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The Canadian Journal of Regional Science gratefully acknowledges the financial assistance of the Social Sciences and Humanities Research Council of Canada.

La Revue canadienne des sciences régionales remercie le Conseil de recherches en sciences humaines du Canada de son soutien.
Regional Productivity Convergence In Canada

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It would certainly not be an exaggeration to say that the study of growth theory is back at the forefront of the research agenda in economics, after a few decades of dormancy. According to Solow (1994: 45), the father of the neoclassical growth model:

"The current wildfire of interest in growth theory was touched off by articles from Romer (1986, from his 1983 thesis) and Lucas (1988, from his 1985 Marshall Lectures). This boom shows no signs of petering out".

These growth models are termed "endogenous" growth models to contrast with the neoclassical model in which technical progress, the ultimate motor of growth in the steady-state, was assumed to be exogenous. The new approach to growth has been motivated by several empirical studies on the convergence

Earlier drafts of this paper were written when the first author was with the Department of Finance. The authors wish to thank Denis Gauthier, Mike Kennedy, Munir A. Sheikh, two anonymous referees and the editor, WilliamMilne, for their valuable comments. Any remaining errors and omissions are the sole responsibility of the authors. The paper does not necessarily reflect the views of the Department of Finance or the Department of Industry.

ISSN: 0705-4580
Printed in Canada/Imprimé au Canada
of the levels and growth rates of per capita income across countries, the so-called "convergence controversy". As Romer (1994: 4) notes

"Both Robert Lucas (1988) and I (Romer, 1986) cited the failure of cross-country convergence to motivate models of growth that drop the two central assumptions of the neoclassical model: that technological change is exogenous and that the same technological opportunities are available in all countries of the world".

In the neoclassical growth framework, convergence was viewed as a transitional dynamic toward the steady-state of economic units with identical technology and preferences. In the framework of endogenous growth models, both convergence and divergence can be observed depending on groups of countries/regions analyzed, growth being endogenous and potentially affected by technological opportunities, the choice of institutions, trade patterns, and economic policies.

One key question analyzed by Lucas (1988) is whether increased trade and economic integration are likely to favour convergence, or divergence, of output per capita across different economic units. The answer provided by Lucas is not clear and both cases are possible depending upon initial conditions, comparative advantage, preferences and technologies. It is then interesting to compare relative growth patterns of regions in the same country with those of different countries. Studies that compare convergence patterns across regions of the same countries with those across different countries were produced by Barro and Sala-i-Martin (1992), and Coulombe and Lee (1995). The results of these studies suggest that convergence of regional incomes in the same countries was taking place, but at a relatively slow rate. The same slow rate of convergence has been estimated across OECD countries. The results for Canadian provinces might be particularly surprising since important inter-regional transfers, like equalization payments, have been introduced and developed during the period studied (1961 to 1991) precisely to alleviate regional disparities. Therefore, two sets of reasons can be used to explain these results. First, following an endogenous growth framework, or any of the structural approaches used to explain divergence in economic development, one could argue that the stylized facts simply reflect differences in industrial structures, and that trade of goods and flows of factors between regions observed in an economic and political union do not by themselves equalize per capita output. Second, following a neoclassical framework, one could argue that the converging forces produced by market adjustments have been neutralized by fiscal/social policies which have impeded factor mobility. Thus, the results do not

support specific policy recommendations since divergent stories can be told to explain the same stylized facts. To provide a hint for policy prescriptions, more refined results are needed and this paper makes a step in this direction.

In this paper, we extend the analysis of Coulombe and Lee (1995) by estimating the convergence speed of labour productivity in the ten Canadian provinces. Our study shows that regional differences in output per worker and output per hour have been converging faster than per capita incomes. In addition, the dispersion of output/income per person is much larger than the dispersion of output/income per worker or per hour. Furthermore, there is no evidence of convergence in unemployment rates. From the point of view of policy prescriptions, these results suggest that convergence in per capita incomes across Canadian regions could be accelerated by removing impediments to labour market adjustments and inter-regional migration that may be attributable to the unemployment insurance scheme. On the other hand, equalization payments that allow residents of poor regions to have an equal access to education would be viewed as a policy that does not restrain convergence across Canadian regions.

This paper is divided into five sections. In the first section, we describe some characteristics of endogenous growth models that will be used for the normative part of this paper. The following section discusses the methodology used in the study. Section 3 describes the data, while Section 4 presents the results. The last section concludes.

### Growth Theories and Convergence

New theories of economic growth and the neoclassical growth model can be used to explain more or less the same stylized facts. However, they provide alternative explanations of those facts and, therefore, can lead to different policy recommendations. We do not view the two approaches as being concurrent (that is, the question is not whether or not growth is exogenous or endogenous in the long run). By treating growth as an exogenous factor, the neoclassical growth approach focuses on convergence to steady states. Thus, the analysis of convergence of regional economies that focuses exclusively on the neoclassical growth model will suffer from reductionism since the approach can explain neither growth nor the location of economic activities. For

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2. Auer (1979) also finds a greater dispersion in income per capita than income per worker. Denny and Fuss (1982), on the other hand, look at regional total factor productivity in the manufacturing sector for the 1961-1977 period. They find greater regional differences in labour productivity than in total factor productivity. They, therefore, argue that differences in factor intensity are likely to be responsible for the observed regional differences in labour productivity levels. They also find that the differences in total factor productivity levels in the 1970s are smaller than those in the 1960s.
example, if either a slow convergence pattern is observed, or convergence is not observed, the only diagnostic the neoclassical growth framework can provide is that some of its assumptions are not met. The role of public policies is extremely limited and the usual policy recommendation is that government interventions should not impede market adjustments. Even though the conclusion is a sound one, it still does not explain much about the relative growth patterns of regional economies.

On the other hand, the purpose of the new growth theory is to explain the growth process, in the long run, by modelling it as an endogenous phenomenon. The key features of the new growth models are imperfect competition, increasing returns and externalities. Krugman (1991) points out the importance of these features that are particularly relevant to the study of regional economy:

"Essentially, to say anything useful or interesting about the location of economic activity in space, it is necessary to get away from the constant-returns, perfect-competition approach that still dominates most economic analysis".

New growth and trade theories that focus on imperfect competition and scale economies provide a framework to understand the evolution of regional disparities that is closely related to those that come out of structural theories such as the staple approach of Innis (1930) and the growth pole approach of Perroux (1955) and Myrdal (1957). The main features of the framework are the following:

- production technology in the manufactured sector is characterized by increasing returns which leads to imperfect competition;
- in turn, the production of manufactured goods for which transportation costs are relatively small will tend to concentrate locally in the core, closer to the markets (for goods, labours and capital), where most of the population of the economy live (Krugman 1991);
- in the periphery, economic activities will mainly concentrate on the exploitation of natural resources, the production of manufactured goods with high transportation costs (housing being the best example), the production of goods characterized by constant returns to scale, and the service industry. The economic structure of the core and the periphery are then necessarily distinct (Krugman 1991);
- following Lucas (1988), one can see that the accumulation of human capital is an imperfect motor of the growth process. Contrary to physical capital accumulation, he points out that human capital should not be con-

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strained by decreasing returns but rather it should contribute to production technology with constant returns (on an inter-generational basis, the education system being the inter-generational technology for storing human capital). The feature of constant returns to education implies that its accumulation can potentially explain a constant growth rate contrary to physical capital. Learning by doing is a technology that allows human capital to accumulate. The potential for learning by doing is not the same for the production of all goods or the exploitation of natural resources. Some learning by doing is generated from the production of high-tech goods. At the other extreme, learning by doing does not have as large an impact in the fishery. Since the regions are specialized in the production of different goods, their growth patterns might differ;

- the other model suggested by Lucas might well be relevant for the understanding of the Canadian situation. Along the lines of the previous point on the critical influence of human capital accumulation, Lucas analyses the incidence of the introduction of human capital as a third factor in the production function. Human capital generates a Marshallian externality at the regional/city level that make all factors of production more productive when the total stock of human capital increases.

The preceding framework is not intended to be complete. Its purpose is to illustrate the richness of the new growth models and their capacity to help understand the evolution of economies. For the Canadian case, this framework suggests that economic convergence between the rich and the poor regions, between the core and the periphery, is not a simple mechanism which is the natural outcome of economic integration. In the empirical part of this paper, we try to understand the growth pattern at the regional level in Canada by comparing convergence patterns of output, income, and productivity. In the conclusion, we return to explain the empirical results in terms of the framework.

Methodology

The empirical part of this paper is an extension of Coulombe and Lee (1995). Following the methodology of Barro and Sala-i-Martin (1991, 1992a, 1992b), we use two different concepts of convergence. The first one, called $\beta$-convergence, refers to the speed of convergence of an economic variable of the poor region to that in the rich one. The second concept referred to is $\sigma$-convergence and is measured by the level of dispersion of an economic variable across the regions.
Estimation of $\beta$-convergence

In a neoclassical framework, convergence between economies is modelled as transitional dynamics toward the steady state. If two economies have relatively similar technologies, preferences, and demographic and natural resource endowments, the key prediction of this framework is that the economy with the lower initial level of output per capita will tend to grow faster during the transition to the steady-state. In this case, the $\beta$ coefficient is referred to as measuring unconditional convergence; that is, the speed of convergence is not conditional on observed differences in other exogenous parameters. This convergence hypothesis is usually tested using cross-sectional data. However, simple cross-section tests are not very reliable for Canada due to the small number of Canadian provinces. Following the procedures established in Coulombe and Lee (1995), we extend the 10 cross-section provincial data by dividing the time series observations into three. For the period 1968-1992, three sub-periods are created to form annual growth rates from 1968-1976, 1976-1984, 1984-1992. In order to control for the decreasing growth rate trend in the nation, we regress the annual growth rate relative to the Canadian average on the initial level of output relative to the Canadian average for each of the three sub-periods as shown in equation (1):

$$\frac{1}{T-t} \ln \left( \frac{y_{i,T} - \bar{y}_T}{y_{i,t} - \bar{y}_t} \right) = B - \left( \frac{1 - e^{-\alpha(T-t)}}{T-t} \right) \ln \left( \frac{\bar{y}_i}{\bar{y}_T} \right) + u_i$$

(1)

where: 

- $i = 1, \ldots, 10$;
- $t = 1968, 1976, 1984$; and

where $i$ refers to the region, $y$ is output per capita, $B$, a constant term across economic units, $u$ an error term, and $t$ and $T$ are initial and final years respectively, $\bar{y}$ refers to the weighted (by population) Canadian average. The higher $\beta$, the faster the poor regions converge to the level of the rich regions.

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5. For illustrative purposes, $y$ is referred to as output per capita, but it can also refer to other variables such as output per worker or output per hours worked or other income measures.
Dispersion Index

Barro and Sala-i-Martin (1995) show that β-convergence, which refers to a tendency for poor regions to grow faster than rich regions, does not necessarily imply σ-convergence (a decline in the dispersion of per capita income/output across a group of regions). The tendency for poor regions to grow faster than rich regions can be offset by increased exogenous disturbances in the economy.

σ-convergence can be measured in several different ways. We can take the standard deviation of log per capita output as Barro and Sala-i-Martin (1991, 1992a, 1992b) have done or alternatively use more commonly used measurements, the coefficient of variation. It is defined as:

\[ \sigma_{it} = \sqrt{\frac{\sum_{t=1}^{T} (y_{it} - \bar{y}_t)^2}{\bar{y}_t}} \]  

Finally, real regional per capita output \( (Y/N_p) \) differentials can be viewed as the product of three variables: labour productivity (GDP per hours worked); average hours worked per person \( (N_{hh}) \); the ratio of actual number of workers to the population \( (N_w/N_p) \). This relationship can be further decomposed into the following:

\[ \frac{Y}{N_p} = \frac{Y}{N_H} \times N_{hh}(1-\mu) \times \Phi \]  

where \( \mu \) is the proportion of working age; \( \Phi \) is the participation rate; and \( \mu \) is the unemployment rate. Thus the regional variation in per capita output/income depend on the differentials in all these variables.

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6. Using different indicators do not change the basic results.
7. The labour force is the population multiplied by the proportion of working age, \( \mu \), multiplied by the participation rate, \( \Phi \): \( L_r = N_{hh} \Phi \). Total employment equals the labour force multiplied by the employment rate: \( N_w = L_r(1-\mu) \), where \( \mu \) = unemployment rate. Total person hours worked is total employment multiplied by average hours worked per worker: \( N_{hh} = N_w N_{hh} \). Therefore, total population is expressed by the following: \( N_p = N_{hh}/(N_{hh} \Phi \times (1-\mu)) \).
Table 1  Per Capita Output/Incomes and Labour Productivity

<table>
<thead>
<tr>
<th>Mnemonic</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPP/POP</td>
<td>Gross Provincial Product at factor cost per capita</td>
</tr>
<tr>
<td>GPP/WR</td>
<td>Gross Provincial Product at factor cost per worker</td>
</tr>
<tr>
<td>GPP/HR</td>
<td>Gross provincial product at factor cost per hour</td>
</tr>
<tr>
<td>EI/POP</td>
<td>Earned income per capita</td>
</tr>
<tr>
<td>EI/WR</td>
<td>Earned income per worker</td>
</tr>
<tr>
<td>EI/HR</td>
<td>Earned income per hour worked</td>
</tr>
</tbody>
</table>

Data

The two basic national income concepts used in this paper are gross provincial product at factor cost (GPP) and earned income (EI). Each is divided by the population, the number of workers and hours worked to measure per capita output/income and labour productivity as shown in Table 1. All per capita output/income and labour productivity are deflated by provincial price indexes. Results based on a national index are presented in Appendix A. Data sources and exact definitions of the variables are available from the authors on request.

Results

β-Convergence for Canada

Figures 1 and 2 plot the average annual growth rate of GPP/POP against the initial and final levels of GPP/POP respectively. In the first figure, an inverse relationship between the average annual growth rate and the initial level of GPP/POP emerges suggesting that there is convergence. In the second figure, this relationship becomes stronger indicating that the ten provinces have converged much more in 1992 compared to 1966. This convergence process becomes more evident in EI/HR as shown in Figures 3 and 4.

Table 2 presents the estimates of β (based on equation (1)) for per capita output/income and labour productivity and their corresponding half-life based on a sample of 10 cross-section and 3 time series as discussed in Section 2.1. We reject the hypothesis of no convergence at the 5 % significant level based on one-tail test for all six variables.
FIGURE 1  Growth vs. Initial GPP per capita: 1966-1992

FIGURE 2  Growth vs. Terminal GPP per capita: 1966-1992
FIGURE 3  Growth vs. Initial EI per hours worked: 1966-1992

FIGURE 4  Growth vs. Terminal EI per hours worked: 1966-1992
TABLE 2 Convergence in Canada: 1968-1992 (based on provincial deflators)

<table>
<thead>
<tr>
<th>Variables</th>
<th>$\beta$</th>
<th>$R^2$</th>
<th>Half-Life (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPP/POP</td>
<td>0.013 (2.94)</td>
<td>0.24</td>
<td>55</td>
</tr>
<tr>
<td>GPP/WR</td>
<td>0.017 (2.80)</td>
<td>0.23</td>
<td>40</td>
</tr>
<tr>
<td>GPP/HR</td>
<td>0.025 (4.01)</td>
<td>0.40</td>
<td>28</td>
</tr>
<tr>
<td>EI/POP</td>
<td>0.021 (2.36)</td>
<td>0.18</td>
<td>34</td>
</tr>
<tr>
<td>EI/WR</td>
<td>0.043 (2.42)</td>
<td>0.22</td>
<td>16</td>
</tr>
<tr>
<td>EI/HR</td>
<td>0.047 (3.03)</td>
<td>0.31</td>
<td>15</td>
</tr>
</tbody>
</table>

Note: Numbers in parentheses under the estimated coefficients are t-statistics. The earned income series are adjusted using the Department of Finance’s cost of living index. The use of provincial versus national cost of living indexes, however, does not have a significant effect on the estimated coefficients.

For both GPP and EI, convergence is slowest on a per capita basis. It becomes faster when they are adjusted for the differences in the proportion of working age, the labour force participation rate and the unemployment rate. The length of half-life is reduced from 55 to 40 years for GPP and from 34 to 16 years for EI. When these are further adjusted for the differences in average hours worked per worker, the length of half-life is further reduced by 12 years for GPP and 1 year for EI. Thus, we have the fastest convergence in labour productivity in terms of hours worked and the slowest convergence in per capita income/output. These results suggest that slow convergence in living standards (as measured by per capita output/income) is not due to slow

8. The faster convergence in EI compared to GPP is discussed in Coulombe and Lee (1995). Basically, it reflects the fact that the evolution of relative output prices (that is, regional terms of trade) has favoured convergence for the period of study. If a national output deflator is used, as in Appendix A, the difference between income and output disappears. Another possible explanation that is not mentioned in Coulombe and Lee (1995) is a larger per capita presence of the Federal Government in the Atlantic provinces. The Federal Government pay scales are the same in all regions, which could partially explain why the rate of convergence of EI is greater than that of GPP. We would like to thank a referee for pointing this out.

9. This refers to the number of years it takes to reduce the initial gap between the poor and the rich region by one-half.

10. This is because average hours worked per worker converges slower than labour productivity in terms of hours worked.

11. As shown in Table 3 in Appendix A, deflating by a national price index does not change basic findings. But since these estimates include the effects of the terms of trade, they are much more sensitive to changes in world resource prices.
convergence in competitiveness (as measured by labour productivity) but due to other factors such as slow adjustments in labour markets or different industrial structure in different regions of Canada. This will be discussed further in the next section.

The Dispersion of Per Capita Output/Income and Productivity Levels

Figures 5 and 6 display the evolution GPP and EI dispersion (coefficient of variation) respectively. Both figures show that the levels dispersion of output and income per capita decreases once they are adjusted for differences in the proportion of working age, the labour force participation rate and the unemployment rate (the dispersion levels of GPP/WR and EI/WR are lower than those of GPP/PO and EI/POP). But adjusting for differences in average hours worked per worker do not make a significant difference. As shown in Figure 5, the dispersion of output per capita and labour productivity fall steadily over the period 1966 to 1992. Comparing this to Figure 6, shows that all three measures of EI dispersion are more volatile than those of GPP. Moreover, contrary to GPP measures, a declining trend reverses in 1986 when the dispersion is measured by EI. This reversal is caused by a decline in EI in the Prairie Provinces (particularly Saskatchewan) since 1986 and an upward trend of Ontario’s EI that started in 1982.

Our results indicate that the convergence speed is slower on a per capita basis than on a per worker or a per hour basis. At the same time, the level of dispersion is higher on a per capita basis than on a per worker or a per hour basis. As mentioned earlier, this appears to be the result of slow labour market adjustments. Figure 7 shows the evolution of the coefficients of variation of a number of different labour market indicators. These indicators are chosen based on equation (3) to distinguish between per capita output/income and per hour output/income. The dispersion of the proportion of working age, the participation rate and average hours worked all declined. On the other hand, the coefficient of variation of regional unemployment rates shows no obvious trend. Furthermore, the relative dispersion of unemployment is five to ten times greater than other labour market variables. In this sense, regional disparities in unemployment rates appear to be the most significant factor in slowing

13. Figures 8 and 9, in Appendix A, show the dispersion when income and output variables are adjusted by a national price deflator. As shown in Figure 8, the GPP series become much more volatile when they are adjusted by the national GDP deflator, since the series reflect changes in the terms of trade (mainly oil price shocks) in addition to changes in real output.
14. However, a measure of absolute dispersion as indicated by the standard deviation of regional unemployment rates has been rising over time.
FIGURE 5 Coefficient of Variation of GPP: 1966-1992 (Provincial GPP Deflator)

FIGURE 6 Coefficient of Variation of Earned Income: 1966-1992 (Provincial CPI's)
down regional labour market adjustments. Thus, regional disparities in unemployment rates appear to impede convergence in living standards across Canada. This slow regional labour market adjustments may, in part, be due to government policies such as regionally extended unemployment benefits and interprovincial trade barriers and, in part, be due to the union density which can create impediments to convergence in earnings, unemployment rates and various measures of output. 

**Conclusion**

This paper has established some stylized facts on the convergence of growth patterns at the regional level in Canada. These stylized facts are:

- since 1968, there is evidence of convergence in living standards and labour productivity;
- the speed of GPP convergence is slower than EI convergence;

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15. We would like to thank a referee for bringing up these points.
the speed of convergence for both GPP and EI increases as we move from a per capita basis to a per worker basis, and from a per worker basis to a per hour basis;
• the speed of GPP convergence increases once the terms of trade effect is included;
• the relative dispersion of GPP and EI on a per capita basis is higher than those on a per worker or on a per hour basis.

These stylized facts can be synthesized in the following proposition:

• slow adjustment in the labour market accounts for the relative slow convergence in regional disparities in living standards in Canada. The convergence in labour productivity is relatively fast.

This leads to the following tentative suggestions for policy prescriptions:

• from an endogenous growth framework, one can fear that the regional specialization that comes from the closed economic integration would provide relatively poor growth prospects for the periphery. When we examine the relative growth patterns of labour productivity in Canada since the 1960s, we conclude that the working of market adjustment has produced a relatively fast convergence in regional productivity in Canada;
• the key to reduce regional disparities in regional living standards in Canada is to reduce regional disparities in unemployment rates. There are many possible solutions for this. We suggest the best way to do it is to facilitate adjustments in the labour market by eliminating regional distortions such as regionally extended unemployment benefits and the perverse subsidy to seasonable employment that comes out of the UI system;
• all inter-regional transfers are not necessarily inefficient from a growth perspective and for the long run convergence of regional economies. Given the importance of human capital accumulation in the dynamic process of growth, we think that inter-regional transfers like equalization payments that allow residents of the poor regions to have access to good education is a policy that stimulates growth in Canada. At least two reasons can be advanced. First, the education acquired by the migrants from the periphery to the core would be beneficial for the overall economy. Second, a high level education of good quality is essential to innovations in the production process of economic activities performed in the periphery: the exploitation of natural resources and in the local small business and service sector.
Appendix A: Convergence Results based on National Price Indexes

Table 3 presents the estimates of $\beta$ using national price indexes. Qualitative these results are not significantly different from those in Table 2.

<table>
<thead>
<tr>
<th>Variables</th>
<th>$\beta$</th>
<th>$R^2$</th>
<th>Half-Life (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPPNAT/POP</td>
<td>0.020</td>
<td>0.18</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>(2.45)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GPPNAT/WR</td>
<td>0.030</td>
<td>0.20</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>(2.41)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GPPNAT/HR</td>
<td>0.038</td>
<td>0.27</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>(2.86)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EINAT/POP</td>
<td>0.020</td>
<td>0.18</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>(2.34)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EINAT/WR</td>
<td>0.030</td>
<td>0.13</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>(1.98)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EINAT/HR</td>
<td>0.034</td>
<td>0.21</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>(2.43)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Numbers in parentheses are t-statistics.

Figures 8 and 9 show the dispersion of GPP and EI using national price indexes. The abnormal behaviour in Figure 8 for the 1974-1986 period, where the coefficients of variation increased beginning in 1974 and drastically dropped in 1986, was essentially driven by Alberta and to a lesser extent by Saskatchewan where their GPP increased dramatically in the late 1970s and declined in 1986 due to the rise and the subsequent decline of oil prices.
FIGURE 8 Coefficient of Variation of GPP: 1966-1992 (National GDP Deflator)

FIGURE 9 Coefficient of Variation of Earned Income: 1966-1992 (National CPI's)
References


GUIDELINES FOR CONTRIBUTORS

The Canadian Journal of Regional Science invites submission, in English or French, of articles (3,000-5,000 words), research notes and comments (not exceeding 2,000 words), and book reviews concerned with regional and urban issues, especially those of relevance to Canada. Only original material, not previously published, will be considered. Manuscripts should be submitted to the Editor in care of Department of Economics, University of New Brunswick, P.O. Box 4400 Fredericton, New Brunswick, Canada E3B 5A3.

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Headings should be in upper and lower case. First-order headings are centred. Second-order headings begin at the left margin. Third-order headings begin at the left margin and are underlined.

References, in parentheses, should consist of the author’s last name and the year of publication, with page number included where appropriate (Martin 1983: 50-55). Reference lists should be arranged in alphabetical order, with the date following immediately after authors’ names.

Persons submitting papers are requested to limit the number of references to one per 300 words of text.

Footnotes, restricted to explanation or provision of further information, should be numbered consecutively. The number of footnotes should be limited to one per 1,000 words of text.

Abstracts in both English and French of about 100 words must accompany articles.

Illustrations should be clear and legible but need not be prepared for reproduction before acceptance of article, when originals or high-quality photographic reproductions will be required. Dimensions of figures, including titles, should not exceed 11 x 6 inches.

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