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Canadian Economic Growth: Random Walk or Just a Walk?

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Canadian Economic Growth: Random Walk or Just a Walk?*

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1. The Issue; 2. The Role of Shocks in Canadian Economic Growth; 3. A Measure of Persistence of Innovations; 4. Results and Discussion; 5. Concluding Remarks.

Abstract: This paper analyzes the role of shocks in Canadian economic growth since 1870. It uses a nonparametric technique to evaluate the degree of persistence of an innovation in long-run GNP. It is found that a one percent shock to Canadian GNP changes the long-run forecast of this variable by approximately the same amount, which is characteristic of a random walk process. It is also shown that in important periods of Canadian economic growth, its GNP evolved as a random walk with constant drift. With the exception of the period 1929-1942, no evidence of business cycles is found. These results lead to the conclusion that movements and oscillations in the GNP of Canada since 1870 have been primarily driven by the accumulation of shocks rather than by cyclical movements. JEL: E32, N11, N12.

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I. THE ISSUE

What are the forces driving the movements and oscillations in GNP? The search for an answer to this question has been one of the main concerns of the literature on macroeconomics in the last several years. According to the traditional view, output movements are separated into an increasing deterministic trend and cyclical oscillations around this trend. Such a view, however, has been challenged, especially after the publication of Nelson and Plosser's (1982) provocative paper, where they show that several macroeconomic variables, including GNP, have a stochastic trend, *i.e.*, a trend which is sensitive to economic shocks and evolves according to a stochastic process.[1] Among several, one implication of the presence of a stochastic trend is that economic shocks are to some extent persistent in the sense that they change one's forecast of long-run GNP.

This paper uses the Canadian case to try to shed additional light on the issue of the stochastic pattern of output movements. The Canadian example is particularly useful because this country has experienced several particular and identifiable shocks in addition to the usual international innovations.

In a recent paper, Inwood and Stengos (1991) have shown that it is not possible to reject the hypothesis of a unit root in Canadian real GNP, suggesting the presence of a stochastic trend in this variable. They also used a procedure of analysis of interventions suggested by Perron (1989) and found that it is possible to reject the hypothesis of a unit root when one removes the effect of a domestic shock (the *wheat boom*) that occurred in the beginning of this century and the effect of the two World Wars. Based on these results, they concluded that a deterministic trend with discontinuities caused by these innovations best characterizes the process of economic growth in Canada. Moreover, they concluded that all other shocks experienced by the Canadian economy were stationary in the sense that they did not have persistent effects.

Nevertheless, as shown by Newbold and Agiakloglou (1991a), this kind of analysis of intervention is very sensitive to the choice of the break points. To face of this problem, a more reliable procedure would be to estimate several different models with different combinations of break points and choose the one which minimizes a model

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[1]Bernard and Durlauf (1991, p.4) give two definitions for a stochastic trend. Informally, a stochastic trend is defined as "the part of the time series which is expected to persist into the indefinite future, yet is not predictable from the past." Formally, a series is said to contain a stochastic trend "if it is nonstationary in levels even after removing a linear trend, whereas the process is stationary in differences."

choice criterion, such as AIC, BIC or AICC.[2] Moreover, Balke and Fomby (1991a, p.269) have shown that the usual unit root tests "tend to reject a unit root too frequently, thus failing to uncover non-stationarity generated by infrequent shocks" with random time of arrival. According to Balke and Fomby (1991b, p.71), a problem with the approach used by Inwood and Stengos (1991) is that the number and occurrence of the break points is chosen by the researcher, hence the uncertainty about how many and when the true breaks occur is not taken into account. According to them, "[i]f dummy variables are chosen after looking at the data, then there may exist a bias toward rejecting the unit root null in the Dickey-Fuller test."[3] Furthermore, there are no definitive results in the literature on the robustness of standard unit root tests to distributional assumptions.[4]

Another important issue related to the discussion above is the uncertainty inherent in future output movements. In the case of a deterministic trend, future uncertainty is limited, whereas in the random walk case this uncertainty grows with the horizon of forecasting, and hence is unbounded. Since the approach suggested by Perron (1989) and used by Inwood and Stengos (1991) does not take into account the randomness in the time of arrival of large, persistent shocks, it accesses zero (*ex ante*) probability for future breaks, hence it is equivalent to the deterministic trend for purposes of long-run uncertainty. The implications of the deterministic approach in this particular case, however, do not seem plausible. "The idea that uncertainty is bounded in the long run would appear to be implausible, since it seems unlike that one could be as confident of a prediction for GNP in the year 2000 as the year 2200" (Sampson, 1991, p. 67).

Furthermore, the issue of measurement of persistence of innovations was not addressed in Inwood and Stengos' (1991) paper. This is the important issue to be studied since a unit root is compatible with both a high and a low degree of persistence of innovations. According to Durlauf (1989, p.71):

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[2]Crafts and Mills (1991), for example, use goodness-of-fit criteria to choose the break point of a trend.

[3]See also Balke and Fomby (1991c).

[4]Roger Koenker brought this point to my attention.

> [W]hat is important about output fluctuations is persistence rather than the presence of an exact unit root. In several respects, exact unit roots findings may not even matter...On the theoretical side, various business cycles models with fundamentally different policy implications may be shown to be compatible with unit roots in economic time series.

This is so because any stationary series with a unit root in its autoregressive structure can be decomposed into a random walk component (usually interpreted as the trend of the series) and a stationary component (usually interpreted as cycles). However, the random walk can have arbitrarily small variance, which implies that unit root tests have arbitrarily low power in finite samples. [See Cochrane (1991) for more details.] Accordingly, as noted by Diebold and Nerlove (1990, p.38), the more interesting issue is the *importance* (*i.e.* the degree of persistence of innovations), rather than the *existence* of unit roots.

In this sense, this paper examines the issue of persistence of innovations in Canadian GNP and the stochastic pattern of this variable. This approach sheds additional light on the factors which have driven Canadian economic growth since 1870 and on the issue of stochastic trends, unit roots and persistence of innovations. The results are twofold. First, it is found that a one percent shock to Canadian GNP changes the long-run forecast of this variable by approximately the same amount. Second, all of the tests done point in the same direction: except for the period 1929-1942, it is not possible to reject the hypothesis that (log) GNP has evolved as a random walk with constant drift. This means that, except for the period mentioned above, it is not possible to reject the hypothesis that there have been no business cycles in Canada. The implication is that all oscillations in GNP have been movements in the trend itself, and not movements around a deterministic trend as previously thought. Similar results for the United States were found by Durlauf (1989,1991a).

The plan of the paper is as follows. Section 2 discusses the main features of the process of economic growth in Canada. Section 3 presents a measure of persistence of innovations due to Cochrane (1988). In Section 4, the results of this paper are presented and analyzed. Finally, some concluding remarks are given in Section 5.

II. THE ROLE OF SHOCKS IN CANADIAN ECONOMIC GROWTH

In a historical context, the claim that an accumulation of shocks has dominated Canada's output movements is based on the fact that a major determinant of economic growth in this country has been the discovery and exploitation of staple goods.[4] The process of Canadian development was based on the production of agricultural, forestry and energy staples, exported mainly to the United States. The classic example of the important role of staple production in Canadian economic growth was the "wheat boom." This term refers to "the rapid growth of wheat and flour exports as well as those of pulp and papers and minerals, the development of hydroelectricity energy, and the growth of secondary manufacturing" from 1895 to 1929 (Marr and Paterson, 1980, p.6).

The effects of this boom were spread throughout the economy. According to Green and Urquhart (1987, p.197):

> [D]uring the extended period of the wheat boom...the shares of agriculture and manufacturing remain relatively constant. Thus, the huge expansion in agricultural production that accompanied the opening of the West apparently was accompanied by significant growth in manufacturing activity. Agriculture, therefore, did *not* expand at the expense of manufacturing output. Canada, it seems, witnessed a long period of balanced economic growth.

This period, therefore, had particular features. These features were mainly due to the spreading out effect of the so-called wheat boom. This determined the process of growth in this period as well as future periods. The wheat boom, in this sense, had persistent effects.

The wheat boom *per se*, however, constitutes only one episode in the process of economic growth in Canada, which has been characterized, as pointed out before, by the discovery, exploitation and exporting of staple

[4]The term "staple goods" refers to raw, oftentimes agricultural goods, which are not usually processed goods.

goods. In this context, the Canadian economy has been very sensitive to the changes in world market conditions and, in particular, to changes in the international prices of its exportable goods. Such changes represented shocks to Canada. Another important innovation has been the fluctuation in international migration. As noted by Urquhart (1988, p.7), "fluctuations in international migration have been the major contributor to fluctuations from decade to decade in overall population growth." The accumulation of the effects of the shocks mentioned above as well as other ones have, to a large extent, driven Canada's output movements.

It is clear from the analysis above that the discovery and exploitation of staple goods have been a source of accumulation of shocks in Canadian output. It should also be said that there is another view of the economic growth in Canada, called *the revisionist view*. It places emphasis on the acquisition of new technology as the source of growth (Urquhart, 1988, p.3). This view also implies an important role for innovations in economic growth since shocks of technology are one of the mainstream explanations for persistence of innovations in GNP. This is so because such shocks have no inherent tendency to dissipate. The new technology is incorporated into the "state of the art" of the economy and remains until new technological shocks occur. Accordingly, Durlauf (1991b) has argued that the existence of dynamic coordination failures, such as technological complementarities associated with incomplete markets, can imply multiple stochastic equilibria. In this setting, aggregate productive shocks play the role of shifting the economy across equilibria. Persistence of innovations arises as a consequence of complementarity among sectors. Thus, according to the revisionist view, economic shocks also play an important role in output movements.

III. A MEASURE OF PERSISTENCE OF INNOVATIONS

In order to understand better the role economic shocks have played and continue to play in Canadian growth, it is useful to understand at the outset the impact which a hypothetical innovation has on this economy.

In this context, suppose that Canada experiences a shock which changes its actual GNP by one percent. How much does such a shock change one's forecast of this variable in the long-run? According to the traditional view, this change should be zero since innovations are viewed only to have effects during the business cycle. Once the shock has passed, the economy returns to its "natural" path of growth. For this to happen, however, it is necessary that the secular component evolves deterministically, that is, this component should not be affected by economic shocks. Still according to this view, these innovations affect the economy only in the short-run. Nevertheless, as noted before, when GNP has a stochastic trend, innovations are to some extent persistent. Thus, it is important to provide a measure for such persistence.

Such a measurement can be done by using the *variance ratio* technique proposed by Cochrane (1988), who has shown that

$$vr(k) = \frac{var(Y_t - Y_{t-k})}{k\ var(Y_t - Y_{t-1})} \qquad (1)$$

is a measure of the remaining effect of a one percent shock after (k-1) periods of time, where Y_t is the natural logarithm of real GNP. The variance ratio in (1) can be viewed as a *filter*, which keeps the information relative to the effect of an innovation while ignoring other information conveyed in the series.[5]

An estimator for the variance ratio above is given by

[5]A problem of interpretation arises due to the fact that the variance ratio is, in essence, a measure of the random walk component of the series, and yet it can take values greater than one. See Aoki (1990, pp.193-6).

$$vr^e(k) = 1 + 2 \sum_{j=1}^{k-1} \frac{k-j}{k} \hat{\rho}_j \,, \tag{2}$$

where $\hat{\rho}_j$ is the *jth* sample autocorrelation of the first difference of the series.[6] It is common to multiply the results obtained from (2) by the factor T/(T-k+1), where T is the number of observations. This is done in order to correct a downward bias of this measure.

IV. RESULTS AND DISCUSSION

The data used for the estimations presented below constitutes the log of the Canadian GNP (henceforth GNP) in billions of 1981 dollars from 1870 to 1985. The source of these data is Urquhart (1988).

Table 1 presents the estimates of the variance ratio for GNP, with the asymptotic standard errors in parentheses.[7] Figure 1 displays these results.

[Table 1 here]

[Figure 1 here]

These results show that a one percent shock to GNP changes the long-run forecast of this variable by approximately the same magnitude. That is, a shock that changes the current level of GNP by one percent also changes the long-run level of this variable by one percent. This is very meaningful since it is the degree of persistence of a drifted random walk. Such a process is given by

[6]For applications of the variance ratio, see Basu and McLeod (1991), Campbell and Mankiw (1989), Cochrane (1988), Cribari-Neto (1991), Kim, Nelson and Startz (1991), and Mills (1991).

[7]It is usual to use the log of the series, since its difference can be interpreted as its rate of growth.

$$Y_t = \mu + Y_{t-1} + \xi_t \,, \tag{3}$$

where ξ_t is second-order white noise.[8] The term μ in equation (3) is a constant, usually called drift, which introduces an upward movement in the series when such a constant is a positive number. When Y_t represents the logarithm of the original series, the drift is interpreted as a long-run growth rate. This process represents an accumulation of disturbances, which can easily be seen when equation (3) is rewritten as

$$Y_t = Y_0 + \mu t + \sum_{i=1}^{t} \xi_i \,. \tag{4}$$

The last term on the right side of the equation above represents the summation of historical disturbances which affect the current output.

According to the traditional view which attributes all the oscillations along a deterministic trend to business cycles, no innovations are persistent. However, the results above show a substantial degree of persistence of shocks implying that movements in the trend itself have accounted for large movements in output. This implies that business cycles in Canada are likely to be smaller than previously thought.[9]

Given the similarity between the results above and the ones expected for a random walk, it is important to test whether or not GNP follows such a process. One way to test this hypothesis is by using the *Portmanteau test*. This is done by computing the Box-Pierce statistic given by (Box and Pierce, 1970)

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[8]A random variable is said to be *second order white noise* if it follows a weakly stationary process, *i.e.*, if it has zero mean and is uncorrelated with constant variance (Bloomfield, 1991, p.153).

[9]Campbell and Mankiw (1989) have found a higher degree of persistence of innovations in Canadian GNP. However, given the small length of the series used in their paper, no inferences on the role of shocks in GNP's secular component can be made. Cogley (1990) has used a longer series for the GNP in Canada and found a degree of persistence of innovations slightly smaller to the one displayed in table 1.

$$Q(m) = T \sum_{j=1}^{m} \hat{\rho}_j^2 , \tag{5}$$

where T is the number of observations and $\hat{\rho}_j$ is the *jth* sample autocorrelation of the first difference of the series. It is shown that this statistic is asymptotically chi-squared distributed with m degrees of freedom.[10]

Computing this statistic for the first twenty sample autocorrelations of the first difference of GNP, it is found that Q(20)=35.66. Therefore, it is possible to reject the hypothesis that GNP evolves as a random walk at the level of significance of 5%.[11] The natural question is: Why was the hypothesis of a drifted random walk rejected once the persistence of an innovation found was similar to the one expected for this process?

It could be argued that such a rejection was due to a non-constant drift, that is, to the presence of a "local linear trend." In this case, GNP would evolve as

$$Y_t = \mu_t + Y_{t-1} + \xi_t , \tag{6}$$

with μ_t (the "evolving growth rate") given by

$$\mu_t = \mu_{t-1} + \eta_t , \tag{7}$$

[10]This statistic is often used to test for randomness of residuals from estimated ARIMA models. In this case, the Box-Pierce statistic is asymptotically chi-squared distributed with (m-p) degrees of freedom, where p is the number of estimated parameters. See Box and Jenkins (1970, pp.290-3).

[11]The critical value at the 5% level is 31.41.

and hence the first difference of the series is not stationary. In the equations above, ξ_t and η_t are independent zero mean white noises.[12] As noted by Newbold and Agiakloglou (1991b, p.344), this hypothesis can be tested by using a Dickey-Fuller test for a unit root in the difference of Y_t. Such a test is carried out by estimating the equation

$$\Delta Y_t = \gamma + \rho \Delta Y_{t-1} + \sum_{j=1}^{4} \phi_j \Delta^2 Y_{t-j} + e_t \qquad (8)$$

and testing the hypothesis that the statistic $\tau=(\rho-1)/\text{se}(\rho)$ is equal to zero using the table in Fuller (1976, p.373). For Canadian GNP the test statistic is -5.35, indicating a rejection of a unit root in the difference of the series at the level of 1%. The corresponding statistic for the Phillips-Perron (1988) test is -8.10, which also leads to the rejection of the null. This result suggests that GNP does not evolve as the process given in equations (6) and (7), where the drift is non-constant and follows a random walk. In other words, the rejection of the random walk hypothesis in the whole sample was not due to the assumption of a constant long-run growth rate.

To explain such a rejection, one should consider separately the different periods of Canadian economic growth. In particular, two periods are considered individually. The first includes the depression of the 1870s and the wheat boom and goes from 1870 to 1928. The second covers the most recent period, from 1943 to 1985. This later period was characterized by sustained economic growth. The wheat boom, as discussed before, was characterized by a period of rapid economic growth. The Box-Pierce statistic for both periods is given in Table 2.

[Table 2 here]

The figures in the table above show that it is not possible to reject the hypothesis that GNP followed a random walk with constant drift within the two subperiods considered. These figures cast some doubt on Inwood

[12]See Harvey (1985).

and Stengos' (1991) result that a discontinuous deterministic trend best characterizes the economic growth in Canada. It is important to note that the first subperiod in table 2 contains the first *two* shocks considered by Inwood and Stengos, namely the wheat boom and the World War I.[13]

The procedure used above tests whether the autocorrelations are *jointly* equal to zero. However, if the series follows a random walk (with or without drift), then the autocorrelations of its first difference are expected to also be *individually* equal to zero. Under the null hypothesis, such autocorrelations are uncorrelated and distributed approximately Normally with mean zero and variance 1/T (Box and Jenkins, 1970, pp.289-90; Brockwell and Davis, 1991, pp.220-5). For the period from 1870 to 1928, all of the first twenty sample autocorrelations are contained in the interval $(-2T_1^{-1/2}, 2T_1^{-1/2})$, the same being true for the period which goes from 1943 to 1985. In other words, the correspondent autocorrelations are contained in the interval $(-2T_2^{-1/2}, 2T_2^{-1/2})$, where T_1 and T_2 are the sample sizes of the respective subperiods. Table 3 displays the first seven sample autocorrelations for each period. Hence, once more it is not possible to reject the hypothesis that GNP followed are random walk within these subperiods.

[Table 3 here]

Since the interest here is in testing whether there is a cyclical component in Canadian GNP in the two subperiods considered, a test for this specific hypothesis can be conducted. A useful test for this is *Fisher's test*.[14] It enables one to test for the presence of hidden periodicities with unspecified frequency. The test statistic is given by

[13]It should be noted that the results above relate to the behavior of the GNP itself, whereas Inwood and Stengos' results relate to the behavior of the trend in GNP. They argue (p.279) that "[i]f the data are characterized by a unit root, then Eq.(3) [a drifted random walk] best describes the time series." However, this is not so. The presence of a unit root implies a (drifted) random walk in the trend of the series, and not in the series itself. [See Beveridge and Nelson (1981).] Consider, for instance, that a variable Z_t is generated by an ARIMA (p,1,q) with $\max\{p,q\} > 0$. Then, Z_t has an autoregressive unit root, and yet it does not follow a random walk.

[14]For more details on this test, see Bloomfield (1976, pp.110-113), Brockwell and Davis (1991, chapter 10) and Fuller (1976, pp.283-285).

$$\psi_q = \frac{\max_{1 \le j \le q} I(\omega_j)}{q^{-1} \sum_{j=1}^{q} I(\omega_j)}, \qquad (9)$$

where $\omega_j = 2\pi j/T$, $I(\cdot)$ is the periodogram of ΔY_t defined as $I(\omega_j) = T^{-1} \mid \Sigma_t \Delta Y_t \exp\{-it\omega_j\} \mid^2$, and $q = (T-1)/2$. The null hypothesis for this test is that the series is a Gaussian white noise. Fisher's statistic was calculated for each period and is displayed in table 4.

[Table 4 here]

The figures in table 4 show that it is not possible to reject the hypothesis of a (Gaussian) random walk in GNP for the subperiods from 1870 to 1928 and from 1943 to 1985 at the significance level of 5%, although it is possible to reject this hypothesis for the entire sample. That is, this test gives the same results obtained before.

However, even though the results of the tests above suggest that GNP evolved as a drifted random walk within the two subperiods, it was possible to reject the random walk hypothesis for the whole series. This can be explained by the fact that the movements in Canadian GNP between 1929 and 1942 were by no means "typical." The shocks that occurred in this period were essentially stationary and viewed as transitory by the economic agents. As shown in table 3, the first and second sample autocorrelations for the difference in GNP for this period are 0.63 and 0.32, respectively. This shows a high degree of predictability in the behavior of output movements. Hence, the rejection of the random walk hypothesis for the entire series was caused by this atypical period. This can be viewed by looking at the basic statistics of the difference in GNP for each period, that is, the growth rate. These statistics are displayed in table 5.

[Table 5 here]

An inspection of the figures in table 5 suggests that the average growth rate has been approximately constant, but the same is not true for the volatility. The growth rate in the period from 1929 to 1942 has a standard deviation which is almost double that of the one found for the entire sample and more than three times the standard deviation

for the last subperiod.

The results discussed above are markedly similar to those found by Durlauf (1989,1991a) for the United States, although in his analysis he has used a different methodology. According to him (1989, p.82),

> For both the pre-Depression and postwar periods, it is impossible to reject the hypothesis that the series are random walks with drift. Over the entire sample [1870-1987], there is considerable deviation from white noise. This evidence, however, is generated by the presence of the Depression and the World War II years. If one believes that the 1930-45 economy is fundamentally different from the pre-Depression and postwar economy, then the evidence is consistent with the view that output innovations are permanent.

This finding is also consistent with the results of Cooley and Ohanian (1991), who have shown that the only period for which there is considerable evidence of procyclical price movements is the period between the two World Wars, in particular the period of the Great Depression.[15] It is also consistent with Plosser's (1990) results, in which it is shown that the evidence of independent variations in the nominal quantity of money as a business cycle impulse is very weak.

Hence, when compared to Durlauf's results the tests carried out above suggest that the movements in Canadian GNP have followed a pattern similar to the one of the GNP in the United States.

In short, the results above show that GNP evolved as a random walk with (constant) drift in important subperiods of Canadian economic growth. They also show that for the entire period (1870-1985) the degree of persistence of shocks to GNP was approximately equal to that expected for a random walk process. Such results imply that the movements and oscillations in the GNP of Canada since 1870 have been primarily due to the accumulation of the effects of various economic shocks. In other words, the oscillations in Canadian GNP have

[15]Recall that procyclical movements in prices are one of the mainstream arguments for the existence of business cycles.

been driven by innovations and not by cycles.[16]

V. CONCLUDING REMARKS

The purpose of this paper was to identify the nature of Canadian economic growth since 1870. This was done by measuring the degree of persistence of innovations in the GNP of Canada. It was shown that a one percent shock to this variable changes its long-run forecast by approximately the same magnitude, a characteristic of a random walk process. Accordingly, it was found that GNP evolved as a random walk with constant drift in important subperiods of Canadian economic growth.

The results of this paper lead to two important conclusions. First, much of Canada's output movements are attributable to movements in a stochastic trend, suggesting that business cycles have been smaller than previously thought. Indeed, no evidence of business cycles was found, with the exception of the period between 1929 and 1942. Second, the behavior of Canadian output has been driven by the accumulation of economic shocks, of which the wheat boom is only a particular case.

[16]Other results in the recent literature on output fluctuations point in the same direction. For instance, Cuddington and Urzúa (1989) have shown that the cyclical component in Colombia's real GDP is markedly smaller when a decomposition accounting for a stochastic trend is used, and Newbold and Agiakloglou (1991b) found no evidence of cycles in British industrial production. Moreover, as noted before, Durlauf (1989) obtained results for the US case similar to those in this paper.

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Table 1: Variance Ratio for Canadian GNP, 1870-1985

k	$ve^c(k)$
1	1.00 (0.09)
2	1.28 (0.17)
4	1.45 (0.23)
5	1.53 (0.28)
8	1.52 (0.31)
6	1.46 (0.33)
7	1.46 (0.33)
8	1.35 (0.35)
9	1.27 (0.35)
10	1.17 (0.34)
11	1.08 (0.33)
12	1.01 (0.33)
13	0.97 (0.32)
14	0.96 (0.33)
15	0.97 (0.35)
20	1.05 (0.43)
25	0.90 (0.42)

Figure 1: Variance Ratio

Canadian GNP, 1870-1985

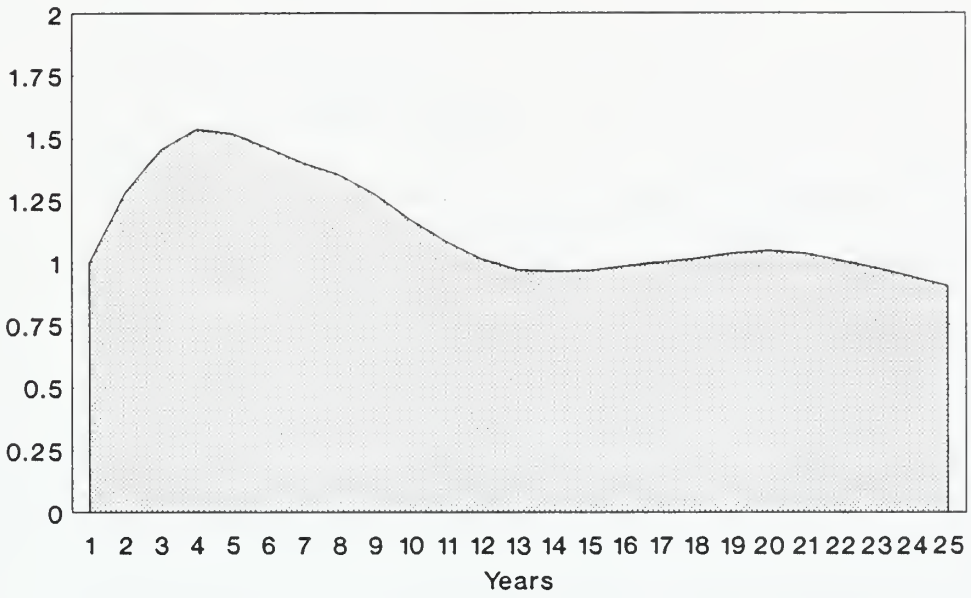

Table 2: Box-Pierce Statistic for Different Subperiods

Period	Q(20)
1870-1928	10.05
1943-1985	9.25

Table 3: Sample Autocorrelations for Different Subperiods

Period	$\hat{\rho}_1$	$\hat{\rho}_2$	$\hat{\rho}_3$	$\hat{\rho}_4$	$\hat{\rho}_5$	$\hat{\rho}_6$	$\hat{\rho}_7$
1870-1928	0.046	0.017	0.005	-0.038	-0.088	0.005	0.045
1929-1942	0.632	0.319	0.039	-0.124	0.023	0.005	-0.021
1943-1985	0.201	-0.036	0.174	-0.071	-0.070	-0.103	-0.057

Table 4: Fisher's Statistic and P-Values

Period	Ψ_q	p-value
1870-1985	4.852	3.47%
1870-1928	3.120	7.88%
1943-1985	2.776	8.16%

Table 5: Average Growth Rate and Standard Deviation

Period	Average Growth Rate	Standard Deviation
1870-1985	3.78%	5.41%
1870-1928	3.68%	5.63%
1929-1942	3.51%	9.58%
1943-1985	3.99%	2.78%

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