HOW DOES THE CANADIAN STOCK MARKET REACT TO THE FED'S POLICY?

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ABSTRACT

This study examines how the Canadian stock market reacts to the Fed's policy. Although many research studies have measured the bilateral correlation among national stock markets, rarely have they investigated this correlation within a Free Trade Zone (FTZ). We use a Vector Error Correction Model (VECM) accounting for monetary and exchange rate policies to measure the long-term elasticity of Toronto Stock Exchange (TSE) not only to the Fed's policy, through the movements of Federal Fund Rate (FFR), but also to the parity value of the Canadian-U.S. dollar exchange rate. The estimated results suggest that TSE is sensitive to both FFR, and the conversion rate of the US-Canadian dollar. The variance decomposition technique helps us to determine the main factors contributing to the movements of TSE. We also use multivariate dynamic forecasts to predict TSE.

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KEYWORDS: Stock market integrity, financial turmoil, North America Free Trade Agreement (NAFTA), Federal Fund Rate (FFR), Vector Error Correction Model (VECM), Toronto Stock Exchange (TSE).

INTRODUCTION

The last two decades have witnessed rapid international capital mobility in the form of investment and intra-regional trade because of increasing interaction among the world economies. The co-movements of the world's national equity markets have long been a popular research topic in the finance literature. Indeed, the integration of global stock markets has important policy implications for trade, exchange rate and monetary policies. Although the co-movements of the world's major stock markets have been studied extensively, the co-movements of stock markets within a Free Trade Zone (FTZ) or a monetary union have rarely received sufficient attention.

As the Canadian-U.S. stock markets' integration seems to have been intensified due to higher amount of trade within NAFTA, we try to investigate the correlation between these two stock markets, using a Vector Error Correction Model (VECM). Since many Canadians remain concerned as to whether the U.S. financial turmoil could spill over into Canada's stock market, this paper tries to address this question by measuring the long-term elasticity of TSE to the U.S. stock market indices, the exchange rate behavior and the Fed's policy changing the FFR. The rest of the paper is organized as follows. In the next section we introduce a brief history of NAFTA. Then we review the literature on the relationship of stock market, exchange rates and monetary variables. In Section III we briefly review the Canadian stock market. While Section IV deals with methodology and data description, Section V is allocated to empirical results. Finally Section VI raps up and concludes.

LITERATURE REVIEW

North America Free Trade Agreement (NAFTA)

Greater integration of the Canadian, Mexican and the U.S. markets has been one of the key developments in North America since the implementation of the Canada-U.S. Free Trade Agreement (CUSTA) in 1989 and its successor accord, the North American Free Trade Agreement (NAFTA), signed on December 17, 1992. This agreement between the U.S., Canada and Mexico created the world's biggest single market by eliminating all trade and investment barriers among these countries. Taking effect on January 1, 1994, NAFTA immediately lifted tariffs on the majority of goods produced by the three nations. The United States has the largest economy of these three; the U.S. GDP is more than 10 times greater than both Canada and Mexico and has the largest growth rate. Therefore, it is expected that the U.S. monetary policy largely affects the two other economies.

Trade relations among Canada, Mexico and the United States have broadened substantially since NAFTA's implementation, though the extent to which this expansion is a direct result of the deal is controversial. According to official data, the overall value of intra-North American trade has more than tripled since the implementation of NAFTA. Canada and the United States are the largest markets for one another's goods. Total cross-border trade has increased almost fivefold since 1980—when a series of Canadian-U.S. tariff reduction agreements began—and now amounts to almost USD $500 billion annually. The integration of the two economies has blossomed Canadians' concerns about becoming overwhelmed by the U.S. financial turmoil. Indeed, the same fears that have driven down the U.S. stock market, have also taken their toll on stocks of America's trading partners. Although Canadians have greatly benefited from NAFTA, this integration may also threaten Canada due to sharply weakened U.S. dollar. Since the contagion from the U.S. stock market turmoil may spill over to Canada's economy, we use a VECM model, to test the hypothesis whether the TSE is sensitive to the Fed's policy, changing FFR, to the parity of the US-Canadian dollar exchange rate, and to the U.S. stock market behavior.

Studying the co-movements of national stock markets has long been a popular research topic in finance (see Makridakis & Wheelwright, 1974; Joy et al., 1976; Hilliard, 1979; Maldonaldo & Saunders, 1981; Phillipatos et al., 1983). The relationship among various stock markets is a hot topic and has both micro and macroeconomic policy implications. Early studies by Ripley (1973), Lessard (1976) and Hilliard (1979) generally find low correlations among stock markets, which validate the benefits of diversifications in international portfolio management. However, after the U.S. stock market crash in October 1987, the trend was reversed. Lee and Kim (1994), among others, find that national stock markets became more interrelated after the crash. Applying a VAR and impulse response function analysis Jeon and Von-Furstenberg (1990), among others, find a stronger co-movement among international stock markets. Similar studies suggest that after the Asian financial crisis in 1998, stock markets became more integrated, showing evidence for the co-movement of the U.S. and other world equity markets (see Eun & Shim, 1989). Cheung and Ng (1992) find that the U.S. stock market plays a dominant role for the Tokyo stock market from January 1985 through December 1989. However, not all the research studies support the integration among stock markets. Koop (1994) uses a Bayesian method to conclude that there are no common stochastic trends in stock prices across selected countries. Forbes and Rigobon (2002) claim that currency crisis lead to lower integration among stock markets.

Some recent studies have investigated the co-movements of national stock markets in a given geographical region. For example, Firedman and Shachmurove (1997) and Meric and Meric (1997) show that the correlation between the European stock markets has been decreasing during the time. Hashimoto and Ito (2004) analyze the co-movement of the exchange rates and the stock prices from the viewpoint of contagion among the eight countries in South East Asia during the period of Asian crisis, 1997–1999. In

their study, contagion is defined among not only the exchange rates and stock prices separately but also between an exchange rate and a stock price of the same country or different countries. Their results prove contagion between the exchange rate and stock price of the same country or different countries during the crisis period; stock prices are found to be higher under influence of exchange rates and stock prices of other countries.

Aggarwal and Kyaw (2005) examine the integration of the three participating equity markets before and after NAFTA based on daily, weekly and monthly data. As expected, unit root tests for the overall period 1988–2001 and the two subperiods 1988–1993 (pre-NAFTA), and 1994-2001 (post-NAFTA) indicate that equity prices are cointegrated only for the post NAFTA period. Chen, Lobo and Wong (2005) examine the bilateral relations between three pairs of stock markets, namely India-U.S., India-China, and China-U.S. They use a Fractionally Integrated Vector Error Correction Model (FIVEC) to examine the cointegration among the three markets. By augmenting the FIVECM with a multivariate GARCH, they study the first and second moment spillover effects. Their results suggest that all three pairs of stock markets are fractionally co-integrated and that the U.S. stock has hegemony relative to two other markets. Meric, Goldberg, Dunne and Meric (2005) use the correlation analysis to study the time-varying correlation patterns between pairs of NAFTA stock. The Granger causality test is used to examine the predictability and the weak-form efficiency of each stock market's returns. Their results suggest that all three NAFTA stock markets are of weak-form efficient; that is, the past returns of none of the three stock markets can be used to predict its future returns.

Gluster, Ratner and Meric (2007) study the co-movements of the weekly index returns of the Egyptian, Israeli, Jordanian, Turkish, the U.K. and the U.S. stock markets from September 9, 1996, to September 11, 2006. They use the Principal Component Analysis (PCA) technique to study the co-movements among the U.S. stock market and the Middle East stock markets. Their results indicate that there is a very low correlation among the Egyptian, Israeli, Jordanian and Turkish stock markets. The rolling correlation analysis suggests that the most volatile correlation can be found between the Turkish and the U.S. stock markets, and the least volatile correlation appears between the Egyptian and the U.S. stock markets.

As it was sketched here, the influence of the U.S. economy and its stock market on the global stock markets is pervasive and well documented in the literature. Indeed, the dominant role of the U.S. dollar in the international monetary system has intensified the hegemony of the U.S. stock market on the international markets.

CANADA'S STOCK MARKET

The existence of stock exchanges in Canada can be traced back to early 1870s. The Montreal Stock Exchange—now known as the Montreal Exchange or ME—was the first to incorporate in 1874, while the Toronto Stock Exchange (TSE) was founded in 1878. By 1999, four main stock exchanges were operating in Canada—the ME, the TSE, the Alberta Stock Exchange (ASE), and the Vancouver Stock Exchange (VSE). The TSE has gradually established itself as Canada's principal market for equity trades, and in 1998, its share in the equity trading reached almost 90%. In March 1999, these four main stock exchanges announced an agreement to restructure the Canadian markets into areas of specialization. The agreement was implemented at the end of 1999 and early 2000. As a result, the trading of senior equities was consolidated on the TSE; derivatives were transferred to the ME, ASE and the VSE, after merging to become the Canadian Venture Exchange (CDNX), which specialized in trading junior securities. The rationale behind the restructuring was a desire to strengthen the overall competitiveness of the Canadian market transactions by reducing fragmentation. At the time, this was seen as especially critical, given the increasing globalization of markets and the growing competition between traditional stock exchanges and new trading mechanisms. However, the TSE is by far, the largest exchange in Canada, and therefore we use TSE as the representative index for the Canadian stock market.

DATA AND METHODOLOGY

Hypothesis

Though the co-movements of the national stock markets in different regions and within NAFTA have already been studied, researchers have generally emphasized on techniques, rather than delving into macroeconomic, monetary, and exchange rate policies. To address this deficiency we include all the related monetary and exchange rate variables in a VECM to test the hypothesis whether there is a contagion between these two stock markets. Indeed, the aim of this paper is twofold. First we investigate how TSE reacts not only to the Fed's policy—changing FFR—but also to the exchange rate movements between the two currencies, and to the U.S. stock market behavior. Second, we try to forecast the TSE level based on a multivariate dynamic forecast technique.

Data Description

We use monthly data from January 1996 through April 2008. The data on the U.S. monetary and macroeconomic variables come from Federal Reserve Bank of St Louis and the Federal Reserve System. The data on the Canadian monetary variables are from Bank of Canada, and the monthly data for TSE come from Canada's National Statistical Agency.The list of variables is shown in the following Table.

Table 1: List of Variables Used in the Model

Abbreviation	Name of Variable
USM2	US Money Supply
FFR	Federal Fund Rate
USGDP	US Gross Domestic Product
USCPI	US Consumer price Index
CGDP	Canada's Gross Domestic Product
EXCH	US dollar parity versus the Canadian dollar
NASDAQ	US Nasdaq Industrial Index
DJ	Dow Jones Index
CINT	Canadian Interest Rate
TSE	Toronto Stock Exchange Index

This table introduces the list of variables that will be used in the Vector error Correction Models in the next sections. The data are used in a monthly basis and pertains to January 1996 through April 2008.

The descriptive statistics of these variables are presented in Table 2. The first step is to test for the non-stationary of the involved series. We implement Augmented Dickey Fuller (ADF) unit root to test whether the series are stationary. The results contained in Table 3 suggest that all the variables in the logarithm forms are I (1) in accordance with the findings in the literature.

Table 2: Descriptive Statistics

Statistics	Mean	Median	No	Std Dev.	Skewness	Kurtosis
USM2	5481.537	5500.300	149	1197.66	0.087	1.74
USGDP	10629.93	10333.30	147	1912.77	0.28	1.96
USCPI	180.57	178.80	149	16.82	0.30	1.96
FFR	4.00	4.80	149	1.76	-0.53	1.76
NASDAQ	2101.32	2027.13	149	708.49	1.27	5.14
EXCH	1.35	1.38	149	0.17	-0.58	2.27
CINT	3.87	4.07	144	1.13	-0.02	1.68
CGDP	282320.40	285303.00	147	32407	-0.193	2.03
TSE	8651.31	7772.70	149	2593	0.749	2.48

This table introduces the descriptive statistics for the data including the mean, median, number of observations, Standard deviation, skewness and kurtosis. As it is shown the exchange rate has the lowest standard deviation.

Table 3: Unit Root Tests (Augmented Dickey Fuller ADF test)

Variables	No. of Lagged Differences	Test Statistic	5% Critical Value	1% Critical Value
USM2	2	-0.622	-2.881	-3.476
USGDP	4	-0.356	-2.881	-3.477
USCPI	2	1.486	-2.881	-3.476
FFR	1	-1.192	-2.881	-3.476
NASDAQ	0	-2.109	-2.881	-3.476
EXCH	2	-1.158	-3.441	-4.023
CINT	2	-2.084	-2.881	-3.477
TSE	1	-0.979	-2.881	-3.475

This table introduces the augmented Dickey Fuller Test for the variables used in the study. As it is shown all the variables in the logarithm forms are I (1) at 99% significance level in accordance with the findings in the literature.

Methodology

To investigate the long-term relationship between the two stock markets, we employ a first difference specification of a VECM model. This specification helps us examine the long-term elasticities of TSE with respect to USM2, FFR, NASDAQ, (or Dow Jones), the exchange rate and the Canadian interest rate. The ordering of the variables in our VECM model is as follows:

$$\begin{bmatrix} TSE \\ USM2 \\ FFR \\ NASDAQ \\ EXCH \\ CINT \end{bmatrix}$$

Finally, we use the variance decomposition technique to examine how the TSE responds to FFR shocks, to changes in the parity value of the US-Canadian dollar exchange rate, and to the movements of NASADAQ and Dow Jones. The monetary transmission mechanism suggests that FFR is negatively correlated with TSE, since when FFR drops, the cost of borrowing decreases, investment increases and the NASDAQ moves up, subsequently. As the two stock markets are positively correlated, a fall in FFR will also lead to higher TSE. On the other hand, it is expected that the US-Canadian dollar exchange be negatively correlated with TSE. Indeed, with a weaker dollar the U.S. exports increases, the U.S. GDP and investment moves up, leading to higher NASDAQ and TSE, highlighting a negative correlation among the exchange rate and TSE.

EMPIRICAL RESULTS

Using the first order difference of a VECM for the period January 1996 through April 2008, we implement both Dow Jones and NASDAQ as representative indices for the US stock market. The estimated results with inclusion of Dow Jones, as shown in Table 4, suggest that all variables are statistically significant and with the expected signs. The long-term elasticity of the TSE with respect to FFR is almost -0.7% and statistically significant. In other words, a 1% standard deviation in FFR decreases TSE by 0.7%. The elasticity of TSE to Dow Jones amounts to 0.4%, highlighting the relatively strong correlation of the two stock markets, as expected in theory. The results also suggest that the long-term elasticity of TSE to exchange rate parity amounts to 0.66%, exceeding its elasticity to DJ, underlining the importance of parity value on TSE movements.

The variance decomposition technique for a period of 24 months, based on the mentioned VECM, as shown in Table 5 indicates that after the Canadian interest rate, TSE is mainly affected by FFR and USM2; almost 1% of the variance of the TSE, after a year, is attributable to the FFR. Though the

Canadian interest rate contribution in explaining the Canadian stock market is stable during the time, the role of FFR increases from 0.2% in the second month to 1% at the end of the first year.

Table 4: Vector Error Correction Estimates (with Dow Jones)

List of Variables	CointEq1
TSE	1
USM2	-0.48
	(-2.99)
FFR	0.69
	(6.04)
DJ	-0.41
	(-3.19)
EXCH	0.66
	(3.43)
CINT	0.89
	(6.04)
Log Likelihood	1664.98
Akaike information Criteria	-27.05
Schwarz Criteria	-25.77

This Table presents the results on the estimation of the Vector Error Correction Model with inclusion of Dow Jones. The Akaike and Schwartz criteria indicate that at least one co-integration equation exists among the variables. Note the Numbers in parentheses are t statistics

Table 5: Variance Decomposition of LOG (TSE)

Period	S.E.	LOG(TSE)	LOG(USM2)	LOG(FFR)	LOG(EXCH)	LOG(DJ)	LOG(CINT)
1	0.045755	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.070433	99.17656	0.366601	0.224346	0.081366	0.014747	0.136380
3	0.089081	98.27206	0.593998	0.483813	0.112551	0.071361	0.466214
4	0.104414	97.55542	0.741906	0.667252	0.109550	0.126112	0.799758
5	0.117697	97.07162	0.835648	0.780836	0.099031	0.163781	1.049080
6	0.129599	96.76614	0.895711	0.848759	0.089354	0.187003	1.213036
7	0.140497	96.57367	0.935641	0.890334	0.081978	0.201121	1.317257
8	0.150617	96.44667	0.963647	0.917519	0.076627	0.210135	1.385405
9	0.160106	96.35654	0.984454	0.936880	0.072737	0.216394	1.432991
10	0.169069	96.28778	1.000703	0.951773	0.069819	0.221131	1.468790
11	0.177582	96.23239	1.013874	0.963857	0.067536	0.224948	1.497401
12	0.185706	96.18622	1.024821	0.973968	0.065675	0.228140	1.521179
13	0.193489	96.14700	1.034079	0.982571	0.064113	0.230861	1.541381
14	0.200970	96.11328	1.042007	0.989967	0.062776	0.233204	1.558764
15	0.208183	96.08405	1.048866	0.996377	0.061618	0.235238	1.573849
16	0.215154	96.05851	1.054854	1.001975	0.060604	0.237016	1.587037
17	0.221906	96.03603	1.060124	1.006901	0.059710	0.238580	1.598650
18	0.228459	96.01610	1.064798	1.011268	0.058917	0.239967	1.608947
19	0.234829	95.99831	1.068971	1.015167	0.058209	0.241205	1.618138
20	0.241030	95.98233	1.072719	1.018668	0.057573	0.242317	1.626393
21	0.247076	95.96790	1.076105	1.021831	0.056998	0.243321	1.633849
22	0.252978	95.95479	1.079179	1.024701	0.056477	0.244233	1.640617
23	0.258745	95.94285	1.081981	1.027319	0.056001	0.245064	1.646788
24	0.264386	95.93191	1.084547	1.029716	0.055566	0.245825	1.652439

This table provides the variance decomposition of TSE with respect to US money supply, Federal Fund Rate, Exchange rate, Dow Jones and Canadian interest rate.

We repeat the estimation of VECM with inclusion of NASDAQ, rather than Dow Jones. The estimated results as presented in Table 6 suggest that the long-term elasticity of the TSE with respect to NASDAQ is almost 0.2, indicating higher correlation of TSE with DJ. However, the long term elasticity of TSE to FFR and to exchange rate amounts to 0.50 and 0.78, respectively, indicating the importance of Fed's policy and the parity value in TSE movements. The variance decomposition technique as presented in Table 7 suggests that the contribution of FFR to TSE movements increases from 0.6 percent in the second month to 2.3 percent at the end of the period. Using a multivariate dynamic technique, we forecast the levels of TSE in the logarithm form, assuming that FFR moves according to its past six months' behavior. The results presented in Appendix 1, closely captures the movements of TSE.

Table 6: Vector Error Correction Estimates (with NASDAQ)

List of Variables	CointEq1
TSE	1
USM2	-0.580
	(-4.29)
FFR	0.505
	(5.48)
Nasdaq	-0.20
	(-4.17)
EXCH	0.78
	(4.69)
CINT	0.79
	(6.98)
Log Likelihood	1605.60
Akaike information Criteria	-26.06
Schwarz Criteria	-24.77

This Table presents the results on the estimation of the Vector Error Correction Model with inclusion of NASDAQ Industrial Index. The Akaike and Schwartz criteria indicate that at least one co-integration equation exists among the variables. Note. Numbers in parentheses are t statistics.

Table 7: Variance Decomposition of LOG (TSE)

Period	S.E.	LOG(TSE)	LOG(USM2)	LOG(FFR)	LOG(EXCH)	LOG(NASDAQ)	LOG(CINT)
1	0.044980	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.069002	98.45666	0.438483	0.612118	0.166846	0.061794	0.264095
3	0.087390	96.77198	0.735177	1.167265	0.239697	0.224240	0.861646
4	0.102584	95.52036	0.916536	1.530485	0.247834	0.342066	1.442717
5	0.115796	94.69147	1.031679	1.757224	0.236149	0.412777	1.870700
6	0.127643	94.15553	1.107414	1.901585	0.222257	0.455435	2.157778
7	0.138482	93.80245	1.159202	1.997188	0.210632	0.482621	2.347906
8	0.148535	93.55983	1.196194	2.063699	0.201726	0.501130	2.477418
9	0.157952	93.38416	1.223820	2.112454	0.195016	0.514576	2.569971
10	0.166841	93.25029	1.245296	2.149947	0.189892	0.524899	2.639672
11	0.175281	93.14383	1.262553	2.179924	0.185871	0.533169	2.694654
12	0.183334	93.05640	1.276780	2.204603	0.182620	0.539993	2.739603
13	0.191048	92.98294	1.288743	2.225355	0.179921	0.545744	2.777298
14	0.198462	92.92019	1.298954	2.243080	0.177632	0.550662	2.809480
15	0.205609	92.86593	1.307775	2.258403	0.175661	0.554917	2.837311
16	0.212516	92.81855	1.315474	2.271780	0.173941	0.558633	2.861621
17	0.219205	92.77683	1.322249	2.283558	0.172428	0.561904	2.883032
18	0.225696	92.73982	1.328258	2.294003	0.171085	0.564806	2.902028
19	0.232006	92.70678	1.333623	2.303329	0.169886	0.567396	2.918990
20	0.238149	92.67710	1.338441	2.311706	0.168808	0.569723	2.934226
21	0.244137	92.65029	1.342793	2.319270	0.167835	0.571824	2.947987
22	0.249981	92.62596	1.346742	2.326136	0.166952	0.573731	2.960475
23	0.255692	92.60379	1.350342	2.332395	0.166147	0.575469	2.971859
24	0.261278	92.58349	1.353638	2.338124	0.165410	0.577061	2.982281

This table provides the variance decomposition of TSE with respect to US money supply, Federal Fund Rate, Exchange rate, NASDAQ Industrial Index and Canadian interest rate.

CONCLUSION

This paper employs a VECM for the period January 1999 to April 2008 to measure the long-term elasticity of TSE to FFR shocks, the US-Canadian dollar exchange rate and the U.S. stock market indices; Dow Jones and NASDAQ. The estimated results suggest that TSE has a higher correlation with Dow Jones, compared with NASDAQ. The results also indicate that TSE is significantly elastic to FFR, highlighting the importance of Fed's policy for Canadian stock market. The results also suggest that the elasticity of TSE to exchange rate is almost -0.66%, emphasizing the importance of the parity value on TSE; as expected in theory.Using a multivariate dynamic technique, we forecast the TSE, assuming that the FFR moves according to its past six months' behavior. The results closely capture the movements of

the TSE. In sum, the results have important policy implications for the Canadian policymakers to avert the US shocks on their stock market.

APPENDIX

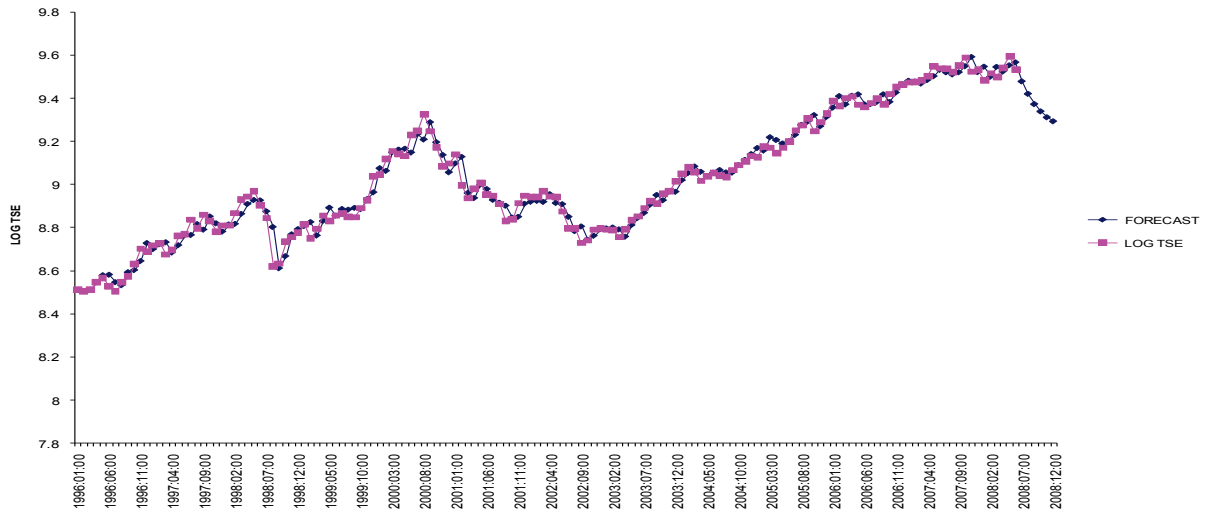
Appendix 1: Multivariate Dynamic Forecasts for the Level of LTSE

145 observations from 1996M5 to 2008M5. Order of VAR = 4, chosen r =1. List of variables included in the cointegrating vector: LTSE, LEXCH, LDJ, LCINT , LFFR

Observation	Actual	Prediction	Error
2008M6	*NONE*	9.5345	*NONE*
2008M7	*NONE*	9.4784	*NONE*
2008M8	*NONE*	9.4206	*NONE*
2008M9	*NONE*	9.3728	*NONE*
2008M10	*NONE*	9.339	*NONE*
2008M11	*NONE*	9.3115	*NONE*
2008M12	*NONE*	9.2928	*NONE*

		Estimated Period	Forecast Period
		1996M5 to 2008M5	2008M6 t0 2008M5
Mean		0.000	*NONE*
Mean	Absolute	. 033725	*NONE*
Mean	Sum Squares	0.001979	*NONE*
Root	Mean Sum Squares	0.044484	*NONE*

Figure1: Multivariate Dynamic Forecasts for the Level of TSE in Logarithm Form



This figure shows that how the logarithm of Toronto Stock Exchange (TSE) will move during the next month

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