

The Effects of Investor Sentiment and the Conditional Volatility in New Zealand Stock Market

Nonthipoth Buranavityawut

Unitec Institute of Technology

Abstract

Using New Zealand market data, this paper provides additional evidence to support recent studies that investor sentiment moves stock prices and, in turn, influences expected returns. It also adds to a number of previous studies that investor sentiment influences the market volatility, and hence the mean-variance relation. The findings in this study help confirm that investor sentiment is time-varying.

1. Introduction

The standard finance model states that asset prices reflect fundamental values, which is the discounted sum of expected future cash flows. The model assumes that investors are rational and there are no market frictions. Hence, any mispricing in the market would be arbitrated away and the market will return to its equilibrium prices. The standard model, however, has been facing difficulty in explaining the deviations from fundamental value in practice. Researchers in behavioral finance have therefore been working to augment the standard model with an alternative model built on two basic assumptions. The first assumption, as pointed out in DeLong, Shleifer, Summers, and Waldmann (1990), is that there are irrational investors, or noise traders, who are subject to sentiment. The second assumption, emphasised by Shleifer and Vishny (1997), is based on the notion that betting against sentimental investors is costly and risky. As a result, rational investors or arbitrageurs are not as aggressive in forcing prices to fundamentals as those in the standard model. This problem is known as “limits to arbitrage”.

Many recent studies find evidence to support the hypothesis that sentiment moves stock prices and, in turn, influences expected returns. For example, Simon and Wiggins (1999), Brown and Cliff (2004), Kaniel, Saar, and Titman (2006) find that investor sentiment predicts market returns in the short run, while Brown and Cliff (2005), Yuan (2005) find the same evidence in the long run. Baker and Wurgler (2006) construct an investor sentiment index and find that the cross-section of expected stock returns displays opposite patterns in low- and high-sentiment periods.

A number of studies also find that investor sentiment influences the market volatility, and hence the mean-variance relation. For example, Yu and Yuan (2010) find that there is a strong positive tradeoff when sentiment is low, but small relation when sentiment is high. These results are consistent with greater participation of sentiment-driven traders in the market when sentiment is high, thereby perturbing prices away from levels that would otherwise reflect a positive mean-variance tradeoff. Karlsson, Loewenstein, and Seppi (2005) find consistent evidence that sentiment-driven investors participate and trade more aggressively in high-sentiment periods. Uygur and Tas (2012) find an asymmetric effect of investor sentiment on market return

volatility. Also, an increase in investor sentiment increases the volatility when investor sentiment is high, where else it decreases the volatility in low sentiment periods.

The existing studies provide a basis for taking into account investor sentiment into standard asset pricing model. It should, however, be noted that none of those studies have examined the risk-return tradeoff using New Zealand market data. This paper, therefore, takes this opportunity.

2. Literature Review

2.1. Theoretical Effects of Investor Sentiment on Asset Price Behaviour

Early researches on the stock return predictability did not explicitly consider the role of sentiment in their studies. They were largely atheoretical, testing in various ways whether the stock market as a whole could be mispriced. For example, Fama and French (1988) and Poterba and Summers (1988) examine the tendency of aggregate returns to mean revert. Shiller (1981) found that there was the volatility in aggregate stock index returns that could not be justified by volatility in fundamentals. Campbell and Shiller (1988) and Fama and French (1989) test the predictability of aggregate returns using simple valuation ratios like the ratio of aggregate dividends to stock market value. However, these studies found that the statistical evidence was not usually very strong. Even when statistical inferences seemed robust, the economic interpretation was still unclear.

More recent studies, for example, DeLong, Shleifer, Summers, and Waldmann (1990) develops a model that includes two types of investors, which are rational arbitrageurs who are sentiment-free and irrational, or noise, traders who are prone to exogenous sentiment. They find that the unpredictability of noise traders' future opinions can diverge asset prices significantly from fundamental values even when there is no fundamental risk. Moreover, arbitrage does not eliminate the effect of noise because noise itself creates risk. Because noise trader risk limits the effectiveness of arbitrage, prices can be excessively volatile. Baker and Wurgler (2006), utilize interim advances

in behavioral finance theory to provide sharper tests for the effects of sentiment. They construct an investor sentiment index and find that the cross-section of expected stock returns displays opposite patterns in low- and high-sentiment periods.

2.2. Measuring Investor Sentiment

Investor sentiment is not straightforward to measure and, as a result, different studies have used different proxies for sentiment. Baker and Wurgler (2006) discuss some generic issues involved in measuring sentiment and describe proxies for sentiment that have come into use. These include surveys; mood proxies; retail investor trades; mutual fund flows; trading volume; premia on dividend-paying stocks; closed-end fund discounts; option implied volatility; first- day returns on initial public offerings (IPOs); volume of initial public offerings; new equity issues; and insider trading.

Since there are numerous measures, it may be concluded that there is no consensus about which sentiment measure is more accurate and efficient. This paper uses trading volume as a proxy for investor sentiment. This is because trading volume is observable in the market and is publicly available. Trading volume, or more generally liquidity, can be viewed as an investor sentiment index. A number of studies provide justification for why trading volume could be used as a measure for investor sentiment. For instance, Baker and Stein (2004) note that if short-selling is costlier than opening and closing long positions (as it is, in practice), irrational investors are more likely to trade, and thus add liquidity (volume), when they are optimistic and betting on rising stocks rather than when they are pessimistic and betting on falling stocks. In Scheinkman and Xiong (2003), volume reveals underlying differences of opinion, which are in turn related to valuation levels when short selling is difficult. Market turnover, the ratio of trading volume to the number of shares listed on the New York Stock Exchange, is a simple proxy for this concept.

3. Data and Methodology

The data used in this study are the weekly NZX 50 Index and the trading volume of such index. The data was obtained from Yahoo! Business & Finance New Zealand

(<http://nz.finance.yahoo.com/>). The period of study starts from the 1st November 2004 and ends at 29th October 2012. Unfortunately, the data series must end in October 2012 because after this time the trading volume data is not available for some weeks.

In this study, the autoregressive moving average (ARMA) type model and the generalized autoregressive conditional heteroscedasticity (GARCH) type model will be used. The use of GARCH-in-mean model to test for the effects of sentiment on returns and volatility was done before in Lee, Jiang and Indro (2002). They find that changes in the sentiment are negatively correlated with the market conditional volatility which means volatility goes up (goes down) if investors become more bearish (bullish). The application of EGARCH model to test for the asymmetric effects of sentiment was done before by Verma and Verma (2006). They find that there is greater effect of bullish than bearish investor sentiments on the volatility of stocks.

To be more specific, in this study, the mean equation for the market return is expressed in the form of ARMA(1,1) model as follows:

$$y_t = \theta_0 + \theta_1 h_t + \theta_2 y_{t-1} + \theta_3 \mu_{t-1} + \theta_4 \Delta SI_t + \mu_t \quad (1)$$

In Equation (1), h_t is the conditional variance of the market index entered the model to capture the risk/return tradeoff as suggested by Engle, Lilien, Robins, (1987). The first order autoregressive term, AR(1), and the first order moving average term, MA(1), are represented by y_{t-1} and μ_{t-1} , respectively. The variable ΔSI_t is the weekly percentage change in the trading volume of the market index, which is used as a proxy for sentiment. The residual term is represented by μ_t .

The conditional variance equation is expressed in the form of EGARCH(1,1) process as follows:

$$\log(h_t) = \gamma_0 + \gamma_1 \frac{|u_{t-1}|}{\sqrt{h_{t-1}}} + \gamma_2 \log(h_{t-1}) + \gamma_3 \frac{u_{t-1}}{\sqrt{h_{t-1}}} + \gamma_4 |\Delta SI_t| D_t + \gamma_5 |\Delta SI_t| (1 - D_t) \quad (2)$$

The first three terms on the right-hand side of Equation (2) are those variables specified in an EGARCH(1,1) model of Nelson (1991). The γ_1 coefficient captures an ARCH(q) effect while the γ_2 coefficient captures a GARCH(p) effect. The fourth term is included in the model to capture the asymmetrical variance behaviour of the equity returns. Specifically, with this parameterisation, a negative value of γ_3 means that negative residuals tend to produce higher variances in the immediate future. In order to capture the effect of investor sentiment in the conditional variance model, dummy variables are used. The ΔSI_t variable is similar to the one used in Equation (1), but expressed in absolute value in the conditional variance model. Note that D_t represents the dummy variable. It is equal to 1 in the high sentiment periods ($\Delta SI_t > 0$) and equal to 0 in the low sentiment periods ($\Delta SI_t < 0$).

In summary, it can be said that Equation (1) and (2) above represent the ARMAX(1,1)-EGARCH(1,1)-X-M with asymmetry model of market returns with investor sentiment. Note that the GARCH model in this study is estimated using maximum likelihood method with BFGS algorithm. See Enders (2010), for more detailed information regarding the estimation techniques.

4. Results

The results obtained from the estimation are presented in Appendix's Table 1. From the table, all coefficients are statistically significant at 1%. The only exception is the constant in the EGARCH model. However, this is not the coefficient of interest. Coefficient θ_1 is negative indicating that the higher return volatility produces negative impact on market returns. The effect of higher sentiment on returns can be seen from θ_4 coefficient. It is positive, which indicates that as investor sentiment (or the

participation of noise traders) increase, the returns go up. However, the magnitude of the coefficient is very small, 0.0076.

The γ_2 parameter measures the persistence in the conditional variance. It can be seen that $\gamma_2 = 0.8324$ is considered highly persistence. This means that the market volatility takes long time to die out following a shock or crisis in the market. The effect of asymmetric volatility in the conditional variance model is captured by coefficient γ_3 . The results shows that it is negative indicating that negative shocks have a larger impact on the conditional variance of returns than positive shocks do. The effects of investor sentiment during the times of high and low sentiment can be measured using coefficients γ_4 and γ_5 , respectively. From the results, γ_4 is positive and γ_5 is negative implying that a rise in investor sentiment increases the volatility in high sentiment periods whereas it lowers the volatility in low sentiment periods. This is consistent with the findings in other studies that noise trader risk causes prices to be excessively volatile.

5. Conclusion

Using weekly NZX 50 Index and its trading volume data, this study finds significant evidence of negative volatility feedback in New Zealand stock market during the period of 15th November 2004 to 29th October 2012. This indicates that higher market volatility produces negative impact on market returns. There is significant evidence that higher investor sentiment has a positive effect on returns. During high sentiment periods when noise traders participate more, the returns increase. However, the magnitude is very small.

The asymmetric volatility is found in the market. This means that negative shocks cause more volatility than positive shocks do. The market exhibits high volatility persistence. The evidence of asymmetric effect of investor sentiment on the volatility is found. This indicates that an increase (decrease) in the investor sentiment also increases (decreases) the market volatility.

The findings in this study can be considered as additional evidence to support the existing evidence that investor sentiment is time-varying and it affects the aggregate stock return. The implications that can be drawn from this study is that the standard methodology for estimating fundamental market betas (an input to long-term capital budgeting and other important financial decisions) does not account for sentiment. Doing so might improve estimates and clarify their interpretation. Also, sentiment affects the cost of capital. Therefore it may have real consequences for the allocation of corporate investment capital between safer and more speculative firms.

References

- Baker, Malcolm, and Jeffrey Wurgler. 2006, “Investor Sentiment and the Cross-Section of Stock Returns,” *Journal of Finance*, 61(4): 1645– 80.
- Brown, Gregory W., and Michael T. Cliff, 2004, Investor sentiment and the near-term stock market, *Journal of Empirical Finance*, 11, 1-27.
- Brown, Gregory W., and Michael T. Cliff, 2005, Investor sentiment and asset valuation, *Journal of Business*, 78, 405-440.
- Campbell, John Y., and Robert J. Shiller. 1988. “The Dividend–Price Ratio and Expectations of Future Dividends and Discount Factors.” *Review of Financial Studies*, 1(3): 195–228.
- DeLong, J. Bradford, Andrei Shleifer, Lawrence H. Summers, and Robert J. Waldmann. 1990. “Noise Trader Risk in Financial Markets.” *Journal of Political Economy*, 98(4): 703–38.
- Engle, R., D.M. Lilien, and R.P. Robins (1987). “Estimating Time Varying Risk Premia in the Term Structure: The ARCH-M Model.” *Econometrica*, Vol. 55, pp. 391-407.
- Fama, Eugene F., and Kenneth R. French. 1988. “Permanent and Temporary Components of Stock Prices.” *Journal of Political Economy*, 96(2): 246 –73.
- Fama, Eugene F., and Kenneth R. French. 1989. “Business Conditions and Expected Returns on Stocks and Bonds.” *Journal of Financial Economics*, 25(1): 23– 49.
- Kaniel, Ron, Gideon Saar, and Sheridan Titman, 2006, Individual investor trading and stock returns, working paper, Duke University.
- Lee , W.Y., C.X. Jiang and D.C. Indro, Stock market volatility, excess returns, and the role of investor sentiment, *Journal of Banking and Finance*, 26, (2002), 2277-

2299.

Nelson, D.B. (1991) "Conditional Heteroskedasticity in Asset Returns: A New Approach." *Econometrica*, Vol. 59, pp. 347-370.

Poterba, James M., and Lawrence H. Summers. 1988. "Mean Reversion in Stock Prices: Evidence and Implications." *Journal of Financial Economics*, 22(1): 27-59.

Shiller, Robert J. 1981. "Do Stock Prices Move Too Much to be Justified by Subsequent Changes in Dividends?" *American Economic Review*, 71(3): 421-36.

Shleifer, Andrei, and Robert Vishny. 1997. "The Limits of Arbitrage." *Journal of Finance*, 52(1): 35-55.

Uygur, U. and O. Tas (2012) Modeling the effects of investor sentiment and conditional volatility in international stock markets, *Journal of Applied Finance and Banking*, 2(5): 239-260

R. Verma and P. Verma, Noise trading and stock market volatility, *Journal Of Multinational Financial Management*, 17, (December, 2006), 231-243.

Yuan, Y., 2005, Investor sentiment predicts stock returns, working paper, University of Iowa.

J. Yu and Y. Yuan, Investor sentiment and the mean-variance relation, *Journal of Financial Economics*, 100(2), (January, 2010), 367-381.

Appendix

Figure 1

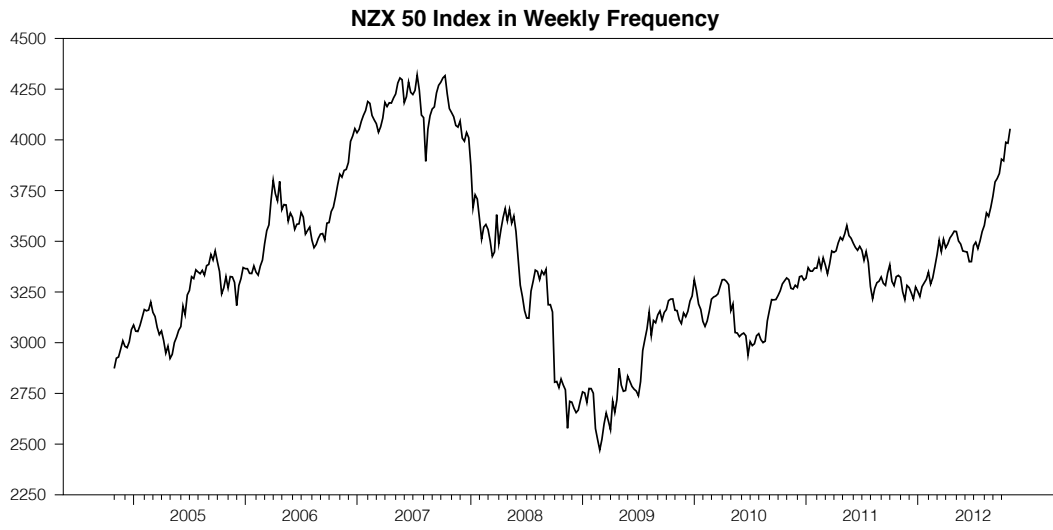


Figure 2

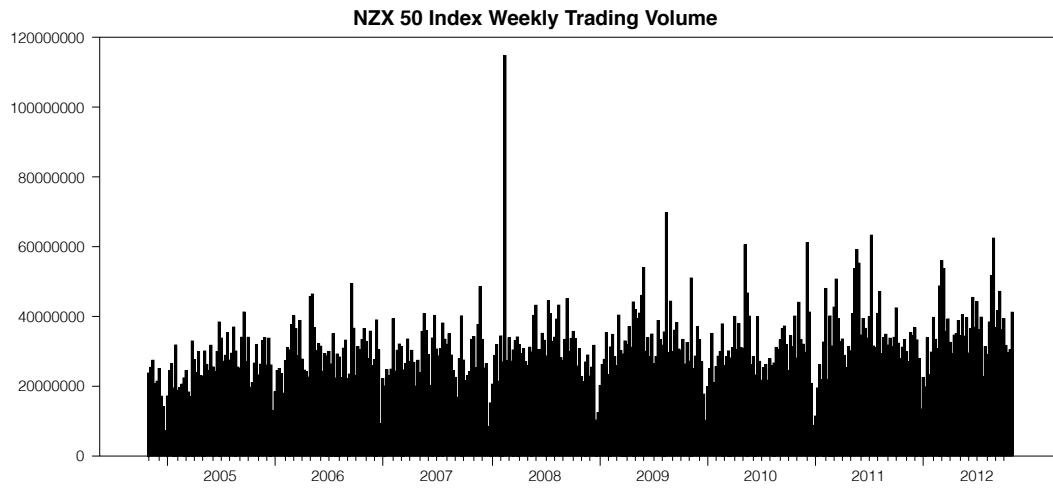


Figure 3

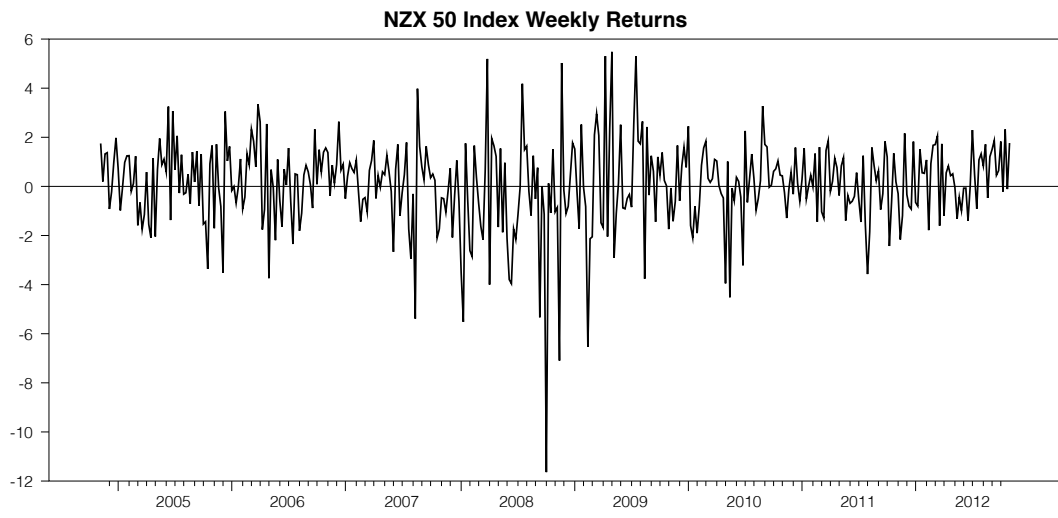


Figure 4

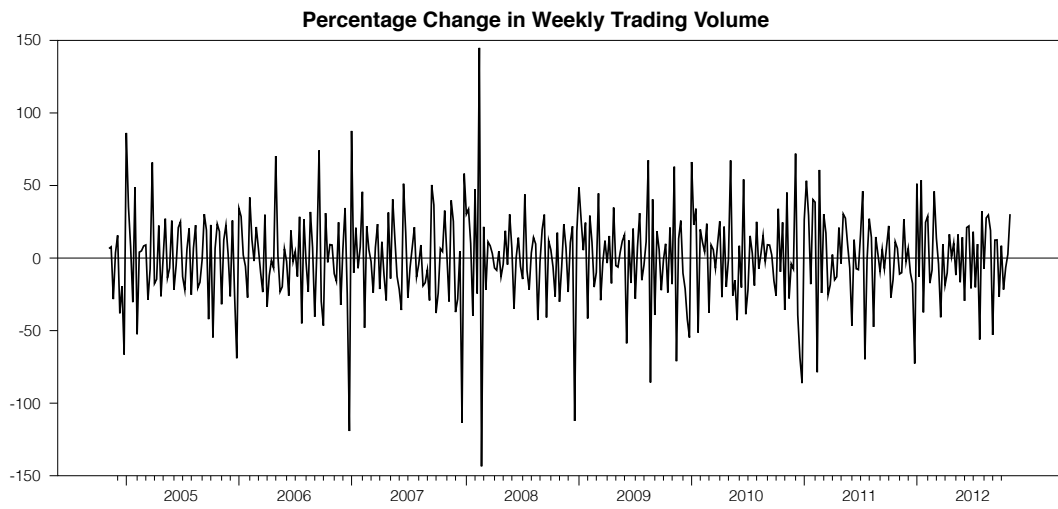


Table 1
ARMAX(1,1)-EGARCH(1,1)-X-M with Asymmetry Model
of Market Returns with Investor Sentiment

	Coefficient	T-Statistics
θ_0	1.0790	6.1575***
θ_1	-0.9935	-6.8933***
θ_2	-0.8178	-26.9329***
θ_3	0.7662	165.6935***
θ_4	0.0076	52.0504***
γ_0	-0.1004	-1.1032
γ_1	0.3989	4.0953***
γ_2	0.8324	14.8583***
γ_3	-0.2253	-4.3780***
γ_4	0.0081	3.2551***
γ_5	-0.0127	-5.1388***

Notes: The table presents the estimated coefficients and their corresponding t-statistics obtained from the ARMAX(1,1)-EGARCH(1,1)-X-M with asymmetry model of market returns with investor sentiment. The asterisks *** indicates that the coefficient is statistically significant at 1%. The data is in weekly frequency and the estimation period is from 15th November 2004 to 29th October 2012. There are 416 numbers of observations.

Figure 5

