Can macroeconomic variables explain long term movements of stock market sector indices?
A comparison of the US and Canada.

by

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ABSTRACT

While the relationship between stock market returns and macro-economic variables has been amply examined, a gap exists in the literature regarding the relationship between different sector indices and various macroeconomic variables. This study intends to examine how certain macroeconomic variables influence different sectors of the stock market differently in the US and Canada. Using monthly data over the period 2000 – 2018, cointegration analysis is applied to model the relationship between real economic activity, money supply, long-term interest rate and different sector indices. Sectors that have been examined in this study include energy, financials, real estate, industrial, healthcare, consumer discretionary, consumer staples, materials, utilities and technology. Results suggest that there is a stable long-term relationship between the macroeconomic variables used in the study and different sector indices for the US but not for Canada. However, US money supply and interest rate can explain the Canadian Stock Market.

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Chapter 1. Introduction

The relationship between macroeconomic variables and stock returns has been of great interest to both academics and practitioners. As such, over the past few decades, attention to the topic generated substantial literature that examined such possible association using a variety of frameworks. While the relationship between stock market returns and macroeconomic variables has been amply examined, there is a void in the literature exploring such relationship in terms of sector specific indices of the stock market. Analysis based on the composite index masks the sensitivity of response of individual sectors and carrying out a sector wise analysis may provide sharper insights as it may be possible to observe the direction and strength of the movement for each sector to changes in macroeconomic variables.

The objective of this paper is to identify whether certain macroeconomic variables can explain stock market sector returns over the long run for Canada and the US by applying cointegration analysis. This paper will also try to identify if the influence by each variable is positive or negative should there be a long-term relationship between different indices and the macroeconomic variables. Along with composite index, different sectors include: energy, financials, consumer discretionary, consumer staples, real estate, health care, industrials, materials, utilities and technology.

Proponents of the Efficient Market Hypothesis (EMH) suggest that all publicly available information is already incorporated in stock prices and as such, economic indicators will be unable to have an influence on stock returns (Fama, 1970). The conclusions drawn by

EMH have been challenged by a variety of approaches providing evidence that key macroeconomic variables help to predict time series of stock returns.

Efficiency or lack of efficiency of the market have important implications for different stakeholders. Pension funds, long term investors, assuming inefficiency, often decide to invest in equities based on the perception that corporate cash flows grow in line with the economy with a slowly moving discount rate (Humpe and Macmillan, 2009). On the other hand, if the market is efficient, then government can conduct macroeconomic policies without influencing capital formation and stock trade process (Mayasami, Howe, Hamzah, 2004).

Earlier studies use the Arbitrage Pricing Theory (APT) framework, which was developed by Ross (1976), to capture the effects of economic forces on stock returns. The APT modeled asset returns as a linear function of different risk factors including macroeconomic variables and the sensitivity of each factor was captured by the coefficients using multivariate regression framework. A host of work using APT framework includes Chen, Roll and Ross (1986), Poon and Taylor (1991), Hamao (1988), Martinez and Rubio (1989), Schwert (1990), Ferson and Harvery (1991). Generally, these papers find a significant relationship between stock market returns and money supply, interest rate, and real economic activity questioning the validity of EMH.

The advent of cointegration by Engle and Granger (1987) allowed for an alternative approach to study long-term equilibrium relations between variables without having to worry about spurious correlations. Regressions in an APT framework with non-stationary variables were susceptible to such correlations. Since its development, a host of literature (Mukherjee and Naka, 1995; Cheung and Ng, 1998; Nasseh and Strauss, 2000;

Ratanapakorn and Sharma, 2007; Humpe and Macmillan, 2009) examined and found significance of macroeconomic variables in explaining stock market returns further questioning the validity of the EMH.

The macroeconomic variables that have been used in this study are money supply, long term interest rate, and real economic activity. The relationship between these economic indicators and various indices may be different for Canada and the US. Canada is a small open economy and is heavily dependent on international trade and commodity prices in contrast to the US. Moreover, the monetary policy is straightforward, and the only policy instrument the Bank of Canada uses is the target it sets for the overnight interest rate to achieve its inflation target whereas the monetary policy is more involved and intricate for the US.

The remainder of this study is organized as follows. Chapter 2 will present empirical literature and briefly go through the past frameworks that have been used to study the relationship between stock returns and macroeconomic variables. Chapter 3 will discuss the methodology used in this paper and will go through unit roots tests, cointegration tests, vector auto-regression and vector error correction modelling. Chapter 4 will present the empirical results. Chapter 5 will include a discussion about the findings. Chapter 6 will provide conclusions and suggest direction for further research.

Chapter 2. Literature Review

2.1 Theoretical Background

The efficient market hypothesis (EMH) suggests that stock prices reflect all publicly available information and, as such, lags of financial variables will not be able to predict future stock prices (Fama, 1970). Advocates of the hypothesis claim that only unanticipated changes in macroeconomic variables are able to influence the stock market (Sorenson, 1982; Davidson and Froyen,1982; Pearce and Roley, 1983). However, Abdullah and Hayworth (1993) argues that most previous studies that support EMH are based on daily and weekly models that do not incorporate variables that theory predicts may influence stock price movements over the long run. Samuelson (1998) suggested that while the stock market may be "micro efficient", it is "macro inefficient" which means that EMH may be applicable for individual stocks and but not the aggregate stock market. This concept of stock market being "micro efficient" but "macro inefficient" became known as Samuelson's dictum which is backed up by some empirical evidence such as Shiller (1981), Campbell and Shiller (1988), Vuolteenaho (2002), Cohen et al. (2001) using vector autoregressive models.

Over the years ample literature has investigated the relationship between stock market returns and a host of macroeconomic and financial variables. The theoretical framework that had been utilized in the earlier studies (Chen, Roll, and Ross, 1986; Poon and Taylor, 1991, Hamao, 1988, Fama, 1981, 1990; Fama and French, 1989; Schwert, 1990; Ferson and Harvey, 1991;) to capture the effect of economic forces on the stock market was based on the Arbitrage Pricing Theory (APT), which was developed by Ross (1976).

APT assumes that an asset's return is a linear function of economic and financial variables and is basically a linear multifactor model that aims to measure the risk attached to the factors that influence the price of the asset. When asset's returns are regressed on different factors in a multivariate regression framework, the coefficients capture the risk/sensitivity of each factor.

The development of cointegration analysis by Engle and Granger (1987) allowed an alternative approach to study the long-term equilibrium relations between the stock market and different economic variables. Prior to the development of cointegration analysis, linear regressions were used on non-stationary time series data and Granger and Newbold (1974) shows that such approach could lead to spurious correlations. If a set of time series variables are integrated of the same order and their linear combination produces a stationary series, then the set of those variables are said to be cointegrated. Cointegration points to the existence of a long-term equilibrium relationship and through error correction modeling, the co-movement among the variables and the adjustment process toward long term equilibrium can be examined. Employing the cointegration approach, a host of literature accumulated challenging the conclusions drawn by EMH and providing evidence that macroeconomic variables help to predict the time series of stock returns (Mukherjee and Naka, 1995; Cheung and Ng,1998; Maysami and Koh,2000; Nasseh and Strauss, 2000; Ratanapakorn and Sharma, 2007; Humpe and Macmillan, 2009).

A pertinent issue is the mechanism behind how variables were chosen to examine their relationship with stock market. Most authors base their choice of variables through "simple and intuitive financial theory" as noted by Chen, Roll, and Ross (1986). The

financial theory involves how the stock prices are determined in terms of expected cash flow and discount rate. If there exists a possibility that a change in macroeconomic variable results in a change in expected cash flow or discount rate then there is a corresponding change in in stock prices and as such, the relationship between that variable and stock prices may be examined. Among others, Mukherjee and Naka (1995), Cheung and Ng (1998), Maysami and Koh (2000), Nasseh and Strauss (2000), Ratanapakorn and Sharma (2007), Humpe and Macmillan (2009) use such an approach to decide which variables to incorporate in their studies.

Theory suggests that an increased money supply may affect the discount rate positively or negatively and thereby the consequent impact on stock prices is inconclusive (Mukherjee and Naka, 1995). On one hand increased money supply may lower interest rate due to increased liquidity and consequently resulting in an increase in stock prices due to lower discount rate (Ratanapakorn and Sharma, 2007). On the other hand, increased money supply may result in inflationary expectations and the interest rate may increase as a consequence, which increases the discount rate and consequently results in lower stock prices (Dhakal et al, 1993). There are other theoretical channels through money supply may influence stock prices as well. For instance, portfolio-balance model suggests that an increased money supply may cause a portfolio shift from non-interest-bearing money to financial assets such as equities (Friedman, 1961; Friedman and Schwartz,1963). Also, an increase in money supply may act as a stimulus for economic growth which may increase expected cashflows (Mukherjee and Naka, 1995).

Several studies attempt to theoretically justify that industrial production, as a proxy for real economic activity, has a positive association with stock prices (Fama,1990;

Schwert,1990; Dhakal et al.,1993). In theory, however, the lead-lag relationship between the industrial production and stock prices is unclear. First, increased output may reflect accumulation of real assets which increases the productive capacity of an economy and consequently increases the ability of firms to generate higher expected cash flows in the future, and this may enhance stock price (Mayasami et al, 2004). Alternatively, higher stock prices indicate increased wealth which may increase the demand for consumption and investment goods (Fama, 1990).

The theory on the impact of interest rate on stock prices is straightforward and suggests an inverse relationship. A higher interest rate will increase the discount rate via its effect on the nominal risk-free rate which will result in lower stock prices (Chen, Roll, and Ross, 1986). Additionally, an increased interest rate may raise the financing cost which will reduce profitability of the firm and consequently unit price of its shares (Ratanapakorn and Sharma, 2007).

2.2 Empirical Evidence

There are primarily two sets of empirical evidence that analyze the relationship between macroeconomic variables and stock returns based on differing methodologies. Earlies studies use the Arbitrage Pricing Theory (APT) framework, and more recent studies use cointegration techniques. In this subsection, first empirical evidence based on APT will be provided before presenting the results based on cointegration techniques.

Based on the Arbitrage Pricing Theory (APT) framework, Chen, Roll, and Ross (1986) study whether industrial production, spread between long- and short-term interest rate, expected and unexpected inflation, spread between yields of high- and low-grade bonds

systematically influence the US stock market using monthly observations for the period 1958 to 1984. The authors find industrial production, changes in risk premium, and changes in term structure to be positively associated to stock returns while both expected and unexpected inflation are negatively associated with stock returns through their impact on future dividends and discount rate.

Poon and Taylor (1991) investigate whether the results found by Chen, Roll and Ross (1986) above for the US can be extended to the UK market using monthly data for the period 1965 to 1984. The authors find that comparable variables for the UK do not affect the UK stock returns. The authors suggest that there could be other macroeconomic factors at work or that the methodology is inadequate to capture such pricing relationship. The authors question whether the price of assets changes in a linear manner and consequently if APT is an appropriate framework and also suggest adopting Granger-causality tests to investigate such relationships. The authors further point out that if size of a firm is an important factor in being influenced by macroeconomic variables in the US then it might not be possible to replicate the test for other countries as many uncontrollable variables such as company legislation, tax laws, other economic variables vary from country to country.

Hamao (1988), using APT framework, replicates Chen, Roll and Ross (1986) study for the Japanese markets as a test of robustness using monthly data for the period 1975 to 1984. The factors investigated in this study include industrial production, interest rate, inflation, investor confidence and exchange rate. Results show that other than industrial production, all other variables have an impact on equity returns in Japan. The sample period for Hamao (1988) is much shorter compared to Chen, Roll and Ross (1986) and

Poon and Taylor (1991). Martinez and Rubio (1989) replicate the above studies using monthly observations for Spain and found no significant relationship between macroeconomic variables and stock returns.

Ratanapakorn and Sharma (2007) use cointegration test and the Vector Error Correction Model (VECM) framework to investigate the long-term relationship between S&P 500 and industrial production, inflation, exchange rate, money supply, long and short-term interest rate over the period from 1975 to 1999 using monthly observations for the US. The authors find that the S&P 500 has a positive relationship with money supply, industrial production, inflation, exchange rate and short-term interest rate but a negative relationship with long-term interest rate. The authors also find that these macroeconomic variables influence the stock price in the long run but not in the short-run by running Granger-causality tests and suggest that given the presence of cointegration the US stock market does not seem to be efficient and can be forecasted by the information provided by these variables.

Humpe and Macmillan (2009) apply the cointegration framework to analyze the long-term relationship between money supply, consumer price index, long term interest rate, industrial production and stock prices for the US and Japan from January 1965 to June 2005 using monthly observations. The authors use the S&P 500 and Nikkei 225 to represent the stock market for the US and Japan respectively. The authors find that for the US, consumer price index and long-term interest rate have an inverse relationship, but industrial production and money supply are positively associated with stock price although effect of money supply is not statistically significant. For Japan, stock prices are negatively related to money supply and positively related to industrial production and the

authors claim that the consumer price index indirectly has a negative impact on stock prices through its effect on industrial production first. The authors attribute the contrasting result for money supply to the liquidity trap that the Japanese economy faced during the 1990's where increasing money supply and falling interest rates were unable to pull the Japanese economy out of its slump.

Mukherjee and Naka (1995) also employed cointegration techniques and VECM to examine whether the money supply, the long-term interest rate, the call money rate, industrial production, inflation, and the exchange rate are cointegrated with the Tokyo Stock Exchange (TSE) using monthly observations from January 1970 to December 1990. They find that the relation between TSE with industrial production, money supply, short term rate, exchange rate is positive while the relation is negative with long term bond rate, and inflation. The authors suggest that long term bond rate is a better proxy than short-term call money rate for the discount rate in the valuation model of stock returns, since long-term bond rate have a negative relationship with TSE while call money rate have a positive relationship.

Maysami, Howe, and Hamza (2004) study whether Singapore's financials, real estate along with a composite index form a cointegrating relationship with inflation, money supply, short- and long-term interest rates and exchange rate using monthly observations from January 1989 to December 2001. For the financials sector, the money supply, inflation, and short-term interest rate have a positive relationship, while industrial production, the long-term interest rate and the exchange rate have a negative relationship with the sector index. For the real estate sector industrial production, money supply, inflation and short-term interest rate have a positive relationship and long-term interest

rate and exchange rate have a negative relationship with the real estate index. For the composite index, money supply, industrial production, inflation and short-term interest rate have a positive relationship while long term interest rate and exchange rate have a negative relationship with the index.

Cheung and Ng (1998) also use cointegration framework to study the relationship between various measures of aggregate real activity that includes money supply and gross national product, and the stock indices of Germany, Italy, Japan and the US. The authors find that the effect of money supply and gross national product are ambiguous given the different direction of influence these variables have over different countries. For instance, money supply has a positive association with the composite indices for Germany, and Italy while it has an inverse relationship for Japan and the US. The authors conclude that the inconclusive result is perhaps due to the perceived differences in the monetary policy implemented across countries. The authors also compare VECM with VAR and finds that inclusion of error correction term in the VECM is an improvement over VAR based on the value of adjusted R^2.

Gan et al. (2006) examine the relationship between several macroeconomic variables including money supply, long- and short- term interest rate, exchange and inflation rate with the official published index of the New Zealand Stock Exchange (NZSE40) using cointegration framework on monthly observations from January 1990 to January 2003. The results show that these macroeconomic variables have a long-term equilibrium relationship with NZSE40. However, based on Granger causality tests authors suggest that money supply and long-term interest rate are not important in determining the stock returns in the short run.

Nasseh and Strauss (2000) investigates if stock indices and macroeconomic variables exhibit a cointegrating relationship for Germany, France, Italy, Netherlands, Switzerland and the U.K. Results show that there is a long-term equilibrium relationship between the stock indices of each country with their domestic industrial production index, long- and short-term interest rates and inflation. Generally, industrial production has a positive association while long term interest rate has a negative association with the stock index. The direction of influence is consistent across all countries. This paper also tests whether German macroeconomic variables can influence the stock indices for France, Italy, Netherlands, Switzerland and the UK given the strong economic linkage of these economies with Germany. Results show that German short-term interest rate, stock prices and industrial production significantly affect stock prices in the other five economies while the reverse is not true.

Survey of various studies has shown that there is a gap in the literature when it comes to exploring the relationship between macroeconomic variables and sector specific stock indices. Moreover, there are very few studies on this topic for Canada based on the author's observation. In addition, this paper did not encounter any recent studies on this topic that has used data from 2005 onward for the US. This may be important because the financial crisis of 2008 could have altered the economy fundamentally in such a way that long-term relationship that existed between S&P 500 and different macroeconomic variables prior to the crisis may no longer exist.

Chapter 3. Methodology

In this section the steps undertaken to conduct this study are explained. First, unit root tests are employed to check for stationarity of all the series using Augmented Dickey Fuller (ADF) test. Then, order of integration of the series is determined if the series contains a unit root.

If all the series are integrated of order 1, cointegration tests can be performed. Next, to determine the lag length to be employed in the cointegration test, an unrestricted Vector Auto Regression (VAR) model is run. Then, the Johansen cointegration test is performed to identify whether the variables are cointegrated. If the variables are indeed cointegrated, then there is a stable long run relationship between the variables and consequently a Vector Error Correction Model (VECM) is run. If variables are not cointegrated, VAR models only capture short-term relationships.

3.1 Unit Root Tests

Economic and Financial variables usually exhibit trending behavior i.e. the series are non-stationary in mean. Existence of a unit root in a series means that the series is not stationary. Consequently, using non-stationary time series in a regression framework may lead to spurious regression and futile economic and statistical inference unless cointegration tests are performed where all the series need to be integrated of the same order. For the purpose of this study all the time series variables must be integrated of order 1.

The Augmented Dickey Fuller (ADF) test has been used in this paper to test for a unit root. Given the nature of the variables in this paper, the null hypothesis under the ADF

test contains a unit root with a constant and a time trend. The following regression, which corresponds to a random walk with drift and time trend, is estimated to implement the ADF test:

$$\Delta Y_t = \propto + \delta t + \theta Y_{t-1} + \sum_{i=1}^{P} \lambda_i \Delta Y_{t-i} + \varepsilon_t$$

Where Δ is the difference operator, Y corresponds to the variable, δt represents the time trend, P is the number of lags and ε represents the error term. The number of lags is chosen by the Akaike Information Criteria (AIC). The t-statistic of θ is compared to the ADF critical values to determine if the series contains unit root.

3.2 VAR

Vector Auto Regressive (VAR) models attempt to capture linear interdependencies among multiple time series. These models are extensions of univariate Auto Regressive (AR) models by allowing for more than one dynamic variable. While in a standard regression framework, dependent and independent variables interact simultaneously, in VAR models, evolution of each variable is based on the lagged values of itself, and lagged values of other variables in the model. The VAR model in this study is as follows:

$$\Delta Index_t = \propto_0 + \sum_{i=1}^{p} \boldsymbol{\beta_{1i}} \Delta Index_{t-i} + \sum_{i=1}^{p} \boldsymbol{\beta_{2i}} \Delta IP_{t-i} + \sum_{i=1}^{p} \boldsymbol{\beta_{3i}} \Delta M1_{t-i} + \sum_{i=1}^{p} \boldsymbol{\beta_{4i}} \Delta LIR_{t-i} + \varepsilon_t$$

$$\Delta IP_t = \propto_0 + \sum_{i=1}^{p} \boldsymbol{\theta_{1i}} \Delta Index_{t-i} + \sum_{i=1}^{p} \boldsymbol{\theta_{2i}} \Delta IP_{t-i} + \sum_{i=1}^{p} \boldsymbol{\theta_{3i}} \Delta M1_{t-i} + \sum_{i=1}^{p} \boldsymbol{\theta_{4i}} \Delta LIR_{t-i} + \mu_t$$

$$\Delta M1_t = \propto_0 + \sum_{i=1}^{p} \boldsymbol{\theta_{1i}} \Delta Index_{t-i} + \sum_{i=1}^{p} \boldsymbol{\theta_{2i}} \Delta IP_{t-i} + \sum_{i=1}^{p} \boldsymbol{\theta_{3i}} \Delta M1_{t-i} + \sum_{i=1}^{p} \boldsymbol{\theta_{4i}} \Delta LIR_{t-i} + €_t$$

$$\Delta LIR_t = \propto_0 + \sum_{i=1}^{p} \boldsymbol{\eta_{1i}}\, \Delta Index_{t-i} + \sum_{i=1}^{p} \boldsymbol{\eta_{2i}}\, \Delta IP_{t-i} + \sum_{i=1}^{p} \boldsymbol{\eta_{3i}}\, \Delta M1_{t-i} + \sum_{i=1}^{p} \boldsymbol{\eta_{4i}}\, \Delta LIR_{t-i} + \mathrm{e}_t$$

Where, $\Delta Index_t$ represents changes in composite or sector indices, ΔM_t represents changes in M1 money supply, ΔLIR_t represents changes in long-term interest rate, ΔIP_t represents changes in real economic activity. $\boldsymbol{\beta}, \boldsymbol{\theta}$, and $\boldsymbol{\eta}$ are vector of parameters for the variables.

The optimal length in this study is determined by using Akaike's Information Criteria (AIC) because according to Ivanov and Kilian (2001), AIC tends to be more accurate with monthly data in the context of VAR models compared to Hannan-Quinn Criterion (HQC) and Schwarz Information Criterion (SIC).

3.3 Johansen Cointegration

When a set of time series variables are each integrated of the same order, then if a linear combination of these variables produce a series which is integrated of order zero, then the set of variables are said to cointegrated. Cointegration is generally utilized to examine whether there exists a stable long run relationship among two or more variables. In the context of this study if stock indices, interest rate, money supply, real economic activity are integrated of order 1 and if the combination of these variables results in a series integrated of order zero then it can be suggested that there exists a long run relationship among these variables. Should the variables be cointegrated, vector error correction model can be applied to test the dynamics among the variables.

The Johansen cointegration test will be applied in this study to determine the existence of a long run relationship among the variables. This test is based on a general VAR model with n variables (Johansen,1995):

$$Y_t = \boldsymbol{v} + \sum_{i=1}^{K} \theta_i Y_{t-i} + \boldsymbol{\varepsilon}_t$$

The following equation is derived after subtracting Y_{t-1} from both sides:

$$\Delta Y_t = \boldsymbol{v} + \prod Y_{t-1} + \sum_{i=1}^{K-1} \text{Ψ}_i \Delta Y_{t-i} + \boldsymbol{\varepsilon}_t$$

$$\text{Here, } \prod = \sum_{I=1}^{K} \theta_i - I \text{ and } \text{Ψ}_i = -\sum_{j=i+1}^{K} \theta_j$$

In the above equations, Y is the n by 1 vector of endogenous variables, $\boldsymbol{v}$ is a vector of parameters, $\boldsymbol{\varepsilon}$ is the vector of residuals. θ is the n by n matrix of parameters for endogenous variables, and I is the identity matrix of dimension n. The matrix $\prod$ has rank $0 \leq r < n$, where r is the number of linearly independent cointegrating vectors. $\prod$ can be written as the product of $\propto$ and β' matrices where $\propto$ represents the parameters for the speed of long run adjustment and β contains r cointegrating vectors.

The trace test and maximum eigenvalue test determines the number of cointegrating vectors. The null hypothesis for the trace test is that there are at most r cointegrating relations against the alternative j cointegrating equations where r = 0, 1,2, …, j – 1. The null hypothesis for maximum eigenvalue test is that there are r cointegrating relations against the alternative of r + 1 cointegrating relations.

3.4 Vector Error Correction Model

A Vector Error Correction Model (VECM) is a restricted Vector Autoregressive (VAR) model designed to use with series that are cointegrated and are non-stationary in level form. VECM is just a special case of the VAR for variables that are stationary in their differences. In VECM, while the model specification allows for short run adjustments, the long run behavior of the endogenous variables is restricted so that they converge to their co-integrating relationships. The cointegration term in the VECM equation is called the *error correction* term because the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments. In the context of this study even if stock index, money supply and industrial production are non-stationary series, should they be cointegrated, then error correction model can be applied. The multivariate VECM in this study is specified as follows:

$$\Delta Index_t = \propto_0 + \sum_{i=1}^{p} \boldsymbol{\beta_{1i}}\, \Delta Index_{t-i} + \sum_{i=1}^{p} \boldsymbol{\beta_{2i}}\, \Delta IP_{t-i} + \sum_{i=1}^{p} \boldsymbol{\beta_{3i}}\, \Delta M1_{t-i} + \sum_{i=1}^{p} \boldsymbol{\beta_{4i}}\, \Delta LIR_{t-i} + \lambda_1 z_{t-1} + \varepsilon_t$$

$$\Delta IP_t = \propto_0 + \sum_{i=1}^{p} \boldsymbol{\theta_{1i}}\, \Delta Index_{t-i} + \sum_{i=1}^{p} \boldsymbol{\theta_{2i}}\, \Delta IP_{t-i} + \sum_{i=1}^{p} \boldsymbol{\theta_{3i}}\, \Delta M1_{t-i} + \sum_{i=1}^{p} \boldsymbol{\theta_{4i}}\, \Delta LIR_{t-i} + \lambda_2 z_{t-1} + \mu_t$$

$$\Delta M1_t = \propto_0 + \sum_{i=1}^{p} \boldsymbol{\theta_{1i}}\, \Delta Index_{t-i} + \sum_{i=1}^{p} \boldsymbol{\theta_{2i}}\, \Delta IP_{t-i} + \sum_{i=1}^{p} \boldsymbol{\theta_{3i}}\, \Delta M1_{t-i} + \sum_{i=1}^{p} \boldsymbol{\theta_{4i}}\, \Delta LIR_{t-i} + \lambda_3 z_{t-1} + ë_t$$

$$\Delta LIR_t = \propto_0 + \sum_{i=1}^{p} \boldsymbol{\eta_{1i}}\, \Delta Index_{t-i} + \sum_{i=1}^{p} \boldsymbol{\eta_{2i}}\, \Delta IP_{t-i} + \sum_{i=1}^{p} \boldsymbol{\eta_{3i}}\, \Delta M1_{t-i} + \sum_{i=1}^{p} \boldsymbol{\eta_{4i}}\, \Delta LIR_{t-i} + \lambda_4 z_{t-1} + e_t$$

Where: ΔIndex represents changes in composite or sector indices from one time period to the next; ΔIP represents changes in industrial production from one time period to the next; ΔM1 represents changes in money supply from one time period to the next; ΔLIR

represents changes in long term interest rate from one time period to the next. All the variables are in natural logarithmic form. 'p' denotes the number of lagged differences. 'z' is the error correction term. ε, μ, $\ddot{e}$, and $\acute{e}$, represent error terms. The coefficient λ, of the error correction term measures the speed of adjustment when there is a deviation from the equilibrium. The coefficient vectors $\boldsymbol{\beta}$, $\boldsymbol{\Upsilon}$, $\boldsymbol{\theta}$, $\boldsymbol{\eta}$ capture the short run dynamics between the variables.

Chapter 4. Data and Results

4.1 Data

This study uses monthly observations for all the stock indices and macroeconomic variables over the period ranging from January 2000 to June 2018 for the United States and from January 2000 to April 2018 for Canada. The sample for the US contains 222 observations, the sample for Canada includes 220 observations. Data for US sector indices are available from January 2000 and data for most Canadian sectors are available from 1997. For comparison purposes with the US, this study uses Canadian data from January 2000. The data for all the macroeconomic variables, Industrial Production index, long term interest rate and narrow money supply, have been collected from Federal Reserve Bank of St. Louis for both countries. Most prior studies use M1 money supply and industrial production index to capture the effects of money supply and real economic activity respectively, and to be consistent, this paper also uses M1 money supply and industrial production index. Following Humpe and Macmillan (2009), seasonally adjusted data for M1 and Industrial Production are used in this study as these variables exhibit strong seasonality. To capture the effect of long-term interest rate, most studies use 10-year or 5-year government bond rate. This paper uses benchmark 10-year government bond rate, since data for this series is available for both Canada and the US at Federal Reserve Bank of St. Louis website. While most studies use additional variables such as short-term interest rate, inflation, exchange rate, they generally test the relationship against a single benchmark index of a country. Since this paper investigates

ten different indices for the US and ten different indices for Canada, attention was given on fewer macroeconomic variables.

All the stock market composite and sector indices data for both the countries have been obtained from Bloomberg and are based on the closing price of the indices on the last business day of each month. All the level series of indices and macroeconomic variables are expressed in natural logarithmic form. Descriptive statistics of stock indices are presented in Appendix 1.

Companies listed in all the sector indices for the US are selected from the stocks listed in the S&P 500. For any US sector index, the weight of any single index constituent is capped at 20%. The S&P 500 itself is not capped. For Canada, constituents of all the sector indices are selected from a stock pool of benchmark S&P/TSX Composite index. For any sector index for Canada, the weight of any single index constituent is capped at 25%. The S&P/TSX Composite Index itself is not capped. All the sector indices are based upon Global Industry Classification Standards (GICS). The GICS is an industry classification system developed by MSCI Inc. and Standard and Poor's (S&P) for use by the global financial community.

There are various forms of indices such as uncapped, equal weight, 35% capped, 20% capped index for almost all the sectors for the US. However, forms of sector indices data are limited for Canada. For comparison purposes across all sectors with the US, only 25% capped index is available. For the US 20% capped indices have been used. The rationale for using capped sector indices is that, the number of stocks listed and consequently the market capitalization of sector indices is much lower compared to the original benchmark index from which sector indices were created. Movement in any stock, which forms

much of a sector in terms of market capitalization, could be due to company specific reasons and not due changes in macroeconomic variables. As a result, movement in uncapped sector indices is subject to a lot of noise due to company specific factors, specifically those companies which have a large weight in the sector. Such a problem does not exist for the benchmark indices for the US or Canada due to the sheer number of stocks listed in each of them. Market capitalization of an individual stock listed in any of the benchmark indices is very low compared to the entire index and as a result, movements in the price of a stock due to company specific factors will hardly cause a dent in the direction of the entire index.

Table 4. 1: Description of Macroeconomic Variables

Variable	*Definition*
Industrial Production (IP)	Industrial Production Index (Seasonally Adjusted)
Money Supply (M1)	Narrowly Defined Money Supply (Seasonally Adjusted)
Long Term Interest Rate (LIR)	Long-Term Government Bond Yields: 10-year

Table 4. 2: Description of US Stock Market Indices

Index	Bloomberg Ticker	Definition
SPX	SPX	S&P 500
Energy	SPSUEP	Capped Energy Index
Financials	SPSUFP	Capped Financials Index
Cons. Disc.	SPSUCDP	Capped Consumer Discretionary Index
Cons. Stap.	SPSUCSP	Capped Consumer Staples Index
Real Estate	SPSUREP	Capped Real Estate Index
Industrials	SPSUIP	Capped Industrial Index
Health Care	SPSUHCP	Capped Health Care Index
Materials	SPSUMP	Capped Materials Index
Utilities	SPSUUP	Capped Utilities Index
Technology	SPSUTP	Capped Technology Index

Table 4. 3: Description of Canadian Stock Market Indices

Index	Bloomberg Ticker	Definition
S&P/TSX	SPTSX	Benchmark S&P/TSX Composite Index
Energy	SPTSEN	Capped Energy Index
Financials	SPTSFN	Capped Financials Index
Cons. Disc.	SPTSCD	Capped Consumer Discretionary Index
Cons. Stap.	SPTSCS	Capped Consumer Staples Index
Real Estate	SPTSRE	Capped Real Estate Index
Industrials	SPTSIN	Capped Industrials Index
Health Care	SPTSHC	Capped Health Care Index
Materials	SPTSMT	Capped Materials Index
Utilities	SPTSUT	Capped Utilities Index
Technology	SPTSIT	Capped Technology Index

Table 4. 4: General Information on US Stock Indices

Index	No. of Constituents	Total Market Cap.	Mean Market Cap
S&P 500	505	25,789	51
Energy	31	1492	48
Financials	67	3529	53
Cons. Disc.	65	2753	42
Cons. Stap.	32	1898	59
Real Estate	32	661	21
Health Care	64	3780	59
Industrials	70	2484	36
Materials	24	615	26
Utilities	29	709	25
Technology	76	7206	94

Note: Market Cap in USD billions. (Source: S&P Global)

Table 4. 5: General Information on Canadian Stock Indices

Index	No. of Constituents	Total Market Cap.	Mean Market Cap
S&P/TSX	248	2,238	9
Energy	37	255	7
Financials	27	764	28
Cons. Disc.	18	98	5
Cons. Stap.	10	75	8
Real Estate	22	67	3
Health Care	8	45	6
Industrials	28	236	8
Materials	53	229	4
Utilities	16	81	5
Technology	16	82	5

Note1: Market Cap. In CAD billions. (Source: TMX Money)

4.2 Unit Root Tests

This study uses Augmented Dickey Fuller (ADF) test to detect the presence of unit root in the variables. The ADF tests are under the null of a unit root with a constant and a time trend, which was selected based on the trending behavior of all the series. Table 4.6 and Table 4.7 displays the results of the ADF test for the different stock indices and macroeconomic variables for the US and Canada respectively. For the purpose of robustness check, results of Phillips-Perron test to detect the presence of unit root are presented in Appendix 2.

Table 4.6 shows that for the US, all macroeconomic series, S&P500 and all sector indices other than Technology sector index contain unit root and are therefore non-stationary processes at the 5% significance level, but the first difference of most of the series turn

out to be stationary at 1% level. This suggests that all the variables other than Technology sector index are integrated of order 1 in level form but integrated of order 0 in first difference form. Since, the index for Technology sector is integrated of order 0 in level form, the cointegration test cannot be performed for this sector.

Table 4.7 shows that similar to the case in the US, all macroeconomic series, S&P/TSX and all sector indices other than Technology sector index contain unit root and are therefore non-stationary processes at the 5% significance level, but the first difference of most of the series turn out to be stationary at 1% level. This suggests that all the variables other than Technology sector index are integrated of order 1 in level form but integrated of order 0 in first difference form. Since, the index for Technology sector is integrated of order 0 in level form, cointegration test cannot be performed for this sector for Canada as well.

Table 4. 6: ADF Unit Root Test for US variables for 2000-2018

Index	Level	First Difference
S&P 500	-2.376	-5.663 ***
Energy	-1.701	-10.094 ***
Financials	-1.837	-3.834 **
Consumer Discretionary	-1.944	-6.855 ***
Consumer Staples	-2.577	-10.492 ***
Real Estate	-2.159	-4.813 ***
Health Care	-1.323	-10.395 ***
Industrials	-2.803	-5.740 ***
Utilities	-2.133	-7.722***
Materials	-3.274	-10.546 ***
Technology	-3.625**	NA
Macroeconomic Variables	Level	First Difference
Industrial Production	-3.071	-4.242 ***
M1	-1.901	-5.050***
Long Term Interest Rate	-3.064	-7.729 ***

Note 1: The numerical values represent ADF test statistic.

Note 2: *** indicates significance at 1% level and ** indicates significance at 5% level.

Note 3: All the level series are in natural logarithmic form.

Table 4. 7: ADF Unit Root Test for Canadian variables for 2000-2018

Index	Level	First Difference
TSX	-2.804	-7.362 ***
Energy	-1.886	-9.278 ***
Financials	-2.929	0.0046 ***
Consumer Discretionary	-1.406	-7.809 ***
Consumer Staples	-1.554	-7.667 ***
Real Estate	-2.851	-5.889 ***
Health Care	-1.475	-9.123 ***
Industrials	-2.272	-8.092 ***
Utilities	-3.027	-6.647 ***
Materials	-1.436	-10.625 ***
Technology	-3.363*	NA
Macroeconomic Variables	Level	First Difference
Industrial Production	-1.692	-5.498 ***
M1	-1.668	-9.063 ***
Long Term Interest Rate	-2.178	-7.442 ***

Note 1: The numerical values represent ADF test statistic.
Note 2: *** indicates significance at 1% level and * indicates significant at 10% level.
Note 3: All the level series are in natural logarithmic form.

4.3 Cointegration tests

Given that all the series, except for those representing Technology sectors, are integrated of order 1 in level but integrated of order zero in first differences for both the US and Canada, the Johansen cointegration test can be employed to see whether there exists a long run relationship between the stock indices and industrial production, long term interest rate and money supply. The trace statistic and the maximum eigenvalue statistic are compared with the critical value at 5% level of significance. Table 4.8 and Table 4.9 display results found using Johansen cointegration test for the US and Canada respectively.

Choosing the number of lags is subjective and is dependent on a multitude of factors such as context of study, empirical evidence and theory. Too few lags could result in residual

autocorrelation and too many lags would lead to losing observations and error in forecasts (Stock and Watson, 2001). This paper has tested for lag lengths between 1 and 12 and the Akaike Information Criteria (AIC) was chosen to determine optimal lag length because according to Ivanov and Kilian (2001), AIC tends to be more accurate with monthly data in the context of Vector Auto Regression (VAR) models.

Trace and maximum eigenvalue statistics for S&P 500 and all the sector indices for the United States reject the null of 0 rank, that is "H_o: no cointegrating vector" at the 5% significance level. For all the indices, both the trace test and maximum eigenvalue test fail to reject the null hypothesis that a rank of 1 exists. The results imply that there exists a singular cointegrating vector between the indices and the macroeconomic variables. This means that there is evidence of long-term relationship among the indices and industrial production, money supply and long-term interest rates for the US. For robustness check, different lag lengths suggested by other information criteria were used, but the outcome does not change for any of the indices.

For Canada, results are substantially different. Both trace test and maximum eigenvalue test indicate that there is no cointegrating relationship between any of the indices and the macroeconomic variables used in the study. Results do not vary when different lag lengths are used as suggested by other information criteria. This implies that industrial production, money supply and long-term interest rate fail to explain the stock market in any capacity at least in the long term.

Table 4. 8: Cointegration Test for US Indices and Macroeconomic Variables

Maximum Rank	Trace statistic	5% Critical value	Max statistic	5% Critical value
S&P 500				
None	66.4367	47.21	44.2645	27.07
At most 1	22.1723*	29.68	15.8943*	20.97
At most 2	6.2780	15.41	6.0377	14.07
Energy				
None	56.6225	47.21	33.8518	27.07
At most 1	22.7708*	29.68	14.9256*	20.97
At most 2	7.8451	15.41	6.2905	14.07
Financials				
None	61.7050	47.21	36.2398	27.07
At most 1	25.4651*	29.68	15.7700*	20.97
At most 2	9.6951	15.41	9.0735	14.07
Consumer Discretionary				
None	60.0300	47.21	42.2188	27.07
At most 1	17.8112*	29.68	12.1290*	20.97
At most 2	5.6821	15.41	5.3998	14.07
Consumer Staples				
None	59.8770	47.21	34.5743	27.07
At most 1	25.3026*	29.68	17.6118*	20.97
At most 2	7.6908	15.41	7.6381	14.07
Real Estate				
None	64.1837	47.21	39.5034	27.07
At most 1	24.6803*	29.68	15.4586*	20.97
At most 2	9.2216	15.41	9.1374	14.07
Health Care				
None	58.9622	47.21	34.2843	27.07
At most 1	24.6780*	29.68	17.4952*	20.97
At most 2	7.1828	15.41	7.1752	14.07
Industrials				
None	56.9095	47.21	27.5443	27.07
At most 1	29.3652*	29.68	20.7590*	20.97
At most 2	8.6062	15.41	8.5580	14.07
Materials				
None	60.3503	47.21	32.6048	27.07
At most 1	27.7454*	29.68	17.5273*	20.97
At most 2	10.2181	15.41	10.1096	14.07
Utilities				
None	70.9180	47.21	40.7032	27.07
At most 1	30.2148	29.68	23.2792	20.97
At most 2	6.9357*	15.41	6.8755*	14.07

Note: * indicates significance at 5% level.

Table 4. 9: Cointegration Test for Canadian Indices and Macroeconomic Variables

Maximum Rank	Trace statistic	5% Critical value	Max statistic	5% Critical value
S&P/TSX				
None	37.0308*	47.21	18.3683*	27.07
At most 1	18.6626	29.68	10.6666	20.97
At most 2	7.9959	15.41	5.2682	14.07
Energy				
None	31.6042*	47.21	13.7036*	27.07
At most 1	17.9006	29.68	9.1548	20.97
At most 2	8.7458	15.41	5.9831	14.07
Financials				
None	29.0896*	47.21	12.7180*	27.07
At most 1	16.3716	29.68	9.1436	20.97
At most 2	7.2280	15.41	5.2000	14.07
Consumer Discretionary				
None	37.2123*	47.21	20.1998*	27.07
At most 1	17.0125	29.68	11.1437	20.97
At most 2	5.8688	15.41	3.1538	14.07
Consumer Staples				
None	36.8213*	47.21	23.8302*	27.07
At most 1	12.9911	29.68	7.0412	20.97
At most 2	5.9499	15.41	5.3737	14.07
Real Estate				
None	31.8286*	47.21	14.9835*	27.07
At most 1	16.8450	29.68	9.0688	20.97
At most 2	7.7762	15.41	5.5110	14.07
Health Care				
None	40.1864*	47.21	25.7687*	27.07
At most 1	14.4176	29.68	8.6298	20.97
At most 2	5.7878	15.41	3.3508	14.07
Industrials				
None	37.0716*	47.21	16.2832*	27.07
At most 1	20.7884	29.68	13.9328	20.97
At most 2	6.8556	15.41	4.6315	14.07
Materials				
None	34.4853*	47.21	17.3312*	27.07
At most 1	17.1541	29.68	9.2622	20.97
At most 2	7.8919	15.41	4.9849	14.07
Utilities				
None	36.1843*	47.21	14.4494*	27.07
At most 1	21.7349	29.68	12.3348	20.97
At most 2	9.4001	15.41	5.9017	14.07

Note: * indicates significance at 5% level.

4.4 VAR/VECM Models

For the United States, as displayed in Table 4.10, it is observed that the equilibrium relation between money supply and the benchmark index, and six sectors is positive. The relationship is positive and significant with S&P 500, consumer discretionary, consumer staples and health care sectors at 5% significance level. The relationship is positive but insignificant with industrials, materials and real estate sectors. The relationship with financials, and energy sectors are negative but statistically insignificant at 5% significance level.

The relationship between long-term interest rate and the benchmark index, and seven sectors is negative as shown in Table 4.10. The association is negative and significant at 5% significance level with financials, consumer staples, industrials sectors and negative but insignificant with S&P 500, consumer discretionary, real estate and health care sectors whereas the relationship is positive and significant with energy and materials sector at 5% significance level.

The relationship between industrial production as a proxy for real economic activity is ambiguous compared to the findings of previous studies in terms of the sign of influence as can be seen in Table 4.10. While there is a positive and significant relationship between industrial production and energy, real estate and materials sectors, the association is negative and significant for financials, consumer discretionary, health care, and industrials sectors. There is also a negative but statistically insignificant relationship with S&P 500 and consumer staples sector.

Table 4. 10: US Long Term Equations

	Index	IP	M1	LIR	Constant
S&P 500	1	0.851 (0.959)	-0.798** (0.238)	0.323 (0.227)	-5.741
Energy	1	-39.851** (8.50)	2.545 (2.15)	-4.081** (2.07)	164.273
Financials	1	7.692** (3.54)	0.097 (0.872)	2.266** (0.854)	-44.211
Cons. Disc.	1	2.401* (1.30)	-1.186** (0.321)	0.603 (0.309)	-7.841
Cons. Stap.	1	0.613 (0.622)	-0.773** (0.155)	0.404** (0.149)	-2.624
Real Estate	1	-2.131** (0.817)	-0.112 (0.187)	0.571 (0.187)	4.823
Health Care	1	2.462** (1.14)	-1.227** (0.287)	0.245 (0.277)	-7.571
Industrials	1	4.521** (2.358)	-0.854 (0.594)	1.222** (0.585)	-21.071
Materials	1	-29.311** (9.19)	-1.824 (2.29)	-7.944** (2.195)	154.811

Note: ** indicates significance at 5 % level and & * indicates significance at 10 % level.

The long-term relationship for utilities sector is not explored in this paper since it is difficult to interpret more than one cointegrating relationship without sound economic theory as mentioned in Dibooglu and Enders (1995).

Given that all the US stock indices have a cointegrating relationship with industrial production, money supply and long-term interest rate, Vector Error Correction models (VECM) have been run in this study for the US. The statistical significance of the coefficient of the error correction term in the VECM framework establishes the long run equilibrium relationship between the stock indices and the macroeconomic variables while the short run relationship is captured by the significance of the coefficients of the lagged regressors. In a VECM framework, the coefficient of the error correction term represents the speed of adjustment by which the dependent variable returns to equilibrium after deviation.

Table 4.11 displays the error correction models for S&P 500, Energy, Financials, Cons. Discretionary and Cons. Staples sector while Table 4.12 displays the error correction models for Real Estate, Health Care, Industrials, and Materials sectors. The full VECM with equations for industrial production, money supply and long-term interest rate is shown in Appendix 3 (Table A3.1 - A3.9).

The coefficients of the error correction terms are significant for S&P 500, financials, consumer discretionary, consumer staples, real estate, health care, and materials sector. The long-term adjustment coefficient is about -0.054 for S&P 500. This suggests that the deviation of the benchmark index from the long-term equilibrium is corrected by about 5.4% each month. The same coefficient for financials sector is about -0.022 which implies a correction of about 2.2% each month. The correction is about 5.5% for consumer discretionary sector, 4.6% for consumer staples sector, 13.1% for real estate sector, 2.3% for health care sector and 0.5% for materials sector.

Table 4. 11: Error Correction Models for S&P 500, Energy, Financials, Cons. Disc. and Cons. Stap. Sector

Variable	S&P 500 *ΔIndex*	Energy *ΔIndex*	Financials *ΔIndex*	Cons. Disc. *ΔIndex*	Cons. Stap. *ΔIndex*
EC-term	-.054**	-.002	-.022**	-.055**	-.046**
	.011	.002	.005	.010	.016
$\Delta Index_{t-1}$	-.001	-.119	.047	.008	.018
	.067	.069	.069	.066	.068
$\Delta Index_{t-2}$	-.171**	-.073	-.151**	-.222**	.015
	.066	.074	.066	.064	.066
$\Delta Index_{t-3}$	.061	-.001	.010	.049	-.118*
	.071	.074	.066	.069	.067
$\Delta Index_{t-4}$	-	.016	.024	-	-
		.074	.066		
$\Delta Index_{t-5}$	-	-.135**	-	-	-
		.074			
ΔIP_{t-1}	-.508	.171	.119	-.592	-.201
	.448	.661	.637	.529	.346
ΔIP_{t-2}	1.432**	2.931**	2.193**	1.301**	.965**
	.418	.658	.634	.498	.342
ΔIP_{t-3}	1.071**	1.762**	1.743**	1.494**	.538
	.436	.681	.622	.516	.354
ΔIP_{t-4}	-	.356	-1.841**	-	-
		.687	.64		
ΔIP_{t-5}	-	-2.191**	-	-	-
		.697			
$\Delta M1_{t-1}$	-.486*	-.277	-.331	-.460	-.337
	.294	.448	.418	.353	.238
$\Delta M1_{t-2}$	-.623**	-.015	-1.391**	-.968**	-.398
	.298	.458	.424	.363	.244
$\Delta M1_{t-3}$	-.641**	-.418	-1.551**	-.685*	-.310
	.294	.454	.432	.359	.240
$\Delta M1_{t-4}$	-	.243	-.427	-	-
		.455	.434		
$\Delta M1_{t-5}$	-	.226	-	-	-
		.449			
ΔLIR_{t-1}	.163**	.262**	.293**	.191**	-.001
	.042	.064	.059	.050	.033
ΔLIR_{t-2}	-.012	.013	.018	-.003	.027
	.042	.067	.063	.051	.034
ΔLIR_{t-3}	.024	-.098	.036	.040	.007
	.040	.067	.059	.047	.032
ΔLIR_{t-4}	-	-.012	.061	-	-
		.065	.057		
ΔLIR_{t-5}	-	-.066	-	-	-
		.060			
Constant	.001	.008	.003	.001	.006*
	.004	.006	.005	.004	.003

*Note 1: ** indicates significance at 5 % level and & * indicates significance at 10 % level.*
Note 2: First number in a cell denotes coefficient of the variable while second number denotes std. error

Table 4. 12: Error Correction Models for Real Estate, HC, Industrials, and Materials sector

	Real Estate	Health Care	Industrials	Materials
Variable	*ΔIndex*	*ΔIndex*	*ΔIndex*	*ΔIndex*
EC-term	-.131**	-.023**	-.006	-.005**
	.025	.011	.007	.002
$\Delta Index_{t-1}$	.072	.005	-.035	-.077
	.072	.071	.072	.071
$\Delta Index_{t-2}$	-.122*	-.008	-.209**	-.063
	.072	.070	.072	.070
$\Delta Index_{t-3}$	.085	.009	-.002	.031
	.073	.070	.069	.071
$\Delta Index_{t-4}$	.125*	-	.074	-
	.072		.068	
ΔIP_{t-1}	-1.041	.430	.665	-.221
	.717	.432	.548	.640
ΔIP_{t-2}	2.361**	.447	.924*	1.831**
	.716	.438	.549	.619
ΔIP_{t-3}	3.061**	-.310	-.108	.841
	.717	.447	.556	.642
ΔIP_{t-4}	-1.271*	-	2.081**	-
	.774		.581	
$\Delta M1_{t-1}$	-.428	-.242	.361	-.637
	.507	.308	.357	.4351
$\Delta M1_{t-2}$	-1.271**	-.342	.447	-.916**
	.507	.317	.364	.448
$\Delta M1_{t-3}$	-1.562**	-.249	-.413	-.579
	.515	.304	.364	.443
$\Delta M1_{t-4}$	-1.223**	-	-.229	-
	.530		.359	
ΔLIR_{t-1}	.007	.017	.097**	.201**
	.068	.041	.049	.062
ΔLIR_{t-2}	.117*	.061	.149**	-.001
	.071	.041	.051	.062
ΔLIR_{t-3}	-.091	-.011	.152**	-.037
	.069	.040	.050	.059
ΔLIR_{t-4}	.128**	-	.033	-
	.065		.049	
Constant	.002	.003	.002	.006
	.007	.003	.004	.005

*Note 1: ** indicates significance at 5 % level and & * indicates significance at 10 % level.*
Note 2: First number in a cell denotes coefficient of the variable while second number denotes std. error

For Canada, industrial production, money supply, and long-term interest rate do not share any co-integrating relationship with the Canadian benchmark S&P/TSX or any of the sector indices. While the lags of macroeconomic variables have an impact on the indices in the unrestricted VAR framework as shown in Appendix 4 (Table A4.1-A4.10), there is no long run relationship and the macroeconomic variables used in this study have limited power in forecasting stock market trends at least in the long run.

Given that most of the companies in S&P/TSX are also listed in US stock exchanges and given strong economic ties between Canada and the US this paper also tests to see whether S&P/TSX and Canadian sector indices have a cointegrating relationship with the US money supply and long-term interest rates.

Both trace test and maximum eigenvalue test indicate that the US money supply and interest rates are cointegrated with Canadian benchmark index and all sector indices at 5% significance level as shown in Appendix 5 and the equilibrium long-term relationships are presented in Appendix 6. The results show that like that of the US, the long-term interest rate have a negative relationship with the Canadian benchmark index. Results for money supply are ambiguous, for some sectors it has positive influence, for other sectors it has negative influence. Given that industrial production is no longer a reliable indicator of real activity as its effect on US stock returns are ambiguous, it is dropped when testing the relationship between US variables and Canadian indices.

The reverse scenario, that is whether Canadian money supply and interest rate have a relationship with the US indices, is also tested. Both trace and maximum eigenvalue tests indicate that the Canadian macroeconomic variables fail to explain the US indices. Results are shown in Appendix 7.

To remove the immediate impact of the financial crisis of 2007/2008 on the long-term relationship between the stock indices and money supply and interest rate, this study repeats cointegration test using data from January 2010. Industrial production index was dropped as ADF test showed that the series does not contain a unit root at level form at 5% significance level. As indicated by both trace and maximum eigenvalue statistics, energy, consumer staples and health care sectors no longer have a relationship with money supply and long-term interest rate. Results are not as robust for the 2010-2018 period for real estate, materials and utilities sector compared to 2000-2018 period. While trace tests suggest that there is a relationship, max eigenvalue tests suggest the opposite for these sectors. Only for S&P 500, financials, consumer discretionary, industrials sectors do both trace and max eigenvalue tests suggest that long-term relationship still exists when data from January 2010 is used. Results are shown in Appendix 8.

Test is repeated for Canada using data from January 2010 and results remain the same, that is, there is still no long-term relationship between S&P/TSX and sector indices with money supply and long-term interest rate. Results are shown in Appendix 9.

Chapter 5. Discussion

This study finds that for the US there is a long-term equilibrium relationship between money supply and S&P 500 and most sector indices. While the relationship is negative with energy and financials sector, the negative relationship is statistically not significant. Earlier studies such as Abdullah and Hayworth (1993) and Mukherjee and Naka (1995) find a positive relationship between money supply and stock market for the US using a different methodology and time period. Mukherjee and Naka (1995) also find a positive relationship with money supply and stock market for Japan. Recent studies such Ratanapakorn and Sharma (2007) and Humpe and Macmillan (2009) also find a positive relationship between money supply and stock index for the US.

There are two channels through which the positive relationship may be explained. One channel could be that an increase in money supply acts as a stimulus for economic growth which may increase expected cashflows (Mukherjee and Naka, 1995). Another channel could be that an increase in money supply lowers interest rates due to increased liquidity which results in portfolio rebalancing into more financial assets such as equities (Ratanapakorn and Sharma, 2007).

While there are authors such as Dhakal et al (1993), who assert that an increase in money supply may be related to unanticipated increases in inflation and uncertainty, which may negatively impact the stock prices, this study lends support, at least for the US case, to the first two theories that support a positive relationship.

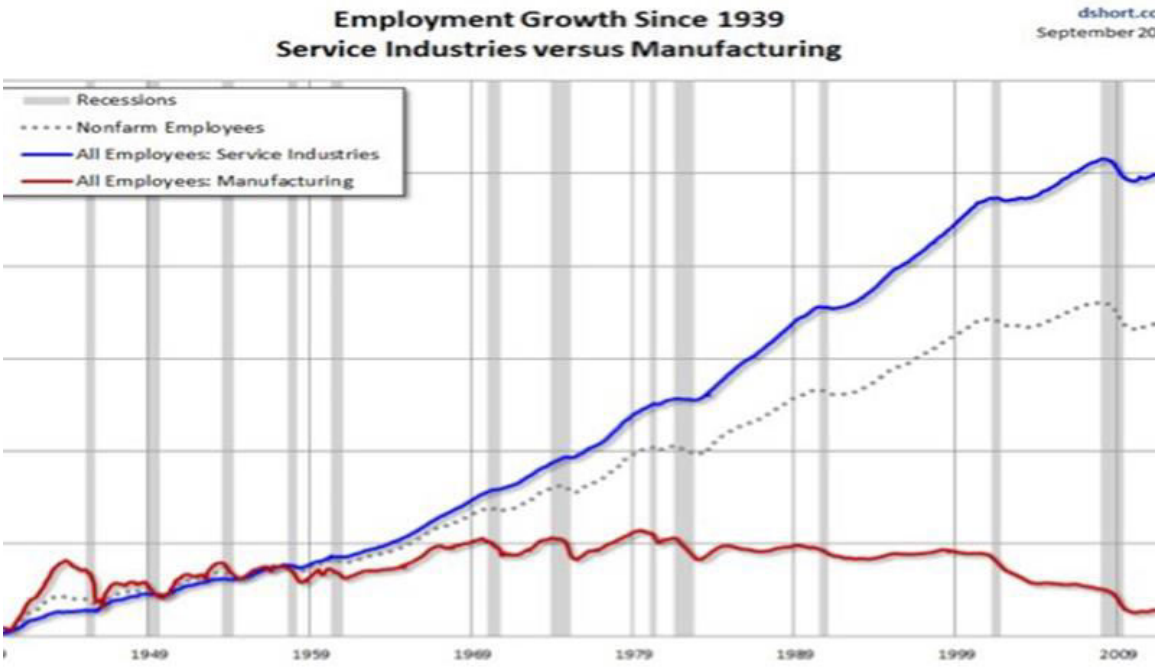
This paper also finds that the association between long-term interest rate and S&P 500, along with six sector indices is negative for the US. Generally, economic theory predicts that rising long-term interest rates have a negative impact on stock returns by raising

financing costs and reducing corporate profitability (Chen, Roll, and Ross, 1986; Ratanapakorn and Sharma, 2007). The findings in this study are consistent with theory and most previous empirical studies. Asprem (1989) found a negative relationship for Germany, Netherlands, Switzerland, Sweden and the U.K. Humpe and Macmillan (2009) find a significantly negative relationship with long-term treasury bond yields. Mayasimi and Koh (2000) and Kwon and Shin (1999) find similar results for Singapore and South Korea Respectively. Mukherjee and Naka (1995) find a negative relationship for Japan.

Previous studies mostly find that the stock market returns are positively related to real economic activity. Like most previous studies, this paper uses industrial production index as a proxy for real economic activity and find ambiguous relationship for the US indices. This finding is contradictory to previous studies on the US and other countries (Chen et al.,1986; Fama, 1990; Abdullah and Hayworth,1993; Mukherjee and Naka, 1995). However, Young (2006) finds that the positive relationship between industrial production and stock market returns no longer stands when more recent data is used for the US and attributes this to the transformation of the US economy from manufacturing based to service oriented based. Figure 5.1[1] shows the employment growth in service industries and manufacturing industries since 1939.

[1] https://www.businessinsider.com/charting-the-incredible-shift-from-manufacturing-to-services-in-america-2011-9

Figure 5. 1: Employment Growth in Service Industries versus Manufacturing



According to a 2014 online article in the Washington Post[2], over the last two decades, employment in the manufacturing sector has dropped from 18 million to 12 million. In 1990, the manufacturing industry employed more workers than any other sector in 36 states and as of 2014 manufacturing is the dominant industry in only seven states. Today, non-manufacturing sector's share of GDP is five-and-a-half times bigger than that of the manufacturing sector.

Considering the financial crisis of 2007/2008, this study repeats cointegration test using data from January 2010 for the US and finds that energy, consumer staples and health care sectors no longer have a long-term relationship with money supply and long-term

[2] https://www.washingtonpost.com/blogs/govbeat/wp/2014/09/03/watch-the-u-s-transition-from-a-manufacturing-economy-to-a-service-economy-in-one-gif/?utm_term=.4db80bca92f9

interest rate. Results are not robust as before for real estate, materials and utilities sectors because trace test and max eigenvalue test show conflicting results. Only S&P 500, financials, and consumer discretionary sectors have long-term relationship with money supply and interest rate according to both trace and max statistics.

Results may indicate to the possibility that the 2007/2008 crisis might have fundamentally changed the economy in such a way that the relationship between stock indices and money supply and interest rate has weakened. As a part of robustness check, since US money supply and long-term interest rate have a long-term equilibrium relationship with Canadian indices using 2000-2018 data, test is now repeated using data from January 2010 onward. Results, presented in Appendix 10, show that US money supply and long-term interest rate are no longer able to explain any of the Canadian stock indices. At the same time, just as before, Canadian money supply and long-term interest rate cannot explain any of the US indices using data from January 2010. Results are shown in Appendix 11.

Moving on to Canada, while this study has found that industrial production, money supply and long-term interest rate have a long-term equilibrium relationship with the United States, such variables failed to explain Canadian stock returns over the long run. In the Canadian context there is an absence of predictability of the indices using money supply and interest rate according to Granger (1986) and many others, lack of cointegration implies that markets are efficient. More interestingly, when US variables are used to explain Canadian indices, there is a presence of cointegration implying predictive causality and hence market inefficiency. And at the same time Canadian variables fail to explain US indices in a cointegrating framework.

The discrepancy between the countries may be explained in the following manner. The monetary policy is much more involved for the US, and the Federal Reserve, beyond utilizing traditional monetary policy instruments, also engages in non-traditional monetary policy. So, for the US, according to Dhakal, Kandil, and Sharma (1993), even if information regarding changes in stock of money is readily available to traders, the implications of these changes on the direction of monetary policy may not be readily apparent. Consequently, information regarding policy changes may not be reflected in the stock prices.

In contrast, the monetary policy for Canada is straightforward. The Bank of Canada's only monetary policy instrument is the target it sets for the overnight interest rate, which is a market determined rate at which commercial banks lend funds to each other for a very short period of time. Given that Bank of Canada's strategies are much easier to interpret compared to the Fed's policies, it is much easier for the traders to assess the direction of Canadian monetary policy. As a result, stock prices in Canada readily incorporate information regarding policy changes compared to the US.

Stocks in S&P/TSX are inter-listed in the US exchanges, moreover the Canadian economy is highly integrated to the US economy with the US being Canada's largest trading partner; Canada exports around 30% of its GDP, equivalent to 80% of its exports, to the US. International trade is very important to Canada relative to the US whose exports account for around 10-12% of its GDP compared to Canada's 30-35%. Such reasons provided the motivation to test whether US variables can explain Canadian stock returns. It turns out that US money supply, M1, and long-term interest rate are co-

integrated with all the Canadian sectors including the composite S&P/TSX. At the same time the Canadian variables are not cointegrated with US indices.

The results are not surprising. For instance, Cheung and Ng (1997a) find that US variables are able to explain European and Pacific Rim's stock market movement, but the reverse was not true. Similarly, Eun and Shim (1989) found that shocks in the US stock market are transmitted to other international markets while no single foreign market can significantly explain the US stock movements. Conover, Jensen and Johnson (1999) find that some foreign stock markets are more strongly related to the US monetary environment than to local monetary conditions and these foreign markets display significantly higher returns when the Federal Reserve is following an expansive monetary policy. Using ARCH framework, Hamao, Masulis and Ng (1990) found evidence of price volatility spillovers from New York markets to Tokyo and London markets but spillover effects in the opposite direction was not there. Harvey (1991) finds that variables that represent the US business cycle have can explain foreign stock returns while Campbell and Hamao (1992) find that US economic variables improve the forecasts of Japanese stock returns. The above studies highlight the dominant role of the US in the world economy.

Chapter 6. Conclusion

This paper finds that there is a long-term equilibrium relationship between macroeconomic variables that represent money supply, real economic activity, and long-term interest rate and S&P 500 and all sector indices for the US for 2000-2018 time period. Money supply generally has a positive relationship, while long-term interest rate has a negative relationship with the indices supporting the results of earlier studies. While prior studies show that industrial production has a positive relationship with stock indices, results are inconclusive based on this study. This paper supports the hypothesis that industrial production is no longer a reliable indicator since the US economy has transformed from a manufacturing-based economy into a service-based economy.

No long-term relationship between the same macroeconomic variables and various stock indices is found for Canada for the same period. Interestingly, the US money supply and interest rate have a relationship with Canadian indices supporting the notion of US dominance in global economy.

The same analysis on 2010-2018 data shows that the long-term relationship breaks down for some of the sectors for the US suggesting a possibility that the financial crisis might have fundamentally altered economic relationships. For the same time period, the US macroeconomic variables fail to explain Canadian indices as well. These results should be viewed with caution since the time frame is shorter.

While earlier studies also analyse additional variables such as short-term interest rate, inflation, exchange rate, they generally test the relationship against a single benchmark index of a country. Since this paper investigates ten different indices for the US and ten

different indices for Canada, attention was given on fewer macroeconomic variables to keep the analysis compact.

However, variables such as inflation, exchange rate, commodity prices may be significant in explaining stock returns. This is especially important in Canadian context since prices of oil and other commodities are critical to Canadian economy and as such, changes in prices of commodities may have an important link with stock prices. The same thing can be said about exchange rate for Canada given the importance of international trade to Canadian economy. As such, an interesting extension of this study would be to see whether the effects are heterogenous across different sectors and across the countries when exchange rate and oil price are incorporated in the model.

A focus on the qualitative differences between sectors not only within a country but also across countries is also not addressed in this study. For instance, as previously mentioned, which sector a company belongs to is classified through the Global Industry Classification Standard (GICS). However, within GICS there are subclassifications. For instance, energy sector in GICS is represented by companies in energy, equipment and service industry and by companies in oil, gas, and consumable fuels. It is very possible that the proportion of companies that belongs to one sub-sector compared to another varies across Canada and the US. In addition, what drives one sector compared to another may be key in determining which variable to focus on for investment or other relevant purposes. For instance, oil price may be more important to energy sector than long-term interest rate or money supply. If these variables can be controlled for, sharper insights may be derived.

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Appendix 1

Table A1.1: Descriptive statistics of US Stock Indices (Natural Log form)

Index	Mean	Std. Dev.	Min	Max
SPX	7.247466	.3014701	6.599993	7.945842
Energy	5.322002	.4419402	4.432137	5.977051
Financials	4.603877	.3200504	3.48765	5.099531
Cons. Disc.	4.732602	.4396156	3.872325	5.710311
Cons. Stap.	5.026783	.3525152	4.437568	5.687236
Real Estate	5.000024	.2997437	3.939054	5.415433
Health Care	4.947539	.3645726	4.418684	5.761136
Industrials	4.952174	.3433907	4.219934	5.733775
Materials	4.884961	.3376732	4.238329	5.535829
Utilities	4.838592	.2602242	4.167254	5.327551
Technology	4.028656	.4099992	3.161458	4.958394
Macro. Variables	Mean	Std. Dev.	Min	Max
IP	4.592483	.051341	4.466705	4.682121
M1	7.507704	.3929106	6.992648	8.20732
LIR	1.186284	.3709966	.4054651	1.874874

Table A1.2: Descriptive statistics Canadian Stock Indices (Natural Log Form)

Index	Mean	Std. Dev.	Min	Max
TSX	9.329051	.2571359	8.729141	9.69333
Energy	5.361032	.4141019	4.23004	6.095171
Financials	5.187586	.3060275	4.569647	5.734958
Cons. Disc.	4.680692	.3107264	4.176539	5.378468
Cons. Stap.	5.393592	.4836243	4.330338	6.332569
Real Estate	5.216901	.368819	4.376512	5.731462
Health Care	4.144203	.3637891	3.271089	5.025918
Industrials	4.70727	.3720437	3.998384	5.487449
Materials	5.370816	.4174563	4.585274	6.101686
Utilities	5.216558	.2667347	4.32968	5.536152
Technology	3.508797	.3698107	2.416806	4.513274
Macro. Variables	Mean	Std. Dev.	Min	Max
IP	4.688045	.0494051	4.533887	4.78737
M1	26.87459	.4408177	26.11981	27.6098
LIR	1.13373	.4664905	.0418397	1.846653

Appendix 2

Table A2.1: Phillips-Perron Unit Root Test for the US variables for 2000-2018

Index	Level	First Difference
S&P 500	-2.118	-13.593***
Energy	-1.835	-15.167***
Financials	-1.462	-12.489***
Consumer Discretionary	-2.003	-13.577***
Consumer Staples	-2.750	-13.674***
Real Estate	-2.196	-11.849***
Health Care	-2.329	-13.232***
Industrials	-1.234	-14.826***
Utilities	-2.109	-14.072***
Materials	-3.697***	NA
Technology	-2.902	-15.068***
Macroeconomic Variables	Level	First Difference
Industrial Production	-1.733	-12.199***
M1	-1.862	-15.544***
Long Term Interest Rate	-2.779	-11.938***

Note 1: The numerical values represent the PP Z(t) test statistic
Note 2: *** indicates significance at 1% level.
Note 3: All the level series are in natural logarithmic form.

Table A2.2: Phillips-Perron Unit Root test for Canadian variables for 2000-2018

Index	Level	First Difference
S&P/TSX	-2.587	-12.089***
Energy	-1.896	-13.650***
Financials	-2.521	-11.821***
Consumer Discretionary	-1.400	-12.218***
Consumer Staples	-1.517	-14.760***
Real Estate	-1.507	-13.913***
Health Care	-2.265	-12.413***
Industrials	-2.331	-11.561***
Utilities	-2.668	-15.567***
Materials	-1.490	-15.105***
Technology	-4.199***	NA
Macroeconomic Variables	Level	First Difference
Industrial Production	-1.259	-13.943***
M1	-1.733	-13.550***
Long Term Interest Rate	-2.552	-11.200***

Note 1: The numerical values represent the PP Z(t) test statistic
Note 2: *** indicates significance at 1% level.
Note 3: All the level series are in natural logarithmic form

Appendix 3

Table A3.1: VECM for S&P 500

	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
D_lnspx						
_ce1						
L1.	-.0543143	.0109575	-4.96	0.000	-.0757905	-.032838
lnspx						
LD.	-.0012516	.0670762	-0.02	0.985	-.1327185	.1302154
L2D.	-.165998	.0659804	-2.52	0.012	-.2953173	-.0366787
L3D.	.0608593	.0705452	0.86	0.388	-.0774067	.1991253
lnip						
LD.	-.5076476	.4486778	-1.13	0.258	-1.38704	.3717446
L2D.	1.435483	.4181114	3.43	0.001	.6159994	2.254966
L3D.	1.077138	.4364496	2.47	0.014	.2217123	1.932563
lnm1						
LD.	-.4861292	.2935893	-1.66	0.098	-1.061554	.0892953
L2D.	-.6233044	.2981945	-2.09	0.037	-1.207755	-.0388538
L3D.	-.6414579	.2949393	-2.17	0.030	-1.219528	-.0633875
lnlir						
LD.	.1630687	.0421024	3.87	0.000	.0805494	.245588
L2D.	-.012064	.0422504	-0.29	0.775	-.0948733	.0707453
L3D.	.0241966	.0400305	0.60	0.546	-.0542617	.1026548
_cons	.0014795	.0036055	0.41	0.682	-.0055871	.0085462
D_lnip						
_ce1						
L1.	-.0021237	.0016849	-1.26	0.208	-.005426	.0011787
lnspx						

```
          LD. |   .0200153    .010314     1.94   0.052    -.0001999    .0402304
         L2D. |   .0537951   .0101455     5.30   0.000     .0339102      .07368
         L3D. |   .0036467   .0108474     0.34   0.737    -.0176139    .0249073
              |
        lnip |
          LD. |   .0279221   .0689914     0.40   0.686    -.1072984    .1631427
         L2D. |   .1380275   .0642913     2.15   0.032     .0120189    .2640361
         L3D. |   .2176957   .0671111     3.24   0.001     .0861604     .349231
              |
        lnm1 |
          LD. |  -.0013835    .045144    -0.03   0.976    -.0898641    .0870972
         L2D. |  -.0374244   .0458522    -0.82   0.414     -.127293    .0524441
         L3D. |  -.0370201   .0453516    -0.82   0.414    -.1259077    .0518674
              |
       lnlir |
          LD. |   .0107425   .0064739     1.66   0.097    -.0019462    .0234311
         L2D. |  -.0063759   .0064967    -0.98   0.326    -.0191091    .0063574
         L3D. |   .0048539   .0061553     0.79   0.430    -.0072103    .0169181
              |
       _cons |   .0001772   .0005544     0.32   0.749    -.0009094    .0012638
-------------+----------------------------------------------------------------
D_lnm1       |
        _ce1 |
          L1. |   -.009811    .002728    -3.60   0.000    -.0151578   -.0044642
              |
       lnspx |
          LD. |  -.0014452   .0166994    -0.09   0.931    -.0341755    .0312851
         L2D. |   -.003266   .0164266    -0.20   0.842    -.0354617    .0289296
         L3D. |   .0219718   .0175631     1.25   0.211    -.0124513    .0563948
              |
        lnip |
          LD. |   .0403935   .1117039     0.36   0.718    -.1785421    .2593291
         L2D. |  -.1277998    .104094    -1.23   0.220    -.3318203    .0762208
         L3D. |  -.3156774   .1086595    -2.91   0.004    -.5286462   -.1027086
              |
        lnm1 |
          LD. |  -.1687616   .0730927    -2.31   0.021    -.3120207   -.0255026
```

```
        L2D. |  -.0244885   .0742392    -0.33   0.742    -.1699948    .1210177
        L3D. |   .0973102   .0734288     1.33   0.185    -.0466076     .241228
             |
       lnlir |
        LD. |  -.0188528   .0104819    -1.80   0.072     -.039397    .0016914
        L2D. |  -.0020337   .0105188    -0.19   0.847    -.0226501    .0185827
        L3D. |  -.0012019   .0099661    -0.12   0.904    -.0207351    .0183313
             |
       _cons |   .0041006   .0008976     4.57   0.000     .0023413    .0058599
-------------+----------------------------------------------------------------
D_lnlir      |
        _ce1 |
        L1. |  -.0431336   .0187767    -2.30   0.022    -.0799353   -.0063319
             |
       lnspx |
        LD. |   .3214923   .1149416     2.80   0.005      .096211    .5467736
        L2D. |   .0315581   .1130639     0.28   0.780     -.190043    .2531592
        L3D. |   .0125534    .120886     0.10   0.917    -.2243789    .2494856
             |
        lnip |
        LD. | -2.061817   .7688528    -2.68   0.007     -3.56874   -.5548927
        L2D. |  -.7733312   .7164745    -1.08   0.280    -2.177595    .6309329
        L3D. |   1.324544   .7478987     1.77   0.077    -.1413106    2.790399
             |
        lnm1 |
        LD. | -1.084149   .5030938    -2.15   0.031    -2.070194    -.098103
        L2D. |   .1029452   .5109853     0.20   0.840    -.8985675    1.104458
        L3D. |  -.6896393   .5054071    -1.36   0.172    -1.680219    .3009403
             |
       lnlir |
        LD. |   .1947503   .0721466     2.70   0.007     .0533455     .336155
        L2D. |  -.1282226   .0724002    -1.77   0.077    -.2701244    .0136791
        L3D. |   .0578064   .0685961     0.84   0.399    -.0766394    .1922523
             |
       _cons |  -.0028045   .0061784    -0.45   0.650    -.0149139    .0093049
------------------------------------------------------------------------------
```

Table A3.2: VECM for Energy Sector

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_lnenergy						
_ce1						
L1.	-.0021753	.0023774	-0.91	0.360	-.0068349	.0024844
lnenergy						
LD.	-.119672	.0699838	-1.71	0.087	-.2568378	.0174938
L2D.	-.0736075	.0737088	-1.00	0.318	-.2180742	.0708591
L3D.	-.0009197	.0744252	-0.01	0.990	-.1467904	.1449511
L4D.	.0157144	.0736191	0.21	0.831	-.1285764	.1600052
L5D.	-.1345824	.0740948	-1.82	0.069	-.2798055	.0106407
lnip						
LD.	.1698688	.6609641	0.26	0.797	-1.125597	1.465335
L2D.	2.935457	.658785	4.46	0.000	1.644262	4.226652
L3D.	1.766666	.680085	2.60	0.009	.4337243	3.099609
L4D.	.3569512	.6875468	0.52	0.604	-.9906158	1.704518
L5D.	-2.196617	.6970744	-3.15	0.002	-3.562858	-.8303762
lnm1						
LD.	-.276822	.4484116	-0.62	0.537	-1.155693	.6020485
L2D.	-.0152693	.4579723	-0.03	0.973	-.9128786	.8823399
L3D.	-.4178271	.4544072	-0.92	0.358	-1.308449	.4727947
L4D.	.2432104	.4550387	0.53	0.593	-.6486492	1.13507
L5D.	.2257248	.4496357	0.50	0.616	-.6555451	1.106995
lnlir						
LD.	.2619683	.0647877	4.04	0.000	.1349868	.3889499
L2D.	.013888	.0671534	0.21	0.836	-.1177301	.1455062
L3D.	-.0984139	.0671877	-1.46	0.143	-.2300994	.0332717
L4D.	-.0124718	.0650645	-0.19	0.848	-.1399959	.1150522
L5D.	-.0662971	.0601741	-1.10	0.271	-.1842362	.051642

```
       _cons |   .0080849    .006421     1.26   0.208       -.0045    .0206698
-------------+----------------------------------------------------------------
D_lnip       |
        _ce1 |
         L1. |    .000568   .0002562     2.22   0.027     .0000658    .0010702
             |
    lnenergy |
         LD. |   .0077072   .0075426     1.02   0.307     -.007076    .0224903
        L2D. |   .0210418    .007944     2.65   0.008     .0054718    .0366118
        L3D. |    .006013   .0080212     0.75   0.453    -.0097083    .0217343
        L4D. |   .0057493   .0079344     0.72   0.469    -.0098017    .0213004
        L5D. |   .0044472   .0079856     0.56   0.578    -.0112043    .0200988
             |
        lnip |
         LD. |    .016498   .0712359     0.23   0.817    -.1231217    .1561177
        L2D. |   .1024269    .071001     1.44   0.149    -.0367325    .2415864
        L3D. |   .1840005   .0732966     2.51   0.012     .0403418    .3276593
        L4D. |   .2087395   .0741008     2.82   0.005     .0635045    .3539745
        L5D. |   .0524188   .0751277     0.70   0.485    -.0948288    .1996663
             |
        lnm1 |
         LD. |   .0212836   .0483279     0.44   0.660    -.0734373    .1160045
        L2D. |  -.0179231   .0493583    -0.36   0.717    -.1146636    .0788174
        L3D. |  -.0465939   .0489741    -0.95   0.341    -.1425813    .0493935
        L4D. |   .0096728   .0490421     0.20   0.844     -.086448    .1057936
        L5D. |   .0233965   .0484598     0.48   0.629     -.071583    .1183759
             |
       lnlir |
         LD. |   .0124552   .0069825     1.78   0.074    -.0012303    .0261407
        L2D. |  -.0008234   .0072375    -0.11   0.909    -.0150087    .0133618
        L3D. |   .0090289   .0072412     1.25   0.212    -.0051636    .0232214
        L4D. |  -.0032134   .0070124    -0.46   0.647    -.0169574    .0105306
        L5D. |    .001357   .0064853     0.21   0.834     -.011354    .0140679
             |
       _cons |   -.000368    .000692    -0.53   0.595    -.0017244    .0009883
-------------+----------------------------------------------------------------
D_lnm1       |
```

```
        _ce1 |
         L1. |   .0012149    .000398     3.05   0.002     .0004348    .0019951
             |
    lnenergy |
         LD. |  -.0237334   .0117173    -2.03   0.043    -.0466988   -.0007679
        L2D. |  -.0167667   .0123409    -1.36   0.174    -.0409545    .0074211
        L3D. |    .004796   .0124609     0.38   0.700    -.0196269    .0292188
        L4D. |   .0116399   .0123259     0.94   0.345    -.0125185    .0357983
        L5D. |   .0178889   .0124056     1.44   0.149    -.0064256    .0422033
             |
        lnip |
         LD. |   .0386984   .1106641     0.35   0.727    -.1781992     .255596
        L2D. |  -.1462157   .1102992    -1.33   0.185    -.3623982    .0699669
        L3D. |  -.3116019   .1138655    -2.74   0.006    -.5347742   -.0884297
        L4D. |  -.0375119   .1151148    -0.33   0.745    -.2631327     .188109
        L5D. |   .2267198     .11671     1.94   0.052    -.0020276    .4554671
             |
        lnm1 |
         LD. |  -.1546636   .0750768    -2.06   0.039    -.3018113   -.0075158
        L2D. |   .0075476   .0766775     0.10   0.922    -.1427375    .1578328
        L3D. |   .1177726   .0760806     1.55   0.122    -.0313427    .2668879
        L4D. |   -.085542   .0761864    -1.12   0.262    -.2348645    .0637806
        L5D. |   .0447571   .0752817     0.59   0.552    -.1027924    .1923066
             |
       lnlir |
         LD. |  -.0140736   .0108473    -1.30   0.194    -.0353339    .0071867
        L2D. |   .0053996   .0112434     0.48   0.631     -.016637    .0274362
        L3D. |    .000497   .0112491     0.04   0.965    -.0215509    .0225449
        L4D. |   -.003971   .0108936    -0.36   0.715    -.0253222    .0173801
        L5D. |   .0016888   .0100749     0.17   0.867    -.0180575    .0214352
             |
       _cons |    .004947   .0010751     4.60   0.000     .0028399     .007054
-------------+----------------------------------------------------------------
D_lnlir      |
        _ce1 |
         L1. |   .0064566   .0026411     2.44   0.014     .0012802     .011633
             |
```

lnenergy						
LD.	.3037857	.0777451	3.91	0.000	.1514081	.4561633
L2D.	-.0175931	.0818832	-0.21	0.830	-.1780813	.142895
L3D.	.0549375	.082679	0.66	0.506	-.1071104	.2169854
L4D.	.1891419	.0817835	2.31	0.021	.0288491	.3494347
L5D.	-.143454	.0823119	-1.74	0.081	-.3047824	.0178745
lnip						
LD.	-1.606737	.7342655	-2.19	0.029	-3.045871	-.1676029
L2D.	-.5570306	.7318448	-0.76	0.447	-1.99142	.8773589
L3D.	1.642495	.755507	2.17	0.030	.161728	3.123261
L4D.	.1392977	.7637963	0.18	0.855	-1.357716	1.636311
L5D.	-1.417992	.7743805	-1.83	0.067	-2.93575	.0997658
lnm1						
LD.	-1.257158	.4981408	-2.52	0.012	-2.233496	-.2808203
L2D.	.3612714	.5087618	0.71	0.478	-.6358835	1.358426
L3D.	-.7134752	.5048013	-1.41	0.158	-1.702868	.2759172
L4D.	-.0395054	.5055029	-0.08	0.938	-1.030273	.9512621
L5D.	-.5764093	.4995007	-1.15	0.249	-1.555413	.4025941
lnlir						
LD.	.2378398	.0719727	3.30	0.001	.0967759	.3789038
L2D.	-.1510988	.0746007	-2.03	0.043	-.2973135	-.004884
L3D.	.0224299	.0746389	0.30	0.764	-.1238597	.1687195
L4D.	-.0830811	.0722802	-1.15	0.250	-.2247477	.0585854
L5D.	-.0676365	.0668475	-1.01	0.312	-.1986552	.0633821
_cons	.0018253	.0071331	0.26	0.798	-.0121552	.0158059

Table A3.3: VECM for Financials Sector

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_lnfin						
_ce1						
L1.	-.0217873	.0049495	-4.40	0.000	-.0314882	-.0120864
lnfin						
LD.	.0472355	.0691197	0.68	0.494	-.0882367	.1827077
L2D.	-.1506181	.066155	-2.28	0.023	-.2802795	-.0209566
L3D.	.0099819	.0664061	0.15	0.881	-.1201717	.1401355
L4D.	.0243162	.0660046	0.37	0.713	-.1050505	.1536829
lnip						
LD.	.1190191	.6373086	0.19	0.852	-1.130083	1.368121
L2D.	2.192806	.6343904	3.46	0.001	.9494235	3.436188
L3D.	1.748417	.6205366	2.82	0.005	.5321879	2.964647
L4D.	-1.844157	.6489731	-2.84	0.004	-3.116121	-.5721929
lnm1						
LD.	-.3311062	.417884	-0.79	0.428	-1.150144	.4879314
L2D.	-1.392314	.4244082	-3.28	0.001	-2.224138	-.5604888
L3D.	-1.559961	.432556	-3.61	0.000	-2.407755	-.7121666
L4D.	-.42692	.4340028	-0.98	0.325	-1.27755	.4237099
lnlir						
LD.	.2931522	.059346	4.94	0.000	.1768362	.4094682
L2D.	.0186361	.0634696	0.29	0.769	-.105762	.1430342
L3D.	.0362366	.0599494	0.60	0.546	-.0812621	.1537352
L4D.	.0611567	.0573401	1.07	0.286	-.0512278	.1735412
_cons	.0031509	.0055091	0.57	0.567	-.0076467	.0139485
D_lnip						
_ce1						

L1.	-.0003519	.0005429	-0.65	0.517	-.001416	.0007122
lnfin						
LD.	.0131439	.007582	1.73	0.083	-.0017167	.0280044
L2D.	.0290508	.0072568	4.00	0.000	.0148276	.0432739
L3D.	.0095348	.0072844	1.31	0.191	-.0047423	.0238119
L4D.	-.001445	.0072403	-0.20	0.842	-.0156358	.0127458
lnip						
LD.	-.0120123	.0699092	-0.17	0.864	-.1490317	.1250072
L2D.	.1045222	.0695891	1.50	0.133	-.0318699	.2409142
L3D.	.1930933	.0680694	2.84	0.005	.0596798	.3265068
L4D.	.1993563	.0711887	2.80	0.005	.059829	.3388836
lnm1						
LD.	.0201225	.0458395	0.44	0.661	-.0697213	.1099663
L2D.	-.0033605	.0465552	-0.07	0.942	-.094607	.087886
L3D.	-.0265334	.047449	-0.56	0.576	-.1195317	.0664648
L4D.	.0689837	.0476077	1.45	0.147	-.0243257	.162293
lnlir						
LD.	.0130476	.0065099	2.00	0.045	.0002884	.0258069
L2D.	-.0053392	.0069623	-0.77	0.443	-.018985	.0083065
L3D.	.008724	.0065761	1.33	0.185	-.004165	.0216129
L4D.	-.0056529	.0062899	-0.90	0.369	-.0179809	.006675
_cons	-.0004132	.0006043	-0.68	0.494	-.0015977	.0007712
D_lnm1						
_ce1						
L1.	-.0030641	.0008804	-3.48	0.001	-.0047896	-.0013386
lnfin						
LD.	-.0014735	.0122945	-0.12	0.905	-.0255703	.0226233
L2D.	-.0077001	.0117672	-0.65	0.513	-.0307633	.0153631
L3D.	.005599	.0118118	0.47	0.635	-.0175517	.0287498
L4D.	-.0143871	.0117404	-1.23	0.220	-.0373978	.0086237

lnip						
LD.	.1009584	.1133596	0.89	0.373	-.1212224	.3231392
L2D.	-.0391919	.1128406	-0.35	0.728	-.2603553	.1819716
L3D.	-.2775164	.1103764	-2.51	0.012	-.4938501	-.0611827
L4D.	-.0189123	.1154344	-0.16	0.870	-.2451596	.207335
lnm1						
LD.	-.1514146	.07433	-2.04	0.042	-.2970988	-.0057304
L2D.	-.010684	.0754905	-0.14	0.887	-.1586427	.1372747
L3D.	.0888252	.0769398	1.15	0.248	-.0619741	.2396244
L4D.	-.0994163	.0771971	-1.29	0.198	-.2507199	.0518873
lnlir						
LD.	-.0162743	.010556	-1.54	0.123	-.0369637	.0044151
L2D.	.0036689	.0112895	0.32	0.745	-.0184581	.0257959
L3D.	.0003944	.0106633	0.04	0.970	-.0205054	.0212941
L4D.	.0036689	.0101992	0.36	0.719	-.0163212	.023659
_cons	.003922	.0009799	4.00	0.000	.0020014	.0058426
D_lnlir						
_ce1						
L1.	-.010875	.0061281	-1.77	0.076	-.0228859	.0011358
lnfin						
LD.	.1542759	.0855783	1.80	0.071	-.0134544	.3220062
L2D.	-.0236047	.0819076	-0.29	0.773	-.1841406	.1369312
L3D.	.0005007	.0822185	0.01	0.995	-.1606446	.1616459
L4D.	-.0071778	.0817214	-0.09	0.930	-.1673487	.1529932
lnip						
LD.	-1.856224	.7890619	-2.35	0.019	-3.402757	-.3096907
L2D.	-.7092415	.7854488	-0.90	0.367	-2.248693	.8302099
L3D.	1.727187	.7682963	2.25	0.025	.2213543	3.23302
L4D.	.1596722	.8035039	0.20	0.842	-1.415167	1.734511

lnm1						
LD.	-1.054098	.5173888	-2.04	0.042	-2.068162	-.0400347
L2D.	.1223566	.5254666	0.23	0.816	-.9075389	1.152252
L3D.	-.4311634	.5355545	-0.81	0.421	-1.480831	.6185042
L4D.	.4145332	.5373459	0.77	0.440	-.6386454	1.467712
lnlir						
LD.	.2276932	.0734772	3.10	0.002	.0836805	.3717058
L2D.	-.1186519	.0785827	-1.51	0.131	-.2726712	.0353674
L3D.	.0956163	.0742243	1.29	0.198	-.0498606	.2410932
L4D.	-.070653	.0709937	-1.00	0.320	-.209798	.068492
_cons	-.0074042	.0068209	-1.09	0.278	-.0207729	.0059644

Table A3.4: VECM for Consumer Discretionary Sector

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_lncd						
_ce1						
L1.	-.0550554	.0100426	-5.48	0.000	-.0747385	-.0353723
lncd						
LD.	.0082294	.0664521	0.12	0.901	-.1220143	.1384731
L2D.	-.2220173	.0645145	-3.44	0.001	-.3484633	-.0955712
L3D.	.0495775	.0692806	0.72	0.474	-.08621	.1853649
lnip						
LD.	-.5928552	.5294283	-1.12	0.263	-1.630516	.4448051
L2D.	1.300834	.4986199	2.61	0.009	.3235565	2.278111
L3D.	1.493026	.5168235	2.89	0.004	.4800704	2.505981
lnm1						
LD.	-.4607721	.3534664	-1.30	0.192	-1.153553	.2320093
L2D.	-.9689847	.3630025	-2.67	0.008	-1.680456	-.2575129
L3D.	-.6858216	.3591593	-1.91	0.056	-1.389761	.0181177
lnlir						
LD.	.1918387	.0509117	3.77	0.000	.0920536	.2916237
L2D.	-.0030459	.0511954	-0.06	0.953	-.103387	.0972953
L3D.	.0400776	.0479561	0.84	0.403	-.0539147	.1340699
_cons	.0014771	.0044214	0.33	0.738	-.0071888	.010143
D_lnip						
_ce1						
L1.	-.0010976	.0013069	-0.84	0.401	-.003659	.0014638
lncd						
LD.	.0128511	.0086476	1.49	0.137	-.0040978	.0297999

```
         L2D. |   .0405738   .0083954     4.83   0.000     .0241191    .0570284
         L3D. |  -.0019986   .0090156    -0.22   0.825    -.0196689    .0156718
              |
        lnip |
         LD. |   .0574743   .0688956     0.83   0.404    -.0775586    .1925073
         L2D. |   .1681353   .0648865     2.59   0.010     .0409601    .2953104
         L3D. |   .2428783   .0672553     3.61   0.000     .1110602    .3746963
              |
        lnm1 |
         LD. |   -.002178   .0459973    -0.05   0.962    -.0923311    .0879751
         L2D. |   -.019505   .0472383    -0.41   0.680    -.1120903    .0730803
         L3D. |   -.027894   .0467382    -0.60   0.551    -.1194991    .0637111
              |
       lnlir |
         LD. |   .0119288   .0066252     1.80   0.072    -.0010564     .024914
         L2D. |  -.0041187   .0066622    -0.62   0.536    -.0171763    .0089389
         L3D. |   .0060287   .0062406     0.97   0.334    -.0062028    .0182601
              |
       _cons |   .0000316   .0005754     0.05   0.956    -.0010961    .0011593
-------------+------------------------------------------------------------------
D_lnm1       |
        _ce1 |
         L1. |   -.005938    .002083    -2.85   0.004    -.0100207   -.0018553
              |
        lncd |
         LD. |   .0164756   .0137835     1.20   0.232    -.0105396    .0434907
         L2D. |   .0025705   .0133816     0.19   0.848    -.0236569     .028798
         L3D. |   .0296335   .0143702     2.06   0.039     .0014684    .0577986
              |
        lnip |
         LD. |   .0151659   .1098142     0.14   0.890    -.2000659    .2303977
         L2D. |   -.105677   .1034239    -1.02   0.307    -.3083841      .09703
         L3D. |  -.3198047   .1071997    -2.98   0.003    -.5299122   -.1096972
              |
        lnm1 |
         LD. |  -.1724242   .0733161    -2.35   0.019    -.3161211   -.0287273
         L2D. |  -.0129557   .0752941    -0.17   0.863    -.1605294    .1346179
```

```
        L3D. |   .1191114   .0744969     1.60   0.110    -.0268999    .2651227
             |
       lnlir |
         LD. |  -.0205787   .0105601    -1.95   0.051    -.0412762    .0001187
        L2D. |  -.0048576    .010619    -0.46   0.647    -.0256704    .0159552
        L3D. |  -.0030423   .0099471    -0.31   0.760    -.0225382    .0164536
             |
       _cons |   .0040494   .0009171     4.42   0.000     .0022519    .0058469
-------------+----------------------------------------------------------------
D_lnlir      |
        _ce1 |
         L1. |  -.0292555   .0143989    -2.03   0.042    -.0574769   -.0010341
             |
        lncd |
         LD. |   .2766792    .095278     2.90   0.004     .0899377    .4634207
        L2D. |  -.0099182   .0924999    -0.11   0.915    -.1912147    .1713783
        L3D. |   .0609792   .0993335     0.61   0.539    -.1337109    .2556693
             |
        lnip |
         LD. |  -1.996189   .7590866    -2.63   0.009    -3.483971   -.5084066
        L2D. |  -.6584318   .7149141    -0.92   0.357    -2.059638     .742774
        L3D. |    1.50937    .741014     2.04   0.042     .0570089     2.96173
             |
        lnm1 |
         LD. |  -1.080655    .506795    -2.13   0.033    -2.073955   -.0873549
        L2D. |   .1180619   .5204677     0.23   0.821     -.902036     1.13816
        L3D. |  -.6032759   .5149575    -1.17   0.241    -1.612574    .4060222
             |
       lnlir |
         LD. |   .2033797   .0729964     2.79   0.005     .0603093    .3464501
        L2D. |  -.1215226   .0734032    -1.66   0.098    -.2653903    .0223452
        L3D. |   .0590733   .0687588     0.86   0.390    -.0756915    .1938381
             |
       _cons |  -.0036029   .0063394    -0.57   0.570    -.0160279    .0088222
------------------------------------------------------------------------------
```

Table A3.5: VECM for Consumer Staples Sector

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_lncs						
_ce1						
L1.	-.0460611	.0158594	-2.90	0.004	-.0771449	-.0149772
lncs						
LD.	.0176224	.0679645	0.26	0.795	-.1155855	.1508303
L2D.	.0146017	.065775	0.22	0.824	-.114315	.1435184
L3D.	-.1177019	.0670834	-1.75	0.079	-.249183	.0137792
lnip						
LD.	-.2038033	.3469752	-0.59	0.557	-.8838623	.4762557
L2D.	.9651216	.3420032	2.82	0.005	.2948077	1.635435
L3D.	.5387559	.3543716	1.52	0.128	-.1557997	1.233312
lnm1						
LD.	-.337446	.2385291	-1.41	0.157	-.8049544	.1300624
L2D.	-.3986835	.2445783	-1.63	0.103	-.8780482	.0806812
L3D.	-.3104214	.2401635	-1.29	0.196	-.7811333	.1602904
lnlir						
LD.	-.0013424	.0332253	-0.04	0.968	-.0664628	.0637779
L2D.	.0267454	.033658	0.79	0.427	-.0392232	.092714
L3D.	.0067005	.031863	0.21	0.833	-.0557498	.0691508
_cons	.0056473	.0030283	1.86	0.062	-.000288	.0115826
D_lnip						
_ce1						
L1.	-.006025	.0030986	-1.94	0.052	-.0120981	.0000481
lncs						
LD.	.0051758	.0132788	0.39	0.697	-.0208501	.0312018

```
         L2D. |   .0456274    .012851     3.55   0.000     .0204399    .0708149
         L3D. |  -.0124079   .0131067    -0.95   0.344    -.0380965    .0132806
              |
         lnip |
          LD. |   .0952773   .0677915     1.41   0.160    -.0375916    .2281461
         L2D. |   .1506191     .06682     2.25   0.024     .0196542    .2815839
         L3D. |   .2581136   .0692366     3.73   0.000     .1224124    .3938147
              |
         lnm1 |
          LD. |   .0176404   .0466034     0.38   0.705    -.0737006    .1089815
         L2D. |  -.0258973   .0477853    -0.54   0.588    -.1195548    .0677602
         L3D. |  -.0438434   .0469228    -0.93   0.350    -.1358103    .0481235
              |
        lnlir |
          LD. |   .0177414   .0064915     2.73   0.006     .0050183    .0304645
         L2D. |   .0024947   .0065761     0.38   0.704    -.0103941    .0153836
         L3D. |   .0097274   .0062253     1.56   0.118    -.0024741    .0219288
              |
        _cons |  -.0001694   .0005917    -0.29   0.775     -.001329    .0009903
-------------+----------------------------------------------------------------
D_lnm1       |
         _ce1 |
          L1. |  -.0120124   .0048465    -2.48   0.013    -.0215114   -.0025133
              |
         lncs |
          LD. |  -.0138661   .0207695    -0.67   0.504    -.0545737    .0268415
         L2D. |   .0083798   .0201005     0.42   0.677    -.0310164     .047776
         L3D. |   .0502188   .0205003     2.45   0.014     .0100389    .0903986
              |
         lnip |
          LD. |   .0249227   .1060336     0.24   0.814    -.1828994    .2327448
         L2D. |  -.1153283   .1045142    -1.10   0.270    -.3201724    .0895158
         L3D. |  -.2995736   .1082939    -2.77   0.006    -.5118258   -.0873214
              |
         lnm1 |
          LD. |  -.1390342   .0728931    -1.91   0.056    -.2819021    .0038337
         L2D. |   .0266077   .0747417     0.36   0.722    -.1198834    .1730988
```

```
        L3D. |   .1330294   .0733926     1.81   0.070    -.0108174    .2768763
             |
       lnlir |
         LD. |  -.0156966   .0101535    -1.55   0.122     -.035597    .0042038
        L2D. |  -.0014549   .0102857    -0.14   0.888    -.0216145    .0187047
        L3D. |   .0024886   .0097372     0.26   0.798    -.0165959    .0215731
             |
       _cons |   .0040372   .0009254     4.36   0.000     .0022234     .005851
-------------+----------------------------------------------------------------
D_lnlir      |
        _ce1 |
         L1. |  -.1014646   .0331914    -3.06   0.002    -.1665186   -.0364106
             |
        lncs |
         LD. |   .3015498   .1422399     2.12   0.034     .0227648    .5803349
        L2D. |  -.1181659   .1376577    -0.86   0.391    -.3879701    .1516383
        L3D. |  -.1021205    .140396    -0.73   0.467    -.3772916    .1730507
             |
        lnip |
         LD. |  -1.893875   .7261697    -2.61   0.009    -3.317141   -.4706084
        L2D. |  -.6955797   .7157638    -0.97   0.331    -2.098451    .7072916
        L3D. |   1.552858   .7416492     2.09   0.036     .0992518    3.006463
             |
        lnm1 |
         LD. |  -1.118885   .4992073    -2.24   0.025    -2.097313   -.1404562
        L2D. |    .029819   .5118675     0.06   0.954     -.973423    1.033061
        L3D. |  -.8089372   .5026279    -1.61   0.108     -1.79407    .1761955
             |
       lnlir |
         LD. |     .24811   .0695358     3.57   0.000     .1118224    .3843976
        L2D. |  -.0831511   .0704415    -1.18   0.238    -.2212138    .0549117
        L3D. |   .0590736   .0666847     0.89   0.376     -.071626    .1897733
             |
       _cons |  -.0030316   .0063377    -0.48   0.632    -.0154532    .0093901
------------------------------------------------------------------------------
```

Table A3.6: VECM for Real Estate Sector

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_lnreal						
_ce1						
L1.	-.1305397	.0245046	-5.33	0.000	-.1785679	-.0825116
lnreal						
LD.	.0725151	.0726045	1.00	0.318	-.0697872	.2148174
L2D.	-.1226589	.0719058	-1.71	0.088	-.2635917	.0182739
L3D.	.0850319	.0725658	1.17	0.241	-.0571944	.2272582
L4D.	.1248238	.0719987	1.73	0.083	-.0162911	.2659388
lnip						
LD.	-1.046734	.7173564	-1.46	0.145	-2.452726	.3592591
L2D.	2.357837	.7161675	3.29	0.001	.954175	3.7615
L3D.	3.057053	.7176136	4.26	0.000	1.650556	4.46355
L4D.	-1.274024	.7748223	-1.64	0.100	-2.792648	.2445999
lnm1						
LD.	-.4284855	.5074771	-0.84	0.398	-1.423122	.5661513
L2D.	-1.271658	.5072709	-2.51	0.012	-2.265891	-.2774256
L3D.	-1.561155	.5157735	-3.03	0.002	-2.572053	-.5502577
L4D.	-1.226559	.5301003	-2.31	0.021	-2.265536	-.1875814
lnlir						
LD.	.0078656	.0686494	0.11	0.909	-.1266848	.142416
L2D.	.1177854	.0713765	1.65	0.099	-.0221099	.2576807
L3D.	-.0910265	.0690901	-1.32	0.188	-.2264406	.0443876
L4D.	.1280796	.065081	1.97	0.049	.0005231	.255636
_cons	.0024485	.0071043	0.34	0.730	-.0114758	.0163727
D_lnip						
_ce1						

```
          L1. |  -.0011078   .0027901    -0.40   0.691    -.0065762    .0043606
              |
      lnreal |
          LD. |   .0163104   .0082667     1.97   0.048     .0001081    .0325128
         L2D. |      .0194   .0081871     2.37   0.018     .0033536    .0354464
         L3D. |   .0098014   .0082622     1.19   0.236    -.0063923    .0259951
         L4D. |  -.0019998   .0081977    -0.24   0.807    -.0180669    .0140674
              |
        lnip |
          LD. |  -.0178904   .0816772    -0.22   0.827    -.1779748     .142194
         L2D. |   .1052381   .0815418     1.29   0.197    -.0545809    .2650572
         L3D. |   .2038378   .0817065     2.49   0.013      .043696    .3639796
         L4D. |   .2040358   .0882202     2.31   0.021     .0311274    .3769441
              |
        lnm1 |
          LD. |   .0442731   .0577806     0.77   0.444    -.0689748    .1575211
         L2D. |   .0343647   .0577572     0.59   0.552    -.0788372    .1475666
         L3D. |  -.0121412   .0587252    -0.21   0.836    -.1272406    .1029582
         L4D. |   .0477052   .0603565     0.79   0.429    -.0705913    .1660018
              |
       lnlir |
          LD. |   .0158623   .0078163     2.03   0.042     .0005426     .031182
         L2D. |   .0025632   .0081268     0.32   0.752    -.0133651    .0184915
         L3D. |   .0158475   .0078665     2.01   0.044     .0004294    .0312655
         L4D. |  -.0036205     .00741    -0.49   0.625    -.0181439    .0109029
              |
       _cons |  -.0006597   .0008089    -0.82   0.415    -.0022451    .0009257
-------------+----------------------------------------------------------------
D_lnm1       |
        _ce1 |
          L1. |  -.0070556   .0041044    -1.72   0.086       -.0151    .0009889
              |
      lnreal |
          LD. |  -.0081167   .0121609    -0.67   0.504    -.0319516    .0157182
         L2D. |   .0162685   .0120439     1.35   0.177    -.0073371     .039874
         L3D. |   .0130848   .0121544     1.08   0.282    -.0107374     .036907
         L4D. |  -.0077482   .0120594    -0.64   0.521    -.0313843    .0158878
```

lnip						
LD.	.075031	.1201536	0.62	0.532	-.1604656	.3105277
L2D.	-.0435105	.1199544	-0.36	0.717	-.2786168	.1915958
L3D.	-.2723166	.1201966	-2.27	0.023	-.5078977	-.0367355
L4D.	-.0346067	.1297788	-0.27	0.790	-.2889685	.2197551
lnm1						
LD.	-.058169	.0849998	-0.68	0.494	-.2247656	.1084276
L2D.	.0902914	.0849653	1.06	0.288	-.0762375	.2568203
L3D.	.1696835	.0863894	1.96	0.050	.0003633	.3390037
L4D.	-.1300617	.0887891	-1.46	0.143	-.3040852	.0439617
lnlir						
LD.	-.0153152	.0114984	-1.33	0.183	-.0378517	.0072214
L2D.	-.0033815	.0119552	-0.28	0.777	-.0268132	.0200503
L3D.	.0054091	.0115722	0.47	0.640	-.0172721	.0280902
L4D.	-.0036286	.0109007	-0.33	0.739	-.0249937	.0177364
_cons	.0041849	.0011899	3.52	0.000	.0018526	.0065171
D_lnlir						
_ce1						
L1.	-.0681609	.02886	-2.36	0.018	-.1247254	-.0115964
lnreal						
LD.	.1327176	.0855091	1.55	0.121	-.034877	.3003123
L2D.	-.0722769	.0846861	-0.85	0.393	-.2382587	.0937048
L3D.	-.0157811	.0854634	-0.18	0.854	-.1832863	.1517241
L4D.	.0507494	.0847956	0.60	0.550	-.1154469	.2169456
lnip						
LD.	-2.333616	.8448572	-2.76	0.006	-3.989506	-.6777264
L2D.	-.8010376	.843457	-0.95	0.342	-2.454183	.8521077
L3D.	2.238861	.8451601	2.65	0.008	.5823777	3.895344
L4D.	.7786632	.9125369	0.85	0.393	-1.009876	2.567203

lnm1						
LD.	-1.146998	.5976745	-1.92	0.055	-2.318419	.0244223
L2D.	.2396698	.5974317	0.40	0.688	-.9312749	1.410614
L3D.	-1.147978	.6074455	-1.89	0.059	-2.338549	.0425938
L4D.	.3401048	.6243187	0.54	0.586	-.8835374	1.563747
lnlir						
LD.	.2630455	.080851	3.25	0.001	.1045805	.4215105
L2D.	-.0074664	.0840627	-0.09	0.929	-.1722263	.1572935
L3D.	.0325537	.08137	0.40	0.689	-.1269285	.1920359
L4D.	-.0613506	.0766483	-0.80	0.423	-.2115785	.0888773
_cons	-.0051117	.008367	-0.61	0.541	-.0215108	.0112874

Table A3.7: VECM for Health Care Sector

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_lnhc						
_ce1						
L1.	-.0229309	.0107896	-2.13	0.034	-.0440782	-.0017836
lnhc						
LD.	.0051412	.0708769	0.07	0.942	-.133775	.1440574
L2D.	-.008729	.0703049	-0.12	0.901	-.146524	.129066
L3D.	.0095884	.0709523	0.14	0.893	-.1294756	.1486523
lnip						
LD.	.4305617	.4327477	0.99	0.320	-.4176082	1.278732
L2D.	.4470738	.4385511	1.02	0.308	-.4124706	1.306618
L3D.	-.3107228	.4470118	-0.70	0.487	-1.18685	.5654042
lnm1						
LD.	-.2425842	.3085271	-0.79	0.432	-.8472862	.3621178
L2D.	-.3421188	.3178029	-1.08	0.282	-.965001	.2807634
L3D.	-.2493623	.3049623	-0.82	0.414	-.8470774	.3483529
lnlir						
LD.	.0175619	.041829	0.42	0.675	-.0644214	.0995452
L2D.	.061344	.0419233	1.46	0.143	-.0208242	.1435123
L3D.	-.0113995	.0401382	-0.28	0.776	-.0900689	.0672699
_cons	.0039787	.0037843	1.05	0.293	-.0034384	.0113958
D_lnip						
_ce1						
L1.	-.0041768	.0017373	-2.40	0.016	-.0075817	-.0007718
lnhc						
LD.	-.0056834	.011412	-0.50	0.618	-.0280505	.0166838

```
         L2D. |  -.0056654   .0113199    -0.50   0.617     -.027852    .0165212
         L3D. |   .0138393   .0114242     1.21   0.226    -.0085517    .0362302
              |
         lnip |
          LD. |   .0979589   .0696775     1.41   0.160    -.0386065    .2345243
         L2D. |   .1798414   .0706119     2.55   0.011     .0414446    .3182383
         L3D. |   .2252239   .0719742     3.13   0.002     .0841571    .3662907
              |
         lnm1 |
          LD. |  -.0057402   .0496765    -0.12   0.908    -.1031044     .091624
         L2D. |  -.0372445     .05117    -0.73   0.467    -.1375359    .0630469
         L3D. |  -.0689288   .0491026    -1.40   0.160    -.1651681    .0273104
              |
        lnlir |
          LD. |   .0191121    .006735     2.84   0.005     .0059118    .0323124
         L2D. |  -.0009718   .0067502    -0.14   0.886    -.0142019    .0122582
         L3D. |   .0097623   .0064627     1.51   0.131    -.0029044     .022429
              |
        _cons |  -.0000152   .0006093    -0.02   0.980    -.0012094     .001179
--------------+----------------------------------------------------------------
D_lnm1        |
         _ce1 |
          L1. |    -.00856   .0026102    -3.28   0.001    -.0136758   -.0034442
              |
         lnhc |
          LD. |   .0492238   .0171461     2.87   0.004     .0156181    .0828296
         L2D. |   .0084676   .0170077     0.50   0.619    -.0248669    .0418021
         L3D. |  -.0063498   .0171643    -0.37   0.711    -.0399913    .0272917
              |
         lnip |
          LD. |   .0022065   .1046876     0.02   0.983    -.2029775    .2073904
         L2D. |  -.1326754   .1060915    -1.25   0.211    -.3406109    .0752602
         L3D. |  -.3305416   .1081383    -3.06   0.002    -.5424887   -.1185945
              |
         lnm1 |
          LD. |   -.182832   .0746369    -2.45   0.014    -.3291177   -.0365463
         L2D. |  -.0171551   .0768809    -0.22   0.823    -.1678389    .1335286
```

```
        L3D. |   .1096167   .0737746     1.49   0.137    -.0349788    .2542122
             |
       lnlir |
         LD. |  -.0202251    .010119    -2.00   0.046     -.040058   -.0003922
        L2D. |  -.0027943   .0101418    -0.28   0.783    -.0226719    .0170834
        L3D. |  -.0053305     .00971    -0.55   0.583    -.0243617    .0137007
             |
       _cons |   .0039071   .0009155     4.27   0.000     .0021128    .0057014
-------------+----------------------------------------------------------------
D_lnlir      |
        _ce1 |
         L1. |  -.0413771   .0183516    -2.25   0.024    -.0773454   -.0054087
             |
        lnhc |
         LD. |  -.0322476   .1205512    -0.27   0.789    -.2685235    .2040283
        L2D. |   .2643013   .1195782     2.21   0.027     .0299324    .4986703
        L3D. |  -.0378522   .1206793    -0.31   0.754    -.2743794     .198675
             |
        lnip |
         LD. |  -2.081345   .7360398    -2.83   0.005    -3.523956   -.6387334
        L2D. |  -1.121519   .7459105    -1.50   0.133    -2.583476    .3404392
        L3D. |   1.844184   .7603009     2.43   0.015     .3540218    3.334346
             |
        lnm1 |
         LD. |  -1.219122   .5247589    -2.32   0.020     -2.24763   -.1906131
        L2D. |   .1177465   .5405357     0.22   0.828     -.941684    1.177177
        L3D. |  -.6625417   .5186958    -1.28   0.201    -1.679167    .3540833
             |
       lnlir |
         LD. |   .2382882   .0711449     3.35   0.001     .0988467    .3777296
        L2D. |  -.0856671   .0713054    -1.20   0.230    -.2254231     .054089
        L3D. |   .0463583   .0682691     0.68   0.497    -.0874467    .1801633
             |
       _cons |  -.0030117   .0064365    -0.47   0.640    -.0156271    .0096036
------------------------------------------------------------------------------
```

Table A3.8: VECM for Industrials Sector

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_lnind						
_ce1						
L1.	-.0062001	.0072987	-0.85	0.396	-.0205054	.0081051
lnind						
LD.	-.0352721	.0722693	-0.49	0.626	-.1769174	.1063732
L2D.	-.2094779	.0716396	-2.92	0.003	-.349889	-.0690668
L3D.	-.0018233	.0695147	-0.03	0.979	-.1380696	.134423
L4D.	.0744052	.0681648	1.09	0.275	-.0591953	.2080058
lnip						
LD.	.6651684	.548177	1.21	0.225	-.4092387	1.739576
L2D.	.9243561	.5498259	1.68	0.093	-.153283	2.001995
L3D.	-.1087733	.5566979	-0.20	0.845	-1.199881	.9823345
L4D.	2.085807	.5808055	3.59	0.000	.9474496	3.224165
lnm1						
LD.	.3611357	.3576644	1.01	0.313	-.3398736	1.062145
L2D.	.4474468	.3641838	1.23	0.219	-.2663403	1.161234
L3D.	-.4139337	.3644461	-1.14	0.256	-1.128235	.3003676
L4D.	-.2298446	.3598847	-0.64	0.523	-.9352058	.4755165
lnlir						
LD.	.0976238	.0498083	1.96	0.050	1.39e-06	.1952463
L2D.	.1495753	.0516308	2.90	0.004	.0483808	.2507698
L3D.	.1525064	.0506825	3.01	0.003	.0531706	.2518422
L4D.	.0337766	.0493792	0.68	0.494	-.0630049	.130558
_cons	.0022562	.0047552	0.47	0.635	-.0070639	.0115762
D_lnip						
_ce1						

```
          L1. |  -.0016637   .0009738    -1.71   0.088    -.0035723    .0002449
              |
       lnind  |
          LD. |   .0021073   .0096421     0.22   0.827    -.0167909    .0210055
         L2D. |  -.0085159   .0095581    -0.89   0.373    -.0272494    .0102177
         L3D. |   .0006745   .0092746     0.07   0.942    -.0175034    .0188523
         L4D. |  -.0108394   .0090945    -1.19   0.233    -.0286643    .0069855
              |
        lnip  |
          LD. |   .0392391   .0731374     0.54   0.592    -.1041075    .1825858
         L2D. |   .1493917   .0733574     2.04   0.042     .0056138    .2931695
         L3D. |   .2326445   .0742743     3.13   0.002     .0870696    .3782193
         L4D. |   .3001358   .0774907     3.87   0.000     .1482568    .4520147
              |
        lnm1  |
          LD. |   .0279649   .0477193     0.59   0.558    -.0655633    .1214931
         L2D. |  -.0045015   .0485892    -0.09   0.926    -.0997345    .0907315
         L3D. |  -.0436615   .0486242    -0.90   0.369    -.1389631    .0516401
         L4D. |   .0171774   .0480156     0.36   0.721    -.0769314    .1112862
              |
       lnlir  |
          LD. |   .0169405   .0066454     2.55   0.011     .0039158    .0299652
         L2D. |   .0046708   .0068885     0.68   0.498    -.0088305    .0181721
         L3D. |   .0140089    .006762     2.07   0.038     .0007556    .0272622
         L4D. |  -.0022408   .0065881    -0.34   0.734    -.0151533    .0106717
              |
       _cons  |  -.0001255   .0006344    -0.20   0.843    -.0013689     .001118
-------------+----------------------------------------------------------------
D_lnm1       |
        _ce1  |
          L1. |  -.0046216    .001527    -3.03   0.002    -.0076144   -.0016288
              |
       lnind  |
          LD. |   .0222536   .0151195     1.47   0.141      -.00738    .0518873
         L2D. |   .0094777   .0149877     0.63   0.527    -.0198977    .0388532
         L3D. |   .0076259   .0145432     0.52   0.600    -.0208782      .03613
         L4D. |   .0237287   .0142608     1.66   0.096    -.0042219    .0516793
```

lnip						
LD.	.0342072	.1146842	0.30	0.765	-.1905697	.2589841
L2D.	-.1254391	.1150292	-1.09	0.275	-.3508921	.1000139
L3D.	-.3432231	.1164668	-2.95	0.003	-.5714939	-.1149522
L4D.	-.1290036	.1215104	-1.06	0.288	-.3671596	.1091523
lnm1						
LD.	-.1456805	.074827	-1.95	0.052	-.2923388	.0009777
L2D.	-.0014048	.0761909	-0.02	0.985	-.1507363	.1479267
L3D.	.0964429	.0762458	1.26	0.206	-.0529962	.245882
L4D.	-.0750304	.0752915	-1.00	0.319	-.2225991	.0725383
lnlir						
LD.	-.016529	.0104204	-1.59	0.113	-.0369526	.0038946
L2D.	-.0017418	.0108017	-0.16	0.872	-.0229127	.0194291
L3D.	-.004097	.0106033	-0.39	0.699	-.0248791	.0166851
L4D.	-.0026008	.0103306	-0.25	0.801	-.0228484	.0176469
_cons	.004745	.0009948	4.77	0.000	.0027951	.0066948
D_lnlir						
_ce1						
L1.	-.0261689	.0104573	-2.50	0.012	-.0466649	-.0056729
lnind						
LD.	-.0784089	.1035445	-0.76	0.449	-.2813524	.1245347
L2D.	.071416	.1026423	0.70	0.487	-.1297593	.2725912
L3D.	-.1252203	.0995978	-1.26	0.209	-.3204284	.0699877
L4D.	-.0991053	.0976637	-1.01	0.310	-.2905226	.092312
lnip						
LD.	-1.771581	.7854053	-2.26	0.024	-3.310948	-.2322154
L2D.	-.8130465	.7877679	-1.03	0.302	-2.357043	.7309502
L3D.	2.296656	.7976138	2.88	0.004	.7333619	3.85995
L4D.	.5620673	.8321541	0.68	0.499	-1.068925	2.193059

lnm1						
LD.	-1.110074	.5124468	-2.17	0.030	-2.114451	-.1056966
L2D.	.1384955	.5217875	0.27	0.791	-.8841891	1.16118
L3D.	-.6461664	.5221634	-1.24	0.216	-1.669588	.377255
L4D.	.0621854	.515628	0.12	0.904	-.9484268	1.072798
lnlir						
LD.	.2502973	.0713632	3.51	0.000	.1104279	.3901667
L2D.	-.0889699	.0739745	-1.20	0.229	-.2339572	.0560174
L3D.	.0796918	.0726158	1.10	0.272	-.0626325	.222016
L4D.	-.0609923	.0707485	-0.86	0.389	-.1996568	.0776722
_cons	-.0013646	.0068131	-0.20	0.841	-.0147179	.0119888

Table A3.9: VECM for Materials Sector

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_lnmat						
_ce1						
L1.	-.0052072	.0020179	2.58	0.010	.0012522	.0091623
lnmat						
LD.	-.0770561	.0714288	-1.08	0.281	-.217054	.0629418
L2D.	-.0632348	.0702802	-0.90	0.368	-.2009815	.0745119
L3D.	.0316879	.0707765	0.45	0.654	-.1070315	.1704073
lnip						
LD.	-.2217883	.6402867	-0.35	0.729	-1.476727	1.03315
L2D.	1.833567	.6198167	2.96	0.003	.6187492	3.048386
L3D.	.8419373	.6427575	1.31	0.190	-.4178443	2.101719
lnm1						
LD.	-.6371195	.4351646	-1.46	0.143	-1.490026	.2157875
L2D.	-.9161705	.4481978	-2.04	0.041	-1.794622	-.0377189
L3D.	-.5796088	.4431855	-1.31	0.191	-1.448236	.2890188
lnlir						
LD.	.2007902	.0628328	3.20	0.001	.0776402	.3239403
L2D.	-.0012345	.0627147	-0.02	0.984	-.124153	.1216841
L3D.	-.0376872	.05987	-0.63	0.529	-.1550302	.0796558
_cons	.0063809	.0055158	1.16	0.247	-.0044298	.0171916
D_lnip						
_ce1						
L1.	.0002532	.0002151	1.18	0.239	-.0001685	.0006748
lnmat						
LD.	.0157144	.0076151	2.06	0.039	.000789	.0306397

```
         L2D. |   .0286043   .0074927     3.82   0.000      .013919    .0432897
         L3D. |    .004693   .0075456     0.62   0.534     -.010096    .0194821
              |
        lnip |
         LD. |   .0538951   .0682618     0.79   0.430    -.0798955    .1876857
         L2D. |   .1626206   .0660794     2.46   0.014     .0331072    .2921339
         L3D. |   .2184972   .0685252     3.19   0.001     .0841903    .3528042
              |
        lnm1 |
         LD. |    .015197   .0463934     0.33   0.743    -.0757325    .1061265
         L2D. |  -.0125632   .0477829    -0.26   0.793     -.106216    .0810896
         L3D. |  -.0254044   .0472486    -0.54   0.591    -.1180099    .0672011
              |
       lnlir |
         LD. |    .014285   .0066987     2.13   0.033     .0011558    .0274142
         L2D. |  -.0050432   .0066861    -0.75   0.451    -.0181477    .0080613
         L3D. |   .0061623   .0063828     0.97   0.334    -.0063478    .0186724
              |
       _cons |  -.0001846    .000588    -0.31   0.754    -.0013371     .000968
-------------+----------------------------------------------------------------
D_lnm1       |
        _ce1 |
         L1. |    .001084   .0003387     3.20   0.001     .0004201    .0017478
              |
       lnmat |
         LD. |  -.0122155   .0119888    -1.02   0.308    -.0357132    .0112821
         L2D. |  -.0037729    .011796    -0.32   0.749    -.0268927    .0193469
         L3D. |    .012309   .0118793     1.04   0.300     -.010974    .0355921
              |
        lnip |
         LD. |   .0764132   .1074675     0.71   0.477    -.1342193    .2870457
         L2D. |  -.0948912   .1040318    -0.91   0.362    -.2987898    .1090073
         L3D. |  -.2763353   .1078823    -2.56   0.010    -.4877806     -.06489
              |
        lnm1 |
         LD. |  -.1513196   .0730393    -2.07   0.038    -.2944739   -.0081652
         L2D. |  -.0016726   .0752268    -0.02   0.982    -.1491144    .1457692
```

```
        L3D. |   .1092027   .0743855     1.47   0.142    -.0365902    .2549956
             |
       lnlir |
        LD. |  -.0128798    .010546    -1.22   0.222    -.0335496    .0077901
        L2D. |   .0030547   .0105262     0.29   0.772    -.0175763    .0236857
        L3D. |   .0003017   .0100487     0.03   0.976    -.0193935    .0199969
             |
       _cons |    .003922   .0009258     4.24   0.000     .0021075    .0057365
-------------+----------------------------------------------------------------
D_lnlir      |
        _ce1 |
        L1. |   .0070019   .0023216     3.02   0.003     .0024517    .0115521
             |
       lnmat |
        LD. |   .1819382   .0821773     2.21   0.027     .0208736    .3430027
        L2D. |  -.0004749   .0808559    -0.01   0.995    -.1589496    .1579997
        L3D. |   .0726624   .0814269     0.89   0.372    -.0869313    .2322561
             |
        lnip |
        LD. |  -1.990836   .7366361    -2.70   0.007    -3.434616   -.5470558
        L2D. |  -.7877068   .7130859    -1.10   0.269    -2.185329    .6099158
        L3D. |   1.527826   .7394788     2.07   0.039     .0784742    2.977178
             |
        lnm1 |
        LD. |  -1.180829   .5006476    -2.36   0.018     -2.16208   -.1995774
        L2D. |   .0401328   .5156421     0.08   0.938     -.970507    1.050773
        L3D. |  -.7605032   .5098755    -1.49   0.136    -1.759841    .2388343
             |
       lnlir |
        LD. |   .2170951   .0722878     3.00   0.003     .0754136    .3587766
        L2D. |  -.1101851   .0721519    -1.53   0.127    -.2516003    .0312301
        L3D. |   .0614405   .0688792     0.89   0.372    -.0735602    .1964411
             |
       _cons |  -.0053459   .0063458    -0.84   0.400    -.0177834    .0070916
------------------------------------------------------------------------------
```

Appendix 4

Table A4.1: VAR for S&P/TSX

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_lntsx						
lntsx						
LD.	.1895834	.0664844	2.85	0.004	.0592764	.3198904
L2D.	.0272806	.0696275	0.39	0.695	-.1091869	.163748
lnip						
LD.	-.023769	.2696823	-0.09	0.930	-.5523367	.5047987
L2D.	.5416059	.2566025	2.11	0.035	.0386743	1.044537
lnm1						
LD.	-.5272391	.4955054	-1.06	0.287	-1.498412	.4439336
L2D.	.0291527	.4974546	0.06	0.953	-.9458403	1.004146
lnlir						
LD.	.0349675	.0441611	0.79	0.428	-.0515867	.1215217
L2D.	.02684	.0437874	0.61	0.540	-.0589816	.1126616
_cons	.005496	.0053425	1.03	0.304	-.004975	.0159671
D_lnip						
lntsx						
LD.	.0610735	.0162599	3.76	0.000	.0292047	.0929423
L2D.	.051462	.0170286	3.02	0.003	.0180865	.0848374
lnip						
LD.	-.0287317	.0659555	-0.44	0.663	-.1580021	.1005386
L2D.	.0345201	.0627566	0.55	0.582	-.0884804	.1575207
lnm1						
LD.	.0382372	.1211844	0.32	0.752	-.1992798	.2757542
L2D.	.1400582	.1216611	1.15	0.250	-.0983932	.3785095
lnlir						
LD.	-.002848	.0108004	-0.26	0.792	-.0240163	.0183204
L2D.	.0218117	.010709	2.04	0.042	.0008226	.0428009
_cons	-.0010935	.0013066	-0.84	0.403	-.0036543	.0014674
D_lnm1						
lntsx						
LD.	.0043014	.0089701	0.48	0.632	-.0132797	.0218825
L2D.	.0116788	.0093942	1.24	0.214	-.0067335	.030091
lnip						
LD.	.0131309	.0363857	0.36	0.718	-.0581838	.0844456
L2D.	-.0744499	.034621	-2.15	0.032	-.1423057	-.0065941
lnm1						
LD.	.0686874	.0668539	1.03	0.304	-.0623438	.1997186
L2D.	.1047112	.0671169	1.56	0.119	-.0268354	.2362579
lnlir						
LD.	-.0062069	.0059582	-1.04	0.298	-.0178849	.005471
L2D.	.0002618	.0059078	0.04	0.965	-.0113173	.0118409
_cons	.0056234	.0007208	7.80	0.000	.0042107	.0070362
D_lnlir						
lntsx						
LD.	.1402343	.1015624	1.38	0.167	-.0588242	.3392929
L2D.	.0927929	.1063639	0.87	0.383	-.1156764	.3012622
lnip						
LD.	-.496787	.41197	-1.21	0.228	-1.304233	.3106594
L2D.	.4684729	.3919891	1.20	0.232	-.2998116	1.236757
lnm1						
LD.	.6623953	.7569401	0.88	0.382	-.8211799	2.145971
L2D.	.9384476	.7599176	1.23	0.217	-.5509636	2.427859
lnlir						
LD.	.2643082	.067461	3.92	0.000	.132087	.3965294
L2D.	-.1411405	.0668901	-2.11	0.035	-.2722426	-.0100383
_cons	-.0160536	.0081612	-1.97	0.049	-.0320493	-.0000579

Table A4.2: VAR for Energy Index

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_lnener						
lnener						
LD.	.0521468	.067761	0.77	0.442	-.0806624	.184956
lnip						
LD.	.1596103	.4214316	0.38	0.705	-.6663804	.985601
lnm1						
LD.	-.9577833	.811102	-1.18	0.238	-2.547514	.6319475
lnlir						
LD.	.156689	.0703163	2.23	0.026	.0188715	.2945064
_cons	.0111168	.0070209	1.58	0.113	-.0026439	.0248775
D_lnip						
lnener						
LD.	.028644	.0106721	2.68	0.007	.0077271	.0495608
lnip						
LD.	.064177	.0663736	0.97	0.334	-.0659129	.1942669
lnm1						
LD.	.0366592	.127745	0.29	0.774	-.2137164	.2870348
lnlir						
LD.	.0080864	.0110745	0.73	0.465	-.0136192	.0297921
_cons	.0000879	.0011058	0.08	0.937	-.0020794	.0022551
D_lnm1						
lnener						
LD.	-.0027988	.0056457	-0.50	0.620	-.0138642	.0082667
lnip						
LD.	.0257027	.0351129	0.73	0.464	-.0431173	.0945228
lnm1						
LD.	.0691788	.0675796	1.02	0.306	-.0632747	.2016323
lnlir						
LD.	-.0028509	.0058586	-0.49	0.627	-.0143336	.0086318
_cons	.0063823	.000585	10.91	0.000	.0052358	.0075288
D_lnlir						
lnener						
LD.	.1294483	.0637806	2.03	0.042	.0044406	.254456
lnip						
LD.	-.4248638	.3966759	-1.07	0.284	-1.202334	.3526066
lnm1						
LD.	.8323434	.7634563	1.09	0.276	-.6640034	2.32869
lnlir						
LD.	.2237977	.0661858	3.38	0.001	.0940759	.3535195
_cons	-.0098536	.0066085	-1.49	0.136	-.0228059	.0030988

Table A4.3: VAR for Financials Sector

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_lnfin						
lnfin						
LD.	.1407669	.0687991	2.05	0.041	.0059231	.2756106
L2D.	-.0013189	.0698767	-0.02	0.985	-.1382748	.135637
lnip						
LD.	.0882768	.2695306	0.33	0.743	-.4399935	.6165471
L2D.	.5401918	.2619969	2.06	0.039	.0266873	1.053696
lnm1						
LD.	-.0197688	.5304464	-0.04	0.970	-1.059425	1.019887
L2D.	-1.171789	.5289387	-2.22	0.027	-2.20849	-.1350885
lnlir						
LD.	.1310488	.045048	2.91	0.004	.0427565	.2193412
L2D.	.0232186	.0454895	0.51	0.610	-.0659393	.1123764
_cons	.0126108	.0055183	2.29	0.022	.001795	.0234265
D_lnip						
lnfin						
LD.	.039559	.017068	2.32	0.020	.0061063	.0730117
L2D.	.0525997	.0173354	3.03	0.002	.018623	.0865765
lnip						
LD.	.0123439	.0668665	0.18	0.854	-.1187121	.1433998
L2D.	.0492798	.0649975	0.76	0.448	-.078113	.1766726
lnm1						
LD.	.0106467	.1315958	0.08	0.936	-.2472764	.2685698
L2D.	.058713	.1312218	0.45	0.655	-.198477	.315903
lnlir						
LD.	-.0026321	.0111757	-0.24	0.814	-.0245361	.0192719
L2D.	.0161649	.0112853	1.43	0.152	-.0059539	.0382836
_cons	-.0005014	.001369	-0.37	0.714	-.0031846	.0021818
D_lnm1						
lnfin						
LD.	.006577	.0088003	0.75	0.455	-.0106712	.0238253
L2D.	.0188733	.0089381	2.11	0.035	.0013549	.0363917
lnip						
LD.	-.0048705	.0344764	-0.14	0.888	-.072443	.0627021
L2D.	-.0732511	.0335128	-2.19	0.029	-.1389349	-.0075673
lnm1						
LD.	.0991092	.0678509	1.46	0.144	-.033876	.2320945
L2D.	.0972033	.067658	1.44	0.151	-.035404	.2298105
lnlir						
LD.	-.0072706	.0057622	-1.26	0.207	-.0185644	.0040231
L2D.	-.0033259	.0058187	-0.57	0.568	-.0147303	.0080786
_cons	.0052803	.0007059	7.48	0.000	.0038968	.0066637
D_lnlir						
lnfin						
LD.	.1497331	.1067197	1.40	0.161	-.0594337	.3588998
L2D.	-.1154638	.1083913	-1.07	0.287	-.3279069	.0969793
lnip						
LD.	-.1677348	.4180902	-0.40	0.688	-.9871765	.651707
L2D.	.5120526	.4064041	1.26	0.208	-.2844849	1.30859
lnm1						
LD.	.5391719	.8228173	0.66	0.512	-1.07352	2.151864
L2D.	1.03967	.8204786	1.27	0.205	-.5684386	2.647778
lnlir						
LD.	.2797546	.0698774	4.00	0.000	.1427973	.4167118
L2D.	-.1315335	.0705624	-1.86	0.062	-.2698334	.0067663
_cons	-.0145134	.0085599	-1.70	0.090	-.0312906	.0022637

Table A4.4: VAR for Consumer Discretionary Sector

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_lncd						
lncd						
LD.	.1905689	.0659523	2.89	0.004	.0613048	.319833
L2D.	-.0471102	.0672559	-0.70	0.484	-.1789293	.084709
lnip						
LD.	-.1972798	.2580827	-0.76	0.445	-.7031126	.308553
L2D.	.8636193	.2492472	3.46	0.001	.3751037	1.352135
lnm1						
LD.	.3762234	.4805201	0.78	0.434	-.5655786	1.318025
L2D.	-.604843	.480918	-1.26	0.209	-1.547425	.3377389
lnlir						
LD.	.0954106	.0424121	2.25	0.024	.0122844	.1785367
L2D.	.0148474	.0428272	0.35	0.729	-.0690925	.0987872
_cons	.0054025	.0051398	1.05	0.293	-.0046713	.0154762
D_lnip						
lncd						
LD.	.0522636	.0169924	3.08	0.002	.0189591	.085568
L2D.	.0398766	.0173283	2.30	0.021	.0059139	.0738394
lnip						
LD.	-.0065028	.0664942	-0.10	0.922	-.136829	.1238233
L2D.	.0563021	.0642177	0.88	0.381	-.0695623	.1821665
lnm1						
LD.	.0116796	.1238044	0.09	0.925	-.2309725	.2543318
L2D.	.0578838	.1239069	0.47	0.640	-.1849693	.300737
lnlir						
LD.	.0034336	.0109273	0.31	0.753	-.0179836	.0248508
L2D.	.0196664	.0110343	1.78	0.075	-.0019604	.0412932
_cons	-.0003614	.0013242	-0.27	0.785	-.0029569	.0022341
D_lnm1						
lncd						
LD.	.0067734	.009194	0.74	0.461	-.0112465	.0247934
L2D.	.0008901	.0093757	0.09	0.924	-.017486	.0192662
lnip						
LD.	.0245812	.0359778	0.68	0.494	-.0459339	.0950964
L2D.	-.0692656	.0347461	-1.99	0.046	-.1373667	-.0011645
lnm1						
LD.	.0693297	.0669865	1.03	0.301	-.0619614	.2006208
L2D.	.0931904	.0670419	1.39	0.165	-.0382094	.2245901
lnlir						
LD.	-.0052569	.0059124	-0.89	0.374	-.016845	.0063312
L2D.	.0004805	.0059703	0.08	0.936	-.011221	.0121821
_cons	.0057188	.0007165	7.98	0.000	.0043145	.0071232
D_lnlir						
lncd						
LD.	.002126	.1040158	0.02	0.984	-.2017413	.2059933
L2D.	.1508212	.1060718	1.42	0.155	-.0570758	.3587182
lnip						
LD.	-.4812598	.4070319	-1.18	0.237	-1.279028	.3165081
L2D.	.4788099	.3930972	1.22	0.223	-.2916464	1.249266
lnm1						
LD.	.576052	.7578463	0.76	0.447	-.9092994	2.061403
L2D.	.8061539	.7584739	1.06	0.288	-.6804276	2.292735
lnlir						
LD.	.2836712	.0668897	4.24	0.000	.1525698	.4147726
L2D.	-.1421275	.0675445	-2.10	0.035	-.2745122	-.0097428
_cons	-.0143434	.0081061	-1.77	0.077	-.0302311	.0015443

Table A4.5: VAR for Consumer Staples Sector

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_lncs						
lncs LD.	-.0005213	.0674829	-0.01	0.994	-.1327853	.1317426
lnip LD.	-.117922	.2272269	-0.52	0.604	-.5632784	.3274344
lnm1 LD.	.6080553	.4362948	1.39	0.163	-.2470668	1.463177
lnlir LD.	-.0602925	.0371865	-1.62	0.105	-.1331766	.0125917
_cons	.0041039	.0038374	1.07	0.285	-.0034173	.0116251
D_lnip						
lncs LD.	.0127822	.0200983	0.64	0.525	-.0266098	.0521743
lnip LD.	.0686593	.0676747	1.01	0.310	-.0639808	.2012993
lnm1 LD.	.032682	.1299412	0.25	0.801	-.2219981	.2873621
lnlir LD.	.0146262	.0110752	1.32	0.187	-.0070808	.0363332
_cons	.0001455	.0011429	0.13	0.899	-.0020946	.0023855
D_lnm1						
lncs LD.	.0162518	.0104196	1.56	0.119	-.0041701	.0366738
lnip LD.	.019148	.0350845	0.55	0.585	-.0496164	.0879123
lnm1 LD.	.0770002	.0673652	1.14	0.253	-.0550331	.2090336
lnlir LD.	-.0025628	.0057417	-0.45	0.655	-.0138164	.0086907
_cons	.0061791	.0005925	10.43	0.000	.0050178	.0073404
D_lnlir						
lncs LD.	.2237519	.1184431	1.89	0.059	-.0083923	.455896
lnip LD.	-.4626224	.398819	-1.16	0.246	-1.244293	.3190484
lnm1 LD.	.8848662	.7657662	1.16	0.248	-.616008	2.38574
lnlir LD.	.2621446	.0652681	4.02	0.000	.1342215	.3900678
_cons	-.0114667	.0067353	-1.70	0.089	-.0246677	.0017342

Table A4.6: VAR for Real Estate Sector

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_lnreal						
lnreal						
LD.	.2620841	.0673515	3.89	0.000	.1300776	.3940907
L2D.	.0250115	.068167	0.37	0.714	-.1085934	.1586165
lnip						
LD.	-.0830632	.2801697	-0.30	0.767	-.6321857	.4660594
L2D.	.3917584	.2704816	1.45	0.148	-.1383757	.9218926
lnm1						
LD.	.0835445	.5204953	0.16	0.872	-.9366076	1.103697
L2D.	-.3373347	.5207806	-0.65	0.517	-1.358046	.6833766
lnlir						
LD.	-.0859242	.0459106	-1.87	0.061	-.1759073	.0040589
L2D.	.0662745	.0460795	1.44	0.150	-.0240398	.1565887
_cons	.0055439	.0056383	0.98	0.325	-.005507	.0165948
D_lnip						
lnreal						
LD.	.0566836	.0160412	3.53	0.000	.0252434	.0881238
L2D.	.0270709	.0162355	1.67	0.095	-.00475	.0588918
lnip						
LD.	-.0164179	.0667285	-0.25	0.806	-.1472033	.1143675
L2D.	.0386829	.064421	0.60	0.548	-.0875801	.1649458
lnm1						
LD.	.0757912	.1239672	0.61	0.541	-.1671801	.3187624
L2D.	.0998688	.1240352	0.81	0.421	-.1432356	.3429732
lnlir						
LD.	.0018235	.0109346	0.17	0.868	-.0196079	.0232549
L2D.	.0318471	.0109748	2.90	0.004	.0103368	.0533574
_cons	-.0011164	.0013429	-0.83	0.406	-.0037484	.0015156
D_lnm1						
lnreal						
LD.	-.0083806	.008579	-0.98	0.329	-.0251952	.0084339
L2D.	.022228	.0086829	2.56	0.010	.0052099	.0392461
lnip						
LD.	.0122772	.035687	0.34	0.731	-.0576681	.0822224
L2D.	-.080746	.034453	-2.34	0.019	-.1482725	-.0132194
lnm1						
LD.	.0717755	.0662988	1.08	0.279	-.0581678	.2017188
L2D.	.1102986	.0663352	1.66	0.096	-.0197159	.2403132
lnlir						
LD.	-.0058306	.0058479	-1.00	0.319	-.0172923	.0056311
L2D.	.0003039	.0058694	0.05	0.959	-.0112	.0118078
_cons	.0055503	.0007182	7.73	0.000	.0041427	.006958
D_lnlir						
lnreal						
LD.	.1288346	.0983723	1.31	0.190	-.0639715	.3216408
L2D.	-.0992611	.0995634	-1.00	0.319	-.2944018	.0958796
lnip						
LD.	-.3368169	.4092103	-0.82	0.410	-1.138854	.4652206
L2D.	.5638143	.3950601	1.43	0.154	-.2104892	1.338118
lnm1						
LD.	.6822271	.7602251	0.90	0.370	-.8077868	2.172241
L2D.	.7430322	.7606419	0.98	0.329	-.7477985	2.233863
lnlir						
LD.	.28451	.0670561	4.24	0.000	.1530825	.4159375
L2D.	-.1195013	.0673029	-1.78	0.076	-.2514125	.0124099
_cons	-.0141802	.0082352	-1.72	0.085	-.030321	.0019605

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Table A4.7: VAR for Health Care Sector

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_lnhc						
lnhc						
LD.	.0649496	.0667536	0.97	0.331	-.0658851	.1957843
L2D.	-.1098937	.0678682	-1.62	0.105	-.2429129	.0231255
lnip						
LD.	.5566456	.4600401	1.21	0.226	-.3450164	1.458308
L2D.	.6672759	.4528591	1.47	0.141	-.2203116	1.554863
lnm1						
LD.	.5551297	.8806776	0.63	0.528	-1.170967	2.281226
L2D.	-.7109885	.8751515	-0.81	0.417	-2.426254	1.004277
lnlir						
LD.	.0662527	.0768799	0.86	0.389	-.0844291	.2169346
L2D.	-.0365054	.0771111	-0.47	0.636	-.1876404	.1146295
_cons	.0016398	.0093512	0.18	0.861	-.0166882	.0199678
D_lnip						
lnhc						
LD.	.017478	.0096376	1.81	0.070	-.0014114	.0363673
L2D.	.0206186	.0097985	2.10	0.035	.0014138	.0398233
lnip						
LD.	.0360293	.0664187	0.54	0.588	-.094149	.1662075
L2D.	.0600638	.0653819	0.92	0.358	-.0680824	.18821
lnm1						
LD.	.0007069	.1271486	0.01	0.996	-.2484997	.2499136
L2D.	.0759963	.1263507	0.60	0.548	-.1716466	.3236392
lnlir						
LD.	.0078624	.0110996	0.71	0.479	-.0138925	.0296172
L2D.	.0248862	.011133	2.24	0.025	.003066	.0467065
_cons	-.0000496	.0013501	-0.04	0.971	-.0026957	.0025965
D_lnm1						
lnhc						
LD.	.0102402	.0050592	2.02	0.043	.0003243	.0201561
L2D.	.0051079	.0051437	0.99	0.321	-.0049735	.0151894
lnip						
LD.	.0255908	.0348661	0.73	0.463	-.0427455	.0939272
L2D.	-.0743179	.0343219	-2.17	0.030	-.1415876	-.0070482
lnm1						
LD.	.0664388	.066746	1.00	0.320	-.064381	.1972585
L2D.	.0939963	.0663272	1.42	0.156	-.0360026	.2239951
lnlir						
LD.	-.0049283	.0058267	-0.85	0.398	-.0163484	.0064918
L2D.	.000343	.0058442	0.06	0.953	-.0111115	.0117974
_cons	.0057466	.0007087	8.11	0.000	.0043575	.0071356
D_lnlir						
lnhc						
LD.	-.0806421	.0577	-1.40	0.162	-.1937321	.0324479
L2D.	.0765443	.0586634	1.30	0.192	-.0384339	.1915225
lnip						
LD.	-.433302	.3976462	-1.09	0.276	-1.212674	.3460701
L2D.	.5912403	.3914391	1.51	0.131	-.1759663	1.358447
lnm1						
LD.	.4671079	.7612339	0.61	0.539	-1.024883	1.959099
L2D.	.8675647	.7564572	1.15	0.251	-.6150642	2.350194
lnlir						
LD.	.2929512	.0664529	4.41	0.000	.1627059	.4231965
L2D.	-.1310778	.0666527	-1.97	0.049	-.2617147	-.0004408
_cons	-.0134021	.0080829	-1.66	0.097	-.0292444	.0024402

Table A4.8: VAR for Industrials Sector

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_lnind						
lnind						
LD.	.1579909	.0673208	2.35	0.019	.0260446	.2899371
L2D.	-.0808208	.0694526	-1.16	0.245	-.2169455	.0553038
lnip						
LD.	.2423034	.3582817	0.68	0.499	-.4599159	.9445227
L2D.	.5772157	.3444229	1.68	0.094	-.0978409	1.252272
lnm1						
LD.	.6020152	.6647947	0.91	0.365	-.7009585	1.904989
L2D.	.0291102	.6655307	0.04	0.965	-1.275306	1.333526
lnlir						
LD.	.1127197	.058866	1.91	0.056	-.0026556	.228095
L2D.	-.0027777	.0589874	-0.05	0.962	-.1183909	.1128354
_cons	.0010724	.007105	0.15	0.880	-.0128531	.014998
D_lnip						
lnind						
LD.	.0401541	.0123509	3.25	0.001	.0159467	.0643615
L2D.	.0420711	.0127421	3.30	0.001	.0170971	.0670451
lnip						
LD.	-.0218094	.0657318	-0.33	0.740	-.1506413	.1070226
L2D.	.0388497	.0631892	0.61	0.539	-.0849989	.1626983
lnm1						
LD.	-.000707	.1219659	-0.01	0.995	-.2397557	.2383418
L2D.	.0482383	.1221009	0.40	0.693	-.1910751	.2875517
lnlir						
LD.	.0004338	.0107998	0.04	0.968	-.0207335	.021601
L2D.	.0200775	.0108221	1.86	0.064	-.0011334	.0412883
_cons	-.0002798	.0013035	-0.21	0.830	-.0028347	.002275
D_lnm1						
lnind						
LD.	.0047285	.0067828	0.70	0.486	-.0085654	.0180225
L2D.	.0027241	.0069975	0.39	0.697	-.0109909	.016439
lnip						
LD.	.0224902	.0360979	0.62	0.533	-.0482604	.0932408
L2D.	-.0717738	.0347016	-2.07	0.039	-.1397877	-.00376
lnm1						
LD.	.067689	.0669799	1.01	0.312	-.0635893	.1989672
L2D.	.0925855	.0670541	1.38	0.167	-.038838	.2240091
lnlir						
LD.	-.0054442	.0059309	-0.92	0.359	-.0170686	.0061802
L2D.	.0004845	.0059431	0.08	0.935	-.0111639	.0121328
_cons	.0057261	.0007159	8.00	0.000	.004323	.0071291
D_lnlir						
lnind						
LD.	.0702705	.0767672	0.92	0.360	-.0801904	.2207315
L2D.	.0766182	.0791982	0.97	0.333	-.0786074	.2318438
lnip						
LD.	-.4741532	.4085557	-1.16	0.246	-1.274908	.3266012
L2D.	.4835023	.3927522	1.23	0.218	-.2862779	1.253283
lnm1						
LD.	.5795815	.7580785	0.76	0.445	-.9062249	2.065388
L2D.	.7550655	.7589177	0.99	0.320	-.7323859	2.242517
lnlir						
LD.	.2732887	.0671261	4.07	0.000	.141724	.4048534
L2D.	-.1432446	.0672645	-2.13	0.033	-.2750805	-.0114087
_cons	-.0142591	.008102	-1.76	0.078	-.0301388	.0016205

Table A4.9: VAR for Materials Sector

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_lnmat						
lnmat LD.	-.0350577	.0676556	-0.52	0.604	-.1676601	.0975448
lnip LD.	-.0694948	.4760538	-0.15	0.884	-1.002543	.8635535
lnm1 LD.	-1.596319	.925639	-1.72	0.085	-3.410538	.2179003
lnlir LD.	-.073027	.077966	-0.94	0.349	-.2258376	.0797836
_cons	.0139618	.0079999	1.75	0.081	-.0017177	.0296414
D_lnip						
lnmat LD.	.0280452	.0093887	2.99	0.003	.0096437	.0464466
lnip LD.	.0783708	.0660627	1.19	0.235	-.0511096	.2078513
lnm1 LD.	.0803927	.1284523	0.63	0.531	-.1713691	.3321545
lnlir LD.	.0131255	.0108195	1.21	0.225	-.0080803	.0343312
_cons	-.0001787	.0011102	-0.16	0.872	-.0023546	.0019972
D_lnm1						
lnmat LD.	-.005106	.0049765	-1.03	0.305	-.0148597	.0046477
lnip LD.	.0238735	.0350166	0.68	0.495	-.0447577	.0925048
lnm1 LD.	.0604231	.0680862	0.89	0.375	-.0730235	.1938697
lnlir LD.	-.0032738	.0057349	-0.57	0.568	-.0145139	.0079664
_cons	.0064479	.0005884	10.96	0.000	.0052945	.0076012
D_lnlir						
lnmat LD.	.0421067	.0567793	0.74	0.458	-.0691785	.153392
lnip LD.	-.376544	.3995234	-0.94	0.346	-1.159596	.4065075
lnm1 LD.	.8696192	.7768332	1.12	0.263	-.652946	2.392184
lnlir LD.	.2490557	.0654322	3.81	0.000	.1208109	.3773005
_cons	-.0096446	.0067139	-1.44	0.151	-.0228035	.0035143

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Table A4.10: VAR for Utilities Sector

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_lnut						
lnut						
LD.	-.0690752	.0663681	-1.04	0.298	-.1991542	.0610039
L2D.	.1619998	.0647791	2.50	0.012	.0350351	.2889645
lnip						
LD.	.4374634	.2366804	1.85	0.065	-.0264217	.9013485
L2D.	.1578425	.2354722	0.67	0.503	-.3036745	.6193595
lnml						
LD.	-.7213695	.4574842	-1.58	0.115	-1.618022	.1752831
L2D.	.3035777	.4587115	0.66	0.508	-.5954803	1.202636
lnlir						
LD.	-.1196296	.0404132	-2.96	0.003	-.1988381	-.0404211
L2D.	-.0020203	.0409473	-0.05	0.961	-.0822756	.078235
_cons	.0063021	.0049461	1.27	0.203	-.0033921	.0159962
D_lnip						
lnut						
LD.	.0190722	.0185273	1.03	0.303	-.0172405	.055385
L2D.	.0460934	.0180837	2.55	0.011	.01065	.0815367
lnip						
LD.	.0387221	.0660715	0.59	0.558	-.0907757	.1682199
L2D.	.0518956	.0657342	0.79	0.430	-.0769411	.1807323
lnml						
LD.	.0224416	.1277109	0.18	0.861	-.2278672	.2727505
L2D.	.1268296	.1280535	0.99	0.322	-.1241508	.3778099
lnlir						
LD.	.002727	.0112817	0.24	0.809	-.0193847	.0248388
L2D.	.0327424	.0114308	2.86	0.004	.0103384	.0551464
_cons	-.0007324	.0013807	-0.53	0.596	-.0034387	.0019738
D_lnml						
lnut						
LD.	.012102	.0097818	1.24	0.216	-.0070699	.031274
L2D.	-.0057753	.0095476	-0.60	0.545	-.0244882	.0129376
lnip						
LD.	.0262618	.0348836	0.75	0.452	-.0421087	.0946324
L2D.	-.0734623	.0347055	-2.12	0.034	-.1414839	-.0054408
lnml						
LD.	.0832563	.0674272	1.23	0.217	-.0488985	.2154111
L2D.	.0953857	.067608	1.41	0.158	-.0371237	.227895
lnlir						
LD.	-.003977	.0059564	-0.67	0.504	-.0156513	.0076973
L2D.	.0019316	.0060351	0.32	0.749	-.0098969	.0137602
_cons	.0056265	.000729	7.72	0.000	.0041977	.0070553
D_lnlir						
lnut						
LD.	.2520757	.1095711	2.30	0.021	.0373203	.4668311
L2D.	-.1666314	.1069477	-1.56	0.119	-.3762451	.0429823
lnip						
LD.	-.3729894	.3907502	-0.95	0.340	-1.138846	.3928668
L2D.	.4571502	.3887554	1.18	0.240	-.3047964	1.219097
lnml						
LD.	.9297184	.7552886	1.23	0.218	-.5506201	2.410057
L2D.	.7525865	.7573148	0.99	0.320	-.7317232	2.236896
lnlir						
LD.	.3078721	.0667207	4.61	0.000	.1771019	.4386422
L2D.	-.1178813	.0676025	-1.74	0.081	-.2503797	.0146171
_cons	-.0159739	.0081658	-1.96	0.050	-.0319785	.0000308

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Appendix 5

Table A5.1: Cointegration Test for Canadian Indices with US M1 and Long-term Interest rate for the period 2000-2018

Maximum Rank	Trace statistic	5% Critical value	Max statistic	5% Critical value
S&P/TSX				
None	44.0746	29.68	38.3942	20.97
At most 1	5.6805*	15.41	5.2463*	14.07
At most 2	0.4342	3.76	0.4342	3.76
Energy				
None	48.8213	29.68	40.3628	20.97
At most 1	8.4585*	15.41	8.0401*	14.07
At most 2	0.4184	3.76	0.4184	3.76
Financials				
None	40.2176	29.68	31.0572	20.97
At most 1	9.1604*	15.41	8.8814*	14.07
At most 2	0.2789	3.76	0.2789	3.76
Consumer Discretionary				
None	61.3384	29.68	41.1133	20.97
At most 1	20.2251	15.41	20.2077*	14.07
At most 2	0.0175*	3.76	0.0175	3.76
Consumer Staples				
None	53.0328	29.68	38.5244	20.97
At most 1	14.5084*	15.41	14.1617	14.07
At most 2	0.3466	3.76	0.3466*	3.76
Real Estate				
None	46.6012	29.68	38.7973	20.97
At most 1	7.8039*	15.41	7.4772*	14.07
At most 2	0.3267	3.76	0.3267	3.76
Health Care				
None	44.9597	29.68	41.1392	20.97
At most 1	3.8205*	15.41	3.6548*	14.07
At most 2	0.1657	3.76	0.1657	3.76
Industrials				
None	54.3442	29.68	39.0072	20.97
At most 1	15.3370*	15.41	14.8767	14.07
At most 2	0.4603	3.76	0.4603*	3.76
Materials				
None	47.3180	29.68	40.0225	20.97
At most 1	7.2956*	15.41	7.0876*	14.07
At most 2	0.2079	3.76	0.2079	3.76
Utilities				
None	46.8717	29.68	38.8219	20.97
At most 1	8.0497*	15.41	8.0333*	14.07
At most 2	0.0164	3.76	0.0164	3.76

Note: * indicates significance at 5% level.

Appendix 6

Table A6.1: Long Term Equations for Canadian Indices with US money supply and Interest Rate

	Index	M1	LIR	Constant
S&P/TSX	1	5.76**	11.08**	-66.07036
		(1.96)	(2.05)	
Energy	1	-16.18**	-29.93**	151.9373
		(5.23)	(5.49)	
Financials	1	1.173*	3.26**	-18.00484
		(0.683)	(0.739)	
Cons. Disc.	1	-0.259	1.143**	-4.249018
		(0.345)	(0.361)	
Cons. Stap.	1	2.46**	6.57**	-31.8472
		(1.19)	(1.252)	
Real Estate	1	2.95**	6.641**	-35.42252
		(1.173)	(1.23)	
Health Care	1	3.16**	6.61**	-36.19436
		(1.212)	(1.271)	
Industrials	1	-9.391**	-14.54**	83.50051
		(2.39)	(2.508)	
Materials	1	-8.55**	-14.77**	76.83764
		(2.634)	(2.76)	

Note: ** indicates significance at 5 % level and & * indicates significance at 10 % level.

Appendix 7

Table A7.1: Cointegration Test for US Indices and Canadian M1 and Long-term Interest rate for the period 2000-2018

Maximum Rank	Trace statistic	5% Critical value	Max statistic	5% Critical value
S&P 500				
None	20.0426*	29.68	12.6484*	20.97
At most 1	7.3942	15.41	7.2849	14.07
At most 2	0.1093	3.76	0.1093	3.76
Energy				
None	18.7532*	29.68	11.8645*	20.97
At most 1	6.8887	15.41	4.5891	14.07
At most 2	2.2996	3.76	2.2996	3.76
Financials				
None	17.6238*	29.68	13.0734*	20.97
At most 1	4.5503	15.41	4.2721	14.07
At most 2	0.2783	3.76	0.2783	3.76
Consumer Discretionary				
None	20.2954*	29.68	13.8492*	20.97
At most 1	6.4462	15.41	5.9711	14.07
At most 2	0.4751	3.76	0.4751	3.76
Consumer Staples				
None	20.9878*	29.68	14.1356*	20.97
At most 1	6.8522	15.41	6.6269	14.07
At most 2	0.2254	3.76	0.2254	3.76
Real Estate				
None	17.4291*	29.68	10.6398*	20.97
At most 1	6.7893	15.41	6.3680	14.07
At most 2	0.4212	3.76	0.4212	3.76
Health Care				
None	18.0047*	29.68	12.2232*	20.97
At most 1	5.7815	15.41	4.6299	14.07
At most 2	1.1516	3.76	1.1516	3.76
Industrials				
None	19.5750*	29.68	13.5022*	20.97
At most 1	6.0728	15.41	5.9079	14.07
At most 2	0.1650	3.76	0.1650	3.76
Materials				
None	21.5681*	29.68	11.8347*	20.97
At most 1	9.7334	15.41	9.5932	14.07
At most 2	0.1402	3.76	0.1402	3.76
Utilities				
None	17.4972*	29.68	11.7250*	20.97
At most 1	5.7722	15.41	5.7697	14.07
At most 2	0.0025	3.76	0.0025	3.76

Note: * indicates significance at 5% level.

Appendix 8

Table A8.1: Cointegration Test for US Indices with US M1 and Long-term Interest rate for the period 2010-2018

Maximum Rank	Trace statistic	5% Critical value	Max statistic	5% Critical value
S&P 500				
None	37.6379	29.68	25.9040	20.97
At most 1	11.7339*	15.41	8.0296*	14.07
At most 2	3.7043	3.76	3.7043	3.76
Energy				
None	24.8165*	29.68	9.6039*	20.97
At most 1	15.2126	15.41	8.9195	14.07
At most 2	6.2931	3.76	6.2931	3.76
Financials				
None	33.2669	29.68	21.3582	20.97
At most 1	11.9086*	15.41	8.0357*	14.07
At most 2	3.8730	3.76	3.8730	3.76
Consumer Discretionary				
None	35.4364	29.68	23.4257	20.97
At most 1	12.0107*	15.41	8.4163*	14.07
At most 2	3.5945	3.76	3.5945	3.76
Consumer Staples				
None	26.7455*	29.68	10.9910*	20.97
At most 1	15.7545	15.41	9.7144	14.07
At most 2	6.0401	3.76	6.0401	3.76
Real Estate				
None	31.3949	29.68	18.9002*	20.97
At most 1	12.4947*	15.41	8.6540	14.07
At most 2	3.8408	3.76	3.8408	3.76
Health Care				
None	27.0799*	29.68	13.0753*	20.97
At most 1	14.0046	15.41	8.5020	14.07
At most 2	5.5026	3.76	5.5026	3.76
Industrials				
None	52.2106	29.68	37.2340	20.97
At most 1	14.9766*	15.41	9.0389*	14.07
At most 2	5.9377	3.76	5.9377	3.76
Materials				
None	31.2295	29.68	16.3243*	20.97
At most 1	14.9052*	15.41	7.8303	14.07
At most 2	7.0749	3.76	7.0749	3.76
Utilities				
None	35.2357	29.68	20.8008*	20.97
At most 1	14.4350*	15.41	8.0369	14.07
At most 2	6.3980	3.76	6.3980	3.76

Note: * indicates significance at 5% level.

Appendix 9

Table A9.1: Cointegration Test for Canadian Indices with Canadian M1 and Long-term Interest rate for the period 2010-2018

Maximum Rank	Trace statistic	5% Critical value	Max statistic	5% Critical value
S&P/TSX				
None	14.9028*	29.68	7.1955*	20.97
At most 1	7.7073	15.41	6.2952	14.07
At most 2	1.4120	3.76	1.4120	3.76
Energy				
None	15.1112*	29.68	7.4531*	20.97
At most 1	7.6581	15.41	6.2931	14.07
At most 2	1.3650	3.76	1.3650	3.76
Financials				
None	16.0086*	29.68	8.9357*	20.97
At most 1	7.0729	15.41	5.8759	14.07
At most 2	1.1970	3.76	1.1970	3.76
Consumer Discretionary				
None	10.2839*	29.68	6.5119*	20.97
At most 1	3.7720	15.41	2.7084	14.07
At most 2	1.0636	3.76	1.0636	3.76
Consumer Staples				
None	12.4557*	29.68	8.8282*	20.97
At most 1	3.6275	15.41	2.6508	14.07
At most 2	0.9768	3.76	0.9768	3.76
Real Estate				
None	22.1142*	29.68	13.1555*	20.97
At most 1	8.9587	15.41	7.9434	14.07
At most 2	1.0153	3.76	1.0153	3.76
Health Care				
None	17.5629*	29.68	11.4171*	20.97
At most 1	6.1457	15.41	5.1593	14.07
At most 2	0.9864	3.76	0.9864	3.76
Industrials				
None	13.1557*	29.68	6.7236*	20.97
At most 1	6.4321	15.41	5.3677	14.07
At most 2	1.0644	3.76	1.0644	3.76
Materials				
None	13.5787*	29.68	10.3667*	20.97
At most 1	3.2119	15.41	2.3007	14.07
At most 2	0.9112	3.76	0.9112	3.76
Utilities				
None	12.5216*	29.68	7.4121*	20.97
At most 1	5.1094	15.41	4.3870	14.07
At most 2	0.7224	3.76	0.7224	3.76

Note: * indicates significance at 5% level.

Appendix 10

Table A10.1: Cointegration Test for Canadian Indices with US M1 and Long-term Interest rate for the period 2010-2018

Maximum Rank	Trace statistic	5% Critical value	Max statistic	5% Critical value
S&P/TSX				
None	24.4837*	29.68	10.9992*	20.97
At most 1	13.4845	15.41	8.2581	14.07
At most 2	5.2264	3.76	5.2264	3.76
Energy				
None	23.7169*	29.68	9.2104*	20.97
At most 1	14.5065	15.41	7.9364	14.07
At most 2	6.5701	3.76	6.5701	3.76
Financials				
None	26.1837*	29.68	11.3397*	20.97
At most 1	14.8440	15.41	7.5709	14.07
At most 2	7.2730	3.76	7.2730	3.76
Consumer Discretionary				
None	20.2540*	29.68	8.9285*	20.97
At most 1	11.3256	15.41	7.8689	14.07
At most 2	3.4567	3.76	3.4567	3.76
Consumer Staples				
None	16.7583*	29.68	7.9308*	20.97
At most 1	8.8275	15.41	6.3503	14.07
At most 2	2.4772	3.76	2.4772	3.76
Real Estate				
None	27.9961*	29.68	11.9446*	20.97
At most 1	16.0515	15.41	9.2007	14.07
At most 2	6.8508	3.76	6.8508	3.76
Health Care				
None	21.8674*	29.68	11.1692*	20.97
At most 1	10.6982	15.41	7.9205	14.07
At most 2	2.7777	3.76	2.7777	3.76
Industrials				
None	25.1527*	29.68	12.1133*	20.97
At most 1	13.0394	15.41	7.4458	14.07
At most 2	5.5936	3.76	5.5936	3.76
Materials				
None	24.7114*	29.68	14.5615*	20.97
At most 1	10.1500	15.41	7.4346	14.07
At most 2	2.7154	3.76	2.7154	3.76
Utilities				
None	22.1175*	29.68	9.8781*	20.97
At most 1	12.2394	15.41	7.7959	14.07
At most 2	4.4435	3.76	4.4435	3.76

Note: * indicates significance at 5% level.

Appendix 11

Table A11.1: Cointegration Test for US Indices and Canadian M1 and Long-term Interest rate for the period 2010-2018

Maximum Rank	Trace statistic	5% Critical value	Max statistic	5% Critical value
S&P 500				
None	20.8721*	29.68	14.7526*	20.97
At most 1	6.1195	15.41	4.4652	14.07
At most 2	1.6543	3.76	1.6543	3.76
Energy				
None	15.6180*	29.68	8.2783*	20.97
At most 1	7.3397	15.41	5.6822	14.07
At most 2	1.6575	3.76	1.6575	3.76
Financials				
None	17.2127*	29.68	9.5075*	20.97
At most 1	7.7052	15.41	6.3855	14.07
At most 2	1.3197	3.76	1.3197	3.76
Consumer Discretionary				
None	18.0180*	29.68	11.1431*	20.97
At most 1	6.8749	15.41	4.7856	14.07
At most 2	2.0893	3.76	2.0893	3.76
Consumer Staples				
None	16.4077*	29.68	10.5909*	20.97
At most 1	5.8168	15.41	3.5108	14.07
At most 2	2.3060	3.76	2.3060	3.76
Real Estate				
None	23.8928*	29.68	16.9601*	20.97
At most 1	6.9328	15.41	4.6981	14.07
At most 2	2.2347	3.76	2.2347	3.76
Health Care				
None	12.3440*	29.68	6.2509*	20.97
At most 1	6.0931	15.41	5.0756	14.07
At most 2	1.0175	3.76	1.0175	3.76
Industrials				
None	28.7837*	29.68	20.8641*	20.97
At most 1	7.9195	15.41	6.2088	14.07
At most 2	1.7107	3.76	1.7107	3.76
Materials				
None	22.6985*	29.68	16.3818*	20.97
At most 1	6.3167	15.41	4.5235	14.07
At most 2	1.7932	3.76	1.7932	3.76
Utilities				
None	29.4700*	29.68	23.1329	20.97
At most 1	6.3372	15.41	4.3197*	14.07
At most 2	2.0175	3.76	2.0175	3.76

Note: * indicates significance at 5% level.

Appendix 12

Table A12.1: ADF Unit Root Test for US variables for 2010-2018

Index	Level	First Difference
S&P 500	-2.958	-8.473***
Energy	-2.266	-7.172***
Financials	-2.689	-7.769***
Consumer Discretionary	-2.484	-8.456***
Consumer Staples	0.493	-8.229***
Real Estate	-2.536	-5.415***
Health Care	-1.529	-7.267***
Industrials	-3.121	-7.525***
Utilities	-3.425**	-5.482***
Materials	-3.005	-8.727***
Technology	-2.506	-6.617***
Macroeconomic Variables	Level	First Difference
Industrial Production	-2.167	-1.982
M1	-0.848	-3.222*
Long Term Interest Rate	-2.338	-5.185***

Note 1: The numerical values represent the ADF test statistic

Note 2: *** indicates significance at 1% level and ** indicates significance at 5% level

Note 3: All the level series are in natural logarithmic form.

Table A12.2: ADF Unit Root test for Canadian variables for 2010-2018

Index	Level	First Difference
S&P/TSX	-2.467	-6.492***
Energy	-2.864	-5.173***
Financials	-2.708	-7.438***
Consumer Discretionary	-1.753	-6.575***
Consumer Staples	-0.933	-7.014***
Real Estate	-2.540	-5.002***
Health Care	-2.181	-7.038***
Industrials	-1.611	-7.591***
Utilities	-2.775	-5.023***
Materials	-1.899	-7.034***
Technology	-1.832	-6.166***
Macroeconomic Variables	Level	First Difference
Industrial Production	-3.495**	NA
M1	-2.735	-7.273
Long Term Interest Rate	-1.611	-6.673

Note 1: The numerical values represent the ADF test statistic.

Note 2: *** indicates significance at 1% level and ** indicates significance at 5% level.

Note 3: All the level series are in natural logarithmic form

Appendix 13

Table A13.1: Phillips-Perron Unit Root Test for the US variables for 2010-2018

Index	Level	First Difference
S&P 500	-3.158	-11.334***
Energy	-2.317	-9.998***
Financials	-2.734	-10.095***
Consumer Discretionary	-2.831	-12.028***
Consumer Staples	-1.267	-11.663***
Real Estate	-3.042	-12.666***
Health Care	-3.397*	-11.123***
Industrials	-3.284	-11.456***
Utilities	-4.719***	NA
Materials	-3.284*	NA
Technology	-3.518**	NA
Macroeconomic Variables	Level	First Difference
Industrial Production	-2.201	-10.275***
M1	-0.618	-11.931***
Long Term Interest Rate	-2.193	-7.730***

Note 1: The numerical values represent the PP Z(t) test statistic
Note 2: *** indicates significance at 1% level and * indicates significant at 10% level.
Note 3: All the level series are in natural logarithmic form

Table A13.2: Phillips-Perron Unit Root Test for Canadian variables for 2010-2018

Index	Level	First Difference
S&P/TSX	-2.598	-9.226***
Energy	-2.584	-8.349***
Financials	-2.692	-9.786***
Consumer Discretionary	-1.762	-8.797***
Consumer Staples	-1.025	-10.254***
Real Estate	-2.834	-10.559***
Health Care	-1.497	-8.879***
Industrials	-2.259	-9.701***
Utilities	-2.834	-10.559***
Materials	-2.120	-10.628***
Technology	-1.985	-10.574***
Macroeconomic Variables	Level	First Difference
Industrial Production	-3.407*	-9.943***
M1	-2.761	-9.171***
Long Term Interest Rate	-1.563	-7.343***

Note 1: The numerical values represent the PP Z(t) test statistic
Note 2: *** indicates significance at 1% level and * indicates significant at 10% level.
Note 3: All the level series are in natural logarithmic form

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