MACROECONOMIC VARIABLES AND STOCK MARKET INTERACTIONS: NEW ZEALAND EVIDENCE

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Abstract

In this paper, we examine the relationships between the New Zealand Stock Index and a set of seven macroeconomic variables from January 1990 to January 2003 using cointegration tests. Specifically, we employ the Johansen Maximum Likelihood and Granger-causality tests to determine whether the New Zealand Stock Index is a leading indicator for macroeconomic variables. In addition, this paper also investigates the short run dynamic linkages between NZSE40 and macroeconomic variables using innovation accounting analyses. In general, the NZSE40 is consistently determined by the interest rate, money supply and real GDP and there is no evidence that the New Zealand Stock Index is a leading indicator for changes in macroeconomic variables.

Key words: share returns, macroeconomic variables, cointegration, Granger-causality.
JEL Classification: G10, G15.

1. Introduction

Over the past few decades, the interaction of share returns and the macroeconomic variables has been a subject of interest among academics and practitioners. It is often argued that stock prices are determined by some fundamental macroeconomic variables such as the interest rate, the exchange rate and the inflation. Anecdotal evidence from the financial press indicates that investors generally believe that monetary policy and macroeconomic events have a large influence on the volatility of the stock price. This implies that macroeconomic variables can influence investors' investment decision and motivates many researchers to investigate the relationships between share returns and macroeconomic variables.

Stock prices are generally believed to be determined by some fundamental macroeconomic variables such as interest rate, exchange rate and inflation rates. Several studies have attempted to capture the effect of economic forces on stock returns in different countries. For example, using, the Arbitrage Pricing Theory (APT), developed by Ross (1976), Chen et al. (1986) used some macroeconomic variables to explain stock returns in the US stock markets. The authors' findings showed industrial production, changes in risk premiums, and changes in the term structure to be positively related to the expected stock returns, while both the anticipated and unanticipated inflation rates were negatively related to the expected stock returns.

The development of cointegration analysis provided another approach to examine the relationships between the macroeconomic variables and stock returns. For example, Mukherjee and Naka (1995) employed the Johansen cointegration test in the Vector Error Correction Model (VECM) and found that the Japanese stock market is cointegrated with six macroeconomic variables namely, exchange rate, money supply, inflation rate, industrial production, long term government bond rate and the short term call money rate. The results of the long-term coefficients of the macroeconomic variables are consistent with the hypothesized equilibrium relationships. Furthermore, Mayasmai and Koh (2000) used the Johansen cointegration test in the Vector Error Correction Model (VECM) and found that the Singapore stock market is cointegrated with five macroeconomic variables.

Kwon and Shin (1999) applied Engle-Granger cointegration and the Granger-causality tests from the Vector Error Correction Model (VECM) and found that the Korean stock market is

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coinegrated with a set of macroeconomic variables. However, using the Granger-causality test on macroeconomic variables and the Korean stock index, the authors found that the Korean stock index is not a leading indicator for economic variables.

Cheung and Ng (1998), employed Johnson's cointegration technique with quarterly data from Canada, Germany, Italy, Japan and US, and conclude that there are long term comovements between the national stock index and some specific variables, such as real oil price, real consumption, real money supply and real GNP output in those five countries. Furthermore, the authors found that the real returns on stock indexes are, generally, related to deviations from empirical long-term relationships and to changes in macroeconomic variables.

Many studies have been published about the relationships between stock returns and macro variables in well-developed countries such as the US, Japan and European countries. However, regional stock markets such as New Zealand and Australia are less explored because of their small sizes and geographic locations. In this paper, we examine the relationships between the New Zealand Stock Exchange stock index and a set of seven macroeconomic variables from January 1990 to January 2003 using cointegration tests. Specifically, we employ the Johansen Maximum Likelihood and Granger-causality tests from a Vector Error Correction Model (VECM) to determine whether the New Zealand Stock Index is a leading indicator for the macroeconomic variables. In addition, this paper also investigates the short run dynamic linkages between NZSE40 and macroeconomic variables using innovation accounting analyses. In general, the NZSE40 is consistently determined by the interest rate, money supply and real GDP and there is no evidence that the New Zealand Stock Index is a leading indicator for changes in macroeconomic variables

The balance of the paper is organized as follows. Section 2 reviews previous literature on the relationships between macroeconomic variables and stock returns. Section 3 provides an overview of the New Zealand stock exchange market and Section 4 describes the data used in the research. The econometric methods and results are discussed in Sections 5 and 6, respectively. Section 7 concludes the paper.

2. Relationships between Macroeconomic Variables and Stock Returns

The dynamic relationships between macroeconomic variables and share returns have been widely discussed and debated. The basis of these studies has been the use of models which state that share prices can be written as expected discounted cash flow. Thus, the determinants of share prices are the required rate of return and expected cash flows (Elton and Gruber, 1991). Economic variables which impact future cash flows and required returns can therefore be expected to influence share prices.

Fama and Gibbon (1982) examine the relationship between inflation, real returns and capital investment. Their results support Mundell (1963) and Tobin (1965) findings that expected real returns on bills and expected inflation rates are negatively correlated. The authors suggest that this relationship arises with share returns due to a positive relationship between expected real returns on financial assets and real activity. Fama (1991) argues early empirical work showing that expected inflation is negatively related to share prices implied the measured relationship between inflation and share returns is a spurious one. Geske and Roll (1983) found that the US stock price is negatively related to the inflation rate and positively related to the real economic activity. The second relationship is consistent with Fama (1981), and Lee (1992) findings.

Lee (1992) argues that share returns signal changes in expected inflation due to a link between money supply and expected real activity. Darrat (1990) examines the effects of monetary and fiscal policy on share returns in the Canadian share market and concludes that budget deficits, long-term bond rates, interest rate volatility and industrial production determine share returns. In testing the validity of the Arbitrage Pricing Theory, Chen, Roll and Ross (1986) conclude macroeconomic variables are causally related to share returns. Najand and Rahman (1991) applied the Schwert (1989) volatility measure and found evidence of the existence of a causal relationship between share returns and inflation.

An increase in interest rate would increase the required rate of return and the share price would decrease with the increase in the interest rate. An increase in interest rate would raise the opportunity costs of holding cash, and the trades off to holding other interest bearing securities would lead to a decrease in share price. French et al. (1987) documented theoretically, that stock returns responded negatively to both the long term and short term interest rates. However, Allen and Jagtianti (1997) pointed out that the interest rate sensitivity to stock returns has decreased dramatically since the late 80's and the early 90's because of the invention of interest rate derivative contracts used for hedging purposes. Futhermore, Bulmash and Trivoli (1991) found that the US current stock price is positively correlated with the previous month's stock price, money supply, recent federal debt, recent tax-exempt government debt, long-term unemployment, the broad money supply and the federal rate. However, there was a negative relationship between stock prices and the Treasury bill rate, the intermediate lagged Treasury bond rate, the longer lagged federal debt, and the recent monetary base.

When the domestic currency depreciates against foreign currencies, export product prices will decrease and, consequently, the volume of the country's exports will increase, assuming that the demand for this product is elastic. Mukherjee and Naka (1995), Achsani and Strohe (2002) confirmed this positive relationship existed in Japan and Indonesia both two large export countries. Ajayi and Mougoue (1996) also showed that an increase in stock price has a negative short-term effect on domestic currency values but in the long term this effect is positive, while currency depreciation has a negative short and long-term effect on the stock market.

Chen (1991) studied the relationship between changes in financial investment opportunities and changes in the macroeconomy in the U.S pointed out that the market excess returns can be forecasted using macroeconomic variables such as the lagged production growth rate, the term structure, the T-bill rate, the default spread and the dividend yield. The market excess on returns is negatively related to the economic growth variables (such as the T-bill rate, lagged production growth rate, the default spread and term structure) and positively related to expected future economic growth factors (such as the market dividend price ratio and unexpected future GNP growth).

Chen, Roll and Ross (1986) suggested the following macroeconomic variables were systematically affecting asset returns: the spread between long and short-term interest rates; expected and unexpected inflation; industrial production growth and the spread between high and low-grade bonds. Industrial production growth is suggested to proxy for real cash flows, inflation affects returns as nominal cash flow growth rates are not equivalent to expected inflation rates, whilst the spread between long and short-term interest rates and the high or low grade bond spread affect the choice of discount rate.

Similar to Chen, Roll and Ross (1986), Hamoa (1988) determines whether the observed relationships between macroeconomic variables and share returns are still applicable when the analysis is conducted in the Japanese market. The author also includes international trade variables. Apart from industrial production appearing insignificant in asset pricing, Hamao's findings are consistent with Chen, Roll and Ross (1986) study.

Poon and Taylor (1991) parallel the Chen, Roll and Ross (1986) study on the United Kingdom market. Their results show that macroeconomic variables do not appear to affect share returns in the United Kingdom as they do in the U.S. Poon and Taylor (1991) suggest that either different macroeconomic factors have an influence on share returns in the United Kingdom or the methodology employed by Chen, Roll and Ross (1986) is inefficient. The authors reemphasize the importance of representing only the unexpected component of share returns and macroeconomic variables in the model and argue Chen, Roll and Ross (1986) findings may be an example of a spurious regression. The authors use an ARIMA model to test their data and use the residuals from the model as innovations.

Theoretically, the money supply has a negative impact on stock prices because, as money growth rate increases, the inflation rate is also expected to increase; consequently the stock price should decrease. However, an increase in the money supply would also stimulate the economy and corporate earnings would increase. This would likely result in an increase in future cash flows and stock prices. Mukherjee and Naka (1995), Maysami and Koh (2000), and Kwon and Shin (1999) found that there is a positive relationship between money supply and stock returns.

During the past decade, researchers have extended the study of interaction between macroeconomic variables and share returns to countries other than the U.S. For example, Kwon and

Shin (1999) examined the Korean market and found the Korean stock markets are cointegrated with the production index, exchange rate, trade balance and money supply. The authors did not find the stock price index to be a leading indicator for macroeconomic variables. Leigh (1997) studied the Singapore stock exchange (SSE) and found the Singapore stock index to be positively related to money demand but with no relationship to macroeconomic fundamentals. Similar results have been identified by Fung and Lie (1990) in Taiwan. Gjerde and Saettem (1999), Achsani and Strohe (2002) examined small regional markets such as Norway and Indonesia and conclude that stock returns respond negatively to changes in interest rate, but positively to oil prices (Norway being a net oil exporting country), and real economic activity. However, the relationship between stock price and inflation rate is ambiguous. Achsani and Strohe's (2002) study showed negative relationships between stock price and inflation rate as well as call money rates. However, a positive relationship was identified between the stock price and gross domestic product, money supply and exchange rate. Furthermore, the authors failed to find any significant relationship between stock price and export or long-term interest rates.

Increases in oil price will be beneficial to those countries whose export products are derived from crude oil or refined oil products. Thus, there should be a positive relationship between the oil price and stock prices in those oil-exporting countries. But there should be a negative relationship in oil importer countries. Increases in oil price would increase the cost of production and, consequently, the expected cash flow would decrease. However, Chen et al. (1986) failed to find any relationship between the stock index and the oil price in US.

3. New Zealand Stock Exchange Market

The New Zealand Stock Exchange (NZSE) is one of the least regulated stock markets compared to other stock markets in Asia such the South Korean Stock Exchange, which is monopolised by the central government (Kwon and Shin, 1999). Since the deregulation of financial markets in 1984, the New Zealand Stock Exchange is self-regulated with minimal government intervention. For example, New Zealand does not impose any statutory control on the Stock Exchange's listing rules while most other countries do. Unlike other countries, insider trading in the NZSE is only a civil offence. While, in most developed countries such as US and Japan, it is considered as a criminal offence (Yu, 2002).

There were five main stock indexes published by the New Zealand Stock Exchange before May 2003, namely, the NZSE10, NZSE30, NZSE40, NZSESC and NZSEALL. The NZSE40 is the main public market index used, and covered the top 40 largest and most frequently traded stocks listed on the NZSE. On the other hand, the NZSESC (small capital) is made up of all small companies that are not included in the NZSE40 index. Since the NZSE40 is an official index for the NZSE, this research uses this index together with the NZSEALL as a proxy for the movement of the New Zealand stock market. Before 1992, the Barclay's Index was the major NZSE market index until its replacement, in 1991, with the NZSE40. The Barclay's Index comprises the top 40 stocks ranked by their market capitalization (Brailsford, 1995). The Barclay's Index is used as the proxy for NZSE stock index before 1992 in this research. From June 3, 2003 the NZSE changed to the NZX and the NZSE50 replaced the NZSE40 as the official published New Zealand Stock Index. However, this will not affect our research findings. The NZSE is still used as New Zealand's Stock Exchange and the symbols of NZSEALL and NZSE40 will be used as New Zealand Stock Indexes throughout this research.

As of April 30, 2003 there were a total of 196 companies listed on the NZSE market and 213 securities quoted. These securities have a total market capitalization of NZ$42.3 billion. In the four months ended April 30, 2003, a total of 2,494 million shares, with a value of $6,131 million, were traded on the NZSE market. In comparison, in the four months ended April 30, 2002, the NZSE processed trades totalling 2,862 million shares with a total value of $5,961 million. Thus, in general, the NZSE is not large and liquid compared with other stock markets, but it is one of the least intervened stock markets in the world.

4. Data

A total of seven macroeconomic variables and NZSE40 are used in the analyses. The definitions of each variable are described in Table 1.

Table 1

Description of Macroeconomic Variables

Variable	Definition
Share price index (NZSE40)	Official published index of the market-weighted value of closing price for 40 shares listed on the New Zealand Stock Exchange
Inflation rate (CPI)	Consumer price index (Quarterly)
Exchange rate (EX)	End of month price of domestic currency rate in terms of trade weighted index (TWI)
Gross domestic product (GDP)	Real production based gross domestic product at constant level
Money supply (M1)	Narrowly defined money supply in New Zealand
Long term interest rate (LR)	End of month average lending rate for loans in the money market rate (Base lending rate)
Short term interest rate (SR)	End of month call deposit rate
Domestic Retail Oil price (ROIL)	End of month domestic retail oil price in terms of the NZ dollar

The macroeconomic variables are monthly frequencies from January 1990 to January 2003 from DataStream except for the CPI, real GDP figures, domestic retail oil price (ROIL), which are obtained from Statistics New Zealand. The reason monthly data is chosen is because most macroeconomic variables are available monthly in New Zealand.

There is a total of 157 monthly observations for each variable except for the CPI, real GDP and, domestic retail oil price (ROIL) that are quarterly data, each with 39 observations. Using the RAT program these quarterly figures were successfully transformed into the monthly figures used in this research. The monthly data for SR is only available from January 1991, and has 145 observations. This time period is chosen because New Zealand experienced financial reforms in 1984 and the New Zealand dollar was floated in 1985. Any macroeconomic variables before 1985 are less reliable and maybe distorted.

5. Methodology

This paper employs the Johansen multivariate cointegration test and Granger-causality test to determine whether selected macroeconomic variables are cointegrated (hence possibly causally related) with share prices in the New Zealand stock exchange. Furthermore, the impulse response and Error Variance Decomposition analyses are used to examine the dynamic relations between stock indices and various macroeconomic variables. The Augmented Dickey-Fuller (ADF) and Philips-Perron (PP) approaches are used to pre-test the order of integration for all time series variables[1]. A visual inspection of the time series plot of the variables investigated suggests that there are no significant break points during the sample period. The lag length for the time series analysis is determined by choosing the lag length given by the minimum Akaike Information Criteria and Schwarz Information Criteria. Lagrange Multiplier tests are run to ensure that the residuals from the chosen lag length are serially uncorrelated.

5.1. Johansen Multivariate Cointegration Test

To investigate the long-run relationship of the NZSE index and macroeconomy as a system of equations, we employed the Johansen multivariate cointegration test. The relationships among the variables are based on the following model:

[1] All stock indexes and most macroeconomic variables are tested in a unit root model with constant but no trend. The CPI, GDP, M1 exhibit a time trend, thus, a unit root model with time trend is chosen in the unit root testing of these variables.

$$\Delta X_t = \Gamma_1 \Delta X_{t-1} + \Gamma_2 \Delta X_{t-2} + \cdots + \Gamma_{k-1} \Delta X_{t-k+1} + \Pi X_{t-k} + \mu + \Phi D_t + \varepsilon_t \,, \quad (1)$$

where $\Gamma_i = -I + \Pi_1 + \Pi_2 + \cdots + \Pi_i$ for i=1,2,k-1;

$\Pi = -I + \Pi_1 + \Pi_2 + \cdots + \Pi_k$ I is an identity matrix

The matrix Γ_i comprises the short-term adjustment parameters, and matrix Π contains the long-term equilibrium relationship information between the *X* variables. The Π could be decomposed into the product of two *n* by *r* matrix α and β so that $\Pi = \alpha\beta'$ where the β matrix contains *r* cointegration vectors and α represents the speed of adjustment parameters (Johansen, 1988).

Johansen developed two likelihood ratio tests for testing the number of cointegration vectors (*r*): the trace test and the maximum Eigenvalue test. The trace statistics tests the null hypothesis of *r* = 0 (i.e. no cointegration) against the alternative that *r* > 0 (i.e. there is one or more cointegration vetcor). The maximum Eigenvalue statistics test the null hypothesis that the number of cointegrating vectors is *r* against the specific alternative of *r* + 1 cointegrating vectors.

5.2. Granger-causality Test

In order to examine whether there are lead-lag relationships between NZSE returns and various macroeconomic variables, we run the Granger-causality test. If the time series of a variable is nonstationary, I(1) and is not cointegrated, the variable is converted into I(0) by first differencing and the Granger-causality test can be applied as follows:

$$\Delta X_t = a_x + \sum_{i=1}^{k} \beta_{x,i} \Delta X_{t-i} + \sum_{i=1}^{k} \gamma_{x,i} \Delta Y_{t-i} + \varepsilon_{x,t} \,, \quad (2)$$

$$\Delta Y_t = a_y + \sum_{i=1}^{k} \beta_{y,i} \Delta Y_{t-i} + \sum_{i=1}^{k} \gamma_{y,i} \Delta X_{t-i} + \varepsilon_{y,t} \,, \quad (3)$$

where ΔX_t and ΔY_t are the first difference of time series variable while the series is nonstationary. However, if a variable is nonstationary and cointegrated, the Granger-causality test will be run based on the following equations:

$$\Delta X_t = a_x + \sum_{i=1}^{k} \beta_{x,i} \Delta X_{t-i} + \sum_{i=1}^{k} \gamma_{x,i} \Delta Y_{t-i} + \varphi_x ECT_{x,t-i} + \varepsilon_{x,t} \,, \quad (4)$$

$$\Delta Y_t = a_y + \sum_{i=1}^{k} \beta_{y,i} \Delta Y_{t-i} + \sum_{i=1}^{k} \gamma_{y,i} \Delta X_{t-i} + \varphi_y ECT_{y,t-i} + \varepsilon_{y,t} \,, \quad (5)$$

where φ_x and φ_y are the parameters of the ECT term, measuring the error correction mechanism that drives the X_t and Y_t back to their long run equilibrium relationship.

The null hypothesis for the equations (2) and (4) is $H_0 : \sum_{i=1}^{k} \gamma_{x,i} = 0$, suggesting that the lagged terms ΔY do not belong to the regression. Conversely, the null hypothesis for the equations (3) and (5) is $H_0 : \sum_{i=1}^{k} \gamma_{y,i} = 0$, that is the lagged terms ΔX do not belong to the regression. These hypotheses are tested using *F*-test.

5.3. Innovation Accounting

Innovation accounting such as the impulse response function and the forecast error variance decomposition (FEVD) is used in analysing the interrelationships among the variables chosen in the system. The impulse response functions are responses of all variables in the model to a one unit structural shock to one variable in the model. The impulse responses are plotted on the Y-axis with the periods from the initial shock on the X-axis. Formally, each $\phi_{jk}(i)$ is interpreted as the time specific partial derivatives of the VMA(∞) function (Enders, 1995):

$$\phi_{jk}(i) = \frac{\partial X_{ji}}{\partial e_k}. \quad (6)$$

Equation (6) measures the change in the j^{th} variable in period t resulting from a unit shock to the k^{th} variable in the present period.

The FEVD measures the proportion of movement in a sequence attributed to its own shock to distinguish it from movements attributable to shocks to another variable (Enders, 1995). In the FEVD analysis, the proportion of Y variance due to Z shock can be expressed as:

$$\frac{\sigma_z^2[a_{12}(0)^2 + a_{12}(1)^2 + ... + a_{12}(m-1)^2]}{\sigma_y(m)^2}. \quad (7)$$

One can see that as *m* period increases the $\sigma_y(m)^2$ also increases. Further, this variance can be separated into two series: y_t and z_t series. Consequently, the error variance for *y* can be composed of e_{yt} and e_{zt}. If e_{yt} approaches unity it implies that y_t series is independent of z_t series. It can be said that y_t is exogenous relative to z_t. On the other hand, if e_{yt} approaches zero (indicates that e_{zt} approaches unity) the y_t is said to be endogenous with respect to the z_t (Enders, 1995).

6. Empirical Results

6.1. Unit Root Test Results

Table 2 shows the ADF and PP unit root tests results. The ADF unit root test results indicate that only the SR in level rejects the null hypothesis of nonstationary at the 5% significance level. The NZSE and other macroeconomic variables are found to be non-stationary in level but stationary in first difference, I(1).

The PP unit root tests present similar results: all macroeconomic variables and the stock index of the NZSE40 have unit roots (non-stationary) when tested in levels and have no unit root (stationary) in the first difference. These results are consistent with previous literature that found most macroeconomic variables and stock indexes are non stationary and non-mean reverting. Thus, all macroeconomic variables and stock indexes are regarded as I (1) in the subsequent tests.

Table 2

Unit Root Test Results (Macroeconomic Variables and NZSE Return)

Variables	ADF Unit Root Test		PP Unit Root Test	
	Level	First Difference	Level	First Difference
NZSE40	-1.82	-13.47**	-1.83	-13.46**
CPI	-0.97	-3.33*	-1.05	-4.00**
EX	-1.46	-12.50**	-1.51	-12.51**
GDP	-3.29	-3.71**	-2.28	-3.14*
LR	-2.58	-7.43**	-2.28	-7.49**
M1	-2.30	-7.04**	-2.52	-17.00**
ROIL	-1.46	-3.87**	-1.51	-12.91**
SR	-3.01*	-8.12**	-2.81	-8.69**

Notes: * Significance at 5% level, ** Significance at 1% level.

6.2. Johansen Multivariate Cointegration Test Results

The results of the Johansen's Trace and Max Eigenvalue tests are shown in Table 3. At the 5% significance level the Trace test suggests that the variables are cointegrated with r = 6 while the Max Eigenvalue test results suggest that the variables are cointegrated with r = 4 if model 2 or model 3 were chosen[1]. It is common for the estimated test statistics to show different results (Harries, 1995). However, in the Max Eigenvalue test, both the null and the alternative hypotheses are more specific. Therefore, the rank will be dependent on the Max Eigenvalue test results, which implies that there are at least four cointegration vectors (r = 4) in model 3.

Table 3

Johansen Cointegration Test Results

	Maximum Eigenvalue Statistics	Trace Statistics (Model 2)[1]	Maximum Eigenvalue Statistics	Trace Statistics (Model 3)[2]
R=0	74.683 (52.00)	321.736 (165.58)	74.281 (51.42)	294.003 (156.00)
R<=1	69.552 (46.45)	247.053 (131.70)	63.030 (45.28)	219.722 (124.24)
R<=2	61.971 (40.30)	177.501 (102.14)	56.142 (39.37)	156.692 (94.15)
R<=3	**52.006 (34.40)**	115.530 (76.07)	**42.008 (33.46)**	100.549 (68.52)
R<=4	27.252 (28.14)	63.523 (53.12)	24.397 (27.07)	58.541 (47.21)
R<=5	19.395 (22.00)	36.271 (34.91)	19.252 (20.97)	34.145 (29.68)
R<=6	12.505 (15.67)	16.876 (19.96)	12.276 (14.07)	14.893 (15.41)
R<=7	4.371 (9.24)	4.337 (9.24)	2.617 (3.76)	2.617 (3.76)

Note: The values in brackets show the 5% critical value due to McKinnon (1988).
[1] Model 2 (with intercept only) and [2] Model 3 (with intercept and trend).

6.3. Granger-Causality Test Results

The Granger-causality test is conducted to study the lead-lag relationships between macroeconomic variables and the NZSE40. The results are reported in Table 4. Four macroeconomic variables, namely, EX, SR, ROIL and GDP are found to be the most important variables in determining the NZSE return when they were considered in pairs with the NZSE40 using the Grange-causality test.

The results also indicate that the NZSE does not Granger cause any macroeconomic variables in New Zealand in the sample period. This suggest that the NZSE40 is not a leading indicator for any macroeconomic variables in New Zealand, which is inconsistent with empirical results in other world dominant stock markets such as the US, and Japan (Fama, 1991; Geske and Roll, 1983). A rational explanation is that the ratio of capitalization of the stock to GDP in New Zealand, compared with other international stock markets, is relatively small. Therefore, the impact of capital markets on the whole economy is also low. Other researchers found similar findings for small open markets. For example Kwon and Shin (1999) did not find the KSE stock index is a leading indicator of macroeconomic variables in Korea.

[1] When restrictions are imposed on the deterministic components of the Johansen's multivariate model, five possible models exist (Hansen and Juselius,1995). In this study, both model 2 (with intercept only) and model 3 (with intercept and trend) restrictions are analysed, since according to Hansen and Juselius (1995), the other models that are too restrictive or least restrictive are unlikely to occur in practice.

Table 4

The Granger-Causality Test Results between Variables

Variables	DNZSE40	DCPI	DEX	DGDP	DM1	DLR	DSR	DROIL
DNZSE40		-	-	-	-	-	-	-
DCPI	-		-	-	-	-	-	-
DEX	5%	-		-	-	-	-	10%
DGDP	10%	-	-		-	5%	1%	-
DM1	-	-	-	10%		-	1%	-
DLR	-	-	-	1%	5%		5%	-
DSR	5%	-	-	5%	-	10%		-
DROIL	1%	10%	-	-	-	-	-	

Note: "-" means variable in row does not Granger cause variables in column; The number indicates how large a percentage the variables in a row Granger cause the variables in the column.

6.4. Innovation Accounting Analysis

The test results of the impulse response function of macroeconomic variables on the NZSE40 are shown in Figure 1. The impact of a shock to share prices experienced a significant positive effect, which weakened at the 6 month horizon. It implies the impact of a shock to share index reduced dramatically, the NZSE40 became more efficient and is less dependent on the previous share index.

The effect of a shock to real GDP on NZSE40 was positive throughout the next 24 months time horizon. This positive impact reached a maximum in the tenth month and became quite stable after 14 months. This result implies that unlike the previous research the shock of Manufacturing Production Index on the NZSE40 index was delayed for nearly one year. The shock of Real GDP on the NZSE40 index was found to be quite direct and effective in this research.

In general, the impacts of a shock on the EX, CPI, LR and GDP on the NZSE40 in this study are consistent with other stock markets empirical results (see Ajayi and Mougoue (1996), Chen et al. (1986), Mukherjee and Naka (1995), Maysami and Koh (2000) and Kwon and Shin (1999)). In the long term the shock of an appreciation of the EX in New Zealand would attract more investors to invest in the stock market although this impact might be negative in the short term. The shocks of CPI and LR always have negative impacts on the stock index as identified in many other countries. For example, Chen et al. (1986), Mukherjee and Naka (1995) confirmed these negative relationships existed in many industrialised countries. The positive impact of a shock of GDP on the NZSE40 is consistent with the empirical results of Maysami and Koh (2000) and Kwon and Shin (1999) implying that the stock index should reflect the real situation of the economy. Fama (1990) and Geske and Roll (1983) identified this positive relationship in their findings.

The negative impact of a shock of M1 on the NZSE40 can be explained by the following factors: the money supply in New Zealand is influenced mainly by foreign investors. If the interest rate is high relative to other countries, the foreign investors are likely to leave their money in the bank rather than invest in the risky stock market. If the interest rate is low the investors might prefer to invest in other markets. Hence, the shock of M1 on the NZSE40 always results in a negative impact during this research-testing period.

The positive impact of a shock of retail oil price on the NZSE40 after eight months contradicts our hypothesis. This is doubtful, as New Zealand is a net oil import country. The shock of the retail oil price should have a negative impact on the NZSE40. The possible explanation of this positive impact, in the long term, is that New Zealand is an agriculture-based country; the NZSE40 may, therefore, be less influenced by the increase in the imported oil price.

The results of forecast error variance decomposition (FEVD) are shown in Table 5. The test results indicated that FEVD for the NZSE40 could be attributed to LR, SR and M1, after two years, which accounts for 21.1%, 18.3% and 18.1%, respectively. It is interesting to note that the

NZSE40 itself accounts for only 16.1% of its own innovation accounting after two years. If considering only one year, the NZSE40 is still the most important variable to account for its own innovation, which accounts for 27.8%. LR and GDP are the next two important variables to be considered in explaining the forecast error variance, which accounts for 25.8% and 20.4%, respectively. SR only contributes 6.5% to the forecast error variance while CPI accounts for 7.41% of the forecast error variance. This implies that after one year the NZSE40 is determined more by GDP and LR, while at the end of two years, SR replaced GDP as the dominant factor to determine the NZSE40. However, FEVD results indicated that there is little evidence to show that the variance in share price can be accounted for by innovations in the exchange rate over the 24 months.

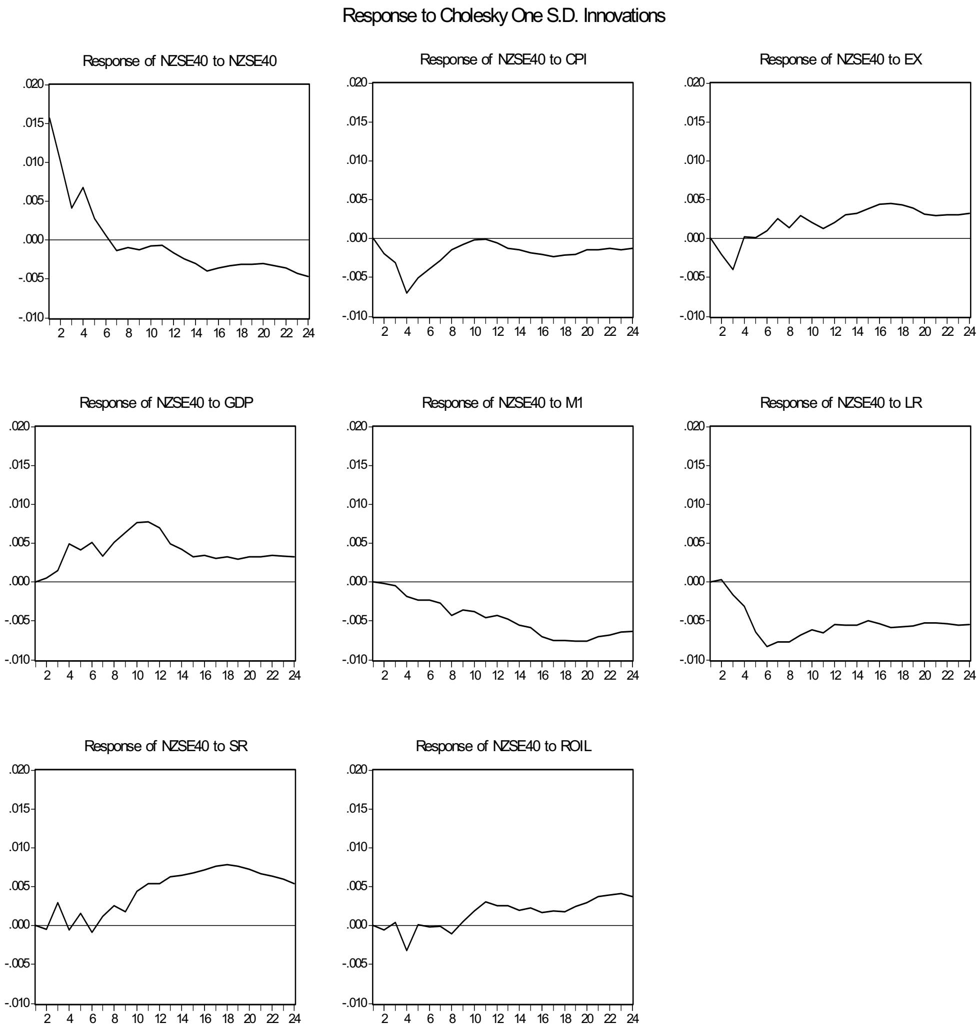

Fig. 1. Impulse Response Function of NZSE40 to Shocks in System Macroeconomic Variables

Table 5

Forecast Error Variance Decomposition of NZSE40

	SE	NZSE40	CPI	EX	GDP	M1	LR	SR	ROIL
(NZSE40)									
1 month	0.016	100.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	0.028	54.310	13.346	2.733	8.999	1.870	15.745	1.577	1.420
12	0.039	27.824	7.415	3.151	20.401	6.927	25.779	6.470	2.034
18	0.051	19.285	5.299	5.563	15.563	13.898	22.663	15.532	2.197
24	0.060	16.066	4.165	5.71	12.871	18.089	21.098	18.313	3.685

7. Conclusions

This study examines the relationships between the NZSE Index and a set of macroeconomic variables during the period of January 1990 to January 2003. The time series data set employed in this study comprises the monthly observations of the New Zealand Stock Index (NZSE40), the inflation rate (CPI), long term interest rate (LR), short term interest rate (SR), the real trade weighted exchange rate index (EX), real gross domestic product (GDP), narrowly defined money supply (M1) and domestic retail oil prices (ROIL).

Using the Johansen multivariate cointegration tests, this study examines whether the New Zealand Stock Index is cointegrated with a group of macroeconomic variables in the long run. This study also examines whether the New Zealand Stock Index is a leading indicator for economic variables by employing Granger-causality tests. In addition, using impulse response function and FEVD analysis, this study also investigates the short run dynamic linkages between NZSE40 and macroeconomic variables. The impulse response function in Figure 1 shows that the shock of CPI has a negative impact on the NZSE40 throughout the testing period and this negative impact reached a maximum in the fourth month. These test results are similar to Chen et al. (1986) findings.

The Johansen cointegration test indicates that there exists a long run relationship between NZSE40 and the macroeconomic variables tested. The Granger-causality test result shows that the NZSE40 is not a leading indicator in New Zealand, possibly because the New Zealand stock market is relatively small as compared to the stock markets of other developed economics. Finally, using innovation accounting, the IRF results indicate that the impact of a shock to EX, CPI, LR and GDP on the NZSE40 in this research was consistent with other stock markets empirical results. The FEVD test results indicate that the NZSE40 could be explained by LR, SR, M1 and GDP.

In general, the NZSE40 is consistently determined by the interest rate, money supply and real GDP during 1990-2003. Our results suggest that investment perception of New Zealand is a mixture of other mature stock markets, as was found in Korea, the US and Japan. Thus, investors who are interested in investing in New Zealand should pay more attention to the above mentioned macroeconomic variables rather than the exchange rate and inflation rate index (CPI).

Since the New Zealand stock market is comparatively small relative to the stock market of other developed countries, the New Zealand stock market might also be very sensitive to global macroeconomic factors or the macroeconomic factors of its major trading partner. Thus, future studies can extend this study to include those factors.

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