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Determinants of Stock Market Index Movements: Evidence from New Zealand Stock Market

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***Abstract*—This study examines the impact of a selected macroeconomic variables on the New Zealand stock market(S&P/NZX 50) index. We use exchange rate, interest rate, inflation rate and foreign stock market index (S&P 500 index) to evaluate their influence on the New Zealand stock market (S&P/NZX 50) index. Daily data from January 2014 to September 2016 are evaluated. Unit root tests, cointegration tests, vector error correction model (VECM) and Granger causality test are employed to examine both long run and short run dynamic relationship between these variables. The study finds that there is no statistically significant long run causality from inflation rate, exchange rate, interest rate and S&P 500 index on the New Zealand stock market index. However, S&P 500 index has a strong significant short run Granger causality to the New Zealand stock market index.**

I. Introduction

Financial markets are regarded as sophisticated, highly interdependent and complex markets whose movements are influenced by multitude of interwoven macroeconomic and non-normal random factors. The globalisation and financial market integration intensifies further complexities. Stock market prices are influenced by the domestic economic environment, government policies, individual and institutional investors motivation and psychology, global economic condition, local & international political situation and the degree of integration with other markets.

Time series prediction of stock market indices become always challenging as they consist of deterministic and stochastic features. These time series mostly exhibit nonlinear characteristics (trends, seasonal, cyclical patterns, random walks, high volatility) combined with some degree of linearity. Stock market prices are dynamic, interdependent and commonly regarded as highly sensitive to economic news.

The government and various organisations constantly release statistics pertaining to the performance of the macroeconomy of a selected country. Such information will eventually be reflected in the financial market of that country in varying degrees of magnitude as the market participants consistently review the current and the future direction of their investments. The globalisation and financial market integration intensifies further complexities as unanticipated world news about the leading macro-economies may rock the local financial market. Much attention has been paid to investigate the interrelationship between stock market returns and a range of fundamental macroeconomic variables using different stock markets and over a range of different time horizons. The purpose of this study is to investigate the interrelationship of the selected macroeconomic variables on the New Zealand stock market (S&P/NZX 50) index. The remainder of the paper is organised as follows. Section 2 reviews the previous literature on the relationships between macroeconomic variables and stock market returns. Section 3 explains the data and research methodology used in the analysis. Results are discussed in section 4 and section 5 concludes the paper.

II. Literature Review

The theoretical foundation of the relationship between macroeconomic variables and stock market returns is explained by the capital asset pricing model (CAPM) and the arbitrager pricing theory (APT). Sharp [1] and Lintner [2] developed the CAPM model, which is regarded as the origin of the asset pricing theories. The CAPM provides the coherent framework to explain the risk return trade-off of the investments. The CAPM measures the relationship between nondiversifiable risk and expected return for assets and postulates that the investors need to be compensated in two ways; time value of money and market risk. Although the model provides an intuitively pleasing prediction about risk and return trade-off, the empirical findings do not support the model.

The Arbitrager Pricing Theory (APT) developed by Ross [3] and extended by Huberman [4] and Connor [5] is regarded as a better testable alternative to the CAPM. The APT is a general theory of asset pricing which assumes that each asset's (stock's) return to an investor is influenced by multiple independent (macroeconomic/risk) factors. Roll and Ross [6] find that the empirical data support the APT against CAPM. Chen [7] finds that the multifactor APT is superior model for explaining cross sectional variation in asset returns.

Most of the subsequent studies based on the APT evaluate the short term relationship between a number of macroeconomic variables and the return of an asset or a stock market index. For example Fama ([8], [9]), Chen et.al [10], Granger [11], Fama & French [12], Chen [13], etc. use the APT model. Fama [9] is one of the pioneering researchers to evaluate the relationship between the stock market returns and macroeconomic variables. He finds that the real stock market returns are positively related with the real macroeconomic

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variables (such as real rate of return on capital and output). Chen et.al [10] examine how stock market prices respond to selected macroeconomic variables and pave the way to the principle of long term equilibrium relationship between macroeconomic variables and stock prices. They use spread of interest rates, inflation rate, industrial production and spread between high and low grade bonds as determinants of stock market return. They find that industrial production and changes in risk premium are crucial determinants and inflation is identified as a relatively insignificant determinant. Chen [13] examines how selected variables such as industrial production, default spread, term structure, T-bill rate, dividend yield, gross national product, consumption, influence the stock returns. He finds that the default spread, term spread, one-month T-bill rate, lagged industrial production growth rate, and the dividend-price ratio are important in determining future stock market returns. Fama [9] has tested market efficiency and asset pricing models. He finds that the stock prices do not respond immediately and concludes efficient market hypothesis is not fully true.

Granger [11] and Engle & Granger [14] elaborate the concept of cointegration analysis applied in macroeconomic analysis thereby enabling to evaluate long-run as well as short run relationships in a meaningful way. This perception results in an error correction process enabling to produce better short run forecasts combined with long run predictions to hold the equilibrium model in a meaningful way. Kwon & Shin [15] examine whether the current economic activities in Korea has influence on stock price indices. Using cointegration and vector error correction model (VECM), they find that the stock price indices are cointegrated with a set of macroeconomic variables (production index, exchange rate, trade balance, and money supply). Using Johansens methodology of multivariate cointegration analysis Gunasekarage et.al [16] evaluate the interrelationship between Sri Lankan stock market and selected macroeconomic variable. They find the presence of a long run equilibrium relationship between the stock prices, inflation and interest. Adam and Tweneboah [17] evaluate the dynamic linkages between some macroeconomic variables and stock prices in Ghana. Using Johansen's multivariate cointegration methodology they find the presence of short run relationship between stock prices, exchange rate and inflation rate, and a long run relationship between stock prices, inflation rate and interest rate. Pal and Mittal [18] evaluate the influence of macroeconomic variables on the Indian capital market. They find inflation rate and interest rate have strong influence on the Indian stock indices. Although there appear to be an abundance of published literature evaluating the relationship between stock market returns and macroeconomic variables, its application to the New Zealand context is relatively rare. Rapach [19] evaluates the relationship between the long-run real stock prices and inflation for 16 industrialised countries including New Zealand. Using the methodology of King and Watson [20], his study finds that there is no evidence of inflation eroding the real value of stock prices due to a long-run inflation neutrality effect on the real stock prices. Eichengreen and Tong [21] evaluate the existence of stock market volatility in the long run. Their study focuses on 12 industrial countries including New Zealand and 11 emerging markets and find that there is a positive association between the stock market volatility and the monetary policy volatility. They also find that a fixed exchange rate regime influences to have a lower stock market volatility in comparison to the flexible exchange rate.

Narayan and Smyth [22] evaluate the equity market integration of New Zealand, Australia and the G7 countries. They apply Johansen [23] and Gregory and Hansen [24] cointegration methodologies. Applying Johansen [23] methodology, they find these equity markets do not depict a long term association. However, using Gregory and Hansen [24] approach which enables to have structural shift in the cointegrating vector, they find that the New Zealand and United States stock markets are cointegrated, but the New Zealand stock market is not cointegrated with the rest of the stock markets evaluated in their study. Gan et.al [25] evaluate the relationship between the New Zealand stock index (NZSE40) and a set of macroeconomic variables. With monthly data from January 1990 to January 2003 they employed the Johansen multivariate cointegration test and Granger-causality test from a VECM to evaluate the association between these variables. Based on the Johansen test they find a long run relationship between NZSE40 and the macroeconomic variables tested. In general they find that the NZSE40 is constantly determined by the interest rate, money supply and real GDP. However their Granger-causality test results show that NZSE40 is not a leading indicator in New Zealand, possibly because the New Zealand stock market is relatively small in comparison to the stock markets of other developed nations. They suggest that it is imperative for future researchers to examine the sensitivity of the New Zealand stock market to the global macroeconomic factors.

Maghrebi et.al [26] examine how the foreign exchange market volatility can impact on the stock markets in the Pacific Basin countries which includes New Zealand. They generally find that stock market volatility is more sensitive to bad news about equity and also more responsive to currency depreciation. Choi et.al [27] evaluate how the volatility spillovers due to exchange rate changes have impacted on the stock market returns in New Zealand. They find that there were significant volatility spillovers from stock market returns to the New Zealand Dollar foreign exchange market prior to the 1997 stock market crash but not after the crash. Kim and Nguyen [28] evaluate the nature of the transmission process of monetary policy news from the U.S. Fed and the ECB on 12 Asia-Pacific stock markets, including New Zealand. During January 1999 to December 2006 information they find that the FED news has no significant effect on stock returns in New Zealand although it increases their volatility. However, the ECB news hinders the stock returns in New Zealand whilst increasing their volatilities.

In this paper we investigate the causal relationship between the selected macroeconomic variables and the New Zealand stock market. To evaluate the causality we employ Johansens

[29] vector error correction model (VECM) instead of vector auto regression (VAR) model as we found strong evidence that all the variables are cointegrated. Additionally we want to evaluate both short run as well as long run dynamics.

III. Data description and Research Methodology

A. Data

The exchange rate, interest rate, inflation rate and foreign stock market index (S&P 500) are used as explanatory variables in forecasting the New Zealand stock market (S&P/NZX 50) index. We use daily data from 1st January 2014 to 30th September 2016. All the original variables are converted into natural logarithm before they are used in the analysis. This is to capture certain statistical properties and also to improve the model fit.

It is illogical to conclude that the linkage between macroeconomy and financial market is precise and entirely in one direction. Stock market indices are reacting to some of the macroeconomic forces, thus, they can act as endogenous to some extent. Also these macroeconomic variables are interconnected, thus, it is difficult to determine the exclusive impact of the individual macroeconomic variable on the stock market index although their combined effect can be determined. Only true random factors such as earthquakes, epidemics, terrorist actions are true exogenous to financial markets. Not surprisingly, the available literature provides contradictory empirical evidence on the relationships between macroeconomic variables and stock markets.

B. Model specification

The unit root tests, cointegration tests, vector error correction model (VECM) and the Granger causality test are used in this study. As these are well established methodologies of testing long and short run relationships, we briefly explain them here and the interested readers may review the original articles for detailed explanation. To determine the order of integration, the stationarity tests are carried out first. The standard tests are the Augmented Dickey Fuller (ADF) unit root test (Dickey, Fuller [30], [31]) and the Phillips-Perron (PP) unit root test [32]. For the purpose of robustness both unit root tests are used as Enders [33] suggests that using both types of the test strengthen the decision. Subsequently the cointegration tests should be applied to our model. Gonzalo & Lee [34] highlight that the Johansen and the Engle-Granger cointegration tests are based on two different rationales. Johansen cointegration test procedure is based on maximizing correlations (canonical correlation) while Engle-Granger minimizes variances (in the spirit of principal components). Thus, Gonzalo & Lee [34]) recommend using both tests as a robustness check. Therefore the Engle-Granger cointegration test and the Johansen cointegration test are used in our analysis. When the nonstationary time series are cointegrated, the long run equilibrium relationship can be represented as the cointegrating equation. Engle and Granger [14] show that although the cointegrating equation accommodates the long run equilibrium relationship, there can be deviations from the equilibrium in the short run. Thus at least one of the time series would correct for these deviations and this correction is called an error correction process. This means when the non-stationary variables are cointegrated, a vector autoregression (VAR) in the first difference becomes misspecified due to the existence of a common trend. Thus, the model should incorporate one period lagged residuals from the vectors to generate a vector error correction mechanism (VECM) as presented in Eq. 1.

$$\begin{aligned}\triangle NZX50_{1,t} &= \mu_{1,t} - \phi_1[NZX50 - \gamma_0 - \gamma_1 Inflation \\ &\quad -\gamma_2 Exchange - \gamma_3 Interest - \gamma_4 S\&P500]_{t-1} \\ &\quad + \sum_{i=1}^{j} \beta_{1,j} \triangle NZX50_{1,t-1} + \sum_{i=1}^{j} \beta_{2,j} \triangle Inflation_{1,t-1} \\ &\quad + \sum_{i=1}^{j} \beta_{3,j} \triangle Exchange_{1,t-1} + \sum_{i=1}^{j} j\beta_{4,j} \triangle Interest_{1,t-1} \\ &\quad + \sum_{i=1}^{j} \beta_{5,j} \triangle S\&P500)_{1,t-1} + \epsilon_{1,t}\end{aligned} \tag{1}$$

This study also examines the Granger causality between New Zealand stock market (S&P/NZX50) index and the macroeconomic variables used in this study. (Granger, 1981, 1988; Granger & Weiss, 1983). The inclusion of lagged error correction process initiates the VECM to materialise two possible channels for Granger causality; (a) the long-run causation through a one period lagged error correction term from the cointegrated regression and/or (b) through the short run causal effects which can be captured through significant joint F-tests, the sum of the lagged differenced causal variables. Suppose the NZX50 index is regressed on inflation rate, exchange rate, interest rate and S&P500 index, and the t-statistic (p-value) of the error correction term (C1) in VECM is statistically significant. This suggests that current stock index values adjust to the previous equilibrium error, past macroeconomic variables have significant explanatory power for current stock index values, and the macroeconomic variables are significant in predicting the changes in the stock index values. This is because if all the time series variables are integrated of order one and are cointegrated, there should be Granger causality in at least one direction as one/some variables can forecast the other (Granger, 1988). Even if the t-statistic (p-value) of the error correction term (C1) is statistically insignificant, as long as the F statistic is statistically significant, it is possible to conclude that Granger causality still exists through short run effects. Therefore the F statistic with the null hypothesis of no Granger causality should be carried out to determine whether the causality to emerge through short run channel. The test of causality is performed with the standard Wald F test as shown in Eq. 2, where $ESSR$ is the residual sum of squares of the restricted regression; $ESSU$ is the residual sum of squares of the unrestricted regression; T is the number of observations in the unrestricted regression; m and n are the optimal order of lags.

$$F_c = \frac{[(ESSR - ESSU)/n]}{[ESSU/(T - m - n)]} \quad (2)$$

The selection of the optimum lag structure of the VECM must not be made arbitrarily. A dubiously selected optimal lag structure may lead to misrepresentation although it can bring the desirable conclusions. The standard lag length selection criteria are the sequential modified likelihood (LR) ratio, final prediction error criterion (FPE), Akaike information criterion (AIC), Schwarz information criterion (SIC) and Hannan-Quinn information criterion (HQ). Liew [35] provides useful guidelines regarding the lag length selection criteria. Based on a simulation analysis Liew [35] finds that no criterion consistently outperforms the rest. However the HQ criterion is found to be the best in selecting the true lag length when the size of the sample is greater than 120 observations. Also he finds different combinations of criteria bring better results.

IV. Results and discussion

A. Descriptive Statistics

The time-plots of each variable at level and at first difference are evaluated. All the variables at level show either upward or downward trends with constant positive intercepts suggesting they are non-stationary at level. However, the first difference of each of these variables portray approximately stationary process over time. The correlation matrix confirms the presence of strong significant correlation between the S&P/NZX 50 index and each of the macroeconomic variable examined. More precisely we find strong positive correlations between inflation and S&P/NZX 50 index, and S&P 500 index and S&P/NZX 50 index. On the other hand we find strong negative correlation between interest rate and S&P/NZX 50 index, and exchange rate and S&P/NZX 50 index. The time-plots and the correlation matrix are not reported, but will be available upon request.

B. Tests for Stationarity

We use Augmented Dickey Fuller (ADF) unit root test [Dickey Fuller [30], [31]] as well as Phillips-Perron (PP) unit root test [Phillips-Perron [32]] in our analysis.

The ADF test is carried out with a trend and intercept on levels for spreads of up to nineteen lags in order to remove serial correlation. As an alternative unit root test, the PP non-parametric test diagnostic with bandwidth 2 (fixed using the Barlett Kernel), corrected by the Newey-West autocorrelation consistent covariance matrix estimator, is carried out with a trend and intercept on levels. We include 'trend and intercept' in our test equations of the unit root as the time plots show the presence of both trends and intercepts. Both tests postulate the presence of unit roots as the null hypothesis.

Both test results confirm that all the variables investigated in our analysis are nonstationary at level. Nonstationary time series are regarded as unpredictable and should never be modelled because the results obtained from such data may be spurious. However, both test results confirm that the first difference of each of these series are stationary. The ADF and PP results provide strong evidence that all the time series variables examined in this study are integrated in order one [I(1)]. Additionally, the ADF and PP test results strengthen the validity of our conclusions. Stationarity test results are not reported, but will be available upon request.

C. Tests for Cointegration

Even though the variables evaluated in this study are non-stationary at level with the same order of integration [I(1)], the first difference of each variable become stationary, therefore, it is possible to use appropriate tests to evaluate cointegration (long run equilibrium relationship) between these variables.

Gonzalo and Lee [34] emphasise that both Johansen and Engle-Granger cointegration tests are based on two different rationales. Thus, both Johansen and Engle-Granger cointegration tests are carried out for robustness.

1) Johansen Cointegration Test: The Johansen [36] cointegration test employs two separate likelihood ratio tests of the significance of these maximizing correlations (canonical correlations), thus, reducing the rank of the phi matrix; namely the trace test and maximum eigenvalue test. If there are n variables each variable with unit roots, there are at most $(n-1)$ cointegrating vectors. Johansen cointegration test evaluates the null hypothesis of 'no cointegrating relationship,' 'at most one cointegrating equation,' etc.

Table I provides the Johansen cointegration test results for S&P/NZX 50 index, inflation rate, exchange rate, interest rate and S&P500 index. The trace statistics and also eigenvalue

TABLE I
JOHANSEN COINTEGRATION TEST RESULTS

Hypothesized No. of CE(s)	Trace Statistic	Critical value 0.05	Prob.**	Maximum Eigenvalue	Critical value 0.05	Prob.**
None *	70.65635	60.06141	0.0049	30.89676	30.43961	0.0438
At most 1	39.75959	40.17493	0.0550	19.95075	24.15921	0.1680
At most 1	39.75959	40.17493	0.0550	19.95075	24.15921	0.1680
At most 2	19.80884	24.27596	0.1652	10.71735	17.79730	0.4125
At most 3	9.091498	12.32090	0.1638	6.048485	11.22480	0.3442
At most 4	3.043014	4.129906	0.0960	3.043014	4.129906	0.0960

* denotes rejection of the hypothesis at 5% level ** MacMkinnon-Haug-Michelis (1999) p-values.

statistic for 'no cointegrating relationship' is greater than the critical values at 0.05. Also MacKinnon-Haug-Michelis (1999) probability values for 'no cointegrating relationship' is less than 0.05 threshold. However the trace statistics and also maximum eigenvalue statistic for 'at most one cointegrating relationship' is less than the critical value at 0.05. These results confirm the presence of one cointegrating equations at 0.05 critical value. These results show that S&P/NZX 50 index, exchange rate, interest rate, inflation rate, and S&P500 index are cointegrated with at least one cointegrating equation suggesting that there is a long run equilibrium relationship between these variables.

2) Engle Granger Cointegration Test: As an alternative to Johansen cointegration test, Engle and Granger [14] test is carried out to investigate the cointegration relationship. Table II provides the Engle and Granger test results.

The Engle-Granger test for cointegration is simply a unit root test applied to the residuals obtained from static ordinary least squares (SOLS) estimation. Therefore, a test of the null hypothesis of no cointegration against the alternative of cointegration may be constructed by computing a unit root test of the null of residual nonstationarity against the alternative of residual stationarity. Both Engle-Granger tau-statistic (t-statistic) and the normalized autocorrelation coefficient (which is termed as the z-statistic) reject the null hypothesis of no cointegration (unit root in the residuals) at 0.05 level. The test statistics confirm that we can reject the null hypothesis of no cointegration.

TABLE II
ENGLE GRANGER COINTEGRATION TEST RESULTS

Dependent variable	tau-statistic	Prob.*	Z-statistic	Prob.*
NZX50 index	-33.1157	0.0045	-206.4143	0.0035
Inflation rate	-30.0011	0.0070	-201.8535	0.0008
Exchange rate	-15.6772	0.0215	-61.5533	0.0103
Interest rate	-34.6983	0.0035	-248.0292	0.0028
S&P500 index	-39.6204	0.0015	-417.5270	0.0002

D. Vector Error Correction Model (VECM)

The ADF and Phillips-Perron tests confirm that S&P/NZX 50 index, inflation rate, exchange rate interest rate and S&P500 index are integrated of order one. The Engle Granger and Johansen cointegration tests confirm the presence of at least one cointegrating relationship. Once the cointegration between the time series has been found, it is evident that there exists a long term equilibrium relationship between them. However, due to the effects of a common trend, the vector auto regression (VAR) model in the first difference becomes misspecified. As such, there may be disequilibrium in the short run although there is a long run equilibrium relationship. Thus, the model must incorporate one period lagged residuals from the vectors to generate a vector error correction mechanism (VECM). With the inclusion of an error correction mechanism, the relative disequilibrium in one period is corrected in the subsequent period. The S&P/NZX 50 index is the dependent variable and inflation rate, exchange rate interest rate and S&P500 index are the independent variables in the VECM. In our analysis the lag length selection for the VECM is made based on the final prediction error criterion (FPE), Akaike information criterion (AIC), Schwarz information criterion (SIC) and Hannan-Quinn information criterion (HQ). Each of these criterion proposes 2 lags to be incorporated in the VECM. The VECM results are presented in Fig. 1 and these results show the two possible channels for Ganger causality; the long run (C1) causality and short run (C2 to C11) causality.

The coefficient C1 in Fig. 1 (ECT_{t-1} in Tabel III) is the error correction term of the cointegrated model. C1 is -0.002252 suggesting that 0.2252% of disequilibrium is corrected daily as data frequency used in this analysis is daily. For the long run causality to be present in the VECM, the error correction term (C1) must be negative and statistically significant. Although the sign and the size of the coefficient (C1) is acceptable it is not statistically significant. This means that there is no statistically significant long run causality from inflation rate, exchange rate, interest rate and S&P500 index on S&P/NZX 50 index. The short run causality can be examined from C2 to C11 coefficients in Fig. 1. The Granger causality results based on VECM are presented in Table III. The Wald test is used to evaluate whether each of the individual explanatory variables (inflation rate, exchange rate, interest rate, S&P 500 index) has a short run joint causality on the S&P/NZX 50 index or not. A null hypothesis is formulated with zero restrictions on the coefficients of each variable from different lags. A null hypothesis of no short run joint causality from

Dependent Variable: D(NZX50)
Method: Least Squares
Date: 01/06/17 Time: 17:42
Sample (adjusted): 4 710
Included observations: 707 after adjustments
D(NZX50) = C(1)*(NZX50(-1) + 16.9219052098*INFLATION(-1) -
0.850135710618*EXCHANGE(-1) + 0.650108905806*INTEREST(-1)
1.40108000703*S_P500(-1) - 118.287078688) + C(2)*D(NZX50(-1))
C(3)*D(NZX50(-2)) + C(4)*D(INFLATION(-1)) + C(5)*D(INFLATION(-
+ C(6)*D(EXCHANGE(-1)) + C(7)*D(EXCHANGE(-2)) + C(8)
*D(INTEREST(-1)) + C(9)*D(INTEREST(-2)) + C(10)*D(S_P500(-1))
C(11)*D(S_P500(-2)) + C(12)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.002252	0.002000	-1.126410	0.2604
C(2)	0.053867	0.038023	1.416683	0.1570
C(3)	0.032343	0.034528	0.936729	0.3492
C(4)	0.063182	0.476701	0.132540	0.8946
C(5)	-0.201247	0.475461	-0.423267	0.6722
C(6)	-0.017190	0.024594	-0.698932	0.4848
C(7)	0.003828	0.024175	0.158356	0.8742
C(8)	0.037812	0.027825	1.358925	0.1746
C(9)	-0.020224	0.027689	-0.730398	0.4654
C(10)	0.248343	0.021050	11.79793	0.0000
C(11)	0.043297	0.023502	1.842265	0.0659
C(12)	0.000341	0.000180	1.898254	0.0581

R-squared	0.192587	Mean dependent var	0.000438
Adjusted R-squared	0.179808	S.D. dependent var	0.005218
S.E. of regression	0.004725	Akaike info criterion	-7.854866
Sum squared resid	0.015519	Schwarz criterion	-7.777451
Log likelihood	2788.695	Hannan-Quinn criter.	-7.824955
F-statistic	15.07032	Durbin-Watson stat	2.012456
Prob(F-statistic)	0.000000		

Fig. 1. Vector Error Correction Model (VECM) - Results from EViews8.1.

TABLE III
GRANGER CAUSALITY RESULTS BASED ON VECM

Dependent variable	Independent variables				
	$\tilde{\chi}^2$ statistics of lagged 1st differenced term				ECT_{t-1}
	△ Infl. rt.	△ Ex. rt.	△ Int. rt.	△ S&P500 in.	
△S&P/50NZX	0.197087	0.540926	2.629341	140.4554**	-0.002252
	0.9062*	0.7630*	0.2686*	0.0000*	0.2604*

Note: ** denotes significanc at 1% significance level. * represents p-values.

each independent variable to S&P/NZX 50 index is tested. For example a 'null hypothesis of C (4) = C (5) = 0' refers to inflation rate (lag 1) and inflation rate (lag 2) have no short run joint influence on S&P/NZX 50 index. The P-values for Chi square statistics reveal that only S&P 500 index is statistically significant. This is a confirmation that out of all the macroeconomic variables used in our analysis only S&P 500 index has a strong short run Granger causality to S&P/NZX 50 index.

A range of model validation diagnostic tests are carried out to determine the validity of the assumptions which underlie the estimated VECM. The properties of the least squares estimator depend on the assumptions of the classical linear regression model (CLRM). We perform the diagnostic tests on the residuals of the VECM to evaluate its validity. We find that our model is free from serial correlation, heteroskedasticity and multicollinearity. The validation diagnostic test results are not reported, but will be available upon request.

V. Conclusion

The motivation of this paper is to investigate how much the current macroeconomic variables (exchange rate, interest rate, inflation rate and foreign stock market index) can explain the current New Zealand stock market (S&P/NZX 500) index. Daily data from January 2014 to September 2016 are used in our study. We employ Augmented Dickey Fuller (ADF) unit root test ([30], [31]) and Phillips-Perron (PP) unit root test ([32]) to determine the order of integration. Both tests confirm that all the macroeconomic variables examined in our study are integrated in order one [I(1)]. To explore the long run equilibrium relationship between the selected macroeconomic variables with the New Zealand stock market index we employ the Engle Granger and Johansen cointegration tests. Both cointegration tests confirm the presence of at least one cointegrating relationship. As all the variables are cointegrated we use VECM instead of VAR so that we could evaluate short run as well as long run equilibrium relationship. The vector error correction model (VECM) and the Granger causality test results suggest that there is no statistically significant long run causality from inflation rate, exchange rate, interest rate and S&P500 index on S&P/NZX 50 index. However, S&P 500 index has a strong significant short run Granger causality to S&P/NZX 50 index.

Future research can extend our study to include more macroeconomic variables, a longer time duration and also to incorporate sliding window approach to determine any changes to the conclusions we have reached here.

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