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Detecting Positive Feedback Trading when Autocorrelation is Positive

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Abstract: The temporary convergence of beliefs and actions is a possibility. Positive feedback trading as a stock exchange trading strategy is commonly used as one of the oldest theories about financial markets. Sentana-Wadhwani model was used to test Positive feedback trading. Even though the model supposes that low volatility is associated with positive autocorrelation and high volatility is associated with negative autocorrelation, empirical research for small and young emerging stock exchange shows that high volatility is followed by positive autocorrelation and positive feedback strategy. Accordingly this is evidence in favour of behavioral over traditional finance. Investors prefer to follow positive feedback strategy, ignoring fundamental values.

Keywords: Positive feedback trading; Behavioral finance; GARCH; EGARCH; GJR GARCH;

JEL Classification: G10; C5

Introduction

Most of the early statistical research of the stock market was concentrated around the same question: are security prices serially correlated or they follow a random walk? Are prices on any given day as likely to go up as they are to go down? The introduction of the term "efficient market" is usually attributed to Eugene Fama. In his paper, "Random Walks in Stock Market Prices," published in the Financial Analysts Journal (1965), he concluded that daily changes had a very small positive correlation, approaching zero for practical purposes. The stock market seemed to work in a way that allowed all information reflected in past prices to be incorporated into the current price. According the efficient market hypothesis, prices contain all relevant information (Eugene Fama, 1965). But stock exchange traders are still seeking infor-

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mation in the past prices or they are following positive feedback strategy. Together with rational expectations models, another major approach to explain stock market aggregate return behavior has been developing. It is so-called behavioral approach. It tries to widen the range of analytic tools with which to approach the processes of decision making. This approach has partially adopted psychological methodology in studying mentioned problems, and it came up with interesting alternatives to conventional economic theories. Cognitive psychology allowed an improved understanding of some investing behaviors that classic economy describes as specific deflections from rationality, but that are actually induced by systematic cognitive processes. So investors are not rational and they are looking at the past prices as easiest way to make decision or they are following positive feedback strategy. Are the reasons to buy stocks in the bull market and to sell in the bear market, fundamentally based or behavioral finance will disclose the reasons?

Empirical evidence on the behavior of investors in developed markets and those in developing countries though showing some similarities in developing countries has a more pronounced positive and negative feedback strategies and group behavior, compared to markets in developed countries (Bohl and Siklos 2004) . This is because non fundamental trading strategies seem to have a more prominent role in the capital markets in developing countries than in developed countries. There is a widely accepted belief among some investors who are looking for trends in price movements that these trends will be repeated and their decisions are made based on those expectations. Consequently, if there are many such feedback traders in the market, it will reflect autocorrelation. Positive feedback trading relates to the practice of following past price patterns (De Long, Shleifer, Summers and Waldman, 1990). A positive feedback trader, trades towards the direction suggested by historical prices and this behavioral pattern bear interesting implications for market prices, as they may well lead to trend-chasing phenomena (Bikhchandani and Sharma, 2001) with the potential for mispricing and excess volatility (Koutmos and Saidi, 2001).

Assuming that some investors follow a positive feedback trading strategy, Sentana and Wadhwani (1992) investigate the presence of positive feedback trading in the US stock market, using daily data on stock market indexes from 1885 to 1988. Their results indicate that positive feedback trading strategies induce negative autocorrelation in stock returns during periods of high fluctuations of security prices. Borrowing the concepts of relationship between volatility and autocorrelation in stock returns by LeBaron (1992), Campbell et al. (1993), and Sentana and Wadhwani (1992), this paper investigates the linkages of the two in the Macedonian stock market as an example for very young and emerging country. Even though the model predicts that the interaction between intelligent and positive feedback traders can produce negative autocorrelation in periods of high volatility, we found positive autocorrelation in the periods of high volatility and positive feedback trading.

Literature review

One of the oldest theories about financial markets, expressed long ago in newspapers and magazines rather than scholarly journals, if translated into academic words, is a price-to-price feedback theory. When speculative prices go up, creating successes for some investors, this may attract public attention, promote word-of-mouth enthusiasm, and heighten expectations for further price increases. The talk attracts attention to "new era" theories and "popular models" that justify the price increases. This process in turn increases investor demand and thus generates another round of price increases. If the feedback is not interrupted, it may produce after many rounds a speculative "bubble," in which high expectations for further price increases support very high current prices. The high prices are ultimately not sustainable, since they are high only because of expectations of further price increases, and so the bubble eventually bursts, and prices come falling down. The feedback that propelled the bubble carries the seeds of its own destruction, and so the end of the bubble may be unrelated to news stories about fundamentals. The same feedback may also produce a negative bubble, downward price movements propelling further downward price movements, promoting word of- mouth pessimism, until the market reaches an unsustainably low level (Charles MacKay1841). A substantial body of research documents the volatility behavior in the finance assets, for use in various important financial issues.

There is extensive literature devoted to determining patterns of stock prices, based on the assumption of the existence of a heterogeneous group of market participants: rational or smart money traders and feedback traders (Shiller 1984). However, the most prominent work on the development of the feedback trading model in the CAPM model is written by Sentana and Wadhwani (1992). The authors provide evidence for the presence of positive feedback traders in the U.S. market even during the nineteenth century and had used exponential GARCH model for measurement of volatility. Positive feedback trading relates to the practice of following past price patterns (De Long, Shleifer, Summers and Waldman, 1990). This model is applied to different markets, both in developed and in developing countries by Koutmos(1997) and Bohl and Reitz (2002) and was confirmed that positive feedback trading causes negative autocorrelation. Venetis and Peel (2005) appears that volatility in stock markets is inversely related to first order autocorrelation.

The Model

"Follow the trend. The trend is your friend " is an old saying on Wall Street.

In its simplest form, tracking the trend is buying shares when they rise and selling them when they fall. Feedback trading is trading based on historical prices and may be:

• Positive feedback trading "buy when prices rise; sell when prices fall."
• Negative feedback trading: "Sell when prices rise; buy when prices fall."

However, positive feedback trading relates to trading on the basis of historical prices and involves buying stocks when the market is improving and selling stocks when the market is declining. Those followers of this strategy are regarded as positive feedback traders.

The model assumes the existence of two types of investors, namely, "rational", which maximize their expected utility or the so called "smart money" investors and "feedback" traders or trend followers, ones who did not trade on the basis of expectations for the fundamental value, but on the basis of lagged past returns (one period back).

Although simple, this model can give conclusions:
• The presence of feedback trading market;
• The relative influence of two groups of traders in the market;
• The speed of price adjustment;
• The impact of the previous schedule of expected volatility trading;
• Are the markets persistent to shocks?

The model also provides arguments for the main role of volatility and autocorrelation. Relative demand for shares of feedback traders, Ft, is:

$$F_t = \gamma R_{t-1} \tag{1}$$

Where R_{t-1} is the return of the previous period *(t-1)*. The parameter γ is the feedback coefficient and gives the possibility to differentiate between types of feedback traders, when $\gamma > 0$ implies the presence of positive feedback trading, while a negative value $\gamma < 0$ implies the presence of negative feedback trading (also known as "contrarian"). Proportionate demand for stocks of rational "smart money" traders, St, is determined by the mean-variance equation:

$$S_t = (E_{t-1}(R_t) - \alpha) / \mu_t \tag{2}$$

Where $E_{t-1}(R_t)$ denotes the expected value of returns in period t, that rational investors do in period t-1. α is risk-free return, or return at which the demand for shares of this type of investors is zero. The difference $(E_{t-1}(R_t)-\alpha)$ is the expected excess return. μt is defined as the risk premium required by rational investors to hold this type of actions. The measure of risk is modeled as a positive function of the conditional variance:

$$\mu_t = \mu(\sigma_t^2) \tag{3}$$

Where σ_t^2 is the conditional variance of returns in period t (expected at time t-1). Smart money investors are assumed to be risk averse ($\mu_t = \mu(\sigma_t^2) \rangle 0$). This would

mean higher expected volatility will encourage the smart traders to hold less stock. Or, in other words, the expected increase in volatility increases the risk premium required for smart traders if St not changed or remained constant. If all investors are rational market equilibrium is St = 1 and would lead to the CAPM:

$$E_{t-1}(R_t) - \alpha = \mu(\sigma_t^2) \tag{4}$$

Because of the existence of two types of investors the equilibrium capital market requires as a condition for all actions to be valid:

$$S_t + F_t = 1$$

or by replacing (1) and (2) the equation is:

$$\frac{(E_{t-1}(R_t) - \alpha)}{\mu_t} + \gamma R_{t-1} = 1 \tag{5}$$

Allowing the presence of both types of investors in the market, we get the equation:

$$\mathrm{E}_{t-1}(R_t) - \alpha = \mu(\sigma_t^2) - \gamma\mu(\sigma_t^2)R_{t-1}. \tag{6}$$

Comparing the equation (6) with the CAPM model equation (4), we see the additional term $(-\gamma\mu(\sigma_t^2)R_{t-1})$, which shows that stock returns show autocorrelation in the presence of feedback traders in the market. Assuming rational expectations: $R_t = E_{t-1}(R_t) + \varepsilon_t$ after rearranging of equation (6) the equation is:

$$R_t = \alpha + \mu(\sigma_t^2) - \gamma\mu(\sigma_t^2)R_{t-1} + \varepsilon_t \tag{7}$$

The function of returns in equation (7) contains additional article, indicating that returns show the first order autocorrelation or it shows the capital market with feedback traders.

Furthermore, the degree to which stock return shows autocorrelation depends on volatility σ_t^2. Relying on the linear form in equation (7) it can be reformulated as:

$$R_t = \alpha + \mu(\sigma_t^2) - (\gamma_0 + \gamma_1\sigma_t^2)R_{t-1} + \varepsilon_t \tag{8}$$

Following the Sentana-Wadhwani model, negative feedback trading dominates when volatility is low and positive is dominated by high levels of volatility. The direct impact of feedback traders is given by the sign γo. With the growing risk level σ_t^2, the impact of positive feedback traders γ_1 grow and may indicate a negative autocorrelation due to the dominance of positive feedback trading. Thus, the model predicts

that the interaction between intelligent and positive feedback traders can produce negative autocorrelation in periods of high volatility. The coefficient μ is a measure of the impact of rational investors in stock prices.

In order to test for positive feedback trading on these premises, we have to specify the measurement equation for the conditional variance. Conditional variance (σ_t^2) is modeled using three different specifications:

1. GARCH (1,1) process (Bollerslev, 1986):

$$\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2 \tag{9}$$

2. EGARCH process (Nelson, 1991, Brooks, 2002):

$$\ln(\sigma_t^2) = \omega + \beta * \ln(\sigma_{t-1}^2) + \alpha * (u_{t-1} / \sqrt{(\sigma_{t-1}^2)} + \delta * \left[(|u_{t-1}| / \sqrt{(\sigma_{t-1}^2)}) - \sqrt{(2/\pi)} \right] \tag{10}$$

3. Asymmetric GARCH (1,1) model developed by Glosten, Jagannathan and Runkle (1993):

$$\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2 + \delta S_{t-1}\varepsilon_{t-1}^2 \tag{11}$$

where δ shows asymmetric responses of volatility during positive versus negative innovations. S_{t-1} is a binary variable equal to one when innovation is negative and zero otherwise:

$$S_{t-1} = \begin{cases} 1, if S_{t=1} < 0 \\ 0, if S_{t-1} \geq 0 \end{cases}$$

If δ is positive and statistically significant then negative innovations increase volatility more that positive innovations. Condition for non-negativity is given by: $\omega \geq 0$, $\alpha \geq 0$, $\beta \geq 0$ and $\beta + \delta \geq 0$.

Empirical Results

This paper uses the daily data for Macedonian stock market using the MBI10 Weighted Stock Index. The empirical period is from 4 January, 2005 to 16 September, 2009. Macedonian Stock Exchange as small and developing market, during the period 2005 – 2009, witnessed its first bull and bear market in its short history. Descriptive statistics shows high volatility provided by positive first order autocorrelation (Table 1).

Table 1. Descriptive Statistics and First order Autocorrelation

Mean	0.097998	Skewnwss	-0.123585
Max	8.089667	Kurtosis	7.365.663
Min	-9.044.581	Jarque-Bera	8.914.750
Standard Deviation	1.812115	Probability	0.000000
Observation: 1119		First order AC	0.518

Table 2 presents the results from the Sentana and Wadhwani (1992) model tests using the three variance-specifications mentioned above.

Table 2: Positive feedback trading tests (Sentana and Wadhwani (1992))

	GARCH	EGARCH	GJRGARCH
Mean equation			
α	0,05	0,01	0,03
	(1,19)	(0,36)	(0,76)
μ	0,009	0,01	0,004
	(0,91)	(0,81)	(0,42)
γ_0	-0,55***	-0,57***	-0,56***
	(-14,73)	(-13,67)	(-14,14)
γ_1	0,006**	0,01**	0,008***
	(-1,99)	(-1,77)	(2,1)
Variance equation			
ω	0,08***	-0,3***	0,09***
	(6,99)	(-12,13)	(6,8)
α	0,26***	-0,04***	0,22***
	(9,71)	(-2,49)	(8,01)
β	0,74***	0,93***	0,73***
	(41,04)	(109,25)	(37,6)
δ		0,46***	0,08***
		(-12,35)	-2,02
AIC	3,34	3,34	3,34
SIC	3,37	3,37	3,37
log L	-1860,2	-1859,400	-1858,100

Note: Equations (8) and (9), (10) and (11) are jointly estimated via maximum likelihood

(= 10% sign. Level, ** = 5% sign. Level, *** = 1% sign. Level). Parentheses include the standard errors of the estimates; sample period: 4/1/2005-16/09/2009.*

Coefficients that describe the conditional variance are statistically significant at the significance level of 1%. Parameters α and μ are statistically insignificant. β is typically high and shows persistence of volatility. This is further confirmed by the coefficient of the Asymmetric GARCH (1,1) which is significantly positive. In accordance with the theoretical model, the parameter γ_o is significantly negative and coefficient γ_1 is significantly positive. The feedback coefficient is indicative of statistically significant positive feedback trading for all three variance-specifications. This means that the positive feedback traders in the short term move stock prices from their fundamental values.

Conclusion

Using an explicit measure of conditional variance, our results under GARCH, EGARCH and GJRGARCH methodologies support the hypothesis about presence of positive feedback trading towards the MBI 10 index.

The difference of the relationships under negative and positive autocorrelation of stock returns as a research field has not yet been much explored. Even though the model supposes that low volatility is associated with positive autocorrelation and high volatility is associated with negative autocorrelation, empirical research for small and young emerging stock exchange shows that high volatility is followed by positive autocorrelation and positive feedback strategy. Intuitively it seems that, if all investors followed positive feedback trading strategies, returns would exhibit positive autocorrelation.

In line with the theoretical model of Shiller, Sentana and Wadhwani, the impact of positive feedback trading is to produce negative first order autocorrelation in stock returns during periods of high volatility. Therefore, feedback trading is the important factor to short term price trend which can destabilize the stock markets by moving prices away from their fundamental values. We contend that the comparative study of the topic across more stock markets would allow us extra insight into the common ground in the relationship between these two behavioral pattern.

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