Long-Run Relationship between Economic Growth and Stock Returns: An Empirical Investigation on Canada and the United States

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Abstract

This article examines the long run relationship between economic growth and stock prices for Canada and the United States through cointegration estimation procedure, and it implements the Vector Error Correction Models (VECM) to abstract simultaneously the short- and long-run information in the modelling process. Results from the cointegration tests reveal that economic growth and stock prices share long run equilibrium relationship for both Canada and the U.S. The results from the VECM indicate that for the U.S., causality runs from economic growth to stock prices but not vice versa. However for Canada, the results reveal that there is a bi-directional causality between economic growth and stock prices.

Keywords: *stock returns, interest rates, economic growth, Canada, the United States*

JEL Classification: E44

1. Introduction

Stock market contributes to economic growth through the specific services it performs either directly or indirectly. Notable among the functions of the stock market are mobilization of savings, creation of liquidity, diversification of risk, improvement of dissemination and acquisition of information, and enhanced incentive for corporate control. Improving the efficiency and effectiveness of

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these functions, through prompt delivery of their services can augment the rate of economic growth. The level of economic activities is affected by the stock market, in particular, through its liquidity creating ability (Bencivenga et al., 1996). The logic of this reasoning is that profitable investment requires long-term capital commitment; often investors are not willing or are reluctant to trade their savings for a long gestation period. With liquid equity markets, risks associated with investment are reduced, making it more attractive to investors. Thus, the easy transfer of capital ownership facilitates firms' permanent access to capital raised through equity issues.

Therefore, as liquid market improves the allocation of capital, the prospect for long-term economic growth is enhanced. Also, savings and investment are increased due to reduction in the riskiness of investment facilitated by stock market liquidity. The proponents of positive relationships between stock market development and economic growth have also argued that as stock prices increase, people feel rich and they spend more on consumption. This is the wealth effect that shifts the consumption function and, through the Keynesian multiplier effect further increases the national income.

Empirical studies of the wealth effect, however, suggest that this gain is rather small. A dollar increase in wealth is likely to lead to a three-to-four cent increase in consumption (Ludrigson and Steindel, 1999; Mehra, 2001). Further changes in wealth are not found to be helpful in predicting changes in consumer spending in the future, implying that however small the effect on consumption, it is largely contemporaneous. It can also be argued that the increases in stock prices lead to increases in investment. The q-theory advanced by Brainard and Tobin (1968) strongly suggests the relationship between asset prices and real investment. Rising stock prices increases the market value of the firm's capital that exceeds its replacement cost, and managers react by undertaking additional investment projects, therefore increasing the total outlays on investment in the economy. Malkiel (1998) argues that the stock market moves the economy in at least three ways. First, the higher stock value creates the usual wealth effect. Second, for many large corporations, the stock price increases lower their cost of new capital. Third, the familiar expectations effect improves the business and consumer confidence for the future.

In short, stock market aids economic growth and development through the mobilization and allocation of savings, risk diversification, liquidity creating ability and corporate governance improvement among others. Yet, an alternative view on stock market and long term economic growth by Demirgüç-Kunt and Levine (1996) suggests that there are some channels through which liquidity can deter growth: Firstly, savings rate may be reduced, this happens when there is

increasing returns on investment through income and substitution effect. As savings rate falls and with the existence of externality attached to capital accumulation, greater stock market liquidity could slow down economic growth. Secondly, reducing uncertainty associated with investment may impact on savings rate, but the extent and the direction remain ambiguous. This is because it is a function of the degree of risk-averseness of economic agents. Thirdly, effective corporate governance often touted as an advantage of liquidity of stock market may be adversely affected. The ease with which equity can be disposed off may weaken investors' commitment and serves as a disincentive to corporate control and vigilance on the part of investors thereby negating their role of monitoring firm's performance. This often culminates in stalling economic growth.

As "asset prices are forward-looking, they constitute a potentially useful predictor of economic growth" (Stock and Watson, 2003), the long run relationship between economic growth and stock prices has been frequently analyzed in the literature. Most of the earlier studies that have examined this relationship based their analyses on bivariate frameworks and, to our knowledge, there exists no study employing the multivariate procedure. Therefore the present study aims at filling this gap in the literature through employing the multivariate procedure in order to avoid distortions resulting from the omission of relevant variables. The novelty of the present analysis is the use of both the short- and long-term interest rates as mediating variables. Interest rates have implications for both economic growth and stock returns. First, high interest rates retard economic growth through investment and consumption. As interest rates rise, businesses and households borrow less for investment and consumption. Second, higher interest rates present competition to stock returns. Investors will keep their money in banks rather than buy stocks when interest rates are high and vice versa. For these reasons, the present study will not only explore the causal relationship between economic growth and stock returns, but it will also shed additional light on the causal effects of interest rates on economic growth and stock returns. Notwithstanding the varied experience of many countries with respect to the role of the stock market, this study attempts to examine the long-term relationship between economic growth and stock prices in two large economies in the Western World, namely Canada and United States. We apply co-integration estimation procedure to explore such relationship and implement the vector error correction models to abstract simultaneously the short-term and long-term information in the modeling process. The remainder of the paper proceeds as follows: section 2 provides a review of the literature and section 3 discusses methodology. Section 4 furnishes the data and the empirical results. Section 5 provides the summary and conclusions of the study.

2. Literature Review

As Stock and Watson (2003) explains, last two decades have seen considerable research on forecasting economic activity using asset prices. The literature on forecasting using asset prices has pointed out a number of asset prices as leading indicators of either economic activity including interest rates, dividend yields, term spreads, stock returns, and exchange rates (Stock and Watson, 2003). One of the earlier studies in the area, Sims (1980), found that including the commercial paper rate in vector autoregressions (VARs) with output, inflation, and money eliminated the marginal predictive content of money for real output using data for the United States. Studies such as Bernanke and Blinder (1992) found similar results. Other studies employing U. S. data such as Laurent (1988, 1989), Harvey (1988, 1989), Stock and Watson (1989), Chen (1991), and Estrella and Hardouvelis (1991) mainly focused on using the term spread to predict output growth. Several studies found that stock returns precede output changes. Fama (1990), Schwart (1990), and Barro (1990), for instance, confirmed that substantial portions of stock value variations could be explained by future value of real activity in the United States and that stock return were highly correlated with future economic growth. Nevertheless, Hassapis and Kalyvitis (2002) contended that such evidence might indicate that stock returns were a good proxy for future activity and could only act as a leading indicator due to the fact that these studies did not conduct any causality test. In addition, they developed a model of stock price changes and economic growth that showed that there was a positive relationship between stock price changes and future growth. Using data for the G-7 countries in a VAR model, they found that real stock price changes served as a useful predictor of output for these countries with the exception of Italy. Levine and Zervos (1996) examined whether there is a strong empirical association between stock market development and long-run economic growth based on data from forty-one countries. The study tow the line of Demirgüç-Kunt and Levine (1996) by conglomerating measures such as stock market size, liquidity, and integration with world markets, into index of stock market development. The growth rate of Gross Domestic Product (GDP) per capita was regressed on a variety of variables designed to control for initial conditions, political stability, investment in human capital, and macroeconomic conditions; and then include the conglomerated index of stock market development. The finding was that a strong correlation between overall stock market development and long-run economic growth existed. A number of studies based their studies on major non-OECD economies. Harvey (1991). For instance, Hu (1993), Davis and Henry (1994), Plosser and Rouwenhorst (1994), Bonser-Neal and Morley (1997), Kozicki (1997), Campbell (1999), Estrella and Mishkin (1997), Estrella *et al.* (2003), and Atta-Mensah and Tkacz (2001) found evidence that the term spread had predictive content for real output growth.

Binswanger (2000), on the other hand, found evidence that the strong relationship between stock returns and real activity in the United States disappeared in the early 1980s. He asserted that although such relationship held in the first stock market boom that lasted from the late 1940s to the mid-1960s, stock returns did not lead real activity any longer. He pointed out that there was a breakdown in the relationship between stock prices and future real activity in the United States since the early 1980s. In a subsequent study, Binswanger (2003) extended this analysis to the other G-7 countries and found that similar breakdowns occurred in Japan and in the aggregate European economy. He concluded that since the 1980s, stock markets did not lead real income activity and that this held even when the 1987 episode was excluded. Laopodis and Sawhney (2002) reach similar conclusions. Kassimatis and Spyrou (2001) explored the relationship between equity, credit-market, and economic growth in several emerging markets. Based on causality tests, they found that in financially repressed markets, the stock market had either a negative impact on economic growth or had no impact on growth at all.

3. Methodology

The time series properties of real GDP, treasury bills rate, 10-yeard treasury bond rate, and stock market index are examined through the modified Dickey and Fuller (1979) test proposed by Elliott, Rothernberg and Stock (1996). The modified DF test is referred to as the DF-GLS test. Elliot *et al.*, (1996) and Perron and Ng (1994) have shown that the DF-GLS has better finite-sample properties than the conventional Dickey-Fuller and Phillips-Perron tests. The DF-GLS unit root test is based on the following regression equation:

$$\Delta y_t^d = \alpha_0 y_{t-1}^d + \sum_{j=1}^{p} \beta_j \Delta y_{t-j}^d + \mu_t \qquad (1)$$

where p is the maximum lag, y_t^d represents locally detrended series of y_t [i.e. $y_t^d = y_t - z_t\tilde{\beta}$, where $zt = (1, t)$ and $\hat{\beta}$ is the regression of y on z]. The Modified Akaike Information Criterion (MAIC) developed by Ng and Perron (2002) is used to determine the maximum lag lengths. Under the DF-GLS unit root test, the null hypothesis is that $\alpha_0 = 0$, while the alternative is $\alpha_0 < 0$.

To determine the long run relationship between real GDP, treasury bills rate and stock prices, we implement the Johansen and Juselius (1990) and Johansen (1991) cointegration procedure. The cointegration test is based on the following vector error correction model (VECM):

$$\Delta Y_t = \delta_0 + \sum_{i=1}^{p} \delta_i \Delta Y_{t-i} + \alpha \beta' Y_{t-p} + \mu_t \quad (2)$$

where, Δ is the first difference operator, Y_t represents (SP_t, TB_t, Y_t), δ_0 represents the intercept, and μ represents the vector of white noise process. The matrix β consists of r ($r \leq n-1$) cointegrating vectors. Matrix α contains the error parameters. In equation (2), the null hypothesis is that the matrix ($\Pi = \alpha\beta'$) has a reduced rank of $r \leq n-1$. However, the alternative hypothesis is that the matrix ($\Pi = \alpha\beta'$) has full rank. The Johansen and Juselius cointegration procedure yields two statistics (i.e. maximum eigenvalue and the trace statistics).

The study estimates the following VECM to determine the long and short run dynamics between stock prices, economic growth, and treasury bills rate:

$$\Delta Y_t = \alpha + \sum_{i=1}^{a} \theta_i \Delta Y_{t-i} + \sum_{i=1}^{b} \varphi_i \Delta SR_{t-i} + \sum_{i=1}^{c} \varphi_i \Delta IR_{t-i} + \Phi Z_{t-1} \quad (3)$$

$$\Delta SP_t = \alpha + \sum_{i=1}^{a} \theta_i \Delta Y_{t-i} + \sum_{i=1}^{b} \varphi_i \Delta SR_{t-i} + \sum_{i=1}^{c} \varphi_i \Delta IR_{t-i} + \Phi Z_{t-1} \quad (4)$$

$$\Delta IR_t = \alpha + \sum_{i=1}^{a} \theta_i \Delta Y_{t-i} + \sum_{i=1}^{b} \varphi_i \Delta SR_{t-i} + \sum_{i=1}^{c} \varphi_i \Delta IR_{t-i} + \Phi Z_{t-1} \quad (5)$$

where Δ stands for difference operator; Y and SR represent economic growth and stock returns, respectively; IR stands for either short-term interest rate (TB – treasury bills rate) or long-term interest rate (10-yeard treasury bond yield). The maximum lags determined by the modified AIC are represented by a, b, and c. Z_{t-1} is the error-correction term lagged by one period. The error correction term assesses the deviations of the variables from the long run equilibrium association. Under the VECM, the null hypothesis of non-causality is rejected if the sum of the regression coefficients on the independent variable is significantly different from zero and/or the error correction term is statistically significant. For instance, in equation (3), the null hypothesis that stock prices do not Granger-cause economic growth is rejected if the set of estimated coefficients on the lagged values of ΔSR and/or the lagged error correction term (Z_{t-1}) is statistically significant.

4. Data and Empirical Results

This paper employs quarterly data on real GDP (Y), treasury bills rate (TB) (proxy for short-term interest rate), 10-year bond rate (R) (proxy for long-term interest rate), and stock returns (SR). The sample covers the period 1970:1 through 2003:4. The data used in this study were all obtained from *International Financial Statistics* (IFS) CD-ROM data disk 2003 published by the International Monetary Fund (Washington, DC).

The time series properties of GDP growth, stock returns, and interest rates (*R* and *TB*) are examined first. Table 1 reports the statistics related to the DF-GLS tests. The results indicate that GDP growth, stock prices, and the interest rates for all countries can be characterized as nonstationary in their autoregressive representation. However, they achieve stationarity after first differencing. Taken together, the unit root test results indicate that all three variables have one order of integration for both Canada and the U.S.

Table 1

Modified Dickey-Fuller Unit Root Test Results

Country	*Series*	*Level*	*Lag*	*Difference*	*Lag*
Canada	Y	–2.28	2	–4.41**	2
Sample Size (135)	*SR*	–2.55	5	–3.68**	2
	R	–1.70	4	5.14**	4
	TB	–1.62	5	–5.74**	5
USA	Y	–2.78	6	–4.16**	6
Sample Size (135)	*SR*	–2.58	5	–3.40**	2
	R	–2.61	4	–4.36**	4
	TB	–1.96	4	–4.43**	4

** Indicates the rejection of the null hypothesis a unit root at the 5% significance level. The critical value at the 5% significance level is –3.00, with constant and trend. The lags were determined by the modified AIC; *Y* is real GDP growth rate, *SR* represents real stock returns, *R* is the real 10-year bond rate (long-term interest rate), and *TB* stands for real treasury bills rates (short-term interest).

Having established that GDP growth, stock prices, and the interest rates are not stationary in their levels, we move on to determine if they are cointegrated. The results from the multivariate cointegration test are presented in Tables 2A and 2B. As can be seen from Tables 2A and 2B, both the λ-max and the trace test statistics indicate that there are two significant cointegrating vectors between economic growth, stock returns, and interest rate series for both Canada and the U.S.

Table 2A

Johansen Multivariate Cointegration Tests Results (with short-term interest rate)

	Trace Test		*Maximum Eigenvalue Test*		
Null Hypothesis	Test Statistic	Critical Value	Null Hypothesis	Test Statistic	Critical Value
Canada					
r = 0	53.59**	34.91	r = 0	30.44**	22.00
r ≤ 1	23.15**	19.96	r ≤ 1	16.21**	15.67
r ≤ 2	6.94	9.24	r ≤ 2	6.94	9.24
USA					
r = 0	71.55**	34.91	r = 0	33.61**	22.00
r ≤ 1	37.95**	19.96	r ≤ 1	29.16**	15.67
r ≤ 2	8.78	9.24	r ≤ 2	8.78	9.24

** Indicates the rejection of the null hypothesis at the 5% significance level. The critical values are obtained from the EVIEWS 4.0 program.

Table 2B

Johansen Multivariate Cointegration Tests Results (with long-term interest rate)

	Trace Test		*Maximum Eigenvalue Test*		
Null Hypothesis	Test Statistic	Critical Value	Null Hypothesis	Test Statistic	Critical Value
Canada					
r = 0	53.56**	34.91	r = 0	30.53**	22.00
r ≤ 1	23.03**	19.96	r ≤ 1	21.04**	15.67
r ≤ 2	1.99	9.24	r ≤ 2	1.99	9.24
USA					
r = 0	66.82**	34.91	r = 0	39.93**	22.00
r ≤ 1	26.90 **	19.96	r ≤ 1	22.52**	15.67
r ≤ 2	4.38	9.24	r ≤ 2	4.38	9.24

** Indicates the rejection of the null hypothesis at the 5% significance level. The critical values are obtained from the EVIEWS 4.0 program.

Prior to estimating the VECM, we conducted the weak-exogeneity tests between real GDP, the interest rates (i.e. treasury bills rate and 10-yeard treasury bond rate), and stock returns for Canada and the United States. The weak-exogeneity test measures the long-run relationship between variables in the cointegrating vector. The procedure is based on a likelihood ratio test, which follows a Chi-square distribution. The results of the weak-exogeneity tests are presented in Table 3.

Table 3

Test for Weak-Exogeneity: LR Test CHISQ(*r*)

r	DGF	CHISQ_5	*Y*	*SR*	*TB*	*R*
Panel A: (Y, SR, and TB)						
Canada						
1	1	3.84	0.50	5.35**	5.30**	–
2	2	5.99	22.88**	23.09**	8.29**	–
USA						
1	1	3.84	2.84	17.94**	15.01**	–
2	2	5.99	33.32**	36.27 **	15.67**	–
Panel B: (Y, SR, and R)						
Canada						
1	1	3.84	0.01	29.07**	–	2.51
2	2	5.99	7.74**	36.77**	–	2.79
USA (Y, SR, and R)						
1	1	3.84	2.75	15.88**	–	5.59**
2	2	5.99	28.35**	40.42**	–	6.77**

** Indicates rejection of the null hypothesis of weak erogeneity at the 5% level of significance; *r* – cointegration rank, DGF – degrees of freedom, CHISQ_5 = 5% critical value of Chi Square statistic, *Y* is real GDP growth rate, *SR* represents real stock returns, *R* is the real 10-year bond rate (long-term interest rate), and *TB* stands for real treasury bills rates (short-term interest). The weak exogeneity test results are reported according to the number of cointegrating ranks (*r*) suggested by the Johansen cointegration tests.

The weak-exogeneity test results are reported according to the number of cointegrating ranks (r) determined by the Johansen cointegration tests for each income group, as presented in Tables 2A and 2B. The results obtained from the weak-exogeneity procedures reveal that most of the variables in the system are endogenous. For example, in Panel A, with $r = 2$, we reject the null hypothesis of weak exogeneity for real GDP (Y), stock return (SR) and real treasury bills (TB) for Canada and the United States at the 5% level of significance. The fact that most of the variables can be characterized as endogenous indicates that short-term innovations in a given variable have implications for long run relationships in the system.

The existence of cointegration between economic growth, stock returns, and interest rate allows us to implement the VECM, which describes the systematic disequilibrium adjustment process and the short-run transmission mechanism. The endogenous variables in the system include lagged variables of the GDP growth, stock prices, and interest rate and the error correction term from the cointegrating equation. The joint significance of the lagged values of GDP growth, stock price, and interest rate coefficients are provided by F-statistics. Tables 4A and 4B present the results from the estimation of the VECM. Several interesting transmission patterns emerge from the examination of Table 4A. We observe from Table 4A that the estimated lagged error-correction term (z_{t-1}) emerges as an important channel of influence. The statistically significant error-correction term, confirms the existence of long run relationships between economic growth, stock returns, and the interest rates. In other words, the series quickly adjusts to eliminate any deviations from the long-run equilibrium relationships that they may share with each other.

Table 4A

Dynamics between Economic Growth, Short-Term Interest Rate and Stock Returns: F-Statistics

	z_{t-1}	$\Sigma\Delta Y$	$\Sigma\Delta SR$	$\Sigma\Delta TB$
Panel A: Real GDP (ΔY) Equation in the VECM				
Canada	4.63**	193.42***	0.07	0.85
USA	0.30	8.94**	0.19	0.01
Panel B: Stock Index (ΔSR) Equation in the VECM				
Canada	4.44**	1.43	2.14	0.22
USA	4.72**	6.44***	8.12***	1.04
Panel C: Interest Rate (ΔTB) Equation in the VECM				
Canada	12.91***	0.68	2.12	4.12**
USA	5.35**	1.71	1.15	7.69***

*, **, and *** Indicate rejection of the null hypothesis of non-causality at the 10%; 5% and 1% level, respectively; Y is real GDP growth rate, SR represents real stock returns and TB is the treasury bills rate.

As can be seen in Panel A of Table 4A, stock returns and short-term interest rate have casual influence on economic growth through the significant error correction term. For the U.S., neither the sum of the lagged coefficients, nor the error correction term is statistically significant, indicating that stock returns and short-term interest rate do not Granger-cause economic growth. Turning to Panel B of Table 4A, we observe that both short-term interest rate and economic growth Granger-cause stock returns through the statistically significant error term for Canada. However for the U.S., both short-term interest rate and economic growth Granger-cause stock returns as either the error term, or the sum of the regression coefficients is significant. Furthermore, Panel C of Table 3A reveals that for both Canada and the U.S., economic growth and stock returns have causal effects on interest rate through the error term.

We next examine the VECM results presented in Panels A through C of Table 4B. From Panel A, we observe that stock market returns and long-term interest rate Granger-cause economic growth for Canada since the sum of their lagged coefficients are statistically different from zero. For the U.S., both stock returns and long-term interest rate Granger-cause economic growth. In this case, causality emerges through the error correction term and the sum of the lagged coefficients of long-term interest rate. It is interesting to observe from Panel B of Table 4B that both economic growth and long-term interest rate have causal influence on stock returns for Canada and the U.S. For Canada, economic growth and long-term interest rate influence stock returns through the statistically significant error correction term. However, for the U.S. economic growth and stock returns affect long-term interest rate through the error correction term and their lagged values. Finally, an examination of Table 4B, Panel C, reveal that stock market returns and economic growth Granger-cause long-term interest rate for Canada and the U.S. Again, the error correction term emerges as the source of causality.

Table 4B
Dynamics between Economic Growth, Long-Term Interest Rate and Stock Returns: F-Statistics

	z_{t-1}	$\Sigma\Delta Y$	$\Sigma\Delta SR$	$\Sigma\Delta TB$
Panel A: Economic Growth (ΔY) Equation in the VECM				
Canada	0.11	0.63	17.85***	4.32**
USA	20.41***	3.78**	0.41	4.35***
Panel B: Stock Returns (ΔSR) Equation in the VECM				
Canada	38.04***	0.75	1.38	4.24**
USA	32.33***	0.48	0.21	1.11
Panel C: Interest Rate (ΔR) Equation in the VECM				
Canada	5.34***	3.12**	0.82	7.50***
USA	7.43***	0.87	1.02	10.16***

*, **, and *** Indicate rejection of the null hypothesis of non-causality at the 10%; 5% and 1% level, respectively; Y is real GDP growth rate, SR represents real stock returns and R is the real 10-year bond rate.

Taken together, the results reveal a web of significant interactions between economic growth, stock returns, and interest rates (short-term and long-term) for both Canada and the U.S. For Canada, we surmise from the results that there is bi-directional causality between stock returns, short- and long-term interest rates and economic growth. However, for the U.S., causality runs from economic growth to stock returns but not vice versa. Bi-directional causality is indicated between stock return and interest rate.

Summary and Conclusions

This paper has examined the relationship between stock prices and economic growth in the context of Canada and the U.S. Three distinct analyses were conducted. Specifically, the modified Dickey-Fuller and Phillips-Perron unit root tests were performed to determine the order of integration for each of the variables in the model. Second, the Johansen cointegration procedure was used to explore the long-run equilibrium relationship between the stock price, treasury bills rate, and the GDP. Third, the VECM was used to ascertain both the long and short run dynamics between the stock price, treasury bills rate, and the GDP.

The modified Dickey-Fuller unit root test results indicate that all of the series are integrated of order one. The Johansen cointegration test results indicate that there is long run equilibrium relationship between the stock price, treasury bills rate, and the GDP for both Canada and the U.S. The results from the VECM suggest that for the U.S., economic growth Granger-cause stock prices but not vice versa. However, for Canada, the results indicate a feedback relationship between economic growth and stock prices.

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