



Catalogue no. 11-624-MIE — No. 008

ISSN: 1708-0169

ISBN: 0-662-38274-9

## Analytical Paper

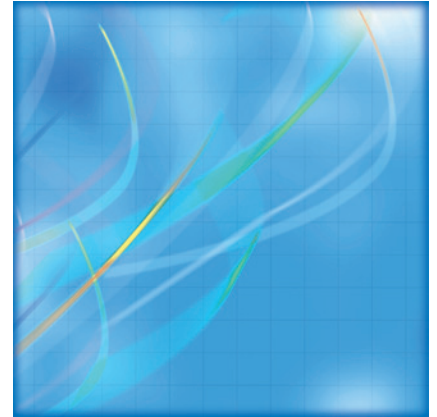
Insights on the Canadian economy

# Four Decades of Creative Destruction: Renewing Canada's Manufacturing Base from 1961-1999

by John R. Baldwin and W. Mark Brown

Micro-economic Analysis Division  
18- F, R.H. Coats Building, Ottawa, K1A 0T6

Telephone: 1 800 263-1136



*This paper represents the views of the authors and does not necessarily reflect the opinions of Statistics Canada.*



Statistics  
Canada

Statistique  
Canada

Canada

---

# **Four Decades of Creative Destruction: Renewing Canada's Manufacturing Base from 1961-1999**

---

John R. Baldwin  
and  
W. Mark Brown

**11-624-MIE No. 008**  
**ISSN: 1708-0169**  
**ISBN: 0-662-38274-9**

Micro-economic Analysis Division  
Statistics Canada  
18-F, R.H. Coats Building  
Ottawa, Ontario  
K1A 0T6

**October 2004**

**How to obtain more information:**  
National inquiries line: 1-800-263-1136  
E-mail inquiries: [infostats@statcan.ca](mailto:infostats@statcan.ca)

Published by authority of the Minister responsible for Statistics Canada

© Minister of Industry, 2004

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise without prior written permission from Licence Services, Marketing Division, Statistics Canada, Ottawa, Ontario, Canada K1A 0T6.

*Aussi disponible en français*

## ***Abstract***

In this paper, we present measures of the extent of renewal in Canada's manufacturing sector over a four decade period (1961-1999)—a period that roughly represents the productive lifetime of a worker.

We measure turnover over periods of one, two, three and four decades. For each time frame, we ask what proportion of jobs in the first year was lost by the last, either because of plant closures or downsizing. We also ask what proportion of jobs in the last year was new, either because of investments in new plants or the expansion of incumbent plants. The former is a measure of the extent to which jobs are fading away, at the level of individual business units; the latter is a measure of the extent to which the economy is being renewed, again at the level of individual business units.

This paper indicates that job turnover in the manufacturing sector has a substantial long-term component. Moreover, it quantifies the size of this process decade by decade. Over a decade, almost 40% of jobs are renewed. Using a 20-year time frame, over 65% of the economy is renewed; over a 30-year period, renewal amounts to just over 75%; and by 40 years, just over 85% of jobs are new.

## ***1. Introduction***

Market economies are dynamic, with new businesses constantly emerging and old ones dying. Evidence of this dynamism can be seen almost every day in the business pages of newspapers or through the casual observation of the comings and goings of businesses in our local communities.

It has become axiomatic to suggest in public discussions that the degree of dynamic change is not only large but becoming more so. Jobs are said to no longer exist for a lifetime. The product lifecycle is described as having shortened. New technologies are described as coming on line at increasingly faster rates.

Examples of change surround us and act as corroborative evidence for these axioms. Considerable attention is given to occasions when mature firms fail. Local layoffs obtain extensive media attention. The high tech boom of the late 1990s and its subsequent bust is now part of common parlance about how rapidly good times can turn to bad.

Despite the widespread description of the increasing rapidity of change, and media coverage of individual events, there is little comprehensive evidence of the amount of change.<sup>1</sup> This paper remedies this in the area of industrial renewal. It investigates how long a population of business establishments takes to renew itself. Does it occur over a decade, or a much longer period?

---

1. See Baldwin (1995) for a study that examines change in the manufacturing sector in the 1970s.

In this brief paper, we present measures of the extent of renewal in Canada's manufacturing sector over a four-decade period (1961-1999)—a period that roughly represents the productive lifetime of a worker. We measure the extent to which plants that were present in 1961 are renewed forty years later.

## ***2. The underlying causes of turnover***

Renewal occurs when old plants are supplanted by new plants. Renewal occurs as well when some plants decline and others grow. In both cases, resources used in production are being shifted from less productive to more productive plants (Baldwin and Gu, 2002). It is this process by which new technologies are introduced into plants.

There are many factors that underlie the decisions of firms to downsize or to close plants. The first is business failure resulting from the inability of a firm to earn a reasonable rate of return. While failures have unfortunate consequences for the labour in these establishments, failures also have long-term benefits. A failure comes from entrepreneurial experimentation and many failed entrepreneurs learn valuable lessons that enable them to start successful firms at a later date.

This sort of plant failure is affected by the degree of competition in the marketplace. Higher levels of competition, be it domestic or foreign based, lead to higher levels of plant turnover. Changes in the level of competition—especially from foreign sources after trade liberalization occurs—may speed up the renewal process.

Plants may also downsize or close because of changes in technology or tastes that favour the production of some industries or plants over others. Technological change may make some plants obsolete resulting in the need to build new ones to accommodate the new technology. Here, renewal is critical to the introduction of new advanced technologies that create a competitive edge for a country.

The passing of time can itself lead to the closure of plants as they deteriorate with the ageing process. At some point, the firm is faced with a decision to reinvest in the plant or to build a new one. In many instances, it may be more profitable to build a new plant.

Finally, there may be geographic shifts in demand or sources of important inputs that change the optimal location of production and lead to plant closings in one location and openings elsewhere. These shifts can occur over relatively short distances, (i.e., when manufacturing firms move from core urban areas to the suburban fringes of cities—see Brown and Baldwin 2003) or across provinces, which in Canada's case has involved a general east to west movement in economic activity.

In summary, there are numerous forces at work that may cause an economy to renew its production base. In this paper, we investigate the size of all of these forces taken together.

### ***3. Measuring turnover: Renewal and fading rates***

For this analysis, we use a database developed from the Census of Manufacturers, what is now the Annual Survey of Manufacturers (ASM). The database allows us to follow individual plants over time. As such, we can determine the employment of a plant in any given year, when it was born and when it was shut down, if ever.

Other studies have also examined a phenomenon called job turnover (see Baldwin and Gorecki, 1990; Davis, Haltiwanger, and Schuh, 1996). Most of these studies are short term in nature. They focus on one-year or five-year periods and calculate rates of job growth or job decline—defined as the growth in jobs in plants where employment is growing divided by initial employment or job loss divided by initial employment. Studies of job turnover conducted over short periods may contain considerable white noise. In the short run, firms may experience random increases one period only to see these reversed the next (Davis, Haltiwanger, and Schuh, 1993). These studies cannot determine whether change is an ephemeral phenomenon or one that has inexorable cumulative consequences. In this study, we focus on the much longer period—in order to remove short-run movements that may be quickly reversed.

In order to develop measures of long-run cumulative change, we measure turnover over periods of one, two, three and four decades. For each time frame, we ask what proportion of jobs in the first year was lost by the last, either because of plant closures or downsizing. We also ask what proportion of jobs in the last year was new, either because of investments in new plants or the expansion of incumbent plants. The former is a measure of the extent to which jobs are fading away, at the level of individual business units; the latter is a measure of the extent to which the economy is being renewed, again at the level of individual business units.

In more concrete terms, we describe the renewal rate for the period from 1961 to 1999 as the sum of jobs in 1999 plants that were new since 1961 and present in 1999 (*New Plants*) plus the sum of job gains in continuing incumbent plants whose employment grew between 1961 and 1999 (*Job Gains*) divided by total employment in 1999 (*Employment1999*) or more formally:

$$\text{Renewal Rate} = \frac{\text{NewPlants} + \text{Job Gains}}{\text{Employment1999}}. \quad (1)$$

The fading rate is similarly defined as the sum of jobs in 1961 plants that closed between 1961 and 1999 (*Closed Plants*) plus the jobs that have been lost in continuing incumbent plants that downsized (*Job Losses*) over this period divided by employment in 1961 (*Employment1961*):

$$\text{Fading Rate} = \frac{\text{Closed Plants} + \text{JobLosses}}{\text{Employment1961}}. \quad (2)$$

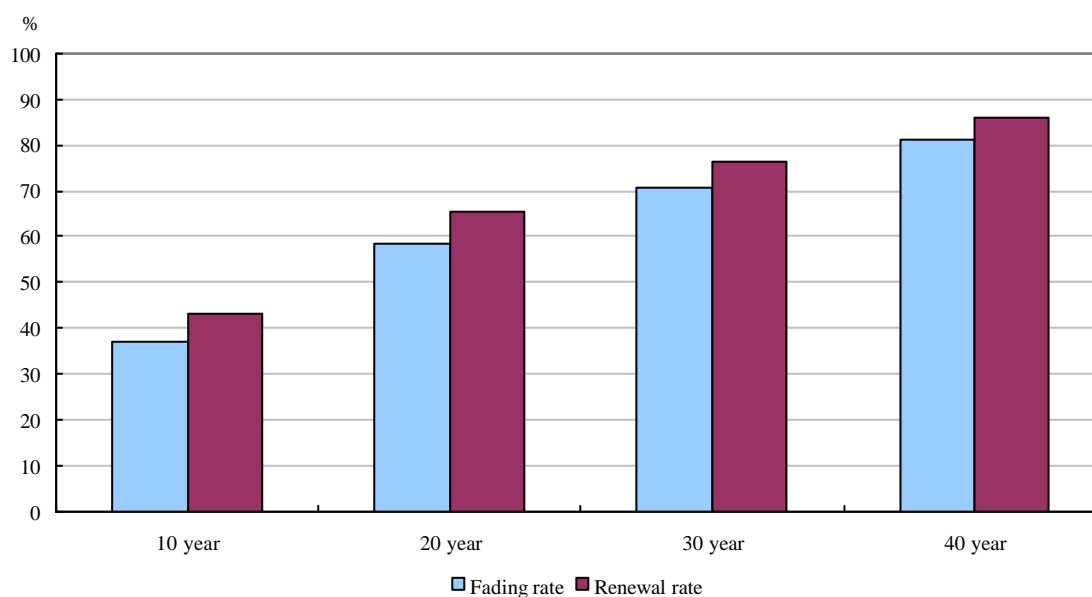
Renewal and fading rates can be calculated for any combination of years between 1961 and 1999. We will calculate these rates for time periods spanning ten, twenty, thirty, and (almost) forty years.<sup>2</sup>

#### 4. *Renewal and fading rates across time*

How long does it take for the manufacturing sector of the Canadian economy to renew itself? The renewal and fading rates for four different periods of time are presented in Figure 1. Using decadal time periods, on average, around 40% of jobs result from renewal. A similar proportion of jobs are lost over a decade. Therefore, over a relatively short period of time, about two in every five jobs are eliminated, either because of plant closures or downsizing and, in turn, are renewed.

Increasing the time frame results, not surprisingly, in a larger proportion of jobs that are renewed. For instance, using 20-year time frame, over 65% of the economy is renewed; over a 30-year period, renewal amounts to just over 75%; and by 40 years, just over 85% of jobs are new. In 40 years, Canada's manufacturing economy has effectively turned over. It is almost completely renewed.

**Figure 1.** Average fading and renewal rates by time period



Source: Special tabulation, Annual Survey of Manufactures.

2. For the decadal estimates, we average 1961-69, 1970-79, 1980-89, and 1990-99; for the twenty year period, we use 1961-79, 1970-89, and 1980-99; for the thirty year period, 1961-89 and 1970-99 ; and for the forty-year period, we use 1961-99.

## 5. Incumbent job gains and losses versus plant entry and exit?

Turnover and renewal can come from different sources. On the one hand, it may come from the redistribution of jobs within incumbent plants—from one group of incumbents which is in decline to another which is growing. Or it may come from the closing down of old plants and the opening of new ones. The former provides a more stable environment since incumbents remain; they just exchange relative positions. The latter involves a more fundamental transformation since some participants disappear while other new ones are created.

Renewal and fading rates are divided into these components in Table 1. The majority of new jobs are in plants that have been established since 1961. That is, of the 86% of jobs that were new since 1961, 76 percentage points are due to the establishment of new plants. Of the 81% of jobs lost since 1961, 72 percentage points were due to plant closures. Therefore, in the long-run, the renewal process is not primarily the result of shifting workers from declining to growing plants. Rather, it results from the nearly complete renewal of the country's stock of manufacturing plants and jobs.

**Table 1.** Fading and renewal rates, 1961-1999

|                         | 1961 Employment  |             | 1999 Employment  |             |
|-------------------------|------------------|-------------|------------------|-------------|
| Job losses [1]          | 106,147          | 9%          |                  |             |
| Job gains [2]           |                  |             | 181,462          | 11%         |
| Closed plants [3]       | 880,139          | 72%         |                  |             |
| New plants [4]          |                  |             | 1,307,148        | 76%         |
| Base                    | 236,682          | 19%         | 236,682          | 14%         |
| <b>Total employment</b> | <b>1,222,968</b> | <b>100%</b> | <b>1,725,292</b> | <b>100%</b> |
| Fading: [1]+[3]         | 986,286          | 81%         |                  |             |
| Renewal: [2]+[4]        |                  |             | 1,488,610        | 86%         |
| Growth rate 1961-1999   | 41%              |             |                  |             |

Source: Special tabulation, Annual Survey of Manufactures.

Our interpretation of the economic effects of these high levels of plant entry and exit depends on whether we view them as independent of, or dependent on, each other. If entry and exit are independent of each other, then the incremental effects of entry and exit that we observe in our daily lives have a large long-run cumulative effect. Without constant investment in new plants to renew the manufacturing base of a country, region or city, their manufacturing sector would almost completely fade away after a generation. However, if the plant entry and exit depend on each other—entry causes some exit—then we have to modify our interpretation. Without entry, many of the plants that exit would probably continue to exist. But because entrants are more productive than exits, without entry the population of plants would use older less productive technology and management practices. In all likelihood, plant exits result from both the competitive push of rivals and the loss of plants due to ‘natural causes’—it results from the twin processes of selection and entropy. From an economic perspective, therefore, renewal is necessary both for replacing the constant erosion of the economic base of an economy and for raising its productivity.

## 6. Renewal and fading rates across provinces

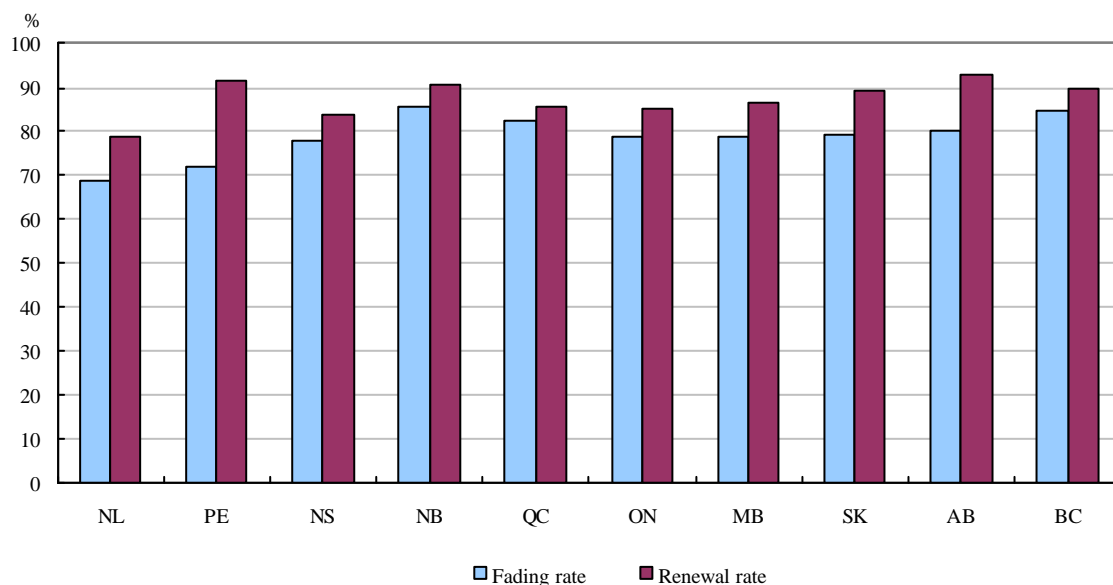
The high fading and renewal rates experienced nationally between 1961 and 1999 suggest there is considerable potential for geographic shifts in employment across the country. This would be manifest by extremely different renewal rates across the country. At issue is whether we find very high renewal rates in those provinces where total manufacturing employment grew and much higher fading rates in those provinces where total manufacturing employment fell.

The renewal and fading rates across provinces are plotted in Figure 2. Provincial fading rates are remarkably similar. From Nova Scotia west, they range from just under 80% to just over 80%. The two exceptions to the provincial pattern are Newfoundland and Prince Edward Island, who both have relatively low fading rates. These two provinces have by far the smallest manufacturing economies of all the provinces. So their low fading rates may result from idiosyncratic factors.

It is also apparent from Figure 2 that none of provinces experienced a particularly high exodus of manufacturing employment. That is, no one province stood out as a location where manufacturing firms were prematurely downsizing or closing their manufacturing activities.

Renewal rates show a similarly consistent pattern. Only Newfoundland had a renewal rate that was below 80%. The highest renewal rate was experienced by Alberta with a rate of 93%. In other words, just over ninety percent of jobs in Alberta in 1999 are in plants that did not exist in 1961 or are new jobs added to incumbent plants since 1961.

**Figure 2.** Fading and renewal rates by province, 1961-1999



Source: Special tabulation, Annual Survey of Manufactures.



## 7. Fading and renewal rates across industries

Since renewal and fading rates vary across provinces, they may also vary across industries. Variations in renewal rates across industries occur because of market structure, changes in technology and differences in underlying possibilities for entrepreneurial activity.

The renewal and fading rates are presented in Table 2 and Figure 3 by industry. Industries such as Primary Metals and Transportation have the lowest fading rates (in the mid 50's). These are also industries where economies of scale and concentrated market structures exist. Refined petroleum, another highly concentrated industry, had a relatively low fading rate of 73%. At the other end of the spectrum, with the highest fading rates, are leather, rubber and plastics, wood, furniture, and fabricated metals whose fading rates are in the high 80's. But most of the industries fall within the range from about 80% to 90%. The renewal rates also fall within a band stretching from the low 80s to the mid 90s. The major exception is the tobacco industry with only a 30% renewal rate.

**Table 2.** Fading and renewal rates by selected industries, 1961-1999

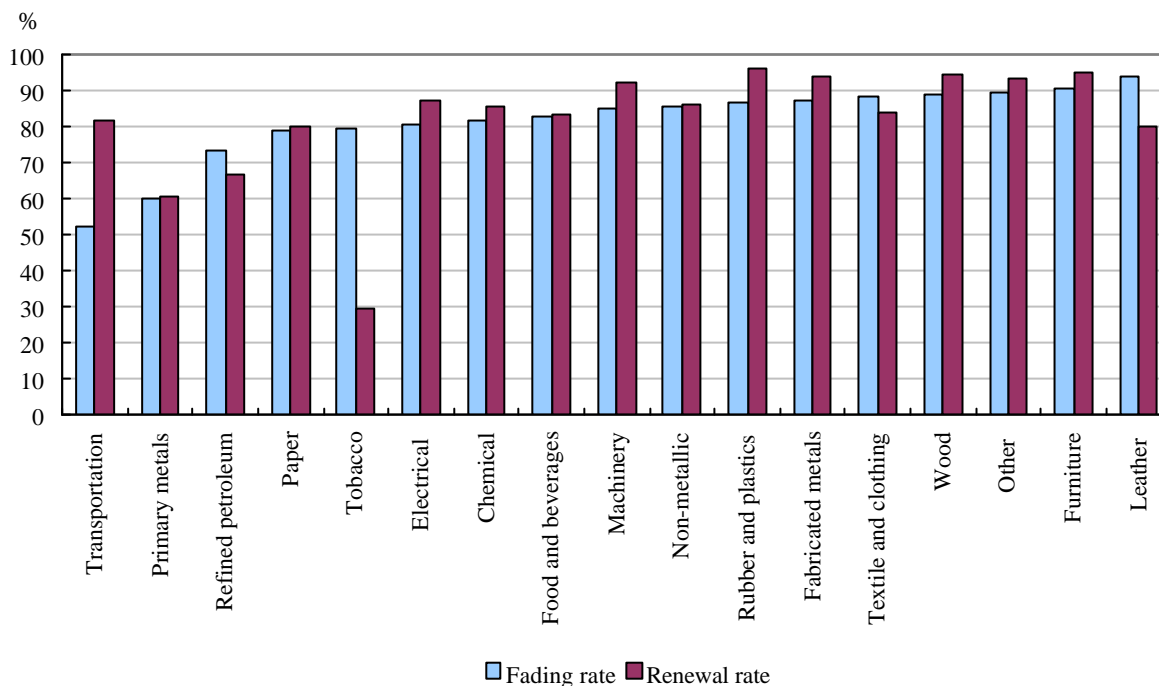
| Industry             | Employment<br>growth rate | Fading<br>rate<br>percent | Renewal<br>rate |
|----------------------|---------------------------|---------------------------|-----------------|
| Food and beverages   | 5.1                       | 82.5                      | 83.4            |
| Tobacco              | -70.4                     | 79.2                      | 29.7            |
| Rubber and plastics  | 251.9                     | 86.7                      | 96.2            |
| Leather              | -68.5                     | 93.6                      | 79.8            |
| Textile and clothing | -25.8                     | 88.1                      | 84.0            |
| Wood                 | 92.5                      | 89.0                      | 94.3            |
| Furniture            | 96.2                      | 90.5                      | 95.2            |
| Paper                | 7.1                       | 78.7                      | 80.1            |
| Primary metals       | 2.0                       | 59.9                      | 60.6            |
| Fabricated metals    | 102.7                     | 87.3                      | 93.7            |
| Machinery            | 86.8                      | 85.2                      | 92.1            |
| Transportation       | 164.5                     | 52.1                      | 81.9            |
| Electrical           | 52.2                      | 80.4                      | 87.1            |
| Non-metallic         | 4.2                       | 85.3                      | 85.9            |
| Refined petroleum    | -20.0                     | 73.2                      | 66.5            |
| Chemical             | 282.0                     | 81.8                      | 85.8            |
| Other                | 61.2                      | 89.2                      | 93.3            |

Growth should influence both the rate of fading and the rate of renewal<sup>3</sup>. The correlation ( $r$ ) between growth and fading at the industry level is negative as expected ( $r = -0.06$ ), but quite small. On the other hand, growth is positively related to renewal ( $r = 0.54$ ). Economies that are growing are economies that are renewing themselves. Economies that are not growing have a slightly higher rate of fading, but not much. This corresponds to the results reported in Baldwin and Gorecki (1990) that suggest exit is a more or less random process that occurs at about the same rate across different industries, geographical areas and time periods. It stems from the more

3. See Appendix A in Brown (2004) for a discussion of the relationship between growth and renewal rates.

or less constant rate of probability that failure will occur. It can respond to economic events, but it does so weakly—at least compared to entry. Entry and renewal, on the other hand, are more sensitive to economic conditions. Where there is more growth, there is more entry and more renewal. Regardless of whether the direction of causation goes from renewal to growth or from growth to renewal, renewal is associated with growth. And that is the reason for the widespread interest in the amount of renewal taking place.

**Figure 3.** Fading and renewal rates by industry, 1961-1999



Source: Special tabulation, Annual Survey of Manufactures.

## ***8. Conclusion***

Previous studies have outlined the existence of high turnover in the job market. But they did not indicate whether this phenomenon was the result of stops and starts that reversed themselves, leaving most producers in the same relative position, or whether this was part of an inexorable long-term growth and decline process.

This paper indicates that job turnover in the manufacturing sector has a substantial long-term component. Moreover, it quantifies the size of this process decade by decade. Over a decade, almost 40% of jobs are renewed. Using 20-year time frame, over 65% of the economy is renewed; over a 30-year period, renewal amounts to just over 75%; and by 40 years, just over 85% of jobs are new.

It is also the case that this process occurs at similarly high levels both across regions and industries. There are exceptions but these are aberrations. This is a phenomenon that offers more similarities across jurisdictions than differences. It is a phenomenon that is pervasive across the industrial system.

The rates of renewal are closely related to growth. Growth may create renewal or renewal may lead to growth. But there is no doubt that the two are found together. Interestingly, rates of fading are less related to growth rates. Producers go out of business at a rate that is relatively similar across industries; but renewal is much higher where growth is higher. This empirical regularity explains the widespread interest in knowing whether a region or an industry is renewing itself.

Finally, most renewal results from entering plants replacing those that have exited. Entry renews the manufacturing sector in two fundamental ways. First, without entry, the high rate of exit would lead to a substantial diminution of the sector. Second, entry leads to the replacement of old, less productive plants with new, more productive plants. Renewal is necessary for replacing the constant erosion of the economic base of an economy and for raising its productivity.

## ***References***

Baldwin, J.R. 1995. *The Dynamics of Industrial Competition: A North American Perspective*. Cambridge: Cambridge University Press.

Baldwin, J.R. and P. Gorecki. 1990. *Structural Change and the Adjustment Process: Perspectives on Firm Growth and Worker Turnover*. Ottawa: Statistics Canada and the Economic Council of Canada.

Baldwin, J.R. and W. Gu. 2003. *Plant Turnover and Productivity Growth in Canadian Manufacturing*. Analytical Studies Research Paper Series 11F0019MIE2003193. Analytical Studies Branch. Ottawa: Statistics Canada.

Brown, W.M. 2004. *Renewing Canada's manufacturing economy: A regional comparison, 1973-1996*. Economic Analysis Research Paper Series 11F0027MIE2004023. Analytical Studies Branch. Ottawa: Statistics Canada.

Brown, W.M. and J.R. Baldwin. 2003. "The changing geography of the Canadian manufacturing sector in metropolitan and rural regions, 1976-1997". *The Canadian Geographer*, 47(2): 116-134.

Davis, S., J. Haltiwanger and S. Schuh. 1996. *Job Creation and Destruction*. Cambridge, Mass.: MIT Press.

Davis, S., J. Haltiwanger and S. Schuh. 1993. "Small Business and Job Creation: Dissecting the Myth and Reassessing the Facts". NBER working paper No. w4492. Cambridge, MA: National Bureau of Economic Research.