Impact of changes in the U.S money supply on Canadian stock markets

by

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Abstract

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The purpose of this study was to determine whether a change in the U.S money supply (M2) growth affects the prices of the S&P/TSX composite index. This paper closely follows the two-stage approach of Sorensen (1982) to dichotomize a change in the U.S money supply (M2) into anticipated and unanticipated components. To conduct the analysis, the observations are collected from December 31, 1976 to June 29, 2012 (except the real GDP data that are from December 31, 1976 to December 31, 2011) and are averaged out to produce quarterly data. The results of this study indicate that the U.S money supply (M2) has a significant positive impact on the prices of the S&P/TSX composite index. Moreover, the results also indicate that there is a long-term relationship between the U.S money supply (M2) and the prices of the S&P/TSX composite index. Last but not least, this paper, on the one hand, supports the Efficient Market Hypothesis (EMH) on the fact that anticipated changes in the U.S money supply (M2) have no significant impact on the prices of the S&P/TSX composite index. On the other hand, the study refutes the EMH on the fact that unanticipated changes in the U.S money supply (M2) have also no significant impact on the prices of the index.

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CHAPTER 1

INTRODUCTION

1.1 OVERVIEW

There are many definitions for monetary policy which, according to the Bank of Canada, is concerned with how much money circulates in the economy and what that money is worth. The U.S Federal Reserve (Fed) defines monetary policy as the actions it undertakes to influence the availability and cost of money and credit.

Johnson (1962) defines monetary policy as:

> "A policy employing the central bank's control of the supply of money as an instrument for achieving the objectives of general economic policy".

In brief, monetary policy could be defined as the actions of the Fed to increase or decrease the interest rates, or change the amount of money banks need to keep in their reserves in order to stabilize the economy.

There are a number of tools of monetary policy that the Fed could use to control inflation and/or stabilize the economy. First of all, the federal funds rate is an overnight interest rate at which a commercial bank lends available funds on the Fed's balance to other depository institutions or banks overnight. Second, the federal discount rate is the short-term interest rate that the Fed lends to commercial banks. The third tool is the open market operations through which the Fed purchases and sells government securities in the market. During the financial crisis, the Fed bought government securities (also called Quantitative Easing policy) to inject capital into the banking system and financial markets in order to push GDP growth. Last but not least, money supply is also important as a monetary policy tool of the Fed. There is a negative relationship between interest rates and money supply in the sense that an excess of money supply will reduce the interest rates and that a shortage of money supply will raise the interest rates. Keynes (1936), a very well-known 20th century British economist, who strongly encouraged the government's intervention to reverse the effects of economic recession, believed that expansionary policy reduces interest rates by increasing the supply of loanable funds available through the banking system.

The Fed has eight regularly scheduled meetings per year (see CFA 2012). At each meeting, it announces whether the interest rate will rise, fall or remain unchanged until the next decision date. And every business day, the Federal Reserve Bank of New York operates in financial markets to implement the Fed's decision and ensure that its target rate is achieved. By watching the economy for clues, market participants, which include but are not limited to, financial market traders, investors and economic journalists, closely follow the Fed's actions to anticipate what it will decide at its next meeting. In fact, when inflation is high, the U.S Federal Reserve could simply reduce the inflation rate by increasing interest rates. On the other hand, it also could lower interest rates to accelerate economic growth and reduce the unemployment rate.

The ultimate goals of U.S monetary policymakers are to achieve the following:

(i) "Maximum employment" which is to keep the unemployment rate close to the natural unemployment rate, reaching the maximum sustainable growth rate of potential GDP and keeping real GDP close to potential GDP

(ii) "Stable price" which means keeping the inflation rate low or close to zero

(iii) "Moderate long-term interest rate" which means keeping long-term nominal interest rate close or even equal to long-term real interest rate. These goals work in the long-run and could reinforce each other. However, they might not work in the short-run due to the fact that high GDP growth will increase the inflation rate (see CFA 2012).

1.2 NEED FOR THE STUDY

Equity is widely used by fund managers as well as general investors to form their portfolios. Therefore, understanding the impact of U.S Federal Reserve monetary policy on the equity market is crucial. This paper will investigate the impact of U.S Federal Reserve monetary policy on the Canadian stock market.

On the one hand, the U.S and Canada have a very strong economic relationship because the U.S is Canada's most important trading partner. In fact, according to the Canadian Encyclopedia 2012, Canada exports 30% of its gross domestic product, equivalent to almost 70% of its exports, to the U.S which in return has provided Canada with much of its investment capital and technology through foreign investment. As a consequence, the U.S has a high level of ownership and control over the Canadian economy. Therefore, if the U.S economy suffers from the European Debt Crisis or other circumstances, the Canadian economy and financial markets would also be affected. On the other hand, this paper uses the S&P/TSX Composite Index as a proxy of the Canadian Stock Market because it is an index where largest Canadian companies are listed.

Standard and Poor's, regarding the *S&P/TSX Canadian Indices,* states:

> "The S&P/TSX Composite Index is the headline index and the principal broad market measure for the Canadian equity markets. It includes common stock and income trust units. Constituents of the S&P/TSX Composite are also members of either the S&P/TSX Equity indices (the S&P/TSX Equity, the S&P/TSX Equity 60, and the S&P/TSX Equity Completion) or the suite of indices which include income trusts (the S&P/TSX Income Trust, the S&P/TSX Capped REIT, and the S&P/TSX Capped Energy Trust), or both", page 3.

1.3 OBJECTIVES OF THE RESEARCH

This paper specifically aims to do the following:

1. Study the impact of changes in money supply (M2) on the prices of the S&P/TSX Composite Index, which is a good proxy of the Canadian stock market.

2. Investigate the long-term relationship between money supply (M2) and the prices of S&P/TSX by conducting Engle-Granger cointegration test; and

3. Investigate the impact of expected and unexpected money supply (M2) growth on the prices of the S&P/TSX composite index.

1.4 STRUCTURE OF THE PAPER

In Chapter 2, theories and a sample of the literature related to the topic will be discussed. Methodology describing the data, time span and variables used in the models will be discussed in Chapter 3. In Chapter 4, the statistical analysis will be conducted and results will be presented. Chapter 5 will offer conclusions, recommendations as well as possible future extensions to the research.

CHAPTER 2

LITERATURE REVIEW

Schwartz (1987), a former economist at the National Bureau of Economic Research in New York, acknowledged the important of money supply by stating that:

> "Money is used virtually all economic transactions, it has a powerful effect on economic activity. An increase in supply of money works both through lowering interest rates which spurs investment, and through putting more money in the hand of consumers, making them feel healthier, and thus stimulating spending. Business firms respond to increase sales by ordering more raw materials and increasing production. The spread of business activity increase the demand for labor and raise the demand for capital goods. In a buoyant economy, stock market prices rise and firms issue equity and debt. If the money supply continues to expand, prices begin to rise, especially if output growth reaches capacity limits. Opposite effects occur when the supply of money falls or when its rate of growth declines".

Retrieved from: <http://www.econlib.org/library/Enc/MoneySupply.html>

The significant effect of the money supply on interest rates was studied by Laeven and Tong (2010), who examined the impact of U.S monetary policy on global stock prices. They found that global stock prices responded strongly to changes in U.S interest rate policy, with stock prices increasing (decreasing) following unexpected monetary loosening (tightening). They collected data on stock prices of 20,121 firms in 44 countries over the period 1990 to 2008. Canada is also included with 1,662 firms. Their stock prices data were extracted from Datastream, and were adjusted for dividends, stock splits and reverse splits. Moreover, the positive relationship between money supply and interest rates is also explained by Fisher's equation concept. According to the Fisher equation, the nominal rate of interest is the sum of the real interest rate and the inflation rate. The latter tends to increase when an expansionary monetary policy takes place. This implies that an increase in the money supply will raise the nominal rate of interest.

Alantiqi and Fazel (2008) investigated whether money supply can predict stock prices by dividing their study into two parts: the relationship between the money supply and interest rates and between interest rates and stock prices. They use monthly data from 1965 to 2005 to empirically analyze the relationship between money supply and stock prices and to conduct the Augmented Dickey-Fuller test, the Engle-Granger cointegration test, and the Granger causality test. Money supply is measured by seasonally adjusted M1 data and stock prices are measured by the S&P 500 index data. The interest rate was measured by both the three month Treasury bill rate as the short-term rate and the average Treasury bond rate as long-term interest rate. The study shows that there is a lack of a stable negative causal relationship from the money supply to interest rates and from interest rates to stock prices, which results in no significant long-term causal relationship from the money supply to stock prices. Their study is contrary to the general concept which argues that there is a negative relationship between the money supply and interest rates and between interest rates and stock prices, which results in a positive relationship between money supply and stock prices.

The study of Sellin (2001) on monetary policy and the stock market shows that money can be helpful in predicting future stock returns to some (small) extent and that there is a negative relationship between inflation and stock return if the central bank conducts counter-cyclical monetary policy but a positive relation if it conducts a pro-cyclical monetary policy. Sorensen (1982) uses a variety of monetary aggregate measures to functionally relate the level of stock market indices to contemporaneous and lagged monetary growth rates. He finds that there is a direct relationship between money supply and stock returns.

Sorensen (1982) concludes his paper by stating that:

> "The stock market does not react abnormally to a large percentage of monetary activity which can be estimated and/or anticipated. On the other hand, current and future changes in monetary aggregates, which are not predicted using Barro's money equation, do cause rather large abnormal stock price returns. This suggests that it is worthwhile to be able to predict money growth using techniques more sophisticated than simple models", page 659.

Sorensen's conclusion supports the EMH theory, Fama (1970) and Bernanke and Kuttner (2005) on the fact that anticipated changes in money supply do not have significant impact on stock prices, but unexpected changes in money supply do have significant impact on stock prices.

Maskay (2007) examined the relationship between a change in money supply and stock market prices. He used change in money supply M2 as an independent variable and S&P 500 as the dependent variable for stock prices. He also included three other explanatory variables such as Real GDP, Consumer Confidence Index and Unemployment rate in his Ordinary Lease Square (OLS) regression model. The data used in his study are quarterly and from 1st quarter of 1959 to 2nd quarter of 2006. He finds that there is a positive relationship between a change in money supply and stock prices and that the impact of the Consumer Confidence Index on the prices of S&P 500 is not statistically significant. He also investigates the effect of unexpected changes in money supply M2 on S&P 500 and finds that anticipated changes in money supply matter more than unanticipated change. His study shows that when the anticipated money supply changes by $48.4485 billion on average, the S&P 500 index increases by 22.91 points, but when the unanticipated positive money supply increases by $8.8746 billion on average, the S&P 500 index increases by only 4.2 points. This contradicts the Efficient Market Hypothesis (EMH) theory at the level of semi-strong form. In fact, according to the EMH, the anticipated change in the money supply should not have a significant effect on stock prices as the information of the change should be reflected in the stock prices, (Fama 1970). In addition, an unanticipated change should have a very significant effect on the stock prices because the market does not expect this and incorporates this change information into the stock prices.

The findings of Maskay (2007), which counter the EMH theory, are not supported by the study of Bernanke and Kutter (2005) on the stock market's reaction to Federal Reserve policy. The latter study shows a relatively strong and consistent response by the stock market to unexpected monetary policy actions. However, the authors use Federal funds rate instead of money supply as a tool of Federal Reserve policy to investigate the impact of expected and unexpected change on stock return.

The models used in this paper are very similar to those employed by Maskay (2007) because, on the one hand, they dichotomize the money supply (M2) growth into expected and unexpected components and follow closely the work of Sorensen (1982) on Rational Expectations and the impact of money upon Stock Prices by employing a two-stage approach to analyze the effect of unexpected money growth on stock prices. First, we use the model developed by Barro and Rush (1980) to identify and determine the expected money supply growth. Second, we regress the stock prices against the anticipated and unanticipated money growth. In Barro and Rush's model, the money supply growth rate in the current period is regressed against the money supply growth rate from previous periods, the unemployment rate from prior periods and real Federal expenditure of current period (it is in the form of an autoregressive distributed lag model). Baro and Rush test the model for serial correlation bias and find that the solution to avoid the autocorrelation problem is to introduce six lag variables for money supply variables and three more lag variables for unemployment rate variables. However, there are four main differences between this paper and the work of Maskay.

First of all, this paper does not include the consumer confidence index as an explanatory variable in the model because Real GDP and the consumer confidence index have a great level of significant relationship. Therefore, including the consumer confidence index might increase "Multi-collinearity" exposure which could possibly destroy the validity of hypothesis testing but not the estimation of OLS regression. In fact, the greater the multicolinearity is, the greater standard errors and the smaller t-statistics are. Second, this paper investigates whether or not the U.S money supply M2 and the stock prices of Canadian S&P/TSX composite index have a long-term relationship, which is not studied by Maskay. Third, Maskay (2007) regresses the S&P 500 index against the anticipated and unanticipated money growth instead of using log transformation of S&P 500 index which is employed by Sorensen (1982) in his study. Using the S&P 500 index to replace log transformation of the index may be spurious rather than causal. This problem is also mentioned by Sorensen in his paper. The problem of spurious regression bias is very serious and could destroy the validity of hypothesis testing and OLS estimation, even though the sample size is large. Last but not least, this paper is different from the work of Maskay and Sorensen on the fact that this paper investigates the effect of changes in the U.S money supply on Canadian stock markets (cross-country effects) instead of the U.S monetary policy on the U.S S&P 500 data.

CHAPTER 3

METHODOLOGY

3.1 REGRESSION MODELS USED FOR THE STUDY

3.1.1 RELATION BETWEEN STOCK PRICES AND MONEY SUPPLY (M2)

This paper investigates the effect of changes in U.S money supply (M2) as a measured of monetary policy on the S&P/TSX composite index, a proxy of Canadian stock markets based on the following model (Equation 3.1)

$$logPX = a_1 + b_1 * logm_t + e_t \qquad 3.1$$

where:

- $logPX$: is the log transformation of the S&P/TSX Composite Index, and
- $logm$: is log transformation of money supply (M2)

Money supply (M2) consists of M1 plus saving deposits (which include money market deposit accounts), small-denomination time deposits (time deposits in amounts of less than $100,000) and balances in retail money market mutual funds. Money stock (M1) includes currency outside the U.S Treasury, Federal Reserve Banks, and the vaults of depository institutions, traveler's checks of non-bank issuers, demand deposits, and other checkable deposits (OCDs), which consist primarily of negotiable order of withdrawal accounts at depository institutions and credit union share draft accounts. Money stock M1 and M2 are and seasonally adjusted (see the Federal Reserve Bank of Saint Louis website <http:// research.stlouisfed.org/fred2>).

We analyze a bit deeper the effect of money supply (M2) on stock prices by adding more explanatory variables such as real GDP growth and unemployment rate to the model (1). We expect a positive impact of real GDP growth, but a negative impact of unemployment rate on the stock prices, meaning that an increase in real GDP growth would increase the prices of the S&P/TSX composite index and an increase in unemployment rate would decrease the stock prices. We obtain a new model (Model 2) as follows:

$$logPX_t = a_2 + b_2 * logm_t + c_2 * Ggdp_t + d_2 * U_t + e_{2t} \quad 3.2$$

where:

- logPX : is the log transformation of S&P/TSX Composite Index
- logm : is log transformation of money supply (M2)
- Ggdp : is the real GDP growth rate (in percentage), and
- U : is unemployment rate (in percentage)

3.1.2 ENGLE – GRANGER COINTEGRATION TEST

The first step in performing the cointegration test is to determine whether or not the money supply (M2) and the prices of the S&P/TSX composite index are stationary. If the series are stationary variables, they are said to be cointegrated. It is crucial to know if a series is stationary or nonstationary before conducting a regression analysis. In fact, there is a danger of obtaining apparently significant regression results from unrelated data when nonstationary series are used in regression analysis. Such regressions are said to be spurious (see Principles of Econometrics, Wiley, fourth edition, page 482). There are many ways to determine whether a series is stationary or nonstationary. One way is to plot the time series on a graph. But the popular way is to test for the presence of a unit root in the individual time series, using Dickey – Fuller test.

To investigate whether or not the money supply (M2) and the prices of the S&P/TSX composite index have a long-term relationship, we need to test if they are cointegrated. Even though they are nonstationary, they could be cointegrated if residuals of the regression model are said to be stationary time-series variables.

We recall the Model in Equation 3.1:

$$\log PX = a_1 + b_1 * \log m_t + e_t \qquad 3.1$$

The regression Model 3.1 allows us to estimate residuals of the model and to formulate the new model (Equation 3.3) as follows:

$$\Delta\hat{e}_t = b_3 * \hat{e}_{t-1} + c_3 * \Delta\hat{e}_{t-1} \qquad 3.3$$

where:

- $\hat{e}_t$: estimated residuals in period t
- $\hat{e}_{t-1}$: estimated residuals in period t-1, and
- $\Delta\hat{e}_{t-1}$: the differences or changes in estimated residuals in period t-1

Model as described in Equation 3.3 allows us to formulate the null and alternative hypotheses in the test for cointegration as the following:

H_0: the series are not cointegrated ⇔ residuals are nonstationary

H_1: the series are cointegrated ⇔ residuals are stationary

We reject the null hypothesis of no cointegration if the t-statistic is smaller than t-critical, and we do not reject the null hypothesis that the series are not cointegrated if t-statistic is greater than t-critical (see Principles of Econometrics, Wiley, fourth edition, page 490).

In the case that the money supply (M2) and the prices of the S&P/TSX composite index are not stationary and not cointegrated due to the fact that residuals of the regression model are not stationary, we could convert nonstationary to stationary time series by doing first differences and we obtain the following model:

$$\Delta \log PX_t = a_4 + b_4 * \Delta \log PX_{t-1} + c_4 * \Delta \log m_t + d_4 * \Delta \log m_{t-1} + e_{4t} \quad 3.4$$

The Model in Equation 3.4 will not be needed if the test hypothesis above confirms the rejection of the null hypothesis H_0 due to the fact that t-statistic is smaller than t-critical. The rejection of the null hypothesis H_0 shows that the time series are cointegrated or residuals are stationary, which is enough to explain that there is a long-term relationship between the prices of the S&P/TSX composite index and the money supply (M2).

3.1.3 MODELS FOR EXPECTED AND UNEXPECTED CHANGES IN THE U.S MONEY SUPPLY

This paper follows the work (two-stage approach) of Sorensen (1982) to dichotomize money growth into anticipated and unanticipated components by replicating Barro's money supply equation for his first stage model:

$$DM_t = \theta_0 + \theta_1 * DM_{t-1} + \theta_2 * DM_{t-2} + \theta_3 * UN_{t-2} + \theta_4 * FEDV_t \quad 3.5$$

where:

- DM_t = log (money supply $M2_t$) – log (money supply $M2_{t-4}$)
- UN_t = log $[U_t/(1-U_t)]$ and U is the unemployment rate
- $FEDV_t$ = log (Federal expenditures$_t$) – log (FED_t^*),
- log (FED_t^*) = 0.2 (log (FED_t)) + 0.8 (log (FED_{t-1})), and
- FED_t = Federal expenditures

The log (FED_t^*) is an exponentially declining distributed lag of log (federal expenditures). It is assumed that what will happen in the future is based on what has happened in the past. In this model, the log of Federal government expenditures at time t is obtained through a weighted sum of the log of Federal government expenditures at time t, and the log of Federal government expenditures at time t-1. The weights of 0.2 and 0.8 were applied, respectively.

Sorensen explains that the use of an unemployment rate variable should capture a countercyclical policy response in money supply. Federal expenditures capture the impact of deficit financing and economic growth upon money creation. The lagged monetary variables pick up any serial dependence not captured by the other independent variables.

LIMITATION OF BARRO'S MONEY SUPPLY EQUATION:

Sorensen argues that the use of Barro's model to dichotomize anticipated money growth from unanticipated money growth would pose some flaws. In fact, the anticipated component of money growth is given by the estimates from Equation 3.5, and the unanticipated component is given by the residuals from Equation 3.5. The use of Equation 3.5 to perform such a dichotomy is certainly arbitrary as Small (1979) has criticized Baro's equation (Barro and Rush (1980) is also based on the work of Barro (1977, 1978)) on the basis that it does not account for periods of wartime. Nevertheless, no single model will provide estimates which all market participants will actually be using. Many or all market participants will no doubt use more complete information than is captured by a process as simple as Equation 3.5.

The second stage model:

$$P = \beta_0 + \beta_1 *DMRES_t + \beta_2 *DMRES_{t-1} + \beta_3 *DMRES_{t-2} + \beta_4 *DMRES_{t-3} \quad 3.6$$

$$P = \rho_1 + \rho_1 * DMEST_t + \rho_2 * DMEST_{t-1} + \rho_3 *DMEST_{t-2} + \rho_4 * DMEST_{t-3} \quad 3.7$$

where:

- P = $\log(PX_t) - \log(PX_{t-1})$
- $DMRES_t$ = residuals of DM_t from Equation 3.5, and
- $DMEST_t$ = estimates of DM_t from Equation 3.5

In the two-stage approach of Sorensen (1982), DMRES is the residual of DM from Equation 3.5 and considered as unexpected component, whereas, DMEST is the estimate of DM from Equation 3.5 and considered as expected component.

3.2 DATA SOURCES

- The observations are averaged out to produce quarterly data.
- The time span of the data is from December 31, 1976 to June 29, 2012, except that of real GDP is from December 31, 1976 to December 31, 2011.
- The data for the S&P/TSX composite index are obtained from Bloomberg.

- The data for the money supply (M2) and Federal government expenditures are averaged out to produce quarterly data and obtained from Federal Reserve Economic Data (FRED) of the Federal Reserve Bank of Saint Louis website, <http://research.stlouisfed.org/fred2>. The money supply (M2) and Federal government expenditures are in billions of dollars and are seasonality adjusted.
- The data for real GDP, whose unit of measurement is in billions of dollars, and unemployment rate are obtained from Statistics Canada, <http://statcan.gc.ca>.

CHAPTER 4

ANALYSIS AND RESULTS

4.1 IMPACT OF MONEY SUPPLY (M2) ON THE STOCK PRICES OF THE S&P/TSX COMPOSITE INDEX

The U.S money stock (M2) and the prices of the S&P/TSX composite index are highly positively correlated (94.5%) while the positive correlation of their log transformation is 97%.

Figure 4.1: Relationship between the money supply (M2) and the prices of the index

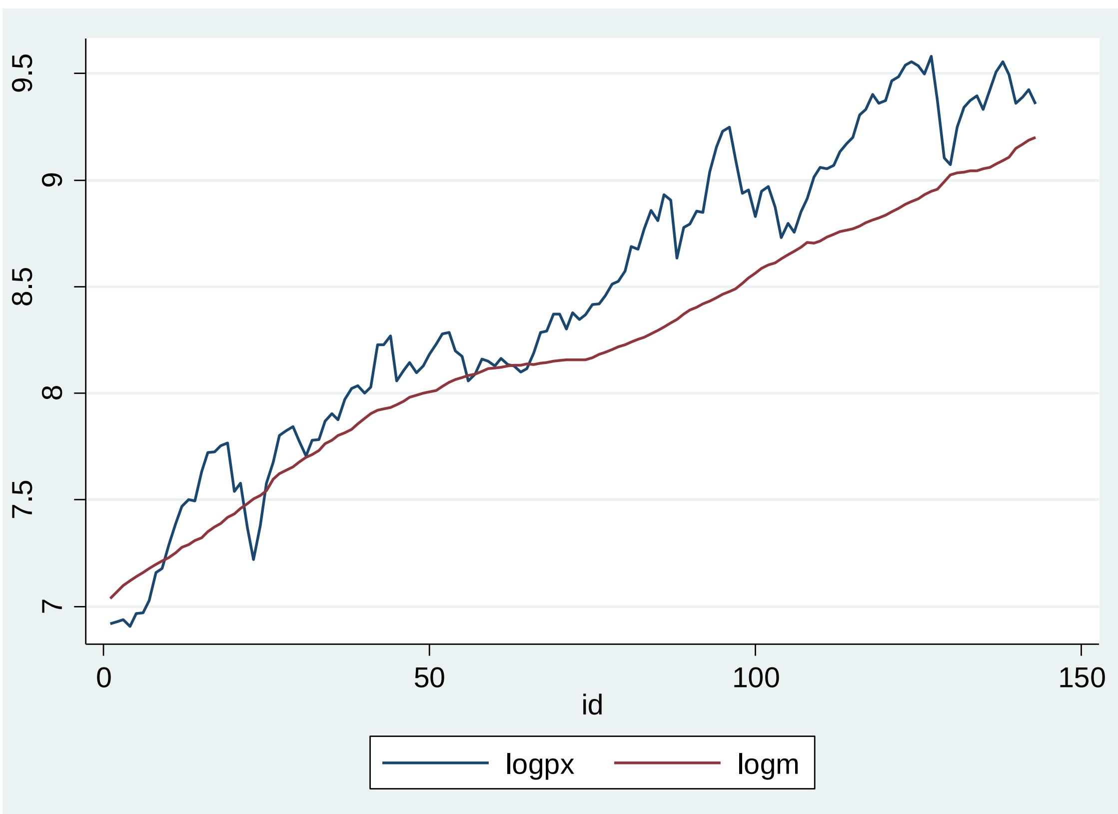


Table 4.1: Descriptive Statistics (without other explanatory variables)

Variable	Observation	Mean	Std. Dev.	Min	Max
logPX	143	8.438459	0.7300001	6.907825	9.579628
Logm	143	8.193596	0.577565	7.037379	9.200381

While Table 4.1 provides the descriptive statistics of the prices of the S&P/TSX and the money supply (M2), Table 4.2 confirms the strong positive relationship between the prices of the S&P/TSX composite index and the money supply (M2). In fact, the result of the regression in Table 4.2 shows there is a significant relationship between log transformations of the money supply (M2) (logm) and that of the index.

Table 4.2: S&P/TSX quarterly data versus money supply (M2)

Independent Variable (logPX)	Coefficient	Std. Errors	t-statistic	P-Value	[95% Confidence Interval]	
Constant	-1.61	0.211	-7.65	0.000	-2.023	-1.195
logm	1.23	0.026	47.8	0.000	1.176	1.277
R-squared = 0.9419 and Adj. R-squared = 0.9415						

Table 4.3 provides the descriptive statistics of the prices of the S&P/TSX composite index, the money supply (M2), real GDP growth and the unemployment rate.

Table 4.3: Descriptive Statistics (with other explanatory variables)

Variable	Observation	Mean	Std. Dev.	Min	Max
logPX	143	8.438459	0.7300001	6.907825	9.579628
Logm	143	8.193596	0.577565	7.037379	9.200381
Ggdp	140	0.644006	0.7565875	-2.04646	2.497878
U	143	8.507692	1.650014	6	13

Table 4.4: S&P/TSX quarterly data versus money supply (M2) and other variables

Independent Variable (logpx)	Coefficient	t-statistic	P-Value	[95% Confidence Interval]	
Constant	-0.8499733	-3.48	0.001	-1.33302	-0.3669297
logm	1.182448	47.34	0.000	1.133049	1.231846
Ggdp	0.0813542	4.73	0.000	0.047354	0.1153543
u	-0.0525174	-6.11	0.000	-0.06953	-0.0355083
R-squared=0.957 and Adj. R-squared =0.956					

Table 4.4 shows that the U.S money supply (M2) has a significant positive impact on the price of the S&P/TSX composite index. As expected, the real GDP growth has a positive impact on the prices of the index, whereas the unemployment rate has a negative impact on the price of the index. The R-squared and adjusted R-squared of model is 0.957 and 0.956, respectively, meaning that the model explains about 95.7% of the variance in the prices of the index.

4.2 LONG-TERM RELATIONSHIP BETWEEN MONEY SUPPLY (M2) AND THE PRICES OF S&P/TSX COMPOSITE INDEX

We recall the models that are used to conduct the cointegration test in order to determine whether the money supply (M2) and the price of the index have a long-term relationship:

$$\log PX = a_1 + b_1 * \log m_t + e_t \quad 3.1$$

$$\Delta \hat{e}_t = b_3 * \hat{e}_{t-1} + c_3 * \Delta \hat{e}_{t-1} \quad 3.3$$

Table 4.5: Unit root test for stationarity in estimates of residuals

Independent variable ($\Delta \hat{e}_t$)	Coefficient	t-statistic	P-value
$\hat{e}_{t-1}$	-0.1488	-3.55	0.001
$\Delta \hat{e}_{t-1}$	0.2345	2.81	0.006

Table 4.6: Augmented Dickey – Fuller test for unit root

	Interpolated Dickey – Fuller			
	Test statistic	1% Critical value	5% Critical value	10% Critical value
Z(t)	-3.546	-2.595	-1.95	-1.613
	Number of observations = 141			

We recall the null and alternative hypotheses in the test for the Engle – Granger cointegration:

H_0: the series are not cointegrated ⇔ residuals are nonstationary

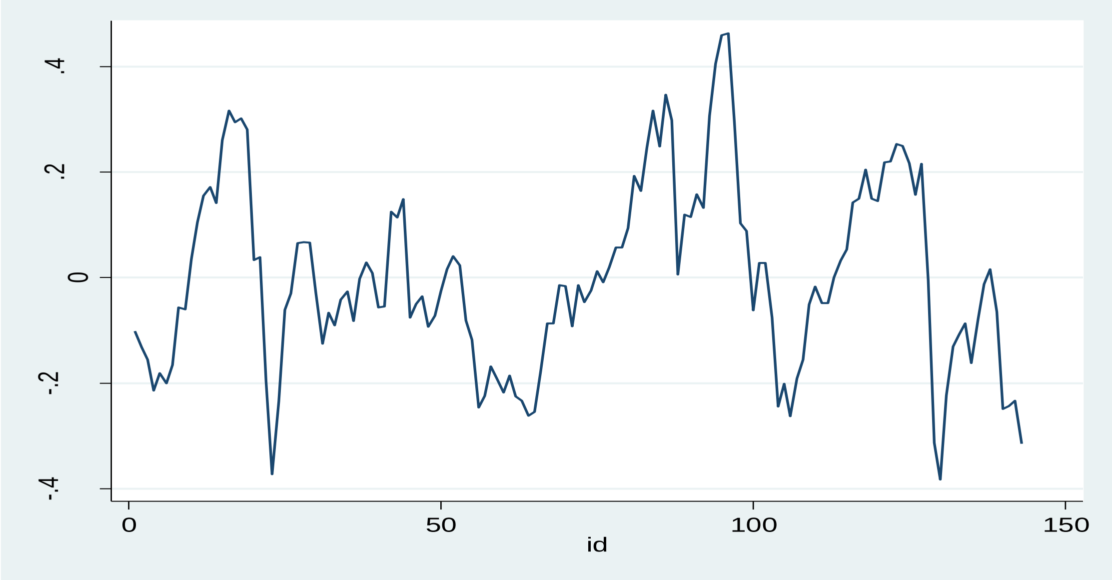
H_1: the series are cointegrated ⇔ residuals are stationary

We reject the null hypothesis of no cointegration if t-statistic is less than t-critical value, and we do not reject the null hypothesis if t-statistic is greater than t-critical value. Table 4.5 and 4.6 show that the t-statistic is -3.55 which is even less than -2.595, the value of t-critical value of %1 level of confidence. Therefore, we reject the null hypothesis that the least squares residuals are nonstationary and conclude that they are stationary. This implies that the U.S money supply (M2) and the prices of the S&P/TSX

composite index are cointegrated. In other words, there is a fundamental relationship between these two variables (the estimated regression between them is valid and not spurious). The result that the U.S money supply (M2) and the index are cointegrated has major economic implications. It means that when the U.S Federal Reserve implements monetary policy by increasing the money supply, the prices of the S&P/TSX composite index will also increase thereby ensuring that the effects of monetary policy are transmitted to the rest of the economy. In contrast, the effectiveness of monetary policy would be severely hampered if the prices of the index and the U.S money supply were spuriously related as this implies that their movements, fundamentally, have little to do with each other.

Figure 4.2 also visually confirms that the estimated residuals of the Equation 3.1 are stationary.

Figure 4.2: Estimated Residuals



4.3 IMPACT OF EXPECTED AND UNEXPECTED CHANGES IN MONEY SUPPLY (M2) ON THE PRICES S&P/TSX COMPOSITE INDEX

First stage results:

$$DM_t = \theta_0 + \theta_1 * DM_{t-1} + \theta_2 * DM_{t-2} + \theta_3 * UN_{t-2} + \theta_4 * FEDV_t \qquad 3.5$$

Table 4.7: Money supply (M2) growth parameters

Independent Variable (DM)	Coefficient	t-statistic	P-value
Constant	-0.00075	-0.11	0.912
DM_{t-1}	0.517845	5.96	0
DM_{t-2}	0.057683	0.68	0.496
UN_{t-2}	-0.00316	-1.1	0.273
FEDV	-0.03756	-0.76	0.447

R-squared =0.3174 SEE=0.006 Durbin-Watson d-statistic = 2.008
Number of observations = 140

Table 4.7 shows that only the first lag of money supply (M2) growth is significant. However, the model contains no serial correlation bias, even though only 31.74% of the time series variation in money supply (M2) is explained by the four exogenous variables.

Second stage results:

$$P = \beta_0 + \beta_1 *DMRES_t + \beta_2 *DMRES_{t-1} + \beta_3 *DMRES_{t-2} + \beta_4 *DMRES_{t-3} \quad 3.6$$

$$P = \rho_1 + \rho_1 * DMEST_t + \rho_2 * DMEST_{t-1} + \rho_3 *DMEST_{t-2} + \rho_4 * DMEST_{t-3} \quad 3.7$$

Table 4.8: S&P/TSX quarterly data versus expected and unexpected money growth

Independent variable (P)	Unanticipated			Anticipated		
	Coefficient	T-statistic	P-value	Coefficient	T-statistic	P-value
Constant	0.03	0.82	0.412			
$DMRES_t$	0.05	0.02	0.982			
$DMRES_{t-1}$	0.38	0.15	0.884			
$DMRES_{t-2}$	-0.54	-0.21	0.836			
$DMRES_{t-3}$	-0.50	-0.22	0.827			
Constant				0.02	2.29	0.024
$DMEST_t$				-1.11	-0.99	0.325
$DMEST_{t-1}$				0.56	0.5	0.618
$DMEST_{t-2}$				0.55	0.49	0.626
$DMEST_{t-3}$				0.3068545	0.27	0.789

Table 4.8 shows that both anticipated and unanticipated changes in the U.S money supply M2 have no significant impact on the prices of the S&P/TSX composite index. The fact that anticipated changes in the money supply have no impact on the prices of the index (none of the coefficients for the DMEST terms is statistically significant) support the Efficient Market Hypothesis. This may explain that market participants use rationally-based money supply estimates in making continual portfolio adjustments. However, the fact that unanticipated changes in money supply also have no impact on the prices of the index (none of the coefficients for the DMRES terms is statistically significant) support the findings of Maskay (2007) but refute the Efficient Market Hypothesis theory, which could be explained by the following:

- In his model, Sorensen uses S&P 500 data that are adjusted for quarterly dividends. But, the model in this paper ignores that criterion.

- Sorensen's two – stage approach that used to dichotomize the anticipated and unanticipated components does not work specifically in the cross-country effects of unexpected changes in the U.S money supply M2 on the prices of the S&P/TSX composite index which represent Canadian stock markets. Moreover, the first stage model which replicates the Barro's money supply equation has only one significant variable (cf. Table 4.7), and explains only 31.74% of the variation in the prices of the S&P/TSX composite index.

CHAPTER 5

CONCLUSION

The results of this study indicate that the U.S money supply (M2) has a significant positive impact on the prices of the S&P/TSX composite index, which support the finding of Sorensen (1982), Sellin (2002) and Maskay (2007). Moreover, the results also indicate that there is a long-term relationship between the U.S money supply (M2) and the prices of the S&P/TSX composite index, which refutes the finding of Alantiqi and Fazel (2008) who find that there is no significant long-term causal relationship from the money supply to stock prices. Last but not least, the study, on the one hand, supports the Efficient Market Hypothesis (EMH) on the fact that anticipated changes in the U.S money supply (M2) have no significant impact on the prices of the S&P/TSX composite index. On the other hand, the study refutes the EMH on the fact that unanticipated changes in the U.S money supply (M2) have also no significant impact on the prices of the index.

To investigate the impact of unexpected changes in the U.S Federal Reserve policy on Canadian stock markets, the study should be extended to include the impact of the U.S Federal funds rate, discount rate and policy easing on the prices of the S&P/TSX composite index. One effective way to study the impact anticipated and unanticipated changes in the U.S Federal funds rate and discount rate on the prices of the index is to follow the model developed by Bernanke and Kuttner (2005). Moreover, studies in the future could adjust the prices of the S&P/TSX composite index for quarterly dividends in order to follow exactly the two-stage approach of Sorensen so that we can determine whether there are significant cross-country effects. Furthermore, the future studies could also include diversified and non-diversified companies as well as industry they are operated in order to distinguish the impact of U.S Federal Reserve policy on the prices of diversified and non-diversified stocks, and on different industries that are listed on the index.

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