENTERS IN 1966

CITY-TOWN-PROVINCE	NO. PATENTS	%
TORONTO ONT	38	23.03030
MONTREAL QUE	27	16.36363
VANCOUVER BC	10	6.060606
OTTAWA ONT	9	5.454545
OAKVILLE ONT	6	3.636363
SCARBOROUGH ONT	6	3.636363
EDMONTON ALB	4	2.424242
POINTE CLAIRE QUE	4	2.424242
ST CATHARINES ONT	3	1.818181
OSHAWA ONT	3	1.818181
ST LAURENT QUE	2	1.212121
ISLINGTON ONT	2	1.212121
GRANBY QUE	2	1.212121
ST DAVID QUE	2	1.212121
LA SALLE QUE	2	1.212121
SARNIA ONT	2	1.212121
HAMILTON ONT	2	1.212121
ST HILIARE QUE	2	1.212121
WOODSTOCK ONT	1	0.606060
MOUNT ROYAL QUE	1	0.606060
DEEP RIVER ONT	1	0.606060
DARTMOUTH NS	1	0.606060
GODERICH ONT	1	0.606060
CARDIFF ONT	1	0.606060
WEST HILL ONT	1	0.606060
PORT COLBORNE ONT	1	0.606060
PRESTON ONT	1	0.606060
GATINEAU QUE	1	0.606060
QUEBEC CITY QUE	1	0.606060
WATERLOO ONT	1	0.606060
REGINA SASK	1	0.606060
DOWNSVIEW ONT	1	0.606060
BARRIE ONT	1	0.606060
MORRISBURG ONT	1	0.606060
LONDON ONT	1	0.606060
WINNIPEG MAN	1	0.606060
VISCOUNT SASK	1	0.606060
LINDSAY ONT	1	0.606060
CHOMEDY QUE	1	0.606060
PORT RENFREW BC	1	0.606060
BURNABY BC	1	0.606060
PORT HOPE ONT	1	0.606060
SILLEY QUE	1	0.606060
JONQUIERE QUE	1	0.606060
WESTMOUNT QUE	1	0.606060
BURLINGTON ONT	1	0.606060
ROUYN QUE	1	0.606060
THORNHILL ONT	1	0.606060
SHERBROOKE QUE	1	0.606060
ROSETOWN SASK	1	0.606060
GATINEAU QUE	1	0.606060

DORVAL QUE	1	0.578034
GODERICH ONT	1	0.578034
NEW LISKEARD ONT	1	0.578034
CLARKSON ONT	1	0.578034
LIVELY ONT	1	0.578034
OUTREMONT QUE	1	0.578034
BROCKET ALB	1	0.578034
SAULT STE MARIE ONT	1	0.578034

173

BROWNSBURG QUE	1	0.492610
THREE RIVERS QUE	1	0.492610
VANCOUVER BC	1	0.492610
BAIE COMEAU QUE	1	0.492610
BEXDALE ONT	1	0.492610
QUEBEC CITY	1	0.492610
MARKHAM ONT	1	0.492610
DORVAL QUE	1	0.492610
KIMBERLY BC	1	0.492610
PORT CREDIT ONT	1	0.492610
BRANTFORD ONT	1	0.492610
STRATFORD ONT	1	0.492610
BARRIE ONT	1	0.492610

203

VICTORIA BC	1	0.606060
WELLAND ONT	1	0.606060
ETOBICOKE ONT	1	0.606060
STETLER ALB	1	0.606060
CALGARY ALB	1	0.606060
KITCHENER ONT	1	0.606060

165

NUMBER AND PERCENTAGE OF PATENTS IN URBAN CENTERS IN CANADA IN 1967

CITY-TOWN-PROV	NO.	PATENTS	%
TORONTO ONT	24		15.09433
MONTREAL QUE	24		15.09433
OTTAWA ONT	10		6.289308
VANCOUVER BC	7		4.402515
OAKVILLE ONT	6		3.773584
EDMONTON ALB	5		3.144654
HAMILTON ONT	5		3.144654
SCARBOROUGH ONT	5		3.144654
WESTON ONT	3		1.886792
CAMPBELL RIVER BC	3		1.886792
GUELPH ONT	3		1.886792
SAULT STE MARIE ONT	3		1.886792
PLESSISVILLE QUE	2		1.257861
PORT BURWELL ONT	2		1.257861
DARTMOUTH NS	2		1.257861
PORT CREDIT ONT	2		1.257861
CALGARY ALB	2		1.257861
ST THOMAS ONT	2		1.257861
WINNIPEG MAN	2		1.257861
WILLOWDALE ONT	2		1.257861
LONDON ONT	2		1.257861
WINDSOR ONT	2		1.257861
BLACK LAKE QUE	1		0.628930
ST FOY QUE	1		0.628930
CORNWALL ONT	1		0.628930
REXDALE ONT	1		0.628930
BRAMPTON ONT	1		0.628930
WALKERVILLE ONT	1		0.628930
THORNHILL ONT	1		0.628930
LONGUEUIL QUE	1		0.628930
TOFIELD ALB	1		0.628930
ST LAMBERT QUE	1		0.628930
POINTE CLAIRE QUE	1		0.628930
BARRIE ONT	1		0.628930
ERINDALE ONT	1		0.628930
ROSEMERE QUE	1		0.628930
GIMLI MAN	1		0.628930
WESTMOUNT QUE	1		0.628930
BURLINGTON ONT	1		0.628930
COOKSVILLE ONT	1		0.628930
LAMBTON VILLAGE QUE	1		0.628930
SHERBROOKE QUE	1		0.628930
ANDREW ABL	1		0.628930
BELLEVILLE ONT	1		0.628930
LA SALLE QUE	1		0.628930
ASSINIBOIA SASK	1		0.628930
ROUYN QUE	1		0.628930
SHAWINIGAN QUE	1		0.628930
MANEY BC	1		0.628930

NUMBERS AND PERCENTAGES OF PATENTS IN URBAN CENTERS IN 1968

CITY-TOWN-PROVINCE	NO.	PATENTS	%
TORONTO ONT	37		20.78651
MONTREAL QUE	36		20.22471
VANCOUVER BC	11		6.179775
OTTAWA ONT	7		3.932584
OAKVILLE ONT	7		3.932584
WILLOWDALE ONT	6		3.370786
SCARBOROUGH ONT	5		2.808988
CALGARY ALB	3		1.685393
COOKSVILLE ONT	3		1.685393
GUELPH ONT	3		1.685393
WESTON ONT	3		1.685393
EDMONTON ALB	3		1.685393
ST LAURENT QUE	3		1.685393
ISLINGTON ONT	2		1.123595
WHITBY ONT	2		1.123595
QUEBEC CITY QUE	2		1.123595
THORNHILL ONT	2		1.123595
STE HILIARE QUE	2		1.123595
OSHAWA ONT	2		1.123595
HAMILTON ONT	2		1.123595
DON MILLS ONT	2		1.123595
SARNIA ONT	2		1.123595
WESTMOUNT QUE	2		1.123595
COPPER CLIFF ONT	1		0.561797
DON MILLS ONT	1		0.561797
KINGSTON ONT	1		0.561797
LETHBRIDGE ALB	1		0.561797
REXDALE ONT	1		0.561797
VICTORIA BC	1		0.561797
ORMEAUX QUE	1		0.561797
GEORGETOWN ONT	1		0.561797
ST LAMBERT QUE	1		0.561797
ELLIOT LAKE ONT	1		0.561797
MILTON ONT	1		0.561797
BEACONSFIELD QUE	1		0.561797
WALLACEBUG ONT	1		0.561797
PORT CREDIT ONT	1		0.561797
WINNIPEG MAN	1		0.561797
POINTE CLAIRE ONT	1		0.561797
STREETSVILLE ONT	1		0.561797
DUNDAS ONT	1		0.561797
STE CLAIRE QUE	1		0.561797
NEW WESTMINISTER BC	1		0.561797
WINGHAM ONT	1		0.561797
PORT CREDIT ONT	1		0.561797
GRANBY QUE	1		0.561797
WOODBRIDGE ONT	1		0.561797
ARVIDA QUE	1		0.561797
BRAMPTON ONT	1		0.561797
BURLINGTON ONT	1		0.561797

CHAMELY	QUE	1 0.628930
ETOBICOKE	ONT	1 0.628930
ELLIOT LAKE	ONT	1 0.628930
COOKSVILLE	ONT	1 0.628930
BATAWA	ONT	1 0.628930
LINDSAY	ONT	1 0.628930
ST LAURENT	QUE	1 0.628930
STRATHMORE	QUE	1 0.628930
BEAUCE	QUE	1 0.628930
QUEBEC CITY	QUE	1 0.628930
RIVERSIDE	ONT	1 0.628930
AGINCOURT	ONT	1 0.628930
MILTON	ONT	1 0.628930

159

OSHAWA	ONT	1 0.561797
PRINCE RUPERT	BC	1 0.561797
WINDSOR	ONT	1 0.561797
LACHINE	QUE	1 0.561797

178

APPENDIX B: PATENT AND TRADEMARK DATA: 1881-1986.

SOURCE: DEPARTMENT OF AGRICULTURE, ANNUAL REPORT, 1881-1921.

DEPARTMENT OF CONSUMER AND CORPORATE AFFAIRS, ANNUAL REPORT ON PATENTS AND STATISTICS, 1931-1986.

NUMBER OF PATENTS IN URBAN CENTERS IN CANADA IN 1881

CITY-TOWN-PROVINCE	# OF PAT	%	POP	PER/10,000
MONTREAL QUE	20	16.00	140747	5.683957
TORONTO ONT	10	8.00	86415	4.628826
HAMILTON ONT	7	5.60	35961	7.786212
HALIFAX NS	5	4.00	31817	6.285947
PARIS ONT	5	4.00	3173	63.03183
IBERVILLE QUE	5	4.00	14459	13.83221
OSHAWA ONT	4	3.20	3992	40.08016
QUEBEC CITY QUE	2	1.60	62446	1.281106
LONDON ONT	2	1.60	19746	4.051453
KITCHENER ONT	2	1.60	4054	19.73359
SILOAM ONT	2	1.60	N.A.	
ST CATHARINES ONT	2	1.60	9631	8.306510
BROCKVILLE ONT	2	1.60	12514	6.392040
WINNIPEG MAN	2	1.60	7985	10.01878
ST JOHN QUE	2	1.60	12265	8.522625
SALEM ONT	1	0.80		
VICTORIA BC	1	0.80		
LOMBARDY ONT	1	0.80		
KENGON ONT	1	0.80		
ST REMI QUE	1	0.80		
ASHBURNHAM ONT	1	0.80		
MAITLAND ONT	1	0.80		
GUELPH ONT	1	0.80		
NORMANDY ONT	1	0.80		
PORTLAND NB	1	0.80		
AYLMER QUE	1	0.80		
DRESDEN ONT	1	0.80		
CAMPBELLTON NB	1	0.80		
TRURO NS	1	0.80		
FREDERICTON NB	1	0.80		
JORDAN ONT	1	0.80		
STRATHROY ONT	1	0.80		
BELLEVILLE ONT	1	0.80		
NEW PERTH PEI	1	0.80		
BARRIE ONT	1	0.80		
OAKVILLE ONT	1	0.80		
WESTMINISTER ONT	1	0.80		
BROCKVILLE ONT	1	0.80		
KINGSTON ONT	1	0.80		
HOCHELAGA QUE	1	0.80		
MIDDLETON ONT	1	0.80		
WOODSTOCK ONT	1	0.80		
FORT ERIE ONT	1	0.80		
CHAMBLY QUE	1	0.80		
RIDGETOWN ONT	1	0.80		
STRATHROY ONT	1	0.80		
BOSTON MILLS ONT	1	0.80		
BLYTHE ONT	1	0.80		

NUMBER OF PATENTS IN URBAN CENTERS IN CANADA IN 1891

CITY-TOWN-PROVINCE	# OF PA.	%	POP.	PER/10,000
TORONTO ONT	31	20.52980	144023	8.609735
MONTREAL QUE	28	18.54304	182695	6.130435
HAMILTON ONT	11	7.284768	47245	9.313154
OTTAWA ONT	6	3.973509	37269	6.439668
BELLEVILLE ONT	3	1.986754	9916	12.10165
WINDSOR ONT	2	1.324503	10322	7.750435
OSHAWA ONT	2	1.324503	4066	19.67535
LONGUEUIL QUE	2	1.324503	2757	29.01704
KITCHENER ONT	2	1.324503	7425	10.77441
ST JOHN NB	2	1.324503	24184	3.307972
SYDNEY NS	2	1.324503	2427	32.96250
DEHLI ONT	1	0.662251		
WOODBRIDGE ONT	1	0.662251		
GUELPH ONT	1	0.662251		
CAMPBELLFORD ONT	1	0.662251		
CANIFTON ONT	1	0.662251		
OAKVILLE ONT	1	0.662251		
VANCOUVER BC	1	0.662251		
KILBOURN NB	1	0.662251		
LONDON ONT	1	0.662251		
PEMBROKE ONT	1	0.662251		
WINNIPEG MAN	1	0.662251		
ST HYACINTHE QUE	1	0.662251		
PENETANGUISHENE ONT	1	0.662251		
MONTMAGNY QUE	1	0.662251		
RIMOUSKI QUE	1	0.662251		
BRAMPTON ONT	1	0.662251		
PORT PERRY ONT	1	0.662251		
WESTPORT NS	1	0.662251		
ELMIRA ONT	1	0.662251		
BURLINGTON ONT	1	0.662251		
WARDEN QUE	1	0.662251		
KINGSTON ONT	1	0.662251		
EARDLEY QUE	1	0.662251		
ST BRIGIDE QUE	1	0.662251		
COWANSVILLE QUE	1	0.662251		
THOROLD ONT	1	0.662251		
PRESCOTT ONT	1	0.662251		
WEST LORNE ONT	1	0.662251		
ALGOMA MILLS ONT	1	0.662251		
QUEBEC CITY QUE	1	0.662251		
CHATHAM ONT	1	0.662251		
CLAREMCEVILLE QUE	1	0.662251		
HALIFAX NS	1	0.662251		
MIDDLETON ONT	1	0.662251		
GODERICH ONT	1	0.662251		
DUNWICH ONT	1	0.662251		
NEW WESTMINISTER BC	1	0.662251		
IROQUOIS ONT	1	0.662251		
MORDEN MAN	1	0.662251		

NUMBER OF PATENTS IN URBAN CENTERS IN CANADA IN 1901

CITY-TOWN-PROVINCE	# OF PAT	%	POP.	PER/10,000
TORONTO ONT	42	22.58064	156098	10.76246
MONTREAL QUE	16	8.602150	203078	3.151498
VANCOUVER BC	8	4.301075	27010	11.84746
KINGSTON ONT	4	2.150537	3176	50.37783
OTTAWA ONT	4	2.150537	57640	2.775850
HAMILTON ONT	4	2.150 7	52634	3.039860
ST JOHN NB	3	1.612903	51759	2.318437
FREDERICTON NB	3	1.612903	7117	16.86103
WINNIPEG MAN	3	1.612903	42340	2.834199
NEW WISTMINISTER BC	3	1.612903	23822	5.037360
WINDSOR ONT	3	1.612903	3720	32.25806
NIAGRA FALLS ONT	2	1.075268	4244	18.85014
BELOEIL QUE	2	1.075268	1661	48.16375
FENELON FALLS ONT	2	1.075268	1132	70.67137
CUMBERLAND BC	2	1.075268		
BRADFORD ONT	2	1.075268	904	81.30081
VICTORIA ONT	2	1.075268		
PERTH ONT	2	1.075268	3588	22.29654
SUDBURY ONT	2	1.075268	2023	39.54522
LONDON ONT	2	1.075268	24415	3.276674
BRANDON MAN	2	1.075268	5620	14.23487
WATERLOO QUE	2	1.075268	1797	44.51864
VARENNES QUE	1	0.537634		
ORISS MAN	1	0.537634		
[illegible]ACOE ONT	1	0.537634		
ROWNTHWAITE MAN	1	0.537634		
SHERBROOKE QUE	1	0.537634		
AYTON ONT	1	0.537634		
COLLINGWORTH ONT	1	0.537634		
RINSMORE MAN	1	0.537634		
MILDMAY ONT	1	0.537634		
L'ASSOMPTION QUE	1	0.537634		
CHENEVILLE ONT	1	0.537634		
HESPLER ONT	1	0.537634		
PICTON ONT	1	0.537634		
NANAIMO BC	1	0.537634		
GALT ONT	1	0.537634		
MARLBANK ONT	1	0.537634		
EDGAR MILLS ONT	1	0.537634		
HARTLAND NB	1	0.537634		
QUEBEC CITY QUE	1	0.537634		
STOKES BAY ONT	1	0.537634		
PALMERSTON ONT	1	0.537634		
APPLE HILL ONT	1	0.537634		
GLENDYER NS	1	0.537634		
REVELSTOKE BC	1	0.537634		
VICTORIA BC	1	0.537634		
WALLACEBURY ONT	1	0.537634		
TWEED ONT	1	0.537634		

UXBRIDGE ONT	1	0.80
SIDNEY ONT	1	0.80
GALT ONT	1	0.80
PORT HOPE ONT	1	0.80
DUFFIN'S CREEK ONT	1	0.80
FENELON FALLS ONT	1	0.80
MORRISBURG ONT	1	0.80
BRAMPTON FALLS QUE	1	0.80
BURGOYNE QUE	1	0.80
JARVIS ONT	1	0.80
ST SOPHIA QUE	1	0.80
ELORA ONT	1	0.80
COBOURG ONT	1	0.80
STRATFORD ONT	1	0.80
STAGNER ONT	1	0.80
SIMCOE ONT	1	0.80
OTTAWA ONT	1	0.80
SWEETBURG QUE	1	0.80
ST HYACINTHE QUE	1	0.80
ORONO ONT	1	0.80

125

WOODSTOCK ONT	1	0.662251
INGERSOLL ONT	1	0.662251
DOON ONT	1	0.662251
BROCKVILLE ONT	1	0.662251
VALLEY FIELD QUE	1	0.662251
PORT DOVER ONT	1	0.662251
SELKIRK ONT	1	0.662251
BARRIE ONT	1	0.662251
MC CLELLAND MAN	1	0.662251
FENELON FALLS ONT	1	0.662251
SUDBURY ONT	1	0.662251
CHATHAM NB	1	0.662251
GEORGETOWN ONT	1	0.662251
BROOKLYN NS	1	0.662251
BRANTFORD ONT	1	0.662251
MORRISBURG ONT	1	0.662251
VICTORIAVILLE QUE	1	0.662251
CONCESION ONT	1	0.662251
NEW MARKET ONT	1	0.662251
HIGHLAND CREEK ONT	1	0.662251
TRENTON ONT	1	0.662251

151

PETITCODIAC NB	1	0.537634
BLACK CREEK ONT	1	0.537634
PLESSISVILLE QUE	1	0.537634
SAND HILL QUE	1	0.537634
ASTON JUNCTION QUE	1	0.537634
INVERARY ONT	1	0.537634
AMHERST NS	1	0.537634
COOKSVILLE ONT	1	0.537634
GUELPH ONT	1	0.537634
WASSEWA MAN	1	0.537634
DUNDAS ONT	1	0.537634
WATERVILLE QUE	1	0.537634
LITTLE METIS QUE	1	0.537634
SOUTHAMPTON ONT	1	0.537634
ST CLAUDE MAN	1	0.537634
HOWARD MAN	1	0.537634
LORETTE MAN	1	0.537634
LEAMINGTON ONT	1	0.537634
CHATHAM ONT	1	0.537634
ALEXANDRIA ONT	1	0.537634
LUCKNOW ONT	1	0.537634
CHICOUTIMI QUE	1	537634
SOREL QUE	1	0.537634
ELGIN ONT	1	0.537634
KINGSVILLE ONT	1	0.537634
HUNNAHAM ONT	1	0.537634
CALGARY ALB	1	0.537634
ST CATHARINES ONT	1	0.537634
BROWNS CORNER ONT	1	0.537634
HARRISTON ONT	1	0.537634
TILLSONBURG ONT	1	0.537634
VALLEY STATION NS	1	0.537634
KAMLOOPS BC	1	0.537634
WINGHAM ONT	1	0.537634
SANDON BC	1	0.537634
LONGUE POINTE QUE	1	0.537634
CARMAN MAN	1	0.537634
AYLMER QUE	1	0.537634
WINDSOR ONT	1	0.537634
PETERBOROUGH ONT	1	0.537634
COPETOWN ONT	1	0.537634
WHITTINGTON ONT	1	0.537634
VICTORIA BC	1	0.537634
READY ONT	1	0.537634

186

NUMBER OF PATENTS IN URBAN CENTERS In CANADA IN 1911

CITY-TOWN-PROVINCE	NO.PATENTS	%	POP.	PER/10,000
TORONTO ONT	66	21.15384	381833	6.914017
MONTREAL QUE	48	15.38461	490504	3.914341
WINNIPEG MAN	15	4.807692	136035	4.410629
VANCOUVER BC	14	4.487179	100401	5.577633
HAMILTON ONT	14	4.487179	81969	6.831851
OTTAWA ONT	14	4.487179	87062	6.432197
KITCHENER ONT	5	1.602564	15196	13.16135
EDMONTON ALB	5	1.602564	24900	8.032128
WESTMOUNT QUE	4	1.282051	14579	10.97468
NEW GLASGOW NS	4	1.282051	6383	25.06658
HALIFAX NS	3	0.961538	46619	2.574057
HERBERT SASK	3	0.961538		
PICTOU NS	2	0.641025		
SHERBROOKE QUE	2	0.641025		
ST JOHN NB	2	0.641025		
PORT HOOD NS	2	0.641025		
BRANTFORD ONT	2	0.641025		
LUCKNOW ONT	1	0.320512		
DUVERNAY ALB	1	0.320512		
RAINY RIVER ONT	1	0.320512		
GILBERT PLAINS MAN	1	0.320512		
ST MARTIN QUE	1	0.320512		
BRIGHTWATER BC	1	0.320512		
LERMAN SASK	1	0.320512		
CARENDUFF SASK	1	0.320512		
HULL QUE	1	0.320512		
CLARESHOM ALB	1	0.320512		
VICTORIA BC	1	0.320512		
HEATHCOTE ONT	1	0.320512		
JULIETTE QUE	1	0.320512		
STONEY MOUNTAIN MAN	1	0.320512		
ST FAUSTINE STATION QUE	1	0.320512		
PRINCEVILLE ONT	1	0.320512		
PARRY SOUND ONT	1	0.320512		
ST MARY'S ONT	1	0.320512		
ANNON ONT	1	0.320512		
LOUISBURG NS	1	0.320512		
ROCKINGHAM ONT	1	0.320512		
COBALT ONT	1	0.320512		
ELMWOOD ONT	1	0.320512		
GADSBY ALB	1	0.320512		
ST JOHN'S NF	1	0.320512		
BRADFORD ONT	1	0.320512		
OXBOW SASK	1	0.320512		
WOODSLEE ONT	1	0.320512		
WATERFORD ONT	1	0.320512		
NIAGARA FALLS ONT	1	0.320512		
LEMBERG SASK	1	0.320512		
GEORGETOWN ONT	1	0.320512		

NUMBER AND PERCENTAGE OF PATENTS IN URBAN CENTERS IN CANADA IN 192[illegible]

CITY-TOWN-PROVINCE	NO.PATENTS	%	POP.	PER 10,000
TORONTO ONT	92	22.38442	521893	7.05
MONTREAL QUE	65	15.81508	618506	4.2
VANCOUVER BC	26	6.326034	117217	8.87
HAMILTON ONT	19	4.622871	114151	6.65
WINNIPEG MAN	15	3.649635	179087	3.35
OTTAWA ONT	13	3.163017	107843	4.82
CALGARY ALB	11	2.676399	63305	6.95
VICTORIA BC	6	1.459854	38727	6.19
MAISONNEUVE QUE	6	1.459854	40476	5.92
EDMONTON ALB	5	1.216545	58821	3.4
DUNDAS ONT	4	0.973236	4978	32.14
NEW WESTMINISTER BC	4	0.973236	14495	11.03
NIAGARA FALLS ONT	3	0.7299[illegible]		
PETERBOROUGH ONT	3	0.729927		
QUEBEC CITY QUE	3	0.729927		
BRANTFORD ONT	3	0.729927		
KITCHENER ONT	2	0.486618		
LONDON ONT	2	0.486618		
ST CATHARINES ONT	2	0.486618		
WINDSOR ONT	2	0.486618		
SHERBROOKE QUE	2	0.486618		
PARIS ONT	2	0.486618		
GUELPH ONT	2	0.486618		
SASKATOON SASK	2	0.486618		
ST LAMBERT QUE	2	0.486618		
STRATFORD ONT	2	0.486618		
CHATHAM ONT	2	0.486618		
PERTH ONT	2	0.486618		
MONCTON NB	2	0.486618		
LEVIS QUE	2	0.486618		
SHAWINIGAN QUE	2	0.486618		
WELLAND ONT	2	0.486618		
HALIFAX NS	2	0.486618		
BOWMANVILLE ONT	1	0.243309		
DUBUC SASK	1	0.243309		
BIG VA[illegible]EY ALB	1	0.243309		
MEDICINE HAT ALB	1	0.243309		
PARRY SOUND ONT	1	0.243309		
BROCKVILLE ONT	1	0.243309		
EAST ANGUS QUE	1	0.243309		
TWIN VALLEY ONT	1	0.243309		
GRAND MERE QUE	1	0.243309		
SYDNEY NS	1	0.243309		
FERGUS ONT	1	0.243309		
CAP TOURMENTE QUE	1	0.243309		
GRAY SASK	1	0.243309		
SHAUNAVON SASK	1	0.243309		
THREE RIVERS QUE	1	0.243309		
BENGOUGH SASK	1	0.243309		

NUMBER OF PATENTS IN URBAN CENTERS IN CANADA IN 1931

CITY-TOWN-PROVINCE	NO.PATENTS	%	POP.	PER/10,[illegible]
MONTREAL QUE	65	23.29749	618577	3.17
TORONTO ONT	64	22.93906	631207	4.05
HAMILTON ONT	29	10.39[illegible]26	155547	7.45
OTTAWA ONT	11	3.942652	126872	3.46
WINNIPEG MAN	6	2.150537	218785	1.09
VANCOUVER BC	6	2.150537	246593	.97
BRANTFORD ONT	4	1.433691	32274	4.95
GALT ONT	7	2.508960	30107	9.3
EDMONTON ALB	3	1.075268	79197	1.51
ST CATHAR[illegible]NES ONT	3	1.075268	24753	4.84
LONDON ONT	2	0.716845		
OUTREMONT QUE	2	0.716845		
LIMERICK SASK	2	0.716845		
REGINA SASK	2	0.716845		
CALGARY ALB	2	0.716845		
GRIMSBY ONT	2	0.716845		
WINDSOR ONT	2	0.716845		
LACHINE QUE	2	0.716845		
PETERBOROUGH ONT	2	0.716845		
VERDUN QUE	2	0.716845		
BARRIE ONT	2	0.716845		
HANTON ALB	1	0.358422		
HAWKESBURY ONT	1	0.358422		
KINGSTON ONT	1	0.358422		
WATERLOO ONT	1	0.358422		
BRIDGEBURG ONT	1	0.358422		
SAINT JOHN NB	1	0.358422		
KENOBERT SASK	1	0.358422		
CRANE VALLEY SASK	1	0.358422		
CESSFORD ALB	1	0.358422		
CORNWALL ONT	1	0.358422		
PERTH ONT	1	0.358422		
STRATFORD ONT	1	0.358422		
OSHAWA ONT	1	0.358422		
WATERFORD ONT	1	0.358422		
ALLANDALE ONT	1	0.358422		
BELLEVILLE ONT	1	0.358422		
PORT HARRY BC	1	0.358422		
CADILLAC SASK	1	0.358422		
GUELPH ONT	1	0.358422		
HALIFAX NS	1	0.358422		
LARDER LAKE ONT	1	0.358422		
ROSEISLE MAN	1	0.358422		
MORDEN MAN	1	0.358422		
PEMBROKE ONT	1	0.358422		
SHAWINIGAN FALLS QUE	1	0.358422		
ST THOMAS ONT	1	0.358422		
NOTTINGHAM SASK	1	0.358422		
WATASKIWIN ALB	1	0.358422		

ISLAY ALB	1	0.320512
PORT DALHOUSIE ONT	1	0.320512
OSHAWA ONT	1	0.320512
EGANVILLE ONT	1	0.320512
RUSH LAKE SASK	1	0.320512
MONCTON NB	1	0.320512
MOYIE BC	1	0.320512
OWEN SOUND ONT	1	0.320512
NORTH BAY ONT	1	0.320512
WINDSOR ONT	1	0.320512
PROSPECT ONT	1	0.320512
ST CHARLES QUE	1	0.320512
WATROUS SASK	1	0.320512
MISSION BC	1	0.320512
LIPTON SASK	1	0.320512
UNITY SASK	1	0.320512
SARNIA ONT	1	0.320512
MELBOURNE QUE	1	0.320512
CALGARY ALB	1	0.320512
ST ELI DE CAXTON QUE	1	0.320512
LONDON ONT	1	0.320512
FERGUS ONT	1	0.320512
PIGEON LAKE MAN	1	0.320512
ST BENOIT QUE	1	0.320512
RICEVILLE ONT	1	0.320512
PETERBOROUGH ONT	1	0.320512
REGINA SAK	1	0.320512
NELSON BC	1	0.320512
IBERVILLE QUE	1	0.320512
KINGSTON ONT	1	0.320512
FERRY POINT ALB	1	0.320512
WARKWORTH ONT	1	0.320512
BOWMANVILLE ONT	1	0.320512
FLETCHER ONT	1	0.320512
HAZELMERE BC	1	0.320512
VERMILION ALB	1	0.320512
BLENHEIM ONT	1	0.320512
BROCKVILLE ONT	1	0.320512
WINDSOR ONT	1	0.320512
WALLACEBURG ONT	1	0.320512
GOSSE ISLE MAN	1	0.320512
NEW WESTMINISTER BC	1	0.320512
RENFREW ONT	1	0.320512
MEDICINE HAT ALB	1	0.320512
CARBON ALB	1	0.320512
PARIS ONT	1	0.320512
TROUT CREEK ONT	1	0.320512
TOFIELD ALB	1	0.320512
ST GREGOIRE QUE	1	0.320512
WHITBY ONT	1	0.320512
STE MADELINE QUE	1	0.320512
GEORGETWON ONT	1	0.320512
GORES LANDING ONT	1	0.320512
STETTLER ALB	1	0.320512
BENGOUGH SASK	1	0.243309
ALLISTON ONT	1	0.243309
ST THOMAS ONT	1	0.243309
MAPLE ONT	1	0.243309
LONGUEUIL QUE	1	0.243309
LA TUQUE QUE	1	0.243309
LETHBRIDGE ALB	1	0.243309
HARPTREE SASK	1	0.243309
FORRES SASK	1	0.243309
GALBRAITH SASK	1	0.243309
BARRIE ONT	1	0.243309
GOUVERNEUR SASK	1	0.243309
RINGWOOD ONT	1	0.243309
LOVETTVILLE ALB	1	0.243309
PRESTON ONT	1	0.243309
GANANOQUE ONT	1	0.243309
ROULEAUL SASK	1	0.243309
PORT COLBORNE ONT	1	0.243309
REGINA SASK	1	0.243309
WILSON ONT	1	0.243309
WOOODSTOCK ONT	1	0.243309
LISTOWELL ONT	1	0.243309
PORT CREDIT ONT	1	0.243309
HULL QUE	1	0.243309
CONISTON ONT	1	0.243309
BANFF ALB	1	0.243309
AGINCOURT ONT	1	0.243309
DUNDAS ONT	1	0.243309
KELLIHER SASK	1	0.243309
CLAYBURN BC	1	0.243309
TIMMINS ONT	1	0.243309
CADOGAN ALB	1	0.243309
FENWOOD SASK	1	0.243309
PORT DOVER ONT	1	0.243309
MAISONNEUVE QUE	1	0.243309
ALLISONVILLE ONT	1	0.243309
BOYEL ALB	1	0.243309
LONGUE POINTE QUE	1	0.243309
WALKERVILLE ONT	1	0.243309
TIMASKAMING ONT	1	0.243309
TRENTON NS	1	0.243309
ESTERHAZY SASK	1	0.243309
LETHBRIDGE ALB	1	0.243309
DORVAL QUE	1	0.243309
WOODSTOCK NB	1	0.243309
BRENVILLE QUE	1	0.243309
BRITANNIA BEACH BC	1	0.243309
LASQUETI ISLAND BC	1	0.243309
BEACHBURG ONT	1	0.243309
MACRORIE SASK	1	0.243309
LEITCHVILLE SASK	1	0.243309
WINONA ONT	1	0.243309
ABBOTSFORD QUE	1	0.243309
WARMEN SASK	1	0.243309
VERDUN QUE	1	0.243309
KERNS ONT	1	0.243309
LACHINE QUE	1	0.243309
APPLET SASK	1	0.243309
FORT ERIE ONT	1	0.243309
DARTSMOUTH NS	1	0.243309
STIRLING ONT	1	0.243309
OUTREMOUT QUE	1	0.243309
PONTE ROUGE QUE	1	0.243309
LANGLEY BC	1	0.243309
SOUTH HALL QUE	1	0.243309
PRINCE ALBERT SASK	1	0.243309
PAQUET QUE	1	0.243309
LEASK SASK	1	0.243309
ST PIERRE QUE	1	0.243309
LESTOCK SASK	1	0.243309
ST MARTIN QUE	1	0.243309
STE MARIE DE BAUCE QUE	1	0.243309
GRAND MERE QUE	1	0.243309
SEXSMITH ALB	1	0.243309
ALLAMONTE ONT	1	0.243309
KELOWNA BC	1	0.243309
NANAIMO BC	1	0.243309
QUENSELL BC	1	0.243309
OSHAWA ONT	1	0.243309
SOUTH INDIAN ONT	1	0.243309
SANFORD DUNE SASK	1	0.243309
BRIDEBURG ONT	1	0.243309
CARON SASK	1	0.243309
WESTMOUNT QUE	1	0.243309
	411	100

ST BRUNO QUE	1	0.320512
MOOSE JAW SASK	1	0.320512
MC TAGGART SASK	1	0.320512
TWEED ONT	1	0.320512
IRISH COVE NS	1	0.320512
LACHINE QUE	1	0.320512
KEELER SASK	1	0.320512
KAMSACK SASK	1	0.320512
WESTINGTON ALB	1	0.320512
HERBERT SASK	1	0.320512
LAMBTON MILLS ONT	1	0.320512
FORT FRANCIS ONT	1	0.320512
CHICOUTIMI QUE	1	0.320512
LEAMINGTON ONT	1	0.320512
TOTTENHAM ONT	1	0.320512
ST CATHARINES ONT	1	0.320512
INNIS FREE ALB	1	0.320512
SELLWOOD ONT	1	0.320512
LEVAN SASK	1	0.320512
FEHR QUE	1	0.320512
	312	100

SELKIRK MAN	1	0.358422
PORT STANLEY ONT	1	0.358422
ALBER MINES NB	1	0.358422
BRISTOL QUE	1	0.358422
STANSTEAD QUE	1	0.358422
ESTEVAN SASK	1	0.358422
SIMCOE ONT	1	0.358422
KENTVILLE NS	1	0.358422
RENFREW ONT	1	0.358422
SCOTLAND ONT	1	0.358422
EAST ANGUS QUE	1	0.358422
NIAGARA FALLS ONT	1	0.358422
FERGUS ONT	1	0.358422
DUNCANN BC	1	0.358422
CALEDONIA ONT	1	0.358422
FLORAL SASK	1	0.358422
VULCAN ALB	1	0.358422
ST JOHN QUE	1	0.358422
IRVINE ALB	1	0.358422
PARIS ONT	1	0.358422
BRACEBRIDGE ONT	1	0.358422
CHICOUTIMI QUE	1	0.358422
WESTMOUNT QUE	1	0.358422
KIRKLAND LAKE ONT	1	0.358422
PRESTON ONT	1	0.358422
WINDSOR NS	1	0.358422
WELLAND ONT	1	0.358422
CHATHAM ONT	1	0.358422
NORTHBANK ALB	1	0.358422
SMITHERS BC	1	0.358422
KITCHENER ONT	1	0.358422
	279	

NUMBER AND PERCENTAGE OF PATENTS IN URBAN CENTERS IN CANADA IN 1941

CITY-TOWN-PROVINCE	NO.PATENTS	%	POP.	PER/10,000
MONTREAL QUE	40	26.31578	903007	1.77
TORONTO ONT	36	23.68421	667457	2.15
HAMILTON ONT	25	16.44736	166337	6.01
VANCOUVER BC	5	3.289473	275353	0.72
WINNIPEG MAN	2	1.315789	221960	0.54
OSHAWA ONT	2	1.315789	265813	0.3
OTTAWA ONT	2	1.315789	154951	0.51
WINDSOR NS	1	0.657894		
SAINT-EPHREM QUE	1	0.657894		
WOODBRIDGE ONT	1	0.657894		
TANTALLON SASK	1	0.657894		
DUNDAS ONT	1	0.657894		
L'ANNONCIATION QUE	1	0.657894		
SHERBROOKE QUE	1	0.657894		
VALOIS QUE	1	0.657894		
NIAGARA FALLS ONT	1	0.657894		
ST LACHARIE QUE	1	0.657894		
KITCHENER ONT	1	0.657894		
GRANBY QUE	1	0.657894		
FERGUS ONT	1	0.657894		
TROIS RIVIERES QUE	1	0.657894		
MAXVILLE ONT	1	0.657894		
LIVERPOOL NS	1	0.657894		
PORT HOPE ONT	1	0.657894		
TOGO SASK	1	0.657894		
BURLINGTON ONT	1	0.657894		
ST JOHN NB	1	0.657894		
THOROLD QUE	1	0.657894		
ABITIBI QUE	1	0.657894		
MONT JOLI QUE	1	0.657894		
GASPE QUE	1	0.657894		
LONDON ONT	1	0.657894		
RICHVALE ONT	1	0.657894		
WESTMOUNT QUE	1	0.657894		
GUELPH ONT	1	0.657894		
EDMONTON ALB	1	0.657894		
BEAMSVILLE ONT	1	0.657894		
KINGSVILLE ONT	1	0.657894		
SCENICVIEW BC	1	0.657894		
LANSING ONT	1	0.657894		
RICETOWN SASK	1	0.657894		
GRIMSBY ONT	1	0.657894		
SACKVILLE NB	1	0.657894		
ECHO BAY ONT	1	0.657894		
COPPER CLIFF ONT	1	0.657894		
TERRACE BC	1	0.657894		

152

NUMBER OF PATENTS IN URBAN CENTERS IN CANADA IN 1951

CITY-TOWN-PROVINCE	NO.TROMAS	%	REGIONAL	POP.	PER/10,000
TORONTO ONT	62	39.49044	62	1031573	2.4
MONTREAL QUE	21	13.37579	21	1358075	0.61
OTTAWA ONT	7	4.458598	7	242247	1.15
HAMILTON ONT	7	4.458598	7	266083	1.05
VANCOUVER BC	5	3.184713	5	649238	0.3
WINNIPEG ONT	5	3.184713	5	330130	0.6
EDMONTON ALB	4	2.547770	4	226199	0.7
LONDON ONT	3	1.910828	3	162139	0.74
ST CATHARINES ONT	3	1.910828	4	212599	0.75
QUEBEC CITY QUE	2	1.273885	2	252890	0.31
COPPER CLIFF ONT	2	1.273885	2	109590	0.7
OSHAWA ONT	2	1.273885	2	117203	0.61
MALDGASH NS	1	0.636942			
BANNED SASK	1	0.636942			
WELLAND ONT	1	0.636942			
DAHLTON SASK	1	0.636942			
MAHONE BAY NS	1	0.636942			
EASTVIEW ONT	1	0.636942			
SCHUMACKER ONT	1	0.636942			
VICTORIA BC	1	0.636942			
RIVERSIDE ONT	1	0.636942			
OWEN SOUND ONT	1	0.636942			
FORT ERIE ONT	1	0.636942			
GALT ONT	1	0.636942			
TROIS RIVIERES	1	0.636942			
AMISK ALB	1	0.636942			
GODERICH ONT	1	0.636942			
BRANTFORD ONT	1	0.636942			
LANSDOWNE ONT	1	0.636942			
SEA ISLAND BC	1	0.636942			
STARBUCK MAN	1	0.636942			
LAKEFIELD ONT	1	0.636942			
PORT ARTHUR ONT	1	0.636942			
ST THOMAS ONT	1	0.636942			
SAINT JOHN NB	1	0.636942			
VILLE LASALLLE QUE	1	0.636942			
MIMICO ONT	1	0.636942			
VAL D'OR QUE	1	0.636942			
WADENA SASK	1	0.636942			
DORCHESTER NB	1	0.636942			
MELVILLE SASK	1	0.636942			
WINDSOR ONT	1	0.636942			
MAGELLA QUE	1	0.636942			
MAITLAND ONT	1	0.636942			
WATROUS SASK	1	0.636942			
CALGARY ALB	1	0.636942			

157

NUMBER OF PATENTS IN URBAN CENTERS IN CANADA IN 1961

CITY-TOWN-PROVINCE	NO.OF PAT	%	REG.POP.	PER/10,000	REG.PAT.
MONTREAL QUE	70	22.36421	1622779	1.77	72
TORONTO ONT	67	21.40575	1698942	1.81	77
OTTAWA ONT	28	8.945686	352932	3.17	28
OAKVILLE ONT	23	7.348242	106967	8.6	23
HAMILTON ONT	10	3.194888	340181	1.14	10
COPPER CLIFF ONT	8	2.555910	165862	1.92	8
VANCOUVER BC	7	2.236421	907531	0.35	8
ST CATHARINES ONT	6	1.916932	291468	1.5	11
SCARBOROUGH ONT	6	1.916932			
MALTON ONT	5	1.597444			
SARNIA ONT	4	1.277955	102131	1.56	4
EDMONTON ALB	4	1.277955	410679	0.38	4
WINNIPEG ONT	3	0.958466	475989	0.25	3
STRATFORD ONT	3	0.958466	57452	2.08	3
NIAGRA FALLS ONT	3	0.958466			
SAULT STE MARIE ONT	2	0.638977			
CALGARY ALB	2	0.638977			
BRANTFORD ONT	3	0.958466	83839	1.43	3
MONTROSE BC	1	0.319488			
CHIPPAWA ONT	1	0.319488			
MORRIS MAN	1	0.319488			
WESTON ONT	1	0.319488			
DOONSIDE SASK	1	0.319488			
SASKATOON SASK	1	0.319488			
CHICOUTIMI QUE	1	0.319488			
THOROLD ONT	1	0.319488			
ORILLIA ONT	1	0.319488			
LIVERPOOL NS	1	0.319488			
WINDSOR NS	1	0.319488			
CHELMSFORD ONT	1	0.319488			
HULL QUE	1	0.319488			
CUMBERLAND ONT	1	0.319488			
ST JEAN QUE	1	0.319488			
PICKERING ONT	1	0.319488			
WESTON ONT	1	0.319488			
JASPER ALB	1	0.319488			
PORT CREDIT ONT	1	0.319488			
ELLIOT LAKE ONT	1	0.319488			
ST LAURENT QUE	1	0.319488			
COCKSVILLE ONT	1	0.319488			
LANGELY BC	1	0.319488			
SAINT MICHEL QUE	1	0.319488			
ST THOMAS ONT	1	0.319488			
WHEATLEY ONT	1	0.319488			
BAIE D'URFE QUE	1	0.319488			
BURNABY BC	1	0.319488			
LOUISEVILLE QUE	1	0.319488			
LASALLE QUE	1	0.319488			

HAILEYBURY ONT	1 0.319488		
LEASIDE ONT	1 0.319488		
KAMLOOPS BC	1 0.319488		
VALOIS QUE	1 0.319488		
UNIONVILLE ONT	1 0.319488		
PLESSISVILLE QUE	1 0.319488		
MILTON ONT	1 0.319488		
ISLINGTON ONT	1 0.319488		
MOOSE JAW SASK	1 0.319488		
ST LAMBERT QUE	1 0.319488		
BELLVILLE ONT	1 0.319488		
BARRHEAD ALB	1 0.319488		
SARNIA ONT	1 0.319488		
BROWNVALE ALB	1 0.319488		
STE ADEL QUE	1 0.319488		
HALIFAX NS	1 0.319488	225723	.17
HUDSON BAY SASK	1 0.319488		
VALCOURT QUE	1 0.319488		
ST JAMES MAN	1 0.319488		
SWIFT CURRENT SASK	1 0.319488		
QUEBEC CITY QUE	1 0.319488		
GEORGETOWN ONT	1 0.319488		
GALT ONT	1 0.319488		
WELLAND ONT	1 0.319488		
LAC DU BONNET MAN	1 0.319488		
ST MARY'S ONT	1 0.319488		
YARMOUTH NS	1 0.319488		
VICTORIA BC	1 0.319488		
WINDSOR ONT	1 0.319488		

NUMBER OF PATENTS IN URBAN CENTERS IN CANADA IN 1971.

CITY-TOWN-PROVINCE	NO.TRDMKS	%	POP.	PER/10,000
TORONTO ONT	94	20.12847	1949687	2.64
MONTREAL QUE	80	17.13062	2119266	2.01
OTTAWA ONT	25	5.353319	453280	2.2
OAKVILLE ONT	23	4.925053	190469	5.46
VANCOUVER BC	14	2.997858	1082350	0.73
ST LAURENT QUE	14	2.997858		
CALGARY ALB	12	2.569593	447079	1.07
SCARBOROUGH ONT	10	2.141327		
EDMONTON ALB	8	1.713062	552461	0.57
LONDON ONT	7	1.498929	282014	0.99
WINNIPEG MAN	7	1.498929	540262	0.51
SARNIA ONT	7	1.498929	114315	2.44
GUELPH ONT	7	1.498929	108581	2.57
HAMILTON ONT	6	1.284796	411500	0.77
WILLOWDALE ONT	6	1.284796		
DON MILLS ONT	5	1.070663		
ISLINGTON ONT	5	1.070663		
KINGSTON ONT	5	1.070663	101692	1.96
BURNABY BC	5	1.070663		
POINTE CLAIRE QUE	4	0.856531		
SASKATOON SASK	4	0.856531		
DORVAL ONT	4	0.856531		
PETERBOROUGH ONT	4	0.856531		
ST CATHARINES ONT	4	0.856531		
PORT WILLIAM ONT	3	0.642398		
QUEBEC CITY QUE	3	0.642398		
WATERLOO ONT	3	0.642398		
REXDALE ONT	3	0.642398		
BURLINGTON ONT	3	0.642398		
KITCHENER ONT	3	0.642398		
MT ST HILAIRE QUE	2	0.428265		
BRAMPTON ONT	2	0.428265		
PORT CREDIT ONT	2	0.428265		
BEACONSFIELD QUE	2	0.428265		
PORT HOPE ONT	2	0.428265		
HURON PARK ONT	2	0.428265		
GALT ONT	2	0.428265		
STONEY CREEK ONT	2	0.428265		
MISSISSAUGA ONT	2	0.428265		
LA SALLE QUE	2	0.428265		
WESTON ONT	2	0.428265		
ST THOMAS ONT	2	0.428265		
PORT HAWKESBURY NS	2	0.428265		
OSHAWA ONT	2	0.428265		
LINDSAY ONT	2	0.428265		
SILLEY QUE	1	0.214132		
OUTLOOK SASK	1	0.214132		
GLENTWORTH SASK	1	0.214132		
RAWDON QUE	1	0.214132		
WEST HILL ONT	1	0.214132		
BOWDEN ALB	1	0.214132		

NUMBER AND PERCENTAGE OF TRADEMARKS IN URBAN CENTERS IN CANADA IN 1981

CITY-TOWN-PROVINCE	NO.TRDMKS	%	REGIONAL	POP.	PER/10,000
TORONTO ONT	330	16.74277	560	2137395	10.48
MONTREAL QUE	183	9.284627	262	2028453	5.16
MISSISSAUGA ONT	85	4.312531	193	490731	10.84
CALGARY ALB	59	2.993404	59	668682	3.52
VANCOUVER BC	58	2.942668	86	1169831	2.94
OTTAWA ONT	47	2.384576	49	456849	4.29
WINNIPEG MAN	44	2.232369	44	564475	3.11
REXDALE ONT	41	2.080162			
WILLOWDALE ONT	39	1.978691			
HAMILTON ONT	39	1.978691	39	411445	3.79
EDMONTON ALB	37	1.877219	37	762041	1.94
DOWNSVIEW ONT	31	1.572805			
SCARBOROUGH ONT	31	1.572805			
ETOBICOKE ONT	30	1.522070			
LONDON ONT	29	1.471334	29	318184	3.64
DON MILLS ONT	27	1.369863			
ST LAURENT	23	1.166920			
KITCHENER ONT	20	1.014713	31	305496	4.05
SASKATOON SASK	16	0.811770			
BURLINGTON ONT	15	0.761035	29	253882	4.56
BRANTFORD ONT	15	0.761035			
VICTORIA BC	14	0.710299			
OAKVILLE ONT	14	0.710299			
BRAMPTON ONT	14	0.710299			
HALIFAX NS	14	0.710299		288126	.38
MARKHAM ONT	14	0.710299	36	252053	5.71
NIAGARA FALLS ONT	12	0.608828	20	368288	2 17
BRAMALEA ONT	11	0.558092			
GUELPH ONT	10	0.507356			
WINDSOR ONT	10	0.507356			
PETERSOROUGH ONT	10	0.507356			
SHERBROOKE QUE	10	0.507356			
LAVALL QUE	9	0.456621			
NEWMARKET ONT	9	0.456621			
OSHAWA ONT	9	0.456621	19	292639	2.68
BURNABY BC	9	0.456621			
MONCTON NB	9	0.456621			
REGINA ASK	9	0.456621			
BRANDON MAN	8	0.405885			
KELOWNA BC	8	0.405885			
POINTE CLAIRE QUE	8	0.405885			
CONCORD ONT	8	0.405885			
WEST HILL ONT	8	0.405885			
TRAIL BC	8	0.405885			
PRINCE ALBERT SASK	8	0.405885			
ISLINGTON ONT	8	0.405885			
CAMBRIDGE ONT	7	0.355149			
WESTON ONT	7	0.355149			
AGINCOURT ONT	7	0.355149			
WHITBY ONT	6	0.304414			
WESTMOUNT QUE	6	0.304414			

NUMBER AND PERCENTAGE OF TRADEMARKS IN URBAN CENTERS IN 1986

CITY-TOWN-PROVINCE	NO.TRDMKS	%	POP.	REGIONAL	PER/10,0
TORONTO ONT	332	18.42397	2192721	520	9.48
MONTREAL QUE	325	18.03551	2036746	411	8.07
VANCOUVER BC	104	5.771365	1266152	150	4.73
MISSISSAUGA ONT	64	3.551609	392169	83	5.6
WINNIPEG MAN	47	2.608213	594551	47	3.16
EDMONTON ALB	46	2.552719	807504	46	2.27
WILLOWDALE ONT	42	2.330743			
CALGARY ALB	40	2.219755	715605	40	2.23
OTTAWA ONT	38	2.108768	606639	40	2.63
CONCORD ONT	29	1.609322			
MARKHAM ONT	29	1.609322	350602	47	5.36
SCARBOROUGH ONT	29	1.609322			
REXDALE ONT	26	1.442841			
DON MILLS ONT	19	1.054384			
BRAMPTON ONT	17	0.943396			
LAVAL QUE	17	0.943396			
DOWNSVIEW ONT	16	0.887902			
LONDON ONT	16	0.887902			
WATERLOO ONT	15	0.832408	329404	38	4.61
WESTON ONT	15	0.832408			
ST LAURENT QUE	15	0.832408			
RICHMOND BC	14	0.776914			
ST HYACINTHE QUE	14	0.776914			
BURLINGTON ONT	14	0.776914	271389	23	3.38
BURNABY BC	12	0.665926			
LONGUEUIL QUE	11	0.610432			
POINTE CLAIRE QUE	10	0.554938			
WINDSOR ONT	10	0.554938			
QUEBEC CITY QUE	10	0.554938			
HAMILTON ONT	9	0.499445			
VILLE ST LAURENT QUE	9	0.499445			
DORVAL QUE	9	0.499445			
KITCHENER ONT	8	0.443951			
ST LEONARD QUE	8	0.443951			
HALIFAX NS	8	0.443951	306418		.2
BRANTFORD ONT	7	0.388457			
LACHINE QUE	7	0.388457			
KELOWNA BC	7	0.388457			
SURREY BC	7	0.388457			
MONT ROYAL QUE	7	0.388457			
ST JACOBS ONT	7	0.388457			
GUELPH ONT	7	0.388457			
CAMBRIDGE ONT	7	0.388457			
COQUITLAM BC	6	0.332963			
DELTA BC	6	0.332963			
OAKVILLE ONT	6	0.332963			
THUNDER BAY ONT	6	0.332963			
ST JOHN'S NF	5	0.277469			
BOUCHERVILLE QUE	5	0.277469			
BOUGEMONT QUE	5	0.277469			

VAL D'OR QUE	1	0.214132	
NORANDA QUE	1	0.214132	
GEORGETOWN ONT	1	0.214132	
CLARKSON ONT	1	0.214132	
THORNHILL ONT	1	0.214132	
WYNYARD SASK	1	0.214132	
ETOBICOKE ONT	1	0.214132	
KELOWNA BC	1	0.214132	
COPPER CLIFF ONT	1	0.214132	
COBOURG ONT	1	0.214132	
LETHBRIDGE ALB	1	0.214132	
PICTURE BUTTE ALB	1	0.214132	
LAVAL QUE	1	0.214132	
MOUNT ROYAL QUE	1	0.214132	
BRANDON MAN	1	0.214132	
WOODSTOCK ONT	1	0.214132	
DRYDEN ONT	1	0.214132	
NANAIMO BC	1	0.214132	
SALMON ARM BC	1	0.214132	
SUDBURY ONT	1	0.214132	
RICHMOND BC	1	0.214132	
PREVILLE QUE	1	0.214132	
BAIE D'URFE QUE	1	0.214132	
ACTON BALE QUE	1	0.214132	
BEAUHARNOIS QUE	1	0.214132	
PICTON ONT	1	0.214132	
UNIONVILLE ONT	1	0.214132	
SELKIRK MAN	1	0.214132	
SHERIDAN PARK ONT	1	0.214132	
LATUQUE QUE	1	0.214132	
WESTMOUNT QUE	1	0.214132	
CORNWALL ONT	1	0.214132	
KETTELBY ONT	1	0.214132	
BRANTFORD ONT	1	0.214132	
NEW HAMBURG ONT	1	0.214132	
GRANDBY QUE	1	0.214132	
WHITE ROCK BC	1	0.214132	
RESTOULE ONT	1	0.214132	
THOMPSON MAN	1	0.214132	
TERRACE BC	1	0.214132	
LONGUEUIL QUE	1	0.214132	
BEDFORD (HALIFAX) NS	1	0.214132	261460 .15
CARTIER QUE	1	0.214132	
LOWBANKS ONT	1	0.214132	
MALTON ONT	1	0.214132	
SYDNEY NS	1	0.214132	
WINDSOR ONT	1	0.214132	
ESTERHAZY SASK	1	0.214132	
CHIPPIWA ONT	1	0.214132	
ROSANVILLE SASK	1	0.214132	
MEDICINE HAT ALB	1	0.214132	
NIAGARA FALLS ONT	1	0.214132	
SAINT JOHN NB	1	0.214132	
	467		

ST HYACINTHE QUE	6	0.304414
THUNDER BAY ONT	6	0.304414
SYDNEY NS	6	0.304414
RICHMOND BC	6	0.304414
BELLEVILLE ONT	6	0.304414
LACHINE QUE	5	0.253678
DORVAL QUE	5	0.253678
SARNIA ONT	5	0.253678
PENTICTON BC	5	0.253678
SAULT STE MARIE ONT	5	0.253678
LEVI QUE	5	0.253678
MIDLAND ONT	5	0.253678
GEORGETOWN ONT	5	0.253678
HAWKESBURY ONT	5	0.253678
BROCKVILLE ONT	5	0.253678
TRURO NS	4	0.202942
VAUDREUIL QUE	4	0.202942
CHARLOTTETOWN PEI	4	0.202942
SAINT TITE QUE	4	0.202942
LETHBRIDGE ALB	4	0.202942
LONGUEILL QUE	4	0.202942
FREDERICTON NB	4	0.202942
ST CATHARINES	4	0.202942
SURREY BC	4	0.202942
STRATFORD ONT	4	0.202942
ST JOHN'S NF	4	0.202942
RICHMOND HILL	4	0.202942
LINDSAI ONT	4	0.202942
SMITH FALLS ONT	4	0.202942
GRANDE PRAIRIE ALB	4	0.202942
MILTON ONT	4	0.202942
BOUCHERVILLE QUE	4	0.202942
KOMOKA ONT	4	0.202942
ST EUSTACHE QUE	4	0.202942
VERNON	4	0.202942
THORNHILL ONT	4	0.202942
MOUNT ROYAL	4	0.202942
ABBOTSFORD BC	4	0.202942
KAMLOOPS BC	4	0.202942
LANGLEY BC	4	0.202942
SAINT FOY QUE	4	0.202942
PICKERING ONT	4	0.202942
CAMPBELL RIVER BC	4	0.202942
VERDUN QUE	3	0.152207
COQUITLAM BC	3	0.152207
DELTA BC	3	0.152207
SWIFT CURRENT SASK	3	0.152207
LASALLE QUE	3	0.152207
HANOVER ONT	3	0.152207
MEDICINE HAT ALB	3	0.152207
AURORA ONT	3	0.152207
DARTMOUTH NS	3	0.152207
KINGSTON ONT	3	0.152207
GRANBY QUE	3	0.152207

RICHMOND HILL ONT	5	0.277469
BARRIE ONT	5	0.277469
VICTORIA BC	5	0.277469
BELLEVILLE ONT	5	0.277469
LETHBRIDGE ALB	5	0.277469
ETOBICOKE ONT	5	0.277469
AURORA ONT	4	0.221975
KIRKLAND QUE	4	0.221975
TROIS RIVIERES QUE	4	0.221975
NEPEAN ONT	4	0.221975
ASTON JUNCTION QUE	4	0.221975
WOODBRIDGE ONT	3	0.166481
NORTH YORK ONT	3	0.166481
GATINEAU QUE	3	0.166481
ST CATHARINES ONT	3	0.166481
MILTON ONT	3	0.166481
STONEY CREEK ONT	3	0.166481
STE FOY QUE	3	0.166481
OSHAWA ONT	3	0.166481
SAINT JOHN NB	3	0.166481
GLOUCESTER ONT	3	0.166481
FRELIGNSFBURG QUE	3	0.166481
SASKATOON SASK	3	0.166481
VANIER ONT	3	0.166481
WHISTLER BC	3	0.166481
FLORENCEVILLE NB	3	0.166481
PORT STANLEY ONT	3	0.166481
ORANGEVILLE ONT	3	0.166481
NIAGARA FALLS ONT	3	0.166481
PETERBOROUGH ONT	3	0.166481
CHARLESBOURG QUE	2	0.110987
HORNBY ONT	2	0.110987
KANATA ONT	2	0.110987
AGINCOURT ONT	2	0.110987
BRAMALEA ONT	2	0.110987
REGINA	2	0.110987
KINGSTON ONT	2	0.110987
WOODSTOCK ONT	2	0.110987
LANSDOWNE ONT	2	0.110987
ST JEROME QUE	2	0.110987
LA POCATIERE QUE	2	0.110987
STELLARTON NS	2	0.110987
THORNHILL ONT	2	0.110987
SMITH FALLS ONT	2	0.110987
LEVI QUE	2	0.110987
STRATFORD ONT	2	0.110987
VILLE VANIER QUE	2	0.110987
MOUNT HOPE ONT	2	0.110987
KAMLOOPS BC	2	0.110987
STE ADELE QUE	2	0.110987
PICKERING ONT	2	0.110987
GRANBY QUE	2	0.110987
ISLINGTON ONT	2	0.110987
ALBANY PEI	2	0.110987

RIMBEY ALB	3 0.152207	LANDERS	2 0.110987
WATERLOO ONT	3 0.152207	TIMMINS ONT	2 0.110987
SAINT JOHN NB	3 0.152207	RED DEER ALB	2 0.110987
GRAND FALLS NF	3 0.152207	SHAWINIGAN QUE	2 0.110987
ESPANOLA ONT	3 0.152207	NEWVILLE QUE	1 0.055493
QUENSEL BC	3 0.152207	EGANVILLE ONT	1 0.055493
ORANGEVILLE ONT	3 0.152207	MOUNT PEARL NF	1 0.055493
TROIS RIVIERES QUE	3 0.152207	ST HILAIRE QUE	1 0.055493
BATTLEFORD ONT	3 0.152207	MIDLAND ONT	1 0.055493
SIMCOE ONT	3 0.152207	SEDGEWICK ALB	1 0.055493
TIMMINS ONT	3 0.152207	MARKDALE ONT	1 0.055493
NANAIMO BC	3 0.152207	ELMIRA ONT	1 0.055493
NEPEAN ONT	3 0.152207	MOOSE JAW SASK	1 0.055493
MALTON ONT	3 0.152207	STE ANTONE DE TILLY QUE	1 0.055493
CHILLOWAK BC	2 0.101471	NEWMARKET ONT	1 0.055493
CORNWALL ONT	2 0.101471	ECKVILLE ALB	1 0.055493
LAC DU BONNET QUE	2 0.101471	NEGUAC QUE	1 0.055493
ROSEMERE QUE	2 0.101471	SALMO BC	1 0.055493
KENORA ONT	2 0.101471	LORETTEVILLE QUE	1 0.055493
RENFREW ONT	2 0.101471	SHERBROOKE QUE	1 0.055493
ST JAMES BC	2 0.101471	LA SALLE QUE	1 0.055493
CLEARBROOKE BC	2 0.101471	SUDBURY ONT	1 0.055493
HARRISTON ONT	2 0.101471	OUTREMONT QUE	1 0 355493
VANIER ONT	2 0.101471	DUNSFORD	1 0.055493
HULL QUE	2 0.101471	OWEN SOUND ONT	1 0.055493
CANDIAC QUE	2 0.101471	STEWART BC	1 0.055493
PRESCOTT ONT	2 0.101471	L'ASSOMPTION QUE	1 0.055493
OWEN SOUND ONT	2 0.101471	ST ROSALIE QUE	1 0.055493
STONEY CREEK ONT	2 0.101471	PORT ROBINSON ONT	1 0.055493
VAL D'OR QUE	2 0.101471	DARTMOUTH NS	1 0.055493
SMITHERS BC	2 0.101471	PORT CREDIT ONT	1 0.055493
BOISBRIAND QUE	2 0.101471	DRUMMONDVILLE QUE	1 0.055493
SEPT ILLE QUE	2 0.101471	PROR WILLIAMS NS	1 0.055493
RIVERVIEW NB	2 0.101471	SAULT STE MARIE ONT	1 0.055493
ESTEVAN SASK	2 0.101471	PORT MOODY	1 0.055493
ORILLIA ONT	2 0.101471	DORCHERSTEF ONT	1 0.055493
DRUMMONDVILLE QUE	2 0.101471	KENTVILLE NS	1 0.055493
WALLECEBURG ONT	2 0.101471	SIDNEY NS	1 0.055493
COWANSVILLE ONT	2 0.101471	REPENTIGNY QUE	1 0.055493
WELLAND ONT	2 0.101471	STRATFORD ONT	1 0.055493
NORWICH ONT	2 0.101471	JASPER ALB	1 0.055493
WETBURN SASK	2 0.101471	ST LUC QUE	1 0.055493
KAPUSKASING ONT	2 0.101471	JONQUIERE QUE	1 0.055493
WINKLER MAN	2 0.101471	ST LAMBERT QUE	1 0.055493
HALIBURTON ONT	2 0.101471	HAMPSTEAD	1 0.055493
WOODSTOCK ONT	2 0.101471	SCOTSBURN NS	1 0.055493
GAGNON QUE	2 0.101471	HAWKESBURY ONT	1 0.055493
PORT MOODY BC	2 0.101471	SARNIA ONT	1 0.055493
FENWICK ONT	2 0.101471	HULL QUE	1 0.055493
WOODBRIDGE ONT	2 0.101471	STE JULIE ONT	1 0.055493
ELLIOT LAKE ONT	2 0.101471	GRANDE-ALLEE EST QUE	1 0.055493
ANCASTER ONT	2 0.101471	CAMROSE ALB	1 0.055493
COLLINGWOOD ONT	2 0.101471	GREENWOOD ONT	1 0.055493
PEMBROKE ONT	2 0.101471	CHILLOWAK BC	1 0.055493

SUSSEX NB	2	0.101471	SUMMERLAN BC	1	0.055493
PRINCE RUPERT BC	2	0.101471	COCHRANE ALB	1	0.055493
MOOSE JAW SASK	2	0.101471	SMITHVILLE ONT	1	0.055493
WALKERTON ONT	2	0.101471	TERREBONNE QUE	1	0.055493
DORION QUE	2	0.101471	FERGUS ONT	1	0.055493
DRAYTON VALLEY	2	0.101471	CHICOUTIMI QUE	1	0.055493
SACKVILLE NB	2	0.101471	ST JEAN RICHELIEU QUE	1	0.055493
KIRKLAND QUE	2	0.101471	CAPE ROUGE QUE	1	0.055493
MORRISBURG ONT	2	0.101471	ESSEX ONT	1	0.055493
ARTHABASKA QUE	2	0.101471	THORNTON	1	0.055493
NEW GLASGOW NS	1	0.050735	ST ALBERT SASK	1	0.055493
DRYDEN ONT	1	0.050735	TOBERMORY ONT	1	0.055493
PINCOURT QUE	1	0.050735	MANOTICK ONT	1	0.055493
TRENTON ONT	1	0.050735	THOROLD ONT	1	0.055493
PORT HARDY BC	1	0.050735	NANAIMO BC	1	0.055493
DUNDAS ONT	1	0.050735	TRURO NS	1	0.055493
PIEDMONT QUE	1	0.050735	NORTH BAY ONT	1	0.055493
DES CHENES QUE	1	0.050735	UNIONVILLE ONT	1	0.055493
PORT COQUITLAM BC	1	0.050735	ORILLIA ONT	1	0.055493
CHICOUTIMI QUE	1	0.050735	UXBRIDGE ONT	1	0.055493
ARMSTRONG ONT	1	0.050735	LANGLEY BC	1	0.055493
CORNER BROOK NF	1	0.050735	CANSUL	1	0.055493
RED DEER ALB	1	0.050735	KING CITY ONT	1	0.055493
THETFORD MINES ONT	1	0.050735	CLARESHOLM ONT	1	0.055493
ROCKLAND ONT	1	0.050735	PORT COQUITLAM BC	1	0.055493
CHATHAM ONT	1	0.050735	BANF ALB	1	0.055493
NORTH YORK ONT	1	0.050735	QUEENSTON ONT	1	0.055493
TEMPLETON QUE	1	0.050735	VILLE LASALLE QUE	1	0.055493
ST HUBERT QUE	1	0.050735	JOLIETTE QUE	1	0.055493
TERRACE BC	1	0.050735	VILLE D'ANJOU QUE	1	0.055493
NORTH BAY ONT	1	0.050735	RICHELIEU QUE	1	0.055493
CHARLESBOURG QUE	1	0.050735	BOLTON ONT	1	0.055493
MANIWAKI	1	0.050735	GAGNES QUE	1	0.055493
CRANBEROOK BC	1	0.050735	BOWMANVILLE ONT	1	0.055493
MACOGIL QUE	1	0.050735	FENWICK ONT	1	0.055493
CAMPBELLTON NB	1	0.050735	VERNON BC	1	0.055493
STE JULIE QUE	1	0.050735	ST GREGOIRE QUE	1	0.055493
CANMORE ALB	1	0.050735	VICTORIAVILLE	1	0.055493
LAMONT ALB	1	0.050735	FORD MINES QUE	1	0.055493
CHESTER NS	1	0.050735	VILLE ST PEIREE QUE	1	0.055493
LOWDALE ONT	1	0.050735	MAPLE RIDGE BC	1	0.055493
VILLE LASALLE QUE	1	0.050735	VILLE DEGELIS QUE	1	0.055493
ST JEROME QUE	1	0.050735	NOTRE DAME ILE PERROT QUE	1	0.055493
CORNWALL ONT	1	0.050735	BEAUCE QUE	1	0.055493
KANATA ONT	1	0.050735	LA POCATIERE QUE	1	0.055493
VILLENEUVE QUE	1	0.050735	BLACK LAKE QUE	1	0.055493
ST HERBERT QUE	1	0.050735	PORTAGE LA PRARIE MAN	1	0.055493
VILL D'ANJOU QUE	1	0.050735	ATWOOD ONT	1	0.055493
KIRKLAND LAKE ONT	1	0.050735	KILBRIDE NF	1	0.055493
VICTORIAVILLE QUE	1	0.050735	AMHERST NS	1	0.055493
SUDBURY ONT	1	0.050735	HARTLAND NB	1	0.055493
CPBOURG ONT	1	0.050735	WILLIAMS NS	1	0.055493
SALMON ARM BC	1	0.050735	FARNHAM QUE	1	0.055493
VERNON BC	1	0.050735	WINKLER MAN	1	0.055493

HEADINGLEY MAN	1	0.050735
WINONA ONT	1	0.050735
ST THOMAS ONT	1	0.050735
COALDALE ALB	1	0.050735
GIFFARD QUE	1	0.050735
CARLISLE ONT	1	0.050735
ST FELICIEN QUE	1	0.050735
BROOKS ALB	1	0.050735
FORT FRASER BC	1	0.050735
BOISSEVAIN MAN	1	0.050735
STE THERESE QUE	1	0.050735
BONAVENTURE QUE	1	0.050735
FURNHAM QUE	1	0.050735
BARRIE ONT	1	0.050735
FLORENCEVILLE NB	1	0.050735
ST JEAN QUE	1	0.050735
BATHURST NS	1	0.050735
PRINCE GEORGE BC	1	0.050735
BELLECHASSE ONT	1	0.050735
PORT COLBORNE ONT	1	0.050735
BAIE D'URFE QUE	1	0.050735
OLIVER BC	1	0.050735
BURNS LAKE BC	1	0.050735
NEW WESTMINISTER BC	1	0.050735
WESTLOCK ALB	1	0.050735
NISKU ALB	1	0.050735
WINDSOR NS	1	0.050735
MC GREGORE ONT	1	0.050735
BELOIL QUE	1	0.050735
LOYDMINSTER ALB	1	0.050735
WATASKIN ALB	1	0.050735
ST PAUL ALB	1	0.050735
BRIDGEWATER NS	1	0.050735
ST LAMBERT QUE	1	0.050735
AJAX ONT	1	0.050735
KINCARDINE ONT	1	0.050735
ASBESTOS QUE	1	0.050735
INGERSOLL ONT	1	0.050735
WILLIAMS LAKE BC	1	0.050735
GRANDE CACHE ALB	1	0.050735
WEYMOUTH NS	1	0.050735
FORT FRANCIS ONT	1	0.050735
WETASKIWIN ALB	1	0.050735
FERNIE BC	1	0.050735
WINGHAM ONT	1	0.050735
ELMVALE ONT	1	0.050735
ARVIDA QUE	1	0.050735
PROVOST ALB	1	0.050735
WESTLOCK ALB	1	0.050735
RIMOUSKI QUE	1	0.050735
YORKTON SASK	1	0.050735
SOULANGES QUE	1	0.050735
BALCARRES SASK	1	0.050735
LITTLE YORK PEI	1	0.050735
SHAWVILLE ONT	1	0.055493
AYERS CLIFF QUE	1	0.055493
LANDER BC	1	0.055493
WHITE ROCK BC	1	0.055493
PLACE ROSEMERE QUE	1	0.055493
WELLAND ONT	1	0.055493
GEORGETOWN ONT	1	0.055493
ANJOU QUE	1	0.055493
NEW GLASGOW NS	1	0.055493
AJAX ONT	1	0.055493
RIVEIRE DU LOUP QUE	1	0.055493
LORAINE QUE	1	0.055493
ST AMABLE QUE	1	0.055493

1802

TRDMKS
CONVERTED

TO PATENT	INDEX	CITY
96	1.75	TORONTO
76	1.49	MONTREAL
28	0.88	VANCOUVER
15	1.01	MISSISSAUGA
9	0.6	WINNIPEG
8	0.39	EDMONTON
7	0.39	CALGARY
7	0.46	OTTAWA
9	1.02	MARKHAM
7	0.85	K-W
4	0.58	BURLINGTON

ALMA ONT	1	0.050735
KINGSVILLE ONT	1	0.050735
CAPE DE LA MADELELINE QUE	1	0.050735
ST HUBERT QUE	1	0.050735
CARBONEAR NF	1	0.050735
FLIN FLON MAN	1	0.050735
GORMLEY ONT	1	0.050735
EMBRO ONT	1	0.050735
HATSPORT NS	1	0.050735
REPENTIGNY QUE	1	0.050735
LAUZANNE ONT	1	0.050735
ST LEONARD QUE	1	0.050735
LUMBY BC	1	0.050735
SHAWINIGAN QUE	1	0.050735
MILE HOUSE BC	1	0.050735
ORMEAUX QUE	1	0.050735
PAQUETVILLE QUE	1	0.050735
STEINBACK ONT	1	0.050735
LANCASTER ONT	1	0.050735
STREETSVILLE ONT	1	0.050735
POINTE GATINEAU QUE	1	0.050735
VAL BELAIR QUE	1	0.050735

1971

TRDMKS

CONVERTED TO PATENT	INDEX	CITY
108	2.02	TORONTO
51	1	MONTREAL
26	2.11	MISSISSAUGA
11	0.658	CALGARY
17	0.58	VANCOUVER
9	0.78	OTTAWA
8	0.56	WINNIPEG
7	0.68	HAMILTON
7	0.36	EDMONTON
6	0.75	LONDON
6	0.78	KITCHENER
6	0.94	BURLINGTON
7	1.11	MARKHAM
4	0.43	NIAGARA FALLS
4	0.56	OSHAWA

APPENDIX C: POPULATION DATA FOR THE GREATER TORONTO ECONOMIC REGION: 1951-1986.

SOURCE: CENSUS CANADA: 1951-1986.

POPULATION DATA FOR GREATER TORONTO ECONOMIC REGION

CENSUS DIV.-1951-POPULATION		1961	1971	1981	1986
BRANT	72857	83839	96765	104427	106270
DUNDAS	15818	17162	17460	18946	-
DURHAM	30115	39916	47490	283639	326175
HALTON	44803	106967	190469	253883	271385
ONTARIO	87088	135895	196260	-	-
PEEL	55673	111575	259400	490731	592170
WATERLOO	126123	176754	347330	305496	329400
LINCOLN	89366	126674	-	-	-
WELLAND	173233	164741	-	-	-
WELLINGTON	06930	84702	108580	129432	139435
WENTWORTH	266083	358837	401885	411445	423395
METRO (YORK)	1179622	1732108	2086015	2137395	2192720
NIAGRA			347330	368288	370130
YORK (REGION)				252053	350605

(-) = INDICATES THAT THE CENSUS DIVISION IN QUESTION HAS BEEN AMALGAMATED WITH ONE OF THE OTHER DIVISION(S).

APPENDIX D: INVENTIVE INDEX IN 1981 AND POPULATION AND UNEMPLOYMENT DATA 1981-1986.

SOURCE: CENSUS CANADA, 1981-1986.

TRADEMARK DATA FOR MAJOR C.M.A.'s : COMPARED TO POPULATION AND EMPLOYMEN

CMA	NO. OF TRDMKS	POP. 1981	TRDMKS PER 10,000	POPULAT. 1981-86	UNEMP: 1986
TORONTO	743	3130392	9.494018	9.5	5.1
KITCHENER	31	287801	4.308532	8.1	5.7
HAMILTON	54	542095	3.984541	2.8	6.6
CLAGARY	59	625966	3.770172	7.2	9
MONTREAL	262	2862286	3.661409	2.1	10
SASKATOON	16	175058	3.659931	14.6	10
LONDON	29	326817	3.549386	4.7	6.1
SHERBROOKE	10	125183	3.195322	3.8	
WINNIPEG	44	592061	2.972666	5.6	6.4
OTTAWA	51	743821	2.742595	10.1	7.8
VANCOUVER	86	1268183	2.712542	8.9	10.3
HALIFAX	17	277727	2.448447	6.6	11.4
ST. CATH- N.F.	20	342645	2.334777	0.2	7.9
VICTORIA	14	241450	2.319320	5.8	9.4
REGINA	9	173226	2.078209	7.7	6.5
EDMONTON	37	740882	1.997619	6	11.1
THUNDER BAY	6	121948	1.968051	0.2	6.8
OSHAWA	9	186446	1.930853	9.2	6.5
WINDSOR	10	250885	1.594355	1.2	9.5
ST JOHN'S	4	154835	1.033358	4.6	12.1
SAINT JOHN	3	121012	0.991637	0.2	11.1
TROIS-RIVIERES	3	125343	0.957372	2.8	11.8
SUDBURY	1	156121	0.256211	-4.6	11.6
CHICOUTIMI	1	158229	0.252798	0.2	8

APPENDIX E: REGRESSION MODEL: INVENTIVE ACTIVITY IN 1981 AND POPULATION GROWTH BETWEEN 1981 AND 1986 FOR MAJOR C.M.A.'S IN CANADA.

20 JUL 89 SPSS-X Release 2.2 for AT&T 3515
15:41:09 Wilfrid Laurier University AT&T 3B4000 UNIX SYS V

**** MULTIPLE REGRESSION ****

Equation Number 1 Dependent Variable.. PCPGR

---------- Variables in the Equation ----------

Variable	B	SE B	95% Confdnce Intrvl B		Beta	SE Beta	Correl	Part Cor	Partial	Tolerance	T
INDE	1.170021	.421915	.295022	2.045021	.508935	.183524	.508935	.508935	.508935	1.000000	2.773
(Constant)	1.771388	1.361259	-1.051e00	4.594467							1.301

------ in -------

Variable	Sig T
INDE	.0111
(Constant)	.2006

End Block Number 1 All requested variables entered.

* *

Summary table

Step	MultR	Rsq	AdjRsq	F(Eqn)	SigF	RsqCh	FCh	SigCh		Variable	BetaIn	Correl
1	.5089	.2590	.2253	7.e9C	.011	.2590	7.e9C	.011	In:	INDE	.5089	.5009

**** MULTIPLE REGRESSION ****

Equation Number 1 Dependent Variable.. POPGR

Casewise Plot of Standardized Residual

*: Selected M: Missing

Case #	M	-3.0 ... 0.0 ... 3.0	POPGR	*PRED	*RESID
1	TORONTO		9.50	12.8749	-3.3749
2	KITCHENER		8.10	6.8025	1.2975
3	HAMILTON		2.80	6.4281	-3.6281
4	CALGARY		7.20	6.1824	1.0176
5	MONTREAL		2.10	6.0537	-3.9537
6	SASKATOON		14.60	6.0420	8.5580
7	LONDON		4.70	5.9133	-1.2133
8	SHERBROOKE		3.80	5.5038	-1.7038
9	WINNIPEG		5.60	5.2464	.3536
10	OTTAWA		10.10	4.9772	5.1228
11	VANCOUVER		8.90	4.9421	3.9579
12	HALIFAX		6.60	4.6262	1.9738
13	ST CATHARINES-NIAGAR		.20	4.4975	-4.2975
14	VICTORIA		5.80	4.4741	1.3259
15	REGINA		7.70	4.1933	3.5067
16	EDMONTON		6.00	4.0997	1.9003
17	THUNDER BAY		.20	4.0646	-3.8646
18	OSHAWA		9.20	4.0295	5.1705
19	WINDSOR		1.20	3.6317	-2.4317
20	ST JOHN'S		4.00	2.9765	1.6235
21	SAINT JOHN		.20	2.9297	-2.7297
22	TROIS-RIVIERES		2.60	2.8829	-.0829
23	SUDBURY		-4.00	2.0639	-6.6639
24	CHICOUTIMI		.20	2.0639	-1.8639
Case #	M	-3.0 ... 0.0 ... 3.0	POPGR	*PRED	*RESID

* * * * MULTIPLE REGRESSION * * * *

Equation Number 1 Dependent Variable.. POPGP

Residuals Statistics:

	Min	Max	Mean	Std Dev	N
*PRED	2.0639	12.3749	4.8958	2.1540	24
*RESID	-6.6639	8.5580	.0000	3.6002	24
*ZPRED	-1.3096	3.6371	.0000	1.0000	24
*ZRESID	-1.7806	2.2867	.0000	.9780	24

Total Cases = 24

Durbin-Watson Test = 2.39055

* *

Outliers - Standardized Residual

Case #	M	*ZRESID
6	SASKATOO	2.2967
23	SUDBURY	-1.7806
16	OSHAWA	1.3915
10	OTTAWA	1.3689
13	ST CATH	-1.1463
11	VANCOUVE	1.0575
5	MONTREAL	-1.0564
17	THUNDER	-1.0324
3	HAMILTON	-.9694
15	REGINA	.9769

APPENDIX F: REGRESSION MODEL: INVENTIVE ACTIVITY IN 1981 AND UNEMPLOYMENT LEVELS IN 1986 FOR MAJOR C.M.A.'S IN CANADA.

* * * * M U L T I P L E R E G R E S S I O N * * * *

Equation number 1 Dependent variable.. LNFNP

---------- Variables in the Equation ----------

Variable	B	SE B	95% Confdnce Intrvl B		Beta	SE Beta	Correl	Part Cor	Partial	Tolerance	T
INDE	-.554526	.181596	-1.100063	-.008719	-.554512	.181596	-.554512	-.554512	-.554512	1.000000	-3.054
(Constant)	10.459764	.691759	9.042194	11.897329							15.119

------ in -------

Variable	Sig T
INDE	.0006
(Constant)	.0000

End Block Number 1 All requested variables entered.

* *

Summary table

Step	MultR	RSq	AdjRSq	F(Eqn)	SigF	RsqCh	FCh	SigCh		Variable	BetaIn	Correl
1	.5545	.3075	.2745	9.324	.0006	.3075	9.324	.0006	In:	INDE	-.5545	-.5545

* * * * M U L T I P L E R E G R E S S I O N * * * *

Equation Number 1 Dependent variable.. U.RAP

Casewise Plot of Standardized Residual

*: Selected M: Missing

Case #	M	-3.0 ... 0.0 ... 3.0	UNEMP	*PRED	*RESID
1	TORONTO		5.10	4.2487	.8513
2	KITCHENER		5.70	7.6449	-1.9449
3	HAMILTON		6.60	7.8543	-1.2543
4	CALGARY		9.00	7.9918	1.0082
5	MONTREAL		10.00	8.0637	1.9363
6	SASKATOON		10.00	8.0703	1.9297
7	LONDON		6.10	8.1423	-2.0423
8	WINNIPEG		6.40	8.5153	-2.1153
9	OTTAWA		7.80	8.0658	-.2658
10	VANCOUVER		10.30	8.6854	1.6146
11	HALIFAX		11.40	8.8621	2.5379
12	ST CATHARINES-NIAGAR		7.90	8.9341	-1.0341
13	VICTORIA		9.40	8.9472	.4528
14	REGINA		6.50	9.1042	-2.6042
15	EDMONTON		11.10	9.1566	1.9434
16	THUNDER BAY		6.80	9.1702	-2.3702
17	OSHAWA		6.50	9.1958	-2.6958
18	WINDSOR		9.50	9.4183	.0817
19	ST JOHN'S		12.10	9.7848	2.3152
20	SAINT JOHN		11.10	9.8109	1.2891
21	TROIS-RIVIERES		11.80	9.8371	1.9629
22	SUDBURY		11.60	10.2952	1.3048
23	CHICOUTIMI		8.00	10.2952	-2.2952
Case #	M	-3.0 ... 0.0 ... 3.0	UNEMP	*PRED	*RESID

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