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# The effect of investor sentiment on futures market returns and volatility

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# THE EFFECT OF INVESTOR SENTIMENT ON FUTURES MARKET RETURNS AND VOLATILITY

A Dissertation

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ABSTRACT

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For over thirty years research has been done on investor sentiment and their effects on market returns and volatility. The theory of De Long et al., (1990) has been used to explain the effect of uninformed investor sentiment (also known as noise trader sentiment) on market returns and volatility. Studies of Wang (2003) and Sanders et al. (2003, 2009) in the futures market have found that uninformed investor sentiment does not affect future market returns, which is contrary to De Long et al. (1990). Also previous studies of investor sentiment in the futures market do not seem to investigate the effects of investor sentiment on volatility nor the asymmetric effects of investor sentiment on futures market returns and volatility. Most theories of investor sentiment on have implied that it is the irrational component of investor sentiment that causes the effects attributed to uninformed investor sentiment, however it seem that this has not been studied in the futures market.

This dissertation has examined the following three areas. First, using survey data from futures market uninformed and institutional investors as a proxy for investor sentiment are used to examine the effects of investor sentiment on market returns and volatility in the futures market. Second, investor sentiment is examined whether it imparts symmetric or asymmetric effects on futures market returns and volatility. Third, the effects of rational and irrational

investor sentiment on futures market returns and the causal relationship between rational and irrational sentiment are examined to determine their effects on returns, volatility and the causal nature of those effects.

This dissertation finds that the theories of De Long et al. (1990) and Brown and Cliff (2005) hold in the futures market contrary to previous studies. That institutional and uninformed investor sentiment affects future market returns and volatility. Results show there are no asymmetric effects of investor sentiment on futures market returns and volatility contrary to theories of Daniel et al. (1998), Hong et al., (2000), and Gervais and Odean (2001). Also, contrary to results implied by theory in the futures market rational and irrational investor sentiment both affect volatility negatively.

# DEDICATION

This is dedicated to my father Dr. Ross W. Lovell for inspiring me to get my Doctorate and my mother Jody Lovell who supported me in many ways she will never know. Also to Dr. Teofilo Ozuna without whose help and guidance I would not have finished.

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# CHAPTER I

# INTRODUCTION

## Background

Over the last three decades, researchers have claimed that market anomalies that defy theories of market efficiency are due to investor sentiment.[1] Early on researchers focused on the sentiment of noise traders, defined as investors (usually small and uninformed) who make market trades for reasons other than fundamentals and other traders who interpret these trades as information and make similar trades which moves market returns away from their fundamental values (Zweig, 1973; Black 1986). In this dissertation noise traders are referred to as uninformed investors.

Following the theories of De Long et al. (1990) the sentiment of institutional investors (market traders who trade on fundamentals and rely on market efficiency) have also been included in studies of market returns and volatility (Brown and Cliff, 2004;Verma and Verma, 2007; Schmeling, 2007; Kling and Gao, 2008; Verma et al.,2008). Some studies have found that investor sentiment (institutional and/or uninformed investor) affects market returns and volatility (Lee et al., 1991; Neal and Wheatley, 1998; Brown and Cliff, 2005; Schmeling, 2007; Verma and Verma 2007) while other studies dispute this finding (Chen et al., 1993; Elton et al., 1998; Kling and Gao, 2008). The issue of whether investor sentiment affects market returns and/or

[1] For the purpose of this study, investor sentiment is defined as "the mood and expectations of the investor" (Schmeling, 2007), and can be used as proxy for investor behavior.

volatility is important for two reasons. The first reason is to understand the relationship between how different investor sentiment affects market returns and volatility. Many early empirical studies used investor sentiment to explain how investors cause market anomalies, which indicate that markets are inefficient (Lee et al. (1991), Chen et al. (1993), Swaminathan (1996), Elton et al. (1998), Neal and Wheatley (1998), Brown and Cliff, 2004). The second reason is that if investor sentiment does affect market returns and/or volatility, then it may be possible to use investor sentiment to predict market returns and/or volatility and make abnormal profits. Many studies relating to investor sentiment have investigated the ability of investor sentiment to predict market returns and/or volatility with mixed results. Some studies found investor sentiments predicted returns (Lee et al., 1991; Neal and Wheatley, 1998;) and others found comovement but not prediction(Solt and Statman, 1988; Elton et al.1998; Brown Cliff, 2004; Verma and Verma 2007; Kling and Gao, 2008).

Since 1990, most research involving investor sentiment is based on the theory provided by De Long et al. (1990). Their theory, which explains noise trader risk, shows that investor sentiment can directly affect market returns. Many of the early empirical studies concentrated on testing different facets of the theory developed by De Long et al. (1990), mostly researching the anomaly of the market price of closed-end funds and the fundamental value of the underlying portfolio using uninformed investor sentiment (Lee et al., 1991; Chen et al., 1993; Elton et al., 1998; Neal and Wheatley, 1998). Eventually, studies began testing uninformed investor sentiment effects on market returns (Brown, 1999; Fisher and Statman, 2000).

It was the work of Brown and Cliff (2004) that reviewed previous investor sentiment studies and found that institutional and uninformed investors work as a system and need to be examined together with market returns. They supported this claim empirically in Brown and

Cliff (2005). Other researchers such as Schmeling (2007) and Verma and Verma (2007) followed, including both noise and institutional investor sentiment in studies of international market returns and volatility.

De Long et al. (1990) also theorized that investor sentiment affects volatility, which in turn indirectly affects markets returns. Yet there are only a few studies that have empirically examined this theory. Lee (2002) empirically tested the De Long et al. (1990) theory regarding volatility and showed that uninformed investors did affect market volatility. The theory was also supported using both uninformed and institutional investors (Verma and Verma, 2008). Verma and Verma (2007) also found that bullish investor sentiment has a greater effect than bearish investor sentiment on stock market volatility.

Brown and Cliff (2005) theorized that investor sentiment might affect market returns asymmetrically and De Long et al. (1990) inferred that it should affect volatility asymmetrically as well. The empirical study of Brown and Cliff (2005) found that positive investor sentiment has a greater effect on market returns than does negative investor sentiment. Empirical studies of investor sentiment effects on conditional variance found conflicting results. Verma and Verma (2007) found that positive institutional and uninformed investor sentiment had a greater effect on market returns and volatility than negative investor sentiment in the U.S. equity markets. However, Kling and Gao (2008) found that negative institutional investor sentiment had a greater effect on market volatility than positive institutional investor sentiment, in the Chinese stock market.

In most investor sentiment studies, institutional investors as well as uninformed investors are considered completely rational in their market reactions (Shleifer and Summers, 1990; Brown and Cliff, 2006). De Long et al. (1990) theorizes that noise or uninformed investors who

are irrational, influence market returns and are able to profit by their actions. Some studies conclude that the irrational component of investor sentiment is what affects volatility (Shleifer and Summers, 1990; Brown and Cliff, 2006). Verma et al. (2008) found that both rational and irrational investor sentiment affect market returns and that rational sentiment has a greater impact on returns than do irrational sentiment.

While studies have looked at the effects of institutional and uninformed investor sentiment on returns in the equity market, studies of the futures markets have only focused on hedger and speculator sentiment (Wang, 2001; Sanders et al, 2009). These studies did not investigate the sentiment theories of De Long et al. (1990) regarding the effect of uninformed investor sentiment or the sentiment of institutional and uninformed investor sentiment of Brown and Cliff (2004; 2005). Also, there has seldom been studied the effects of the rational and irrational sentiment components of sentiment on futures market returns as Verma and Verma (2007) have done with stock market returns.

While investor sentiment theories are not limited to the stock market, most empirical studies of investor sentiment uses stock market data. Other markets such as the futures market, which is more volatile and has fewer uninformed investors, may offer different results, as compared to stock market studies on investor sentiment (Gorton and Rowenhorst, 2006). Yet, very few studies have investigated the effects of investor sentiment in futures markets. The few studies that have examined investor sentiment in the futures market have either used stock market sentiment or only used uninformed investor sentiment in futures markets. This indicates a gap in the investment sentiment literature. The opportunity exists to comprehensively study the effects of investor sentiment on market returns and volatility in the futures market.

## Purpose

The purpose of this study is threefold. First, using survey data from futures market uninformed and institutional investors as a proxy for investor sentiment I examine the effects of investor sentiment on market returns and volatility in the futures market. Second, I examine whether investor sentiment imparts symmetric or asymmetric effects on futures market returns and volatility. Third, I examine the effects of rational and irrational investor sentiment on futures market returns and the causal relationship between rational and irrational sentiment to determine their effects on returns and the causal nature of those effects.

Previous futures market studies have shown that an investor sentiment, particularly uninformed investor sentiment has no effect on futures market returns (Wang, 2003; Sanders et al., 2003, 2009). Yet theory says that not only does investor sentiment affect market returns but volatility as well (De Long et al., 1990; Brown and Cliff, 2004). If investor sentiment does affect futures market returns and volatility then understanding if it can be used to predict returns and volatility then this information useful for investors. Investor sentiment index providers like Consensus, Inc. and Network Press, Inc. have been selling to investors for over 20 years. It seems if there was no value they would not be successful. Given the recent issues with futures and other derivatives it is important to understand the effect investors' sentiments have on pricing and volatility if the effects are predictable then we use this information to better understand how to reduce volatility spikes that cause greater damage. Also it is important to determine if investor sentiment variables should be included in future studies of futures market risk and returns. Based on the literature reviews this is not currently taking place.

## Contribution

This study contributes to the current literature in four distinct ways. First, this dissertation provides a comprehensive study of investor sentiment and futures market returns and volatility. Second, this study is the first to use survey data from actual futures market investors to examine the effects of investor sentiment (uninformed and institutional) on conditional volatility in the futures market. Third, this study is the first to examine asymmetric effects of investor sentiment of market returns and volatility in the futures market. Finally, the study is the first to examine the effects of rational and irrational investor sentiment on futures market returns and the causal relationship. This is an important extension since the higher level of knowledge required of a futures uninformed investor than a stock market uninformed investor, may provide results not found or contrary to the results found in stock market studies of investor sentiment.

## Organization

The rest of this dissertation is organized as follows. In Chapter II, synthesis of the literature is provided starting with the evolution of investor sentiment theories followed by the empirical studies on the relationship between investor sentiment and market returns and volatility. Next, theoretical and empirical studies are reviewed covering asymmetric, rational, and irrational effects of investor sentiment on market returns and volatility. Finally, the difference between the futures market and the stock market are presented and a review of the empirical studies of investor sentiment effects on futures market returns is provided. Chapter III describes the selection and sources of the data for both uninformed and institutional investors and provides descriptive statistics. Next, transformations of these data are discussed which enable studies of asymmetric, rational, and irrational effects of investor sentiment on market returns and volatility, descriptive statistics are also included. Chapter IV describes the

methodology used in this study. The chapter starts by explaining the methodology used for testing the systematic relationship between investor sentiment and futures market returns and volatility. This is followed by the methodology for testing asymmetric effects of investor sentiment on futures market returns and volatility and finally the methodology for testing the effect of rational and irrational sentiment on futures market and volatility.

Chapter V presents and discusses the results of the econometric analysis of the effect of futures market institutional and uninformed investor sentiment on the returns and volatility of the S&P 500 e-mini futures and the robustness checks of the estimated model. The results of the analysis of the rational and irrational components of institutional and uninformed investor sentiment on returns and volatility of S&P 500 e-mini futures and robustness checks of the model are also presented and discussed. Chapter VI provides a brief summary of the dissertation including highlights of the analysis results and conclusions. Suggestions for future research topics are also provided in chapter VI.

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# CHAPTER II

# LITERATURE REVIEW

This literature review provides background on the theories and empirical studies relating to investor sentiment and market returns and volatility in the stock market and futures market. This chapter is composed of three sections. First, an overall view of investor sentiment is presented to provide an understanding of the theoretical foundation of investor sentiment and market returns and volatility. A theoretical justification is also provided for the occurrence of asymmetric effects. The decomposition of investor sentiment into rational and irrational sentiment is also discussed. Second, empirical studies of investor sentiment and market returns and volatility are discussed starting with the early studies up to recent investigations. Finally, the difference between the futures market and stock market are discussed and investor sentiment studies in the futures market are reviewed.

## The Evolution of Investor Sentiment Theories

This section is comprised of three parts and is presented as follows. The first part discusses early theories regarding how uninformed investor sentiment moves market prices away from their mean. The second part discusses theories explaining how investor sentiment affects market returns and volatility. The third part discusses the theoretical justification for the asymmetric response of market returns and volatility to optimistic and pessimistic investor sentiment and how rational and irrational investor sentiment affects market returns and volatility.

**Moving Price Away From Mean**

Early studies looking for solutions to anomalies in the efficient market theory of Fama (1970) theorized that individual (uninformed) investors were responsible for some of these anomalies. The authors of these studies theorized that it is the uninformed investor behavior that occasionally moves market prices away from their mean. This price movement offers opportunities for either those same investors or others who observed these movements to make abnormal returns (Zweig, 1973; Grossman and Stiglitz, 1980; Shiller, 1984; Kyle, 1985; Black, 1986; DeLong et al., 1990; Shleifer and Summers, 1990; Campbell and Kyle, 1993). While these early theories may differ on how uninformed investors may affect returns they all agree that it is the behavior of uninformed investors that cause prices to move away from their mean.

Sentiments were first noted by Zweig (1973), who suggested that discounts on closed-end funds reflect expectations of individual (uninformed) investors. Zweig (1973) theorizes that when non-professional investors' expectations are unified "sufficiently" as a group they can cause stock prices to move in an unexpected direction away from their mean. Grossman and Stiglitz (1980) follow with a theory that actions of uninformed investors do not allow for an efficient market. Shiller (1984) argues that uninformed investors that trade using fad or popular stock trading models can make the stock market inefficient. Black (1986) proposed that the trading behavior of a relatively small group of investors who based their trades on other than fundamentals create noise. He defines noise as a "…diversified array of unrelated causal elements used to explain what happens in the world.…Noise in the sense of a large number of small events is often a causal factor much more powerful than a small number of large events can be." In financial markets, Black (1986) contends that some traders interpret noise as information and, in turn, use this noise as a basis for making trades and thus amplify the effect of

noise. It is the combined actions of the uninformed investors and the misinterpretation of noise by institutional investors as true information that, according to Black (1986), causes markets to be inefficient. These early models use investor sentiment to explain how markets are not efficient rather than to explain how investor sentiment may affect returns.

It is important to note that in these early studies, the concept of the uninformed or "noise investor" does not have standardized definition. Uninformed, individual, small, and "noise" investors are not easy to identify in the markets and as such most researchers define them based on the available data. While this is not ideal and does not allow for direct comparison between studies that investigate uninformed or "noise" investors most definitions seem to agree that these investors do not primarily trade or invest based on analysis of business and market fundamentals.

**Effects on Returns and Volatility**

In 1990, De Long et al. established the first comprehensive theory of investor sentiment that has become the basis of all investor sentiment studies. This theory states that change in investor sentiment on mean returns depends on the importance of the 'price-pressure' relative to the 'hold-more' effects. Consequently, the mean return is higher (lower) when the sentiment of uninformed investors becomes more bullish only if the hold-more effect dominates (is weaker than) the price-pressure effect. But when uninformed investor sentiment becomes more bearish, the net result on mean return is always negative since both the price-pressure and hold-more effects are reinforcing. "Price-pressure" is when the average sentiment of uninformed investors is bullish (bearish); the trading of uninformed investors creates price pressure that results in a purchase or sale price that is higher (lower) than fundamental value and thereby lowers expected returns. The "hold more" effect is when uninformed investor increase (decrease) demand for the risky assets as their sentiment becomes more bullish (bearish), it amplifies (reduces) the level of

market risk, and thereby results in higher (lower) expected returns. The price-pressure and hold more effects are considered to be short-term effects (De Long et al., 1990; Lee et al., 2002).

De Long et al. (1990) also proposes that the "Friedman" and "create-space" effects are related to the magnitude of the shifts in uninformed investor sentiment, and influence mean returns indirectly through changes in uninformed investor misperceptions of the asset's risk via conditional volatility. "Friedman" effect changes in uninformed investor misperceptions occur at the worst possible time. Because uninformed investors buy (sell) most of the risky asset just when other uninformed investor are buying (selling), they are most likely to suffer a capital loss. The greater the magnitude of the change in their misperceptions, the more damage their poor market timing inflicts on their returns. The changes in the uninformed investor misperceptions about the asset's risk result in lower expected returns.

"Create space" effect is where a rise in uninformed investor misperceptions about the asset's risk increases price uncertainty and reduces risk-averse sophisticated investor's desired holdings in risky assets. Uninformed investors benefit more from their trading when their momentum crowds out risk-averse sophisticated investors. Mean returns are higher (lower) when the create-space effect is more (less) important than the Friedman effect. This theory is the basis of this study implying that investor sentiment affect futures returns and also affect volatility which in turn indirectly affects the future returns. The Friedman and create-space effect are considered the long-term effects of uninformed investors (De Long et al., 1990; Lee et al., 2002).

While working with DeLong et al. (1990), Shleifer and Summers (1990) also developed a non-efficient market model that assumed that not all investors are fully rational and their irrational sentiment influences their demand for risky assets. They also concluded that trading by rational traders who were not affected by sentiment is considerably more risky and therefore

reduce fundamental values. This model, like that of DeLong et al. (1990), indicated that stock price movements caused by irrational investors were not fully returned to fundamental values by rational investors using arbitrage, thus affecting returns.

Campbell and Kyle (1993) also offer a model based on Black (1986). This model shows that the competitive trading of uninformed investors and institutional investors influence stock prices. They hypothesize that uninformed investors do not maximize their utility in their trading and that since institutional investors are risk-adverse they do not fully take advantage of price changes caused by the uninformed investors.

In their development of a behavioral capital asset pricing theory, Shefrin and Statman (1994) hypothesize that the market depends on the errors made by uninformed investors. Their thesis is that uninformed investors act to move the market away from efficiency. By misinterpreting the market signals of institutional investors and market fundamentals, uninformed investors move the market.

Palomino (1996) also develops a model that shows an imperfectly competitive market. Extending the De Long et al. (1990) model, Palomino (1996) shows that in an imperfect market with risk adverse investors uninformed investors can earn higher returns and gain higher expected utility than institutional investors. The study implies that contrary to the efficient market theories, uninformed investors can survive in the long term.

More recently, F.Wang (2001) theorized that the DeLong et al. (1990) model was unable to show how uninformed investors survive over the long-term due to the static nature of the model. F. Wang (2001) develops a model showing the wealth accumulation process based on the market competition between rational and irrational investors. The model shows that bullish and

bearish sentiment influence the stock market differently and that bullish sentiment survive in the long-run while bearish sentiment do not.

In general, these models show that the investor sentiment of uninformed investors influence market returns. Also, these models indicate that to a certain extent both uninformed and institutional investors together influence market returns. A certain subgroup of these models also deals with the concept of investors' rationality and irrationality thereby implying that uninformed investors are irrational and that institutional investors are rational (Black, 1986; DeLong et al., 1991; Campbell and Kyle, 1993: Wang, 2001).

**Asymmetric, Rational and Irrational Effects**

Several behavioral models imply that investor sentiment may affect market returns and volatility asymmetrically (Daniel et al., 1998; Hong et al., 2000; Gervais and Odean, 2001). Based on these models, Brown and Cliff (2005) theorized that the effects of investor sentiment are due to two reasons; a practical limit to arbitrage and overreaction to information due to overconfidence. Occasionally limitations to short-selling/long positions by institutional investors due to increased risk, inhibit them from pushing market price back to equilibrium during periods of excessive optimism/pessimism by uninformed investors (Hong et al.2000; Brown and Cliff 2005). Also, Daniel et al. (1998) theorizes that overvaluation/undervaluation usually follows a trend of good/bad news. When either of these two conditions are combined with an overreaction, which is usually followed by periods of gains, an asymmetric effect may ensue (Gervais and Odean, 2001; Brown and Cliff, 2005).

Alternatively, the theoretical basis for isolating the rational and irrational components starts with the assumption that uninformed investor sentiment is completely irrational and much of the investor sentiment theoretical research is based on this assumption (Brown and Cliff,

2005). However, it is recognized by some researchers that uninformed investors do get some of their trading information from sources such as analysts, brokers, and newsletters that base their analysis on fundamental market information (De Long et al, 1990; Brown and Cliff, 2005; Verma and Verma, 2007; Verma and Soydemir, 2009). De Long et al. (1990) also explains that uninformed investors get information from technical analysts, stockbrokers, or economic consultants, but since the uninformed investor does not have the knowledge to filter the fundamental market information from the additional noise provided in this information, the uninformed investors irrationally misinterpret it. Brown and Cliff (2005) maintain that uninformed investor sentiment includes some amount of fundamental information and it is important when empirically testing theories that this be excluded from the irrational sentiment.

## Empirical Studies of Investor Sentiment

### Uninformed Investor Sentiment Studies

Many of the early empirical studies of investor sentiment used closed-end fund discounts as a proxy for uninformed investor sentiment. Some of these studies found that investor sentiment affected prices (Lee et al., 1991; Swaminathan, 1996; Neal and Wheatley, 1998), while others provide contrary evidence (Chen et al., 1993; Elton et al., 1998). Other empirical studies used newsletter writers as proxies for uninformed investor sentiment and they obtain contradictory results. For example, Solt and Statman (1988) found no effect, Clarke and Statman (1998) found some effects and Fisher and Statman (2000) found that uninformed investor sentiment did affect prices. Other researchers used different proxies such as consumer sentiment (Otto, 1999) and S&P 500 futures (Simon and Wiggins, 1999), to show that uninformed investor sentiment is influenced by market returns.

Some studies used uninformed investor sentiment to explore the effect on conditional volatility as mentioned in the theory of De Long et al. (1990) (Brown, 1999; Lee. et al., 2002). Both Brown (1999) and Lee et al. (2002) found that uninformed investor sentiment affected volatility. A study of the Taiwan stock market by Chuang et al. (2010) also found that uninformed investor sentiment affects both market returns and volatility. The majority of the studies that used uninformed investor sentiment to investigate the effects of market returns and/or volatility did find that uninformed investor sentiment affects market returns and/or volatility in equity markets.

**Institutional Investor Sentiment Studies**

Kling and Gao (2008) investigated the effect of institutional investor sentiment on stock market returns and volatility using an EGARCH model. They also studied the presence of asymmetric effects. They found that negative institutional investor sentiment has a greater effect on volatility and that sentiment has an effect on market returns and volatility. They also found these effects to be asymmetric.

**Uninformed and Institutional Investor Sentiment Studies**

Uninformed and institutional investor sentiment work as a system where both uninformed and institutional investors interact with each other and affect market returns, thus both need to be jointly examined (Brown and Cliff, 2004). The first empirical study to jointly use both uninformed and institutional investor sentiment was Brown and Cliff (2004). They found that while both uninformed and institutional investor sentiment affect market returns, institutional investor sentiment seemed to have the greater impact. Schmeling (2007) using European investor sentiment in several European markets, confirmed the findings of Brown and Cliff (2004).

De Long et al. (1990) theorized that investor sentiment not only affects returns but also affects volatility. The first study to explore both uninformed and institutional investor sentiment effects on market returns and volatility (Wang et al., 2006) used Granger causality test and found that neither investor sentiment affected market returns or volatility. Contrary to Wang et al. (2006), Verma and Verma (2007) using a GARCH model found that both institutional and uninformed investor sentiment significantly and positively affect stock market returns and significantly and negatively affect volatility, which is consistent with the theory of De Long et al. (1990).

**Asymmetric Investor Sentiment Studies**

In their 2005 study, Brown and Cliff theorized that the effects of investor sentiment on returns could be asymmetrical. The VAR analysis used in their study empirically supports this claim. Verma and Verma (2007) also support this claim using an E-GARCH model and also investigate the effect of uninformed and institutional investor sentiment on volatility. They find that positive (bullish) uninformed and institutional sentiment has a greater effect than negative (bearish) sentiments on market returns. However, uninformed investor sentiment has a greater negative (bearish) effect on volatility than positive (bullish) sentiments. This is in contrast to a study of the Taiwan stock market where the asymmetric effects of uninformed and institutional investor sentiment on market returns were not significant (Chuang et al., 2010).

**Rational and Irrational Investor Sentiment Studies**

Brown and Cliff (2005) studied the effects of the irrational components of uninformed and institutional investor sentiment on market returns. The justification for using only the irrational component of investor sentiment was to investigate if according to behavioral theories that irrational behavior affects market returns. The results of the study found that irrational

investor sentiment do affect market returns. In an extension of the Brown and Cliff (2005) study, Verma et al. (2008) also find that irrational investor sentiment does affect market returns. However, using VAR analysis they find that rational investor sentiment has a greater effect on market returns. Verma and Verma (2007) extend the study of rational and irrational sentiment to include market returns and volatility and asymmetric effects and they confirm the results of Verma et al. (2008) but also find that positive rational investor sentiment have greater effect on market returns than irrational investor sentiment. The study by Verma and Verma (2007) also found that irrational (rational) sentiment has significant (irrational) and bullish (bearish) effect of on volatility. Hu and Li (2010) contradict this result in a study of the Taiwan stock market. In their study, Hu and Li (2010) find that negative (bearish) irrational institutional investor sentiment has a greater influence than do positive (bullish) ones, and positive (bullish) irrational uninformed investor sentiment has a greater influence than do negative (bearish) ones.

## Futures Market and Investor Sentiment

Most theoretical studies that explain the relationship between investor sentiment and market returns imply that the theory holds in any financial market. They make no distinction between stock or futures markets, yet there are some major differences between the stock and futures markets. Some major examples of these differences are: 1) the use and market conditions of stocks and futures securities; 2) the short maturity claim on real assets of futures; 3) also futures are always leveraged, thus volatility is a greater factor than stock securities; 4) the types of participants in the futures market; 5) limited available data sources (Gorton and Rouwenhorst, 2006). Due to market differences, it is important to investigate whether investor sentiment theories that help explain stock market returns and volatility apply to futures returns and return volatility, as well.

While the purpose of this dissertation is not to analyze the differences between investor sentiment and returns and returns volatility in the stock and futures market, it is important to emphasize how the markets are different. As this chapter will show, the futures and stock market differences are significant enough that empirical tests may show different results in relationships between investor sentiment and futures market returns and volatility.

**Security Differences**

One of the main differences between the stock market and futures market is in their use or purpose. The purpose of the futures market is not to raise capital but to allow investors who are sellers (buyers) of futures (hedgers) to obtain insurance against a decline (increase) in future asset prices held by these investors. In return for a risk premium, other investors (speculators) willing to take the risk and offer the insurance and cover the hedgers trades. The futures prices represent bets on the expected future spot price of the asset referred to in the derivative (Gordon and Rowenhorst, 2006). Unlike a stock which represents the spot price for a firm, the futures derivative represents the expected value of a future spot price plus a risk premium. The unexpected deviations from the future spot price are by definition unpredictable and add risk for any given futures derivative.

According to Gorton and Rowenhorst (2006), since speculators are the ones taking the risk and they are constantly buying futures over time the unexpected deviations will average out to zero over time and the professional speculator incurs no more additional risk in the long term than speculators in the stock market. However, just like in the stock market there are uninformed investors that are hedgers and speculators, as well as, institutional investors that are hedgers and speculators (Daigler and Wiley, 1999). Given that uninformed investors do not tend to trade as frequently as institutional investors (Pagano, 1989) and they are more likely to misinterpret

market information and/or signals (DeLong, 1990), uninformed investors in the futures market may be subject to more risk than uninformed investors in the stock market and thus may cause trading sentiment to be different in the stock market than the futures market.

Futures are derivative securities; they are not permanent claims on corporations like stocks. The pricing of derivatives are a function of time and changes in information regarding the future spot price during the time to maturity. According to Gordon and Rowenhorst (2006), unlike a long position in a stock where the stock represents the spot price of a firm, the futures derivative derives its value indirectly through the future value of the underlying asset at a future date. Thus, while the derivative price is indirectly based on an asset such as an index of stocks, the price is also includes a risk premium to account for the possible difference between the expected spot price of the stock index at the time of purchase and the actual spot price of the stock index on the expiration date. Since futures securities are short-term claims, this compresses the time in which both institutional and uninformed investors must make decisions and may amplify the occurrence of errors. This may affect the trading behaviors of both institutional and uninformed investors in the futures market.

Unlike the equity and bond markets, in the futures market all positions are leveraged and are mark to market (*i.e.,* all positions must be closed and settled at the end of the trading period). All futures are purchased at a market price; however the purchaser acquires the futures on margin and an amount significantly below the actual value of the underlying asset (such as a stock). Thus, unlike a long stock position if the future price is lower than the market price originally paid the difference is deducted from the margin account. If it is significantly lower and the difference is greater than the amount in the margin account the purchaser must deposit the difference. This daily adjustment to the investors' accounts in the futures market is significantly

different from the stock market. This requires investors to be more vigilant to the daily fluctuation in the futures pricing in case a margin call is made. This also may cause uninformed investors who are not as accustomed to investing under these conditions to change their sentiment toward volatility in the futures market relative to their sentiment in the stock market.

Due to the leveraged nature of the futures market the National Futures Association (NFA) require all brokers who trade client's orders in the futures markets to assess the customers that place trades through the broker. To insure that the customers are aware of the risks and that the trading of futures is suitable for the broker's clients based on the customers knowledge and financial ability. This rule is 2-30 "Customer Information and Risk Disclosure" of the NFA manual. This prequalification by brokers is not required for stock investors. The action by brokers to make sure that customers trading in futures are both knowledgeable and financially capable may also change the nature of the uninformed investor sentiment in the futures market. The prequalification seems to indicate that uninformed investors in the futures market are more knowledgeable than those in the stock market and consequently their sentiment should be closer to institutional investor sentiment.

Studies have shown that futures markets returns tend to have less variation than returns of stocks in the Standard and Poor's 500 (Dusak, 1978). This suggests that futures markets are efficient, yet anomalies such as liquidity and volatility shocks exist in futures markets as they do in the stock market. While most theoretical studies that seek to explain the relationships between investor sentiment and market returns do not make a distinction as to the different markets there is enough differences between the equity and the futures markets to justify separate investigations of both the futures and stock markets regarding investor sentiment effects.

**Futures Market Studies of Investor Sentiment**

While most of the theoretical studies that are used to explain the relationship between investor sentiment and market returns and volatility do not make distinctions regarding market or type of security, there are some studies (Gordon and Rowenhorst, 2006) which do posit how investor sentiment may be different in the futures market. The purpose of this section is to review the existing theoretical and empirical studies that posit how investor sentiment affects futures market returns and volatility. Also, this section reviews and discusses the issues with data used in investor sentiment studies in the futures market and how that may lead to conflicting results.

Few theoretical studies have investigated the role of investor sentiment in futures markets. A majority of these studies utilize trader type rather than investor sentiment. A study by Bessimbinder and Segin (1993) is one of the earliest studies to investigate volatility and future market return; this study implied that type of trader may cause changes in volatility. They stated that traders that were farther away from the trading pits traded more infrequently and less knowledgeable (uninformed general public traders) than institutional pit traders. Their study found that trades from floor traders and clearing members of the exchange reduced the volatility and thus stabilizing and lowering pricing, while the uninformed general public traders increased volatility and pricing.

Other trader-type studies have focused on forecasting power. Chang (1985) found that speculators earn abnormal profits in corn, wheat, and soybean futures. Hartzmark (1991) found that large traders had abnormal returns compared to small traders. C. Wang (2001) showed speculators outperformed hedgers in agricultural futures. Wang (2003) observed that in financial, agricultural, commodity, and currency futures, speculators (hedgers) were positively (negatively)

correlated with abnormal returns. In all of these studies, the focus was on speculators and hedgers rather than uninformed and institutional investors.

Wang (2002) was one of the first studies to show a relationship between investor behavior and volatility and the relationship was found to be asymmetric. In this study, volatility is related to the change of trading positions of speculators, hedgers and small investors. This relationship is asymmetrical where volatility is positively related to changes of futures market positions of speculators and small investors and negatively related to changes in hedger futures market positions.

Sanders et al. (2003, 2009) are two of the few studies that have studied investor sentiment and futures market returns. These studies looked at the use of investor sentiment as a contrarian indicator where bullish (bearish) changes in investor sentiment cause bearish (bullish) changes in returns. In the first study, Sanders et al. (2003) using a single survey of professional investor sentiment as a proxy for uninformed investor sentiment found that uninformed investor sentiment was not a contrarian indicator, that bullish (bearish) investor sentiment in some cases was insignificant and in others lead to bullish (bearish) future market returns which support De Long, et al. (1990). The survey used by Sanders et al. (2003) as a proxy for uninformed investors is similar to the survey used in the stock market studies for institutional investors by other researchers (Brown and Cliff, 2004 & 2005; Schmelling, 2007; Verma and Verma, 2007; Verma et al., 2008). The Sanders et al. (2003) study also does not include investor sentiment for uninformed investors as recommended by Brown and Cliff (2004, 2005). In the later study, Sanders et al. (2009) using prior trades of large speculators and hedgers as a proxy for sentiment and found that these investor actions do not predict market returns. These results are contrary to

those of C. Wang (2001) who found that speculators' actions could predict market returns but hedger actions could not.

In his study of order flows, Kurov (2008) implies that institutional and uninformed investor sentiment affects returns. Using stock market uninformed and institutional investor sentiment surveys from the stock market as proxies for uninformed and institutional sentiment, Kurov (2008) investigates the investor sentiment effects on futures market order flows. The results show that uninformed investors in futures markets buy when prices increase and sell when prices decline and trading appears to be more active in periods of high investor sentiment, which implies returns may be positively asymmetrically related to both institutional and uninformed investor sentiment. These results are similar to those found by Verma and Verma (2007) in the stock market. Wang et al. (2009) is the only other study to use investor sentiment using an indirect index to study if uninformed investor sentiment can predict future volatility. Their finding indicates investor sentiment can predict volatility in the futures market.

**Hypotheses**

**Institutional and uninformed investor sentiment effects on futures market.** Existing studies on the effects investor sentiment and futures market returns are limited. There have been a few studies on the effects of investor sentiment on futures market returns (Simon and Wiggins, 2001; Wang, 2001, 2002, 2003; Sanders et al., 2003, 2009; Kurov, 2008). There are even fewer studies that have included institutional investors as well as uninformed investors (Wang, 2003; Sanders et al., 2003; Kurov, 2008) and even less that have used futures investors based survey data ( Sanders et al., 2003 ). Many of these studies use the S&P 500 for return data (Simon and Wiggins, 2001; Wang 2003; Kurov 2008). The concurrent S&P 500 e-mini futures contracts pricing data is used in this essay because it is one of the most widely traded futures contracts. The S&P 500 e-mini contract is a smaller size than the traditional S&P 500 contract and offers

easier trading by smaller individual (uninformed) investors due to its lower cost and lower margin requirements Using the theories of De Long et al. (1990), Brown and Cliff (2004) as a base I hypothesize that:

**1.a. Institutional investor sentiment will positively affect S&P 500 e-mini futures returns.**

**1.b. Uninformed investor sentiment will positively affect S&P 500 e-mini futures returns**.

The effect of investor sentiment on volatility in the futures market has primarily been investigated using the hedger and speculator as investors (Bessimbinder and Segin, 1993; Daigler and Wiley, 1999, Wang et al., 2009) little attention has been paid to institutional and uninformed investor sentiment effects on volatility and the indirect effect on returns. Investor sentiment studies in the stock market have found that investor sentiment effects market returns indirectly through conditional volatility (De Long et al, 1990, Lee et al. 2002, Verma and Verma 2007). Based on these studies it is hypothesized that:

**2. Investor sentiment will affect S&P e-mini futures returns indirectly through conditional volatility.**

Studies have shown that uninformed investors can affect volatility in the futures market (Bessimbinder and Segin, 1993; Daigler and Wiley, 1999, Wang et al., 2009). Stock market studies have shown that institutional and uninformed investor sentiment affects volatility differently (Kyle, 1985; De Long et al., 1990; Lee et al., 2002; Wang et al., 2006; Verma and Verma, 2007; Kling and Gao, 2008). Based on these studies it is hypothesized that:

**3.a. Institutional investor sentiment will have a negative or no effect on S&P 500 e-mini futures volatility.**

**3.b. Uninformed investor sentiment will have a positive effect on S&P 500 e-mini futures volatility.**

In the stock market has been shown that investor sentiment affects volatility and indirectly through conditional volatility market returns asymmetrically Daniel et al., 1998; Hong et al., 2000; Gervais and Odean, 2001; Brown and Cliff, 2005; Verma and Verma, 2007; Verma and Soydemir, 2008; Chuang, 2010). Given that in the futures market more risk due to positive news as opposed to negative news since losses are limited at zero it is hypothesized that that:

**4.a. Institutional investor sentiment will have a asymmetric effect on S&P 500 e-mini futures volatility and indirectly market returns.**

**4.b. Uninformed investor sentiment will have a asymmetric effect on S&P 500 e-mini futures volatility and indirectly market returns.**

**Rational and irrational investor sentiment hypotheses.** Investor Sentiment literature has theorized and empirical studies have shown that it is uninformed investor sentiment moves market returns away from the mean (Zweig, 1973; Black,1976; Grossman and Stiglitz, 1980; Shiller, 1984; De Long et al., 1990; Brown and Cliff, 2005; Verma and Verma, 2007; Verma et al., 2008). In these studies it is the irrational or moving away from fundamentals that is attributed to uninformed investor sentiment moving returns away from the mean (Brown and Cliff, 2005; Verma and Verma, 2007; Verma et al., 2008).

Brown and Cliff (2005) state that though it may be the irrationality that moves returns from the mean, institutional and uninformed investor sentiment has both rational and irrational components. But it is the irrational component that moves returns from the mean. Verma et al. (2008) empirically showed this in the stock market. Because of the leverage effect the

institutional investor sentiment may be more irrational and the uninformed investor may be rational. Therefore the following is hypothesized:

**5.a. Rational institutional investor sentiment will positively affect S&P 500 e-mini futures returns.**

**5.b. Irrational institutional investor sentiment will not affect S&P 500 e-mini futures returns.**

**5.c. Rational uninformed investor sentiment will positively affect S&P 500 e-mini futures returns.**

**5.d. Irrational uninformed investor sentiment will positively affect S&P 500 e-mini futures returns.**

Studies have also stated that the irrationality of institutional and uninformed investors affect volatility as well and that through conditional volatility affects returns (Lee. et al., 2002; Verma and Verma, 2007; Chuang et al., 2010). There has been little if any research in the futures market regarding the effect of rational and irrational investor sentiment on volatility. Based on the theories of Delong et al. (1990) , Daniel et al., 1998; Hong et al., 2000; Gervais and Odean, 2001, Brown and Cliff (2005) it is the irrational sentiments that contribute to volatility and through conditional volatility affect returns. Based on theory it is hypothesized that:

**6.a. Rational Investor sentiment will not affect S&P e-mini futures returns indirectly through conditional volatility.**

**6.b. Irrational Investor sentiment will affect S&P e-mini futures returns indirectly through conditional volatility.**

Again theories of Delong et al. (1990), Daniel et al., 1998, and Brown and Cliff (2005) it is the irrational sentiments that contribute to volatility. However Kling and Gao (2008) found that institutional investors had a tremendous effect on volatility in the Chinese market.

**7.a. Institutional rational investor sentiment will have a negative or no effect on S&P 500 e-mini futures volatility.**

**7.b. Institutional irrational investor sentiment will have a positive effect on S&P 500 e-mini futures volatility.**

**7.c. Uninformed rational investor sentiment will have a negative or no effect on S&P 500 e-mini futures volatility.**

**7.d. Uninformed irrational investor sentiment will have a positive effect on S&P 500 e-mini futures volatility.**

Studies by Daniel et al., (1998), Hong et al., (2000), and Gervais and Odean, (2001) theorize that investor sentiment affects volatility asymmetrically. Daniel et al., (1998) and Brown and Cliff, (2004) theorize that asymmetric effects of investor sentiment are due overreaction to information or news. In the futures market there is greater upside risk than down due to the zero floor therefore positive news will be viewed negatively and negative more positive so it is hypothesized that:

**8.a. Institutional rational investor sentiment will have a asymmetric effect on S&P 500 e-mini futures volatility and indirectly market returns.**

**8.b. Institutional irrational investor sentiment will have a asymmetric effect on S&P 500 e-mini futures volatility and indirectly market returns.**

**8.c. Uninformed rational investor sentiment will have a asymmetric effect on S&P 500 e-mini futures volatility and indirectly market returns.**

**8.d. Institutional irrational investor sentiment will have a asymmetric effect on S&P 500 e-mini futures volatility and indirectly market returns.**

The above hypotheses serve to shape the methodology. They can be segmented into to two distinct studies. The first study will focus on the effect of institutional and uninformed investor sentiment on futures market returns, volatility, and asymmetric effect on returns and volatility. The second study will focus on the role of irrational component of investor sentiment on futures market returns, volatility and asymmetric effects on returns and volatility.

# CHAPTER III

## DATA

The variables used in this study are the S&P 500 e-mini futures returns (R), and the institutional investor sentiment data for the S&P 500 futures (I), and uninformed investor sentiment data (U) for the S&P 500 futures. The raw data for each of these variables covers 679 weeks from the first week of January 1998 to the end of December 2010. All of these data are in a weekly format which minimizes certain biases that are explained in detail in this chapter.

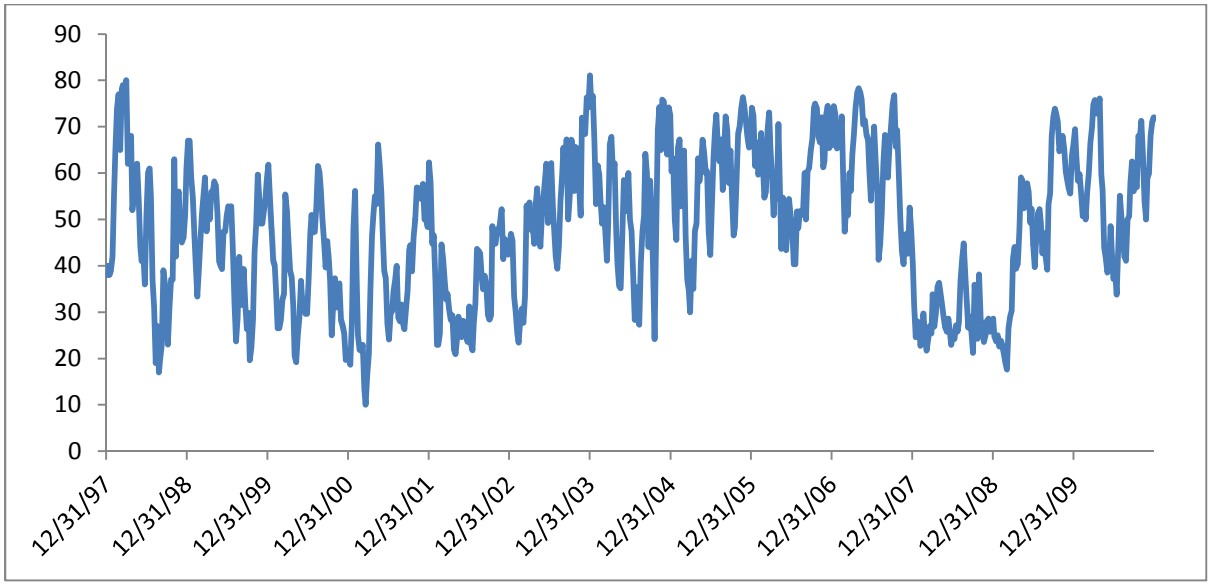
The institutional investor sentiment data comes from Consensus, Inc., which compiles a bullish sentiment index using surveys of market advisory services, professional newsletters, and hotlines. Consensus, Inc., states that the Consensus Bullish Sentiment Index (CBSI) is a gauge of positions and attitudes of major professional brokerage firms and advisors as interpreted and recorded by Consensus, Inc. The CBSI draws from an extensive mix of both brokerage house analysts and independent advisory services, from both contributors and non-contributors, to provide the broadest possible survey data. Because the survey is based on opinions of professional firms and advisors, the CBSI is used as a proxy for institutional investor sentiment. Consensus, Inc., publishes a weekly market paper *Consensus: National Futures and Financial Weekly*, which contains the proprietary weekly sentiment survey index for 32 major futures markets that is released each Friday. This study uses the weekly S&P 500 futures index score (which ranges from 0 to 100), as the data for the institutional investor sentiment. A high/low

index score indicates a positive/negative outlook by institutional investors for returns of future contracts within the survey category.

The selection of CBSI is based on its similarity to the "Investors Intelligence Sentiment Index" (IISI) from research firm Investor Intelligence. IISI is the choice of institutional investor sentiment survey data in many of investor sentiment studies of the stock market such as Brown and Cliff (2004,2005), Lee et al. (2002), Clarke and Statman (1998), Solt and Statman (1988), Verma and Verma (2007) and Verma et al.(2008). The descriptive statement provided by Investor Intelligence on their website (Investors Intelligence, 2013) "The Sentiment Index is a reflection of the recommendations of over 130 independent stock market newsletter editors.

**Figure 1**

**Institutional Investor Sentiment Data**




It originated in 1963, and includes only newsletters not affiliated with brokerage houses or mutual funds." is substantially similar to that provided CBSI by Consensus Inc. "latest information from more than 100 top national and international contributors from major stock and

commodity firms, independent advisory services and government agencies is used to compile the Index". Both indexes are issued one week lagged on Fridays.

It is important to note that even during periods of "irrational exuberance"[2] the index did not exceed 80. Note that at the lowest point the index reaches only 10 out of 100 (Figure 1). Also, notice in Figure 1 that sentiment dips after 9/11/2001 and from the end of 2007 to February 2009 in response to the 2008 recession, but there was no extended effect from the 1999 "Internet bubble".

The uninformed investor sentiment data used for this study comes from the Jake Bernstein Daily Sentiment Index (DSI) and is available daily from *Jake Bernstein on Futures*, a proprietary service of Network Press, Inc. This survey seems to be the only one of its kind currently available for uninformed investors in the futures market. The DSI surveys small individual (uninformed) investors on their sentiment as to the future for 32 major futures markets and are formed into an index for each of these markets (e.g., S&P 500 index, NASDAQ 100 index, Gold, Light Crude Oil, and Corn). The surveys are collected daily at 4 pm and transformed by Network Press, Inc., into a daily index score. For the purposes of this study, the S&P 500 futures Wednesday index score for each week is used as a proxy for uninformed investor sentiment weekly data. In the event that the Wednesday data is unavailable (this generally once every four years for each of the holidays recognized by the CME Group), the Tuesday and Thursday survey values are averaged and that value is used for the data.

Because this data is daily not weekly as with the informed investor sentiment data, this study uses the Wednesday index score to avoid bias resulting from beginning of week and end of

[2] Remark by Chairman Alan Greenspan warning that the market might be somewhat overvalued at the Annual Dinner and Francis Boyer Lecture of The American Enterprise Institute for Public Policy Research, Washington, D.C., December 5, 1996.

week as well as surrounding holidays. Wednesday is one of the least bias-affected days of the week. (Gibbons and Hess, 1981) The index is between 0 and 100 where a higher/lower index value indicates a positive/negative outlook by uninformed investors as to the returns for the futures contracts within the index category. The weekly informed investor sentiment data is not subject to the same bias as daily data.

Figure 2 indicates that uninformed investor sentiment is much more volatile than the institutional investor sentiment as shown in Figure 1, especially prior to 2002. This is possibly due to new regulations put into effect to reduce S&P 500 volatility trading as a result of investigations after the "9/11" and "Internet bubble" market crashes. It is also interesting that the uninformed investor sentiment data is between 95 and 4 out of 100 (Figure 2), which is a much wider spread than recorded for the institutional investor sentiment (see Figure 1). Sentiment from uninformed investors (Figure 2) were much more volatile during the "9/11" slowdown and recent 2008 recession than institutional investor sentiment (Figure 1).

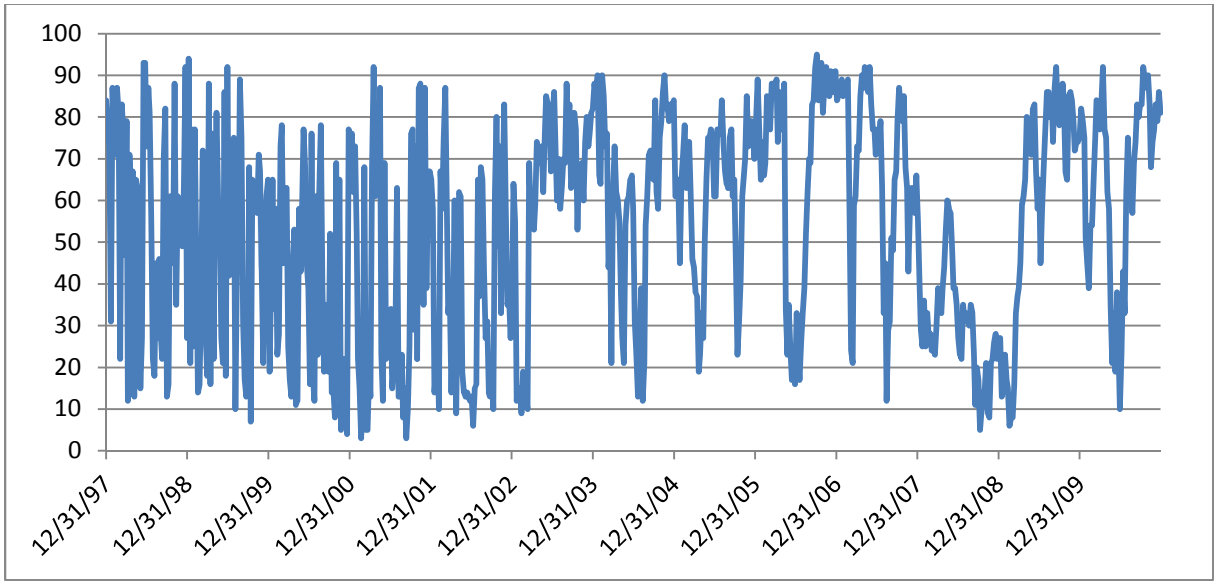
The S&P 500 e-mini futures returns data is obtained from Datastream, Inc. The concurrent S&P 500 e-mini futures contracts pricing data is used in this essay because it is one of the most widely traded futures contracts. The S&P 500 e-mini contract is a smaller size than the traditional S&P 500 contract and offers easier trading by smaller individual (uninformed) investors due to its lower cost and lower margin requirements. The Wednesday price is used following the arguments presented for the uninformed investor sentiment data above. This data is then transformed into returns by taking the log of the contract price of the current Wednesday divided by the log of the contract price of the previous Wednesday and this provides a continuously compounded return (Tsay, 2010).

It is interesting to note that institutional investor sentiment (Figure 1) and uninformed investor sentiment (Figure 2) clearly show the October 2007 to February 2009 recession but do not clearly indicate the market slowdown from August 2000 to September 2002. Note also that in Figure 3 that the futures return data also clearly indicates the market slowdowns after October 2007 to February 2009 similar to Figures 1 and 2.

Descriptive statistics for the S&P 500 e-mini futures returns "R" data indicates that the data is normal using the LaGrange Multiplier Jarque-Bera (LMJB) test and that the data is stationary based on the augmented Dickey-Fuller test (see Table 1). The Institutional (I) and Uninformed (U) investor sentiment data are both normal and stationary, based on the same tests used for the return (R) data. The I and U means indicate that the uninformed investors were slightly more optimistic than the institutional investors over this period. The LaGrange Multiplier tests for the variables indicate that all three variables have ARCH effects.

**Figure 2**

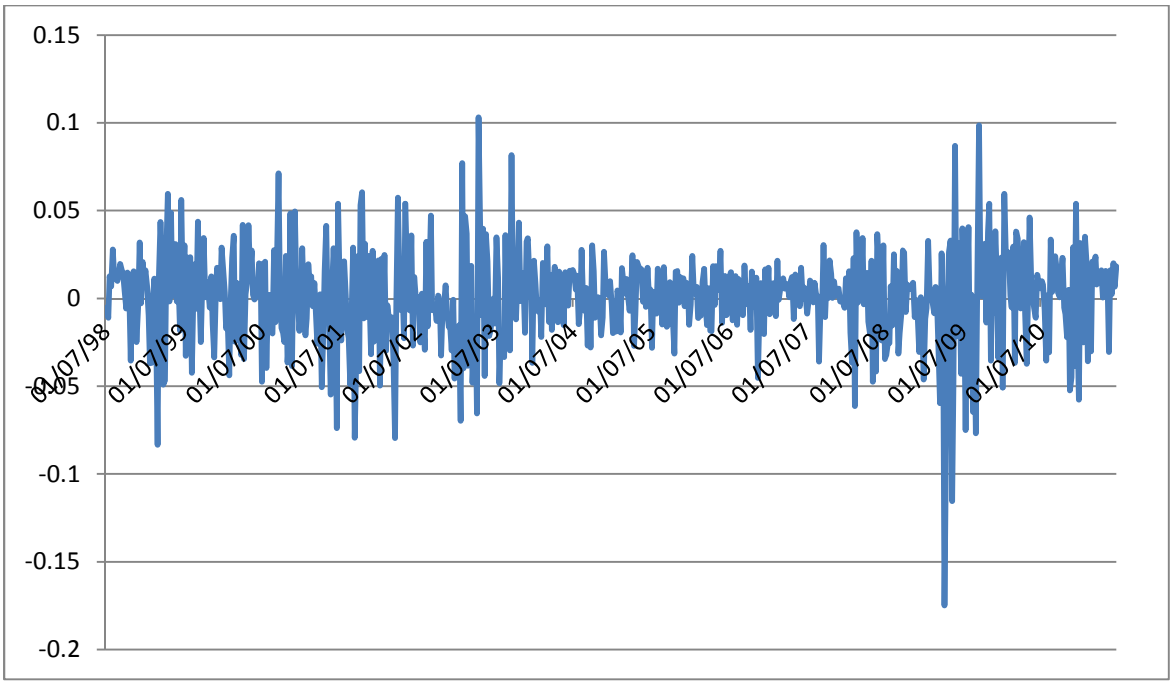
**Uninformed Investor Sentiment Data**



To enable the analysis of the asymmetric effect of investor sentiment on market returns and volatility, the investor sentiment must be transformed into positive (bullish) and negative (bearish) variables (Verma and Verma, 2007). Thus, both the uninformed and institutional investor sentiment variables are transformed in accordance to the models shown in Chapter IV.

**Figure 3**

**S&P 500 E-mini Futures Returns**




The bearish variables are transformed by taking the $U_{t-1}$ or $I_{t-1}$ variable and squaring it then multiplying it times the $U_{t-1}$ or $I_{t-1}$ variables if it is less than 50 which indicates a negative (bearish) shift in the index. The bullish variables are transformed by taking the $U_{t-1}$ or $I_{t-1}$ variable and squaring it then multiplying it times 1 minus the $U_{t-1}$ or $I_{t-1}$ variable if it is less than 50 which is designed to capture a positive (bullish) shift in the index. This transformation indicates a positive (bullish) or negative (bearish) percentage change from the previous data. A

similar transformation will also be done to analyze the rational and irrational data mentioned below.

**Table 1**

**Descriptive Statistics for Futures Returns and Sentiment**

| | *R* | *I* | *U* |
|---|---|---|---|
| *Descriptive Statistics*: | | | |
| Mean | 0.0026 | 48.1204 | 53.7584 |
| Std. Dev. | 0.0004 | 15.7803 | 26.0479 |
| Skewness | 0.7545 | - 0.0617 | -0.3064 |
| Min | 0.0020 | 10.0000 | 3.0000 |
| Max | 0.0041 | 81.0345 | 95.0000 |
| Kurtosis | 3.2352 | 2.0222 | 1.7213 |
| LMJB | 0.0000 | 0.0000 | 0.0000 |
| *Unit root tests*: | | | |
| ADF | 0.0678 | 0.0000 | 0.0000 |
| *ARCH Effects*: | | | |
| LM Test | 0.0000 | 0.0000 | 0.0000 |

The variables are returns of the S&P 500 e-mini futures contracts (*R*), natural log of uninformed investor sentiment index (*U*) and natural log of institutional investor sentiment index (*I*). Descriptives are based on weekly data from January 1998 to December 2010 consisting of 678 observations. Normality test used is the LaGrange Multiplier Jarque-Bera (LMJB) test and the results are shown as (probability>$Chi^2$). Unit root tests used are Augmented Dickey-Fuller, and the test results are shown as (P-values). The test for ARCH effects used is the LaGrange Multiplier (LM) and the test results are shown as (probability>$Chi^2$).

The descriptive statistics in Table 1 shows the mean of I and U are approximately 48 and 53 respectively. This suggests that the institutional investor sentiment has been slightly bearish during the sample period and the uninformed investor sentiment has been slightly bullish. This may indicate that there may be an asymmetric effect when using both together.

## Data for Rational and Irrational Investor Analysis

The data required for the analysis of rational and irrational components of investor sentiment are the returns data, the sentiment data, and the decomposition data. The futures returns used are the S&P 500 e-mini futures (previously described). The sentiment data is the same as described in the previous section. The decomposition data is comprised of fundamentals that have been shown in the literature to carry non-redundant information in asset-pricing literature particularly for futures markets.

In order to decompose institutional and uninformed investor sentiment into rational and irrational components they must be analyzed with fundamental variables that represent rational expectations based on risk factors common to the market of the asset being analyzed (Verma and Verma, 2007; Verma et al., 2008). Bessimbinder and Chan (1992) found that the T-bill yield, default premium, and equity dividend yield represent risk factors that are used in futures markets. Simon and Wiggins (2001) found that the VIX index was used by specialists in estimating futures pricing. Therefore, the data used in this study to decompose investor sentiment is as follows: 1) 3-month T-bill yield (Bessimbinder and Chan, 1992); 2) Barclays BAA long-term corporate bond yield minus Barclays AAA long-term corporate bond yield to represent default premium (Bessimbinder and Chan, 1992), and 3) the S&P 500 dividend yield to represent the equity dividend yield (Wang, 2003). French (1989) found that four factors influence the pricing of equity futures. The first factor is the premium on portfolios of small stocks relative to portfolios of large stocks or "Small minus Big" (SMB) (Fama and French, 1993). SMB is the average return on three small portfolios minus the average return on three big portfolios. The second factor is the premium on portfolios of high-book/market stocks relative to low-book/market stocks or "High minus Low" (HML) (Fama and French, 1993). This Fama/French

benchmark factor is constructed from six size/book-to-market benchmark portfolios that do not include hold ranges and do not incur transaction costs. HML is the average return on two-value portfolios minus the average return on two-growth portfolios. The third factor is the market risk premium that involves the market return minus the risk-free rate. The fourth factor is the risk-free rate itself.

Table 2 shows a high standard deviation for the VIX but this is normal given the two economic slowdown periods of August 2000 to September 2002 and October 2007 to February 2009. Also the S&P 500 dividend yield, the default premium, and three month T-Bill seem to have high kurtosis. This is also due to the two slowdown periods. Given the high number of observations this decreases the effect on normality.

**Table 2**

**Descriptive Statistics for Fundamental Variables**

| | Mean | Median | Maximum | Minimum | Std. Dev. | Skewness | Kurtosis | Obs |
|---|---|---|---|---|---|---|---|---|
| VIX | 22.5415 | 21.4900 | 74.2600 | 9.8900 | 9.0623 | 1.7936 | 8.8766 | 678 |
| MKT_RF | 0.0765 | 0.2550 | 13.0300 | -18.4100 | 2.7960 | -0.5810 | 8.2370 | 678 |
| SMB | 0.0731 | 0.08000 | 6.4400 | -9.3700 | 1.4828 | -0.4432 | 8.0012 | 678 |
| HML | 0.0717 | 0.02500 | 9.7900 | -7.0000 | 1.6083 | 0.4104 | 7.5396 | 678 |
| SPDIVYLD | 3.84E-05 | 0.0000 | 0.0360 | -0.0350 | 0.0054 | 0.0516 | 14.1129 | 677 |
| DPREM | 0.0103 | 0.0093 | 0.0342 | -0.0422 | 0.0051 | -0.0441 | 24.3876 | 677 |
| TBILL3M | -0.00085 | 0.0000 | 0.0810 | -0.1590 | 0.0138 | -3.4974 | 40.6825 | 677 |

Note: The variables are: returns for S&P500 (R), returns for NASDAQ 100 (RN), uninformed investor sentiment (I), uninformed investor sentiment (U), the volatility index (VIX), marker premium (MKT-RF), premium on portfolio of small stocks relative to large stocks (SMB), premium on portfolio of high-book/market stocks (HML), S&P500 dividend yield (1st difference due unit root) (SPDIVYLD), dividend premium (DPREM), three-month T-bill interest rate (1st difference due to unit root) (TBILL3M), risk-free rate (1st difference due to unit root) (RF).

Table 3 reports the cross-correlation between futures market returns, sentiment variables and the fundamentals. The contemporaneous correlations between the two indexes and

uninformed investor sentiment are higher than those with institutional investor sentiment. This finding gives an a priori indication that uninformed investors are more active as noise traders than are institutional investors (Verma et al., 2008). Also, the relatively low correlations among the fundamentals suggest that each variable represents a unique risk which is independent from the other.

Each variable used in the rational and irrational sentiment analysis was checked to determine its time-series properties by performing a unit root test: Augmented Dickey-Fuller (ADF) test (Dickey and Fuller, 1979, 1981). Based on the consistent and asymptotically efficient AIC and SIC criteria (Diebold, 2003) and considering the loss in degrees of freedom, the appropriate number of lags is determined to be two. In the case of the ADF test, the null hypothesis of non-stationarity is rejected. The inclusion of drift/trend terms in the ADF equations does not change these results (Dolado et al., 1990).

An initial test was performed and revealed that three variables showed a presence of the unit root; S&P 500 dividend yield, 3-month T-bill, and the risk-free rate. The unit root test in EViews showed that by using the first difference of these variables the unit root issue would be eliminated, thus the first difference of these variables is used. Table 4 reports the final results of the ADF test and indicates that all variables now pass.

## Table 3

## Cross Correlations for Fundamental Variables

| | R | I | U | VIX | MKT-RF | SMB | HML | SPDIVYD | DPREM | TBILL3M | RF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| R | 1. | .1384 | 0.4666 | 0.2419 | 0.3559 | 0.0116 | 0.0486 | 0.0698 | .01519 | -0.0508 | 0.0288 |
| I | 0.1384 | 1 | 0.6120 | -.5667 | 0.2365 | 0.0753 | -0.0139 | -0.1833 | -0.3274 | 0.1077 | 0.0326 |
| U | 0.4666 | 0.6121 | 1 | -0.5083 | 0.2791 | 0.1106 | -0.0065 | -0.2025 | -0.1873 | 0.0906 | 7.3496 |
| VIX | 0.2419 | -0.5668 | -0.5083 | 1 | -0.1872 | -0.0835 | -0.0804 | 0.1241 | 0.5873 | -0.1405 | -0.0980 |
| MKT-RF | 0.3559 | 0.2366 | 0.2791 | -0.1872 | 1 | 0.17039 | -0.0808 | -0.5341 | -0.0040 | 0.0300 | 0.0845 |
| SMB | 0.0116 | 0.0753 | 0.1106 | -0.0835 | 0.1704 | 1 | -0.2237 | -0.0947 | -0.0031 | -0.0031 | 0.0299 |
| HML | 0.0486 | -0.0140 | -0.0065 | -0.0805 | -0.0808 | -0.2237 | 1 | -0.1293 | 0.0639 | -0.0846 | -0.0165 |
| SPDIVYD | 0.0697 | -0.1833 | -0.2025 | 0.1241 | -0.5341 | -0.0947 | -0.1293 | 1 | -0.0637 | -0.2092 | -0.0852 |
| DPREM | 0.0151 | -0.3274 | -0.1873 | 0.5873 | -0.0040 | -0.0031 | 0.06392 | -0.0637 | 1 | -0.0681 | -0.04872 |
| TBILL3M | 0.0508 | 0.1077 | 0.0906 | -0.1405 | 0.0300 | -0.0031 | -0.0845 | -0.2093 | -0.0681 | 1 | 0.0517 |
| RF | 0.0288 | 0.0326 | 7.3496 | -0.0980 | 0.0845 | 0.0299 | -0.0165 | -0.0852 | -0.0487 | 0.0517 | 1 |

Note: The variables are: returns S&P500 (R), returns NASDAQ100 (RN), institutional investor sentiment (I), uninformed investor sentiment (U), the volatility index (VIX), marker premium (MKT-RF), premium on portfolio of small stocks relative to large stocks (SMB), premium on portfolio of high-book/market stocks (HML), S&P500 dividend yield ($1^{st}$ difference due unit root) (SPDIVYD), dividend premium (DPREM), three-month T-Bill interest rate($1^{st}$ difference due to unit root) (TBILL3M), risk-free rate (1st difference due to unit root (RF).

## Table 4

## Unit Root Tests

| | ADF test results | Probability |
|---|---|---|
| Institutional investor sentiment | -5.9396 | 0.0000 |
| Uninformed investor sentiment | -8.2149 | 0.0000 |
| R | -27.1392 | 0.0000 |
| VIX | -3.6101 | 0.0058 |
| MKT_RF | -27.7780 | 0.0000 |
| SMB | -24.4010 | 0.0000 |
| HML | -15.8961 | 0.0000 |
| SPDIVYLD | -27.7978 | 0.0000 |
| DPREM | -5.1282 | 0.0000 |
| TBILL3M | -27.7871 | 0.0000 |
| RF | -15.4496 | 0.0000 |

Note: The variables are: returns S&P500 (R), returns NASDAQ100 (RN), institutional investor sentiment (I), uninformed investor sentiment (U), the volatility index (VIX), marker premium (MKT-RF), premium on portfolio of small stocks relative to large stocks (SMB), premium on portfolio of high-book/market stocks (HML), S&P500 dividend yield (1st difference due unit root) (SPDIVYLD), dividend premium(DPREM), three-month T-Bill interest rate (1st difference due to unit root) (TBILL3M), risk-free rate (1st difference due to unit root (RF).

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# CHAPTER IV

# METHODOLOGY

The goals of this study are to: 1) Investigate the effects of institutional and uninformed investor sentiment on futures market returns and volatility, 2) Examine the asymmetric effect of institutional and uninformed investor sentiment on futures market returns and volatility, and 3) analyze the effect of the rational and irrational components of institutional and uninformed investor sentiment on futures market returns and volatility. This chapter presents the methodology of this study in two sections. The first section presents the methodology and model used to test the effects of institutional and uninformed investor sentiment on futures market returns and volatility and also to test for asymmetric effects as described in the studies by De Long et al. (1990), Wang (2001), Lee et al. (2002), and Brown and Cliff (2006). The methodology used to examine the robustness of the results is also presented in this section. The second section presents the methodology and model used to test the effects of the rational and irrational components of institutional and uninformed investor sentiment on futures market returns and volatility. The methodologies used to examine the robustness of the results are presented in this section.

## Futures Market Investor Sentiment Model

Following the theory of De Long et al. (1990) and the empirical studies of Lee et al. (2002) and Brown and Cliff (2004), it is hypothesized that futures market returns and volatility are a function of institutional and uninformed investor sentiment and that volatility indirectly

influences futures market returns. Also, previous studies have found that investors perceive that negative shocks of investor sentiment affect volatility greater than do positive investor sentiment shocks, thus there should be an indirect asymmetric effect of investor sentiment on futures market returns (Lee 2002; Brown and Cliff, 2005; Verma and Verma, 2007).

Brown and Cliff (2004) and Fisher and Statman (2000) also argued that informed investor sentiment is distinct from uninformed investor sentiment. Consequently, to avoid model misspecification it is important that both types of investor sentiment be included in the analysis of the effect of investor sentiment on futures market returns and volatility. Specifically, shocks originating from sentiment of one class of investors not considered might mistakenly be seen as a disturbance originating from sentiment of another class of investors included in the analysis. Hirshleifer (2001) also relates expected returns to both risks and investor misevaluation. Therefore, both institutional and uninformed investor sentiments need to be modeled together.

To test the hypotheses that futures market returns and volatility are a function of institutional and uninformed investor sentiments and that volatility indirectly affects futures market returns, in this study an EGARCH-M(1, 1) model[3] will be estimated. The EGARCH-M model is appropriate for this analysis for three reasons. First, as the variance equation in the EGARCH-M model is specified in logarithmic form there is no need to artificially impose non-negativity constraints on the parameters of the model. Second, the EGARCH-M can account for asymmetries of the error terms as well (Brooks, 2008). Third, the mean equation of the

[3] Note that only one lag is specified in the GARCH model. Bollerslev et al. (1992) suggest that GARCH (1, 1) is a parsimonious yet appropriate specification in most applications. This is empirically supported by Hansen and Lunde (2005). Additionally, Awartani and Corradi (2005) find that in cases where the data are asymmetric, the asymmetric GARCH (1,1) model such as the GJR-GARCH or EGARCH model outperforms the regular GARCH (1,1) model.

EGARCH-M model includes the conditional standard deviation which models the long term effect of investor sentiment on future returns (De Long et al., 1990).

Based on the above, the mean equation of the EGARCH-M (1,1) model can be specified as:

$$r_t = \alpha_0 + \alpha_1 I_t + \alpha_2 U_t + \alpha_3 h_t + \varepsilon_t \quad (1)$$

where $r_t$ is the weekly return for the S&P 500 e-mini futures contracts, $I_t$ is the institutional investor sentiment variable, $U_t$ is the uninformed investor sentiment variable, $h_t$ is the square root of the time-varying conditional variance, and $\varepsilon_t$ is the error term distributed as $\varepsilon_t \sim N(0, h_t)$. Based on Brown and Cliff (2004), the coefficient of the variable $I_t$ should be significant and positive. Note also that if the coefficent for the variable $U_t$ is significant and positive, the "hold more" effect dominates, but if the coefficient is significant and negative the "price-pressure" effect dominates (De Long et al., 1990). If the hold more effect dominates this implies that uninformed investor sentiment becomes more bullish, optimistic uninformed investors hold more risky assets than fundamentals would dictate, and consequently receive a higher return for bearing the greater risk associated with the sentiment. Also, the reverse is true, where uninformed investor sentiment becomes more bearish, there is a reduction in returns, thus uninformed investors hold less risky assets when they are more pessimistic. As a result, uninformed investors don't capture the risk premium related to the sentiment. If the price pressure effect dominates this implies that the average sentiment of uninformed investors is bullish (bearish); the trading of uninformed investors creates price pressure that results in a purchase or sale price that is higher (lower) than fundamental value and thereby lowers expected returns.

The coefficient associated with $h_t$ can be positive or negative depending on the preferences of the representative agent and the probability structure of the economy (Backus and Gregory, 1993). According to De Long et al. (1990), the conditional variance (or square root of the conditional variance) in the mean equation reflects the long run impact of investor sentiment on returns associated with the magnitude of sentiment changes on the future volatility of returns. A significant and positive coefficient for $h_t$ signifies that the investor sentiment is influenced more by the "create space" effect, while a significant and negative coefficient indicates they are influenced more by the "Friedman" effect (De Long, 1990). Also, a positive or negative and significant coefficient for $h_t$ implies that investor sentiment indirectly affects futures market returns positively or negatively through volatility, while an insignificant coefficient, regardless of sign, does not.

The variance equation for the EGARCH-M(1,1) model is specified as follows:

$$\ln(h_t^2) = \beta_0 + \beta_1 \left[ \frac{|\varepsilon_{t-1}|}{\sqrt{h_{t-1}^2}} - \sqrt{\frac{2}{\pi}} \right] + \beta_2 \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}^2}} + \beta_3 \ln(h_{t-1}^2) +$$

$$\beta_4 I_{t-1} + \beta_5 U_{t-1} + \beta_6 (I_{t-1})^2 (I_{t-1} > 50) + \beta_7 (I_{t-1})^2 \left( (I_{t-1} < 50) \right) +$$

$$\beta_8 (U_{t-1})^2 \, (U_{t-1} > 50) + \beta_9 (U_{t-1})^2 \left( (U_{t-1} < 50) \right) \qquad (2)$$

where coefficient $\beta_0$ is a constant, coefficient $\beta_1$measures the magnitude effect, coefficient $\beta_2$ measures asymmetry and $\beta_3$ is the measures persistence (Schwert, 2012). If decreases in the futures market ($|\varepsilon_{t-1}|$ <0) are followed by higher (lower) volatility than the futures market advances ($|\varepsilon_{t-1}|$ >0), then coefficient $\beta_2$ would be expected to be negative (positive). A significant positive coefficient $\beta_1$ coupled with a significant negative coefficient $\beta_2$ implies that negative shocks in the futures market have a higher impact on the volatility of the futures market

than do positive shocks; i.e., the volatility transmission is asymmetric.[4] Coefficients $\beta_4$ and $\beta_5$ show the effect of institutional ($I_{t-1}$) and uninformed ($U_{t-1}$) investor sentiment lagged one period on volatility. According to De Long et al. (1990) the uninformed investor sentiment should affect volatility and Brown and Cliff (2005) state that institutional investors should affect volatitity.

In equation (2), $(I_{t-1})^2$ represents the square of the institutional investor sentiment index variable lagged one period and $(I_{t-1} > 50)$ is a dummy variable which takes a value of one if the institutional investor sentiment index variable lagged one period is greater than 50. This implies that investor sentiment is bullish. Similarly, $(I_{t-1} < 50))$ represents a dummy variable where it is equal to 1 if the institutional investor sentiment index variable is less than 50. This implies that investor sentiment is bearish. The variable $(U_{t-1})^2$ represents the uninformed investor sentiment index variable lagged one period and $(U_{t-1} > 50)$ represents a dummy variable which is equal to 1 if the uninformed sentiment index variable is greater than 50. This implies that uninformed investor sentiment is bullish. Likewise, $(U_{t-1} < 50)$ represents represents a dummy variable which is equal to 1 if the uninformed investor sentiment index variable is is less than 50. This implies that uninformed investor sentiment is bearish.

The coefficient $\beta_6$ represents the effect on volatility of institutional investor sentiment from a negative shock and $\beta_7$ represents the effect on volatility of institutional investor sentiment from a positive shock. If the coefficients of these variables have opposite signs and significant then institutional investor sentiment will affect volatility asymmetrically. Research by Verma

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[4] Eviews represents the EGARCH-M model of Nelson (1991) where $g(z_{t-i}) = \left[\frac{|\varepsilon_{t-1}|}{\sqrt{h_{t-1}^2}} - \sqrt{\frac{2}{\pi}}\right]$(magnitude effect) + $\frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}^2}}$ (sign effect). According to Nelson (1991) *"to accommodate the asymmetric relation between stock returns and volatility changes (…) the value of $g(z_t)$ must be a function of both the magnitude and the sign of $z_t$"*.

and Verma (2007) found that institutional investor sentiment has a negative effect on volatilty. The coefficient $\beta_8$ represents the effect on volatility of uninformed investor sentiment during a negative shock and $\beta_9$ represents the effect on volatility of uninformed investor sentiment from a positive shock. Based on the theories of De Long et al. (1990) and Brown and Cliff (2005) the coefficients $\beta_8$ and $\beta_9$ are expected to affect volatility significantly.

**Robustness Checks for Futures Market Investor Sentiment Model**

To examine the robustness of the results of the EGARCH-M(1,1) model as specified above, alternative variable definitions (as used in other studies) and models are employed. The first robustness check (based on Lee et al., 2002) involves using futures market excess returns ($r_t - Rf_t$) instead of simply futures market returns ($Rf_t$ is the risk-free rate at time $t$). Excess returns are used as the dependent variable to eliminate bias due to systematic market risk in accordance with the studies of De Loong et al.(1990) and Lee et al. (2002).

The second robustness check is to account for the effect of bull and bear market movements which occurred during the period of analysis for this study. The reasoning behind this check is to exclude bias during these periods, such as negative bias during bear markets and positive bias during bull markets (Backus and Gregory, 1993).

For the bull and bear robustness check, an additional variable is added to equation (1);

$$r_t = \alpha_0 + \alpha_1 I_t + \alpha_2 U_t + \alpha_3 h_t + \alpha_4 BB_t + \varepsilon_t \quad (3)$$

In this case, the variable $BB_t$ is a dummy variable that takes a value of 1 if in a bull market and a value of 0 if in a bear market. The bull periods were calculated to be from November 1995 to August 2000; from September 2002 to October 2007; and from April 2009 to December 2010 using the methodology presented in Pagan and Soussounov (2003). The bear market periods were calculated as from September 2000 to August 2002, November 2007 to February 2009,

November 1995 to August 2000, and from September 2002 to October 2007 also using the methodology presented in Pagan and Soussounov (2003). If the coefficent for the $BB$ variable is significant and positive (negative) then the bull (bear) market affects returns differently and sentiment variables may have different results. If the coeffcient is insignificant, then sentiment should have the same results as the main model.

For the third robustness check a three variable VAR model (Sims, 1980) is used similar to Brown and Cliff (2004) in which sentiment and returns are jointly modeled as a system. Specifically the impluse response functions are analysed to capture the unanticipated components of the variables. Sims (1980) recommends focusing on the system's response to typical random shocks; i.e., impulse response functions (IMFs) rather than the coefficients.

The reason for using a VAR model as a robustness check is that Brown and Cliff (2004) also used a VAR model to chech the robustness of their analysis of informed and uninformed investor sentiment on stock market returns. In an efficient financial market, one would expectfutures market to react only to the unanticipated component of explanatory variables. Elton and Gruber (1991) argued that all the variables in a multi-index model need to be surprises or innovations and therefore should not be predicted from their past values. Consequently, asset-pricing models such as Arbitrage Pricing theory use the unanticipated component (innovations) of explanatory variables. Since the formulated models are multi-index models, the direct estimation in its present form would only give the relationships between the anticipated components. Such estimation would mean ignoring the effect of changes in the unanticipated components of investor sentiment and stock market returns and could be misleading. To overcome these potential misspecification problems, powerful impulse response functions (predicted pattern of surprise changes or innovations) generated from the VAR model are used.

Additionally, the prediction performance of VAR models has been shown to be better than the structural models used during the past two decades (Litterman and Supel, 1983; Hakkio and Morris, 1984; Litterman, 1984; Lupoletti and Webb, 1986; Webb, 1999).

Reporting delays may create lags between the observation of data concerning such variables and the incorporation of this information into futures prices (Verma et al., 2008). Thus, a model in which all variables are measured at time *t*, would imply an unrealistic assumption of only contemporaneous association. For this purpose the use of Akaike Information Criterion (AIC) and Schwarz Information Criterion (SIC) also helps in identifying the appropriate lag lengths of the variables in the VAR model. Thus, the lags in the VAR model capture the dynamic feedback effects in a relatively unconstrained fashion and are therefore a good approximation to the true data generating process (Verma et al., 2008; Verma and Soydemir, 2008). The VAR model used in this robustness check is similar to that used by Verma and Ozuna (2007) and is expressed as:

$$r_{i,t} = \beta_{i,0} + \sum_{j=1}^{3} \beta_{i,j} r_{j,t-1} + \varepsilon_{i,t} \qquad for\ i,j = 1,2,3 \qquad (4)$$

where, $r_{i,t}$ is a column vector of variables under consideration (which are $r_t$ , $I_t$, and $U_t$), $\beta_{i,0}$ is the deterministic component comprised of constants, $\beta_{i,j}$ is a matrix of parameters to be estimated, and $\varepsilon_{i,t}$represents innovations with mean zero and variance $\sigma_{i,j}$. By construction, the positive and negative innovations of market $i$ become part of the information set in market $j$ ($i, j$ = 1, 2, 3, where 1 = futures market returns, 2 = informed investor sentiment, and 3 = uninformed investor sentiment).

In the VAR specification, the likely response of one variable to a one-time unitary shock in another variable can be captured by impulse response functions. As such, they represent the behaviour of the series in response to pure shocks while keeping the effect of other variables

constant. Since impulse responses are highly nonlinear functions of the estimated parameters, confidence bands are constructed around the mean response. Responses are considered statistically significant at the 95% confidence level when the upper and lower bands carry the same sign. It is expected that the impulse response function for the VAR model will reflect the results of the estimation of equation 1 in terms of significance and sign.

It is well known that traditional orthogonalized forecast error variance decomposition results based on the widely used Choleski factorization of VAR innovations may be sensitive to variable ordering (Pesaran and Shin, 1996; Koop et al., 1996; Pesaran and Shin, 1998). To mitigate such potential problems of misspecifications, the recently developed generalized impulses technique as described by Pesaran and Shin (1998) in which an orthogonal set of innovations is used, does not depend on the VAR ordering.

All the estimated models areare checked for goodness of fit and the estimated coefficients are examined to determine if they have the appropriate sign and are significant. The residuals of all the estimated models are examined to determine if they are white noise and thus indicate if they are correctly specified or not.

**Rational and Irrational Futures Market Investor Sentiment Model**

In order to determine if rational and irrational futures market investor sentiment affect futures market returns and volatility, the institutional and uninformed investor sentiment is decomposed into irrational and rational components since sentiment could reflect investors' biases such as excessive optimism or pessimism. Excessive optimism (pessimism) may drive prices above (below) their intrinsic values. Since sentiment partially contains rational expectations based on risk factors (Brown and Cliff, 2004; Hirshleifer, 2001; Shleifer and Summers, 1990), it is quite possible that futures market returns and volatility are affected by both

rational and irrational components of sentiment. When investorsare bullish or bearish, their behavior could be a rational reflection of a future period's expectation or irrational enthusiasm or a combination of both. Therefore, it is important to determine whether investor sentiment effects on futures market returns and volatility are a function of rational or irrational components.

It is important to jointly model the sentiment of institutional and uninformed investors to avoid misspecification (Brown and Cliff, 2004). Specifically, shocks originating from sentiment of one class of investors which is not considered might mistakenly be seen as a disturbance originating from sentiment of another class of investors included in the analysis. In order to obtain the correct investor rational and irrational sentiment of the institutional and uninformed investor, sentiment variables must be decomposed (Verma and Verma, 2007; Verma et al., 2008). Since sentiment partially contains rational expectations-based risk factors (Shleifer and Summers, 1990; Brown and Cliff, 2005), it is quite possible that future returns may be affected by both fundamental and noise components of sentiment. Hirshleifer (2001) also relates expected returns to both risks and investor misevaluation. When an investor is bullish or bearish, then this could be a rational reflection of a future period's expectation or irrational enthusiasm or a combination of both. Accordingly,investor sentiment is first decomposed into two components: (i) a rational component based on the fundamentals and (ii) an irrational component based on noise (Verma and Verma, 2007).

Accordingly, I specify equations 6 and 7 to model rational and irrational effects of fundamentals and institutional and uninformed investor sentiment, respectively:

$$I_t = \gamma_0 + \gamma_j \sum_{j=1}^{j} Fund_{jt} + \vartheta_t \quad (5)$$

$$U_t = \theta_0 + \theta_j \sum_{j=1}^{j} Fund_{jt} + \omega_t \quad (6)$$

where $\gamma_0$ and $\theta_0$ are constants, $\gamma_j$ and $\theta_j$ are the parameters to be estimated; $\vartheta_t$ and $\mu_t$ are the random error terms. $I_t$ and $U_t$ represent the shifts in sentiment of uninformed and institutional investors, respectively, at time *t*. $Fund_{jt}$ is the set of fundamentals (see Chapter 3) representing rational expectations based on risk factors that have been shown to carry non-redundant information in conditional asset-pricing literature. The fitted values of Equations 5 and 6 capture the rational component of sentiment (i.e. $\hat{I}_t^{ra}$ and $\widehat{U}_t^{ra}$respectively). On the other hand, the residuals of equations 6 and 7 capture the irrational component of sentiment (i.e., $\hat{I}_t^{ir}$ and $\widehat{U}_t^{ir}$respectively).

Next, the extent to which the futures returns are affected by investor sentiment is analyzed. Sentiment may be irrational or rational. Accordingly, the sentiment variables are decomposed into the rational and irrational components based on equations 5 and 6 and included in the return generating process as:

$$r_t = \alpha_0 + \alpha_1 \hat{I}_t^{ra} + \alpha_2 \hat{I}_t^{ir} + \alpha_3 \widehat{U}_t^{ra} + \alpha_4 \widehat{U}_t^{ir} + h_t + \varepsilon_t \quad (7)$$

where $r_t$ is the weekly return for the S&P 500 e-mini futures contracts, coefficient $\alpha_0$ is a constant while $\hat{I}_t^{ra}$ is the rational institutional investor sentiment variable, $\hat{I}_t^{ir}$ is the irrational institutional investor sentiment variable; $\widehat{U}_t^{ra}$ is the rational uninformed investor sentiment variable, $\widehat{U}_t^{ir}$ is the irrational uninformed investor sentiment variable, $h_t$ is the square root of the time-varying conditional variance, and $\varepsilon_t$ is the random error term. Specifically, the coefficients $\alpha_1$ and $\alpha_3$ capture the effects of sentiment induced by fundamental trading on the part of institutional and uninformed investors, respectively; while coefficients $\alpha_2$and $\alpha_4$ capture the effects of sentiment-induced noise trading by institutional and uninformed investors, respectively. The coefficients $\alpha_2$ institutional and $\alpha_3$uninformed investor sentiment (both rational and irrational) in the mean (equation 7) are expected to be both positive and significant

(Lee et al., 2002; Verma and Verma, 2007). As before, the coefficient of $h_t$ can be positive or negative depending on the preferences of the representative agent and the probability structure of the economy (Backus and Gregory, 1993).

For the rational institutional and uninformed investor sentiment ($\hat{I}_t^{ra}$ and $\widehat{U}_t^{ra}$), the coefficients are expected to be positive and significant since rational sentiment is expected to have a positive effect on returns (Verma and Verma, 2007). The irrational institutional and uninformed investor sentiment ($\hat{I}_t^{ir}$ and $\widehat{U}_t^{ir}$) may be either positive (indicating that the "hold more" effect is dominant) or negative (indicating that the "price-pressure" effect is dominant). A positive and significant coefficient for $h_t$ signifies that the investor sentiment is influenced more by the "create-space" effect, while a negative and significant coefficient signifies they are influenced more by the "Friedman" effect (De Long, 1990). Also a positive (negative) and significant coefficient for $h_t$ implies that the investor sentiment indirectly affect futures market returns positively (negatively) through volatility, while an insignificant coefficient regardless of sign indicates the conditional volatility has no effect on returns.

The variance equation, where $\varepsilon_t \sim N(0, h_t)$, can be specified as:

$$\ln(h_t^2) = \beta_0 + \beta_1\left[\frac{|\varepsilon_{t-1}|}{\sqrt{h_{t-1}^2}} - \sqrt{\frac{2}{\pi}}\right] + \beta_2\frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}^2}} + \beta_3\ln(h_{t-1}^2) + \beta_4\hat{I}_{t-1}^{ra} + \beta_5\hat{I}_{t-1}^{ir} + \beta_6\widehat{U}_{t-1}^{ra} +$$

$$\beta_7\widehat{U}_{t-1}^{ir} + \beta_8(\hat{I}_{t-1}^{ra})^2(\hat{I}_{t-1}^{ra} < 50) + \beta_9(\hat{I}_{t-1}^{ra})^2(1 - (\hat{I}_{t-1}^{ra} < 50)) + \beta_{10}(\hat{I}_{t-1}^{ir})^2(\hat{I}_{t-1}^{ir} <$$

$$50) + \beta_{11}((\hat{I}_{t-1}^{ir})^2(1 - (\hat{I}_{t-1}^{ir} < 50)) + \beta_{12}(\widehat{U}_{t-1}^{ra})^2(\widehat{U}_{t-1}^{ra} < 50) + \beta_{13}(\widehat{U}_{t-1}^{ra})^2(1 -$$

$$(\widehat{U}_{t-1}^{ra} < 50)) + \beta_{14}(\widehat{U}_{t-1}^{ir})^2(\widehat{U}_{t-1}^{ir} < 50) + \beta_{15}(\widehat{U}_{t-1}^{ir})^2(1 - (\widehat{U}_{t-1}^{ir} < 50)) \quad (8)$$

where coefficient $\beta_0$ is the constant for the variance equation, coefficient $\beta_1$measures the magnitude effect, $\beta_2$ is the asymmetry coefficient and $\beta_3$is the persistence parameter (Schwert, 2012). If decreases in the futures market ($\varepsilon_{t-1}$ <0) are followed by higher (lower) volatility than

the futures market advances ($\varepsilon_{t-1}$>0), then $\beta_2$ would be expected to be negative (positive) and significant. A significant and positive $\beta_1$ coefficient coupled with a significant and negative (positive) $\beta_2$ coefficient implies that negative (positive) movements in the futures market have a higher impact on the volatility of the futures market than positive movements; i.e., the volatility transmission is asymmetric.

The $\beta_4$ and $\beta_5$ coefficients represent the effects of rational and irrational institutional investor sentiment on volatility and the $\beta_6$ and $\beta_7$ coefficients represent the effects of rational and irrational uninformed investor sentiment on volatility. Brown and Cliff (2004) state that both institutional and uninformed investor sentiment should be included and may have an effect on volatility. Verma and Verma (2007) found that rational institutional and uninformed sentiments were insignificant and irrational institutional and uninformed sentiments were significant in line with De Long (1990).

The explanation of the dummy investor sentiment variables provided in the previous section also holds in this model as well. The only difference is that the dummy variables are split into their rational and irrational components where the $\beta_8$ and $\beta_{12}$ coefficents are designed to capture negative shifts in rational institutional and uninformed investor sentiment, $\beta_9$ and $\beta_{13}$ coefficients are designed to capture positive shifts in rational institutional and uninformed investor sentiment. Also the $\beta_{10}$ and $\beta_{14}$ coefficients are designed to capture negative shifts in irrational institutional and uninformed sentiment, while the $\beta_{11}$ and $\beta_{15}$ coefficients are designed to capture positive shifts in irrational institutional and uninformed investor sentiment. It is expected that the results for irrational sentiment variables will be positive since it is the irrational sentiment that lead to greater volatility (Verma and Verma, 2007). The institutional investor rational sentiment the $\beta_8$ and $\beta_9$ coefficients represent how the market should move

based on rational sentiment and it is expected that they should be asymmetric. For the uninformed investor rational sentiment the $\beta_{12}$ and $\beta_{13}$ coefficients may or may not be significant depending on the level of knowledge and understanding uninformed investors incorporate in futures market trading but they should also be asymmetric. The irrational institutional investor sentiment $\beta_{10}$ and $\beta_{11}$ coefficients may or may not be significant depending on the level of risk institutional investors incorporate in futures market trading but should be asymmetric. Irrational uninformed investor sentiment $\beta_{14}$ and $\beta_{15}$ coefficients are expected to be significant since these are pure irrational sentiment and should be asymmetric; however, their effect depends on the influence uninformed investors have at any given time in the futures market (De Long et al., 1990).

**Robustness Checks for Rational and Irrational Investor Sentiment Model**

It is proposed that the same tests for robustness also be performed on the rational and irrational investor sentiment model, as in the investor sentiment model. The only variation is the substitution of the rational and irrational components ($\hat{I}_t^{ra}$ and $\hat{I}_t^{ir}$) for the $I_t$ and ($\widehat{U}_t^{ra}$ and $\widehat{U}_t^{ir}$) for the $U_t$ variables.

For the excess returns version of the rational and irrational investor sentiment model, the results are expected to be similar to the excess returns futures market investor sentiment model. Similar results are expected for the bull/bear version of the Rational and Irrational Investor Sentiment to that of the Bull/Bear futures market investor sentiment model except that the coefficient of the bull/bear dummy variable can be either significant and positive (bull) or negative (bear) (depending on if a bull or bear market affects the returns) or insignificant which implies that neither bull or bear markets affect the model differently.. The results for the VAR

model are also expected to show that the rational and irrational components ($\hat{I}_t^{ra}$ and $\hat{I}_t^{ir}$) for the $I_t$ and ($\widehat{U}_t^{ra}$ and $\widehat{U}_t^{ir}$) do affect futures market returns.

# CHAPTER V

# RESULTS AND DISCUSSION

This chapter contains two major sections. The first section presents and discusses the results of an analysis of the effects of the futures market institutional and uninformed investor sentiment on the returns and volatility of the S&P 500 e-mini futures and the robustness of these effects. This section is further divided into three subsections: (a) a presentation and discussion of the results of the effects of investor sentiment on futures returns, (b) a presentation and discussion of the results of the effect of investor sentiment on futures volatility and asymmetric effects, and (c) a presentation and discussion of the robustness checks.

The second section presents and discusses the results of the analysis of the rational and irrational components of institutional and uninformed investor sentiment on returns and volatility of S&P 500 e-mini futures and the robustness of these effects. The second section is divided into three subsections, namely: (a) a results of effects of fundamentals on investor sentiment, (b) comparison of rational and irrational model variations, (c) a presentation and discussion of the results of rational and irrational investor sentiment on futures market returns, (d) a presentation and discussion of the results of rational and irrational investor sentiment on futures market volatility and asymmetric effects and (e) a presentation and discussion of the robustness of these effects.

## Investor Sentiment Effects on Futures Market

### Results of Investor Sentiment on Futures Market Returns

The EGARCH-M (1, 1) model as specified in equations (1) and (2) in the methodology section were estimated using EViews. The estimated results of equation (1) and (2) are provided in Model I in Table 5.

**Table 5**

**Estimation of Futures Market Investor Sentiment**

| Variables | Coefficient | Model I | Model II | Model III |
|---|---|---|---|---|
| Constant | $\alpha_0$ | -0.109514*** | -0.108775*** | -0.088560*** |
| $U$ | $\alpha_1$ | 0.000767*** | 0.000758*** | 0.000911*** |
| $I$ | $\alpha_2$ | 0.000308*** | 0.000282*** | -5.65E-05 |
| $h_t$ | $\alpha_3$ | 2.868449*** | 2.961519*** | 2.326831*** |
| $r_{t-1}$ | $\alpha_4$ | -0.172674*** | -0.166257*** | -0.201996*** |
| Constant | $\beta_0$ | -4.332027*** | -4.153186*** | -1.896850*** |
| Magnitude | $\beta_1$ | 0.173696*** | 0.170398*** | 0.201205*** |
| Asymmetry | $\beta_2$ | -0.067105** | -0.067651*** | 0.006062 |
| Persistence | $\beta_3$ | 0.411758*** | 0.436332*** | 0.710694*** |
| $I_{t-1}$ | $\beta_4$ | -0.003765 | n/a | -0.001088 |
| $U_{t-1}$ | $\beta_5$ | 0.007332** | n/a | -0.010081*** |
| $I_{t-1}\,Bull$ | $\beta_6$ | -5.04E-05 | -7.27E-05*** | n/a |
| $I_{t-1}\,Bear$ | $\beta_7$ | 1.65E-05 | -7.99E-06 | n/a |
| $U_{t-1}\,Bull$ | $\beta_8$ | -0.000183*** | -0.000105*** | n/a |
| $U_{t-1}\,Bear$ | $\beta_9$ | -0.000177*** | -7.84E-05** | n/a |
| ***Diagnostic test on standardized residuals*** | | | | |
| Log likehood | | 1813.389 | 1810.951 | 1786.489 |
| Ljung-Box Q | | 4.945888*** | 3.158788*** | 4.997423* |

This table reports the results of EGARCH-in-mean models for the S&P 500 e-mini futures over the period from January 7, 1998 to December 29, 2010. The Ljung–Box Q-statistic tests for serial correlation in standardized residuals for lags up to 36. *Significance at 10% level. **Significance at 5% level. ***Significance at 1% level.

An important question in this dissertation is: Does investor sentiment affect futures market returns? The significant and positive coefficients of $U$ ($\alpha_1$) and $I$ ($\alpha_2$) in Model I indicate that both uninformed and institutional investor sentiment play a significant role in determining S&P500 e-mini futures market returns. De Long et al. (1990) states that uninformed investor sentiment affects returns either through the "price pressure" effect or the "hold more" effect (see Chapter II). The results show that uninformed investor sentiment ($\alpha_1$) is positive and significant indicating that the "hold more" effect dominates the "price-pressure" effect and this leads to an increase in futures returns when uninformed investors are more bullish. The "hold more" effect states that when uninformed investor sentiment becomes more bullish, optimistic uninformed investors hold more risky assets than fundamentals would dictate, and consequently receive a higher return for bearing the greater risk associated with the sentiment. Also, the reverse is true, where uninformed investor sentiment becomes more bearish, there is a reduction in returns, thus uninformed investors hold less risky assets when they are more pessimistic. As a result, uninformed investors don't capture the risk premium related to the sentiment. These results are the opposite of those found by Lee et al. (2002) but the same as those found by Verma and Verma (2007) in the stock market.

The significant and positive effect of uninformed investor sentiment ($\alpha_1$) on S&P 500 e-mini futures market returns is contrary to the existing literature. According to Sanders et al. (2003) uninformed investor sentiment does not affect futures market returns. It is important to note here that Sanders et al. used the same variable used in this study as a proxy for uninformed investor sentiment that this study used for institutional investor sentiment (see Chapter II). However, the results of the coefficient in the present study are in accordance with the theory of Delong et al. (1990).

The results for institutional investor sentiment ($\alpha_2$) are also positive and statistically significant indicating that institutional investor sentiment also affects market returns. The effect of institutional investor sentiment on S&P 500 e-mini futures market returns is contrary to the findings of Sanders et al (2009), but in accordance with the findings of Wang (2003) who used trades of institutional investors as a proxy for institutional investor sentiment. Wang (2003) found that previous institutional investor trades affect futures market returns. The reason that institutional investor sentiments are not subject to "hold more" and "price-pressure" effects is that these are the effects that differentiate actions of noise traders based on uninformed investor sentiments from institutional traders' actions based on institutional sentiment (De Long et al., 1990).

The significant estimate of $\alpha_3$ shows that ($h_t$) positively affects S&P 500 e-mini returns. When there is a positive effect of the uninformed investor sentiment on volatility and positive effect of volatility on S&P500 e-mini returns this indicates that uninformed investor sentiment affects S&P500 e-mini returns indirectly and positively. This is in accord with De Long et al. (1990) "create space" effect where volatility always affects returns positively (see CHAPTER II). These results are contrary to results from the stock market where the "Freidman" effect on volatility always affects returns negatively was found (see CHAPTER II) (Lee et al., 2002 and Verma and Verma, 2007). This seems to indicate that the futures market is governed by De Long et al. (1990) "create space" effect and the stock market by the "Freidman" effect. This may be attributed to uninformed traders who misinterpret shocks and increase their positions leading to higher pricing and greater returns. Also, uninformed trader positions offset the institutional traders' actions thus slightly lowering volatility as well as increasing returns.

In preliminary analysis of Equation (1) it was determined that the data exhibited serial correlation in the residuals. One method of controlling for serial correlation in an EGARCH model is to include a lag of the dependent variable in the mean equation (Dickey and Fuller, 1979; Brooks, 2008). By including the first lag of the S&P 500 e-mini returns as a variable in the mean equation, the serial correlation was controlled. The results showed that the coefficient of the first lag of the S&P 500 e-mini returns ($\alpha_4$) was negative and significant as expected (see Table 5).

**Results of Investor Sentiment on Futures Market Volatility and Asymmetric Effects**

Continuing with the results of Model I, the $\beta_1$ coefficient "magnitude of the asymmetry effect" is positive and significant and less than 1 indicating that the asymmetric effect is minimal (Nelson, 1991). The coefficient for the asymmetry variable of the residuals $\beta_2$, is positive and significant suggesting that positive shocks imply a higher next period conditional variance than negative shocks of the same sign do. These results are different than those found by Lee et al. (2002) in the stock market where negative shocks cause higher upward revisions in volatility. This may be due to the fact in the futures market there is greater loss potential to a speculator due increased prices than decline prices that have 0 as floor. However, the$\beta_3$ coefficient, "persistence of the asymmetry effect" is positive, significant and greater than 0 indicating the shock is persistent and not transitory. This implies that positive shocks will affect volatility in such a way that it can affect the risk premium (Nelson, 1991).

The results of Model I for the $I_{t-1}$ coefficient $\beta_4$ and the $U_{t-1}$ coefficient $\beta_5$ show that institutional investor sentiment ($I_{t-1}$) is negative and not significant and that uninformed investor sentiment ($U_{t-1}$) is positive and significant. This indicates that positive uninformed investor sentiment affects volatility in S&P 500 e-mini futures positively and institutional investor

sentiment has an insignificant effect on volatility. These results are different from those found in the stock market where Verma and Verma (2007) showed the effect of both institutional and uninformed investor sentiment on volatility to be negative and significant. The results of this estimation are in line with De Long et al. (1990) theory that uninformed investor sentiment has an effect on volatility.

When results of the $\beta_5$ coefficient are combined with the results of the $\alpha_3$ coefficient they show how uninformed investor sentiment affects S&P 500 e-mini returns. Since the $\beta_5$ coefficient shows that uninformed investor sentiment positively affects volatility and coefficient $\alpha_3$ shows that volatility positively affects returns, the combination indicates that uninformed investor sentiment positively affects S&P 500 e-mini returns indirectly. This is also in line with the theory of De Long et al. (1990).

The result for the $\beta_6$, $\beta_7$, $\beta_8$, and $\beta_9$ coefficients are used to indicate if the institutional and uninformed investor sentiment are asymmetric. The bullish institutional investor sentiment ($\beta_6$) is negative and insignificant and bearish institutional investor ($\beta_7$) is positive and insignificant. This indicates that neither bullish nor bearish institutional investor sentiment affects volatility. The results are different to those found by Verma and Verma (2008) in the stock market where the results were significant and asymmetric. This indicates that investor sentiment has an asymmetric effect on volatility in the stock market but not in the futures market.

The estimation shows that coefficients that capture both bullish and bearish uninformed investor sentiment ($\beta_8$ and $\beta_9$) are negative and significant. This indicates that uninformed investor sentiment affects volatility. This also supports the findings for the $\beta_5$ coefficient that uninformed investor sentiment indirectly affects returns. However, these results also show that uninformed investor sentiment does not affect S&P 500 e-mini returns asymmetrically. The

results are different from those in the stock market where according to Lee et al. (2002) and Verma and Verma (2007), uninformed investor bullish and bearish sentiment coefficients are asymmetrical and significant. This indicates that unlike the stock market, uninformed investor sentiment in the futures market is not asymmetric but do indirectly affect S&P500 e-mini returns and directly affect volatility.

One of the differences in the futures market as compared to the stock market is the existence of speculators and hedgers that take positions opposite of each other. The hedger seeks to reduce risk by protecting their positions by buying or selling futures contracts. The speculator provides that insurance by buying the hedger contracts (Gelhorst and Rowland, 2006). The uninformed sentiment index used does not differentiate between hedgers and speculators therefore both are included in the sample. According to Chang et al. (2000) hedgers change their positions and lower volatility during bearish shocks and speculators change their positions and lower volatility during bullish shocks. This seems to be what is being shown by the results. During bullish shocks, uninformed speculators go against the institutional hedgers' consensus and lower volatility and signal some portion of institutional investors to change their positions because they feel that the uninformed speculators will cause hedger to capitulate creating greater demand thus increasing prices. The same is true for uninformed hedgers during bearish shocks. Thus, uninformed sentiment acts as a counter indicator that signals some institutional investors to change positions to which together increase returns. This is similar to the uninformed liquidity trader explained by Kyle, (1985).

Based on the insignificance of the institution investor sentiment on volatility it is important to determine if Model I is the best fitting model. The likelihood-ratio test is used to compare Model I to other models without certain groups of variables. To determine if the

inclusion of the variables $I_{t-1}$ and $U_{t-1}$ are required, restricted Model II excludes variables $I_{t-1}$ and $U_{t-1}$. The results of restricted Model II differ from Model I (see Table 5). The results for both models for the mean equation are similar. In the variance equation in Model II, the coefficient signs and significance for both models are the same except for the bullish institutional investor sentiment ($\beta_6$) which is significant and bearish institutional investor sentiment ($\beta_7$) which is negative. The likelihood ratio indicates that Model I is the more appropriate model, thereby indicating that the variables $I_{t-1}$ and $U_{t-1}$ should be included in the analysis.

To determine if the inclusion of the asymmetric variables *($I_{t-1}$ Bull, $I_{t-1}$ Bear, $U_{t-1}$ Bull, $I_{t-1}$ Bear)* are required, restricted Model III excludes asymmetric variables ($I_{t-1}$ *Bull*, $I_{t-1}$ *Bear*, $U_{t-1}$ *Bull*, $I_{t-1}$ *Bear*). The results of restricted Model III differ from Model 1 (see Table 5). The results of the mean equation are similar except the $\alpha_2$ (*I*) coefficient of Model III is negative and not significant. In the variance equation the significant differences in Model III are; the $\beta_2$ coefficient is positive and not significant, and the $U_{t-1}$ ($\beta_5$) coefficient is negative has the same significance as Model I. Hence, the likelihood ratio indicates that Model I is the more appropriate model indicating that the asymmetric variables ($I_{t-1}$ *Bull*, $I_{t-1}$ *Bear*, $U_{t-1}$ *Bull*, $I_{t-1}$ *Bear*) should not be dropped from the analysis.

**Robustness Checks for Futures Market Investor Sentiment**

In order to determine the robustness of the model, it is tested in three ways. First, Model I results are compared to Bull/Bear Model. The second robustness check consists of comparing Model I to the Excess Returns Model. For the third check, a VAR model is run to verify if the results are consistent.

For the first robustness check the Bull/Bear Model is estimated. The mean equation results of this model are substantially similar to those of Model I. The results show the same

signs and significance for each coefficient as in Model I. In the variance equation both models show the bullish institutional investor sentiment coefficients $\beta_6$ as negative and significant. For the bearish institutional investor sentiment, the $\beta_7$ coefficient in Model I is positive and insignificant and Bull/Bear Model is opposite. The bullish uninformed investor sentiment ($\beta_8$) coefficients are the same for both models, while the bearish uninformed investor sentiment ($\beta_9$) coefficients are both negative and the Model I uninformed investor sentiment ($\beta_9$) coefficient is significant. The difference may be explained by the coefficients in Model I that are extremely close to zero indicating they may be sensitive to any changes in the variables. Except for the differences in the asymmetric coefficients the results are similar. The likelihood ratio indicates that Model I is the more appropriate thus the Model I is robust in relation to the Bull/Bear Model.

The results of the second robustness check (Excess Returns Model) show some substantially different results from Model I. For example, the ($\alpha_2$) coefficient for institutional investor sentiment is insignificant. Also, the sign on ($\beta_2$), coefficient which is the asymmetric variable is positive indicating that in the case of excess returns negative shocks affect the variance greater than do positive ones. This may be due to the period of smaller risk-free rates at the end of the sample period. For the institutional and uninformed sentiment variables the signs on the ($\beta_4$ and $\beta_5$) coefficients are the same as in Model I, however the significance for $\beta_5$ is different from Model I.

## Table 6

## Estimation of Futures Market Investor Sentiment Robustness

| Variables | Coefficient | Bull/Bear Model | Excess Returns Model |
|---|---|---|---|
| Constant | $\alpha_0$ | -0.114885*** | -0.178758*** |
| $I$ | $\alpha_1$ | 0.000752*** | 0.000731*** |
| $U$ | $\alpha_2$ | 0.000325*** | 1.53E-05 |
| $h_t$ | $\alpha_3$ | 3.013620*** | 3.797600*** |
| $r_{t-1}$ | $\alpha_4$ | -0.180024*** | -0.328394*** |
| Bull/Bear | $\alpha_5$ | 0.004423*** | n/a |
| Constant | $\beta_0$ | -4.306290*** | -0.610878*** |
| Magnitude | $\beta_1$ | 0.167639*** | 0.067778*** |
| Asymmetry | $\beta_2$ | -0.061470** | 0.146629*** |
| Persistence | $\beta_3$ | 0.406305 | 0.911698*** |
| $I_{t-1}$ | $\beta_4$ | 0.006747 | -0.001080 |
| $U_{t-1}$ | $\beta_5$ | -0.239747 | 0.001655 |
| $I_{t-1}\,Bull$ | $\beta_6$ | -0.011630 | 4.20E-06 |
| $I_{t-1}\,Bear$ | $\beta_7$ | -7.99E-06*** | 9.00E-06 |
| $U_{t-1}\,Bull$ | $\beta_8$ | -9.18E-05*** | -2.83E-05 |
| $U_{t-1}\,Bear$ | $\beta_9$ | -5.94E-05 | -4.41E-05 |
| ***Diagnostic test on standardized residuals*** | | | |
| Log likehood | | 1812.326 | 1655.971 |
| Ljung-Box Q statistic | | 4.945888*** | 1.952435*** |

This table reports the results of EGARCH-in-mean models for the S&P 500 e-mini futures over the period from January 7, 1998 to December 29, 2010. The Bull/Bear model uses a dummy variable Bull/Bear to adjust for bull and bear cycles, where 1 = a bull period and 0 = a bear period. The excess returns model uses excess returns for the dependent variable. The Ljung–Box Q-statistic tests for serial correlation in standardized residuals for lags up to 36.
*Significance at 10% level. **Significance at 5% level. ***Significance at 1% level.

The other differences in the Excess Returns Model are the bullish institutional investor sentiment ($\beta_6$) coefficients is positive while Model I $\beta_6$ is negative and both are insignificant.

The bearish institutional investor sentiment ($\beta_7$) coefficient is opposite of $\beta_6$ for each model making both models asymmetric for institutional investor sentiment and both are insignificant. The bullish and bearish uninformed investor sentiment coefficients $\beta_8$ and $\beta_9$ of the Excess Returns Model are negative but not significant, but the signs are similar to Model I and the coefficients are significant.

Overall, the results of the bull/bear and excess returns EGARCH-in-mean models support the mean equation in Model I. The bull/bear model supports Model I as to the signs but varies slightly as to significance. The excess returns model supports the signs of the institutional and uninformed investor sentiment in the variance and bullish and bearish uninformed investor sentiment, but not the significance. The bullish and bearish institutional investor sentiments are not supported.

For the third robustness check a VAR model is used. The VAR model confirms that the institutional and uninformed investor sentiment do affect future returns (Figure 3). Sims (1980) recommends focusing on the system's response to typical random shocks; i.e., impulse response functions (IMFs). Given this recommendation, the relevant IRFs are analyzed and not much emphasis is placed on the estimated coefficients of the VAR models (see APPENDIX).

EViews offers multiple methods to construct confidence bands around the mean response. Monte Carlo methods are used because according to Doan and Litterman (1986), these methods provide more statistically accurate results. When the upper and lower bounds carry the same sign, the responses become statistically significant at the 95% confidence level.

Figures 4(a) and 4(b) plot the IMFs of the S&P 500 e-mini futures returns based on a one-time standard deviation increase in institutional and uninformed investor sentiment respectively. The effect of the institutional investor sentiment is positive and significant during

the first and second weeks and insignificant thereafter. The response to the uninformed investor sentiment is also positive and significant during the first and second weeks and insignificant thereafter during the remaining weeks.

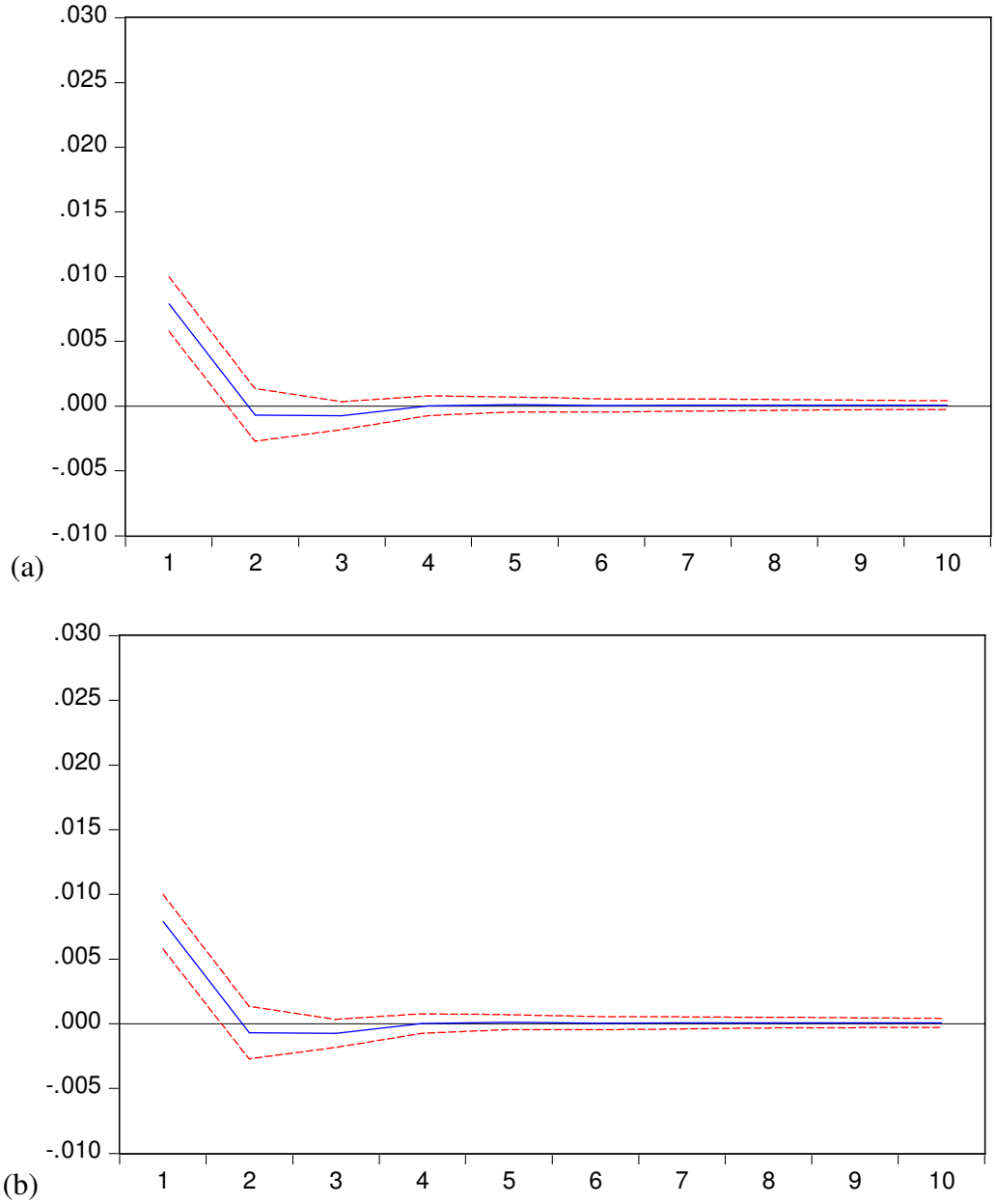


**Fig. 4. Response of S&P 500 e-mini futures returns to the institutional and uninformed investor sentiment.** (a) Institutional investor sentiment; (b) Uninformed investor sentiment. Notes: The dashed lines on each graph represent the upper- and lower-95% confidence bands. When the upper- and lower bounds carry the same sign the response becomes statistically significant.*On each graph, 'percentage returns' are on the vertical and 'horizon' is on the horizontal axis.

The results of the VAR model confirm the results of the EGARCH-in-mean for both magnitude and direction. The VAR model results show that the institutional and uninformed investor sentiment do affect S&P 500 e-mini returns. Also, the uninformed investor sentiment has a greater effect on S&P 500 e-mini returns than does institutional investor sentiment.

## Rational and Irrational Investor Sentiment Effects

This section presents the results and analysis of the effects of rational and irrational institutional and uninformed investor sentiment on returns and volatility as well as the asymmetric effects of sentiment on returns over the time period studied. This section is in five sub-sections.

### Results of Effects of Fundamentals on Investor Sentiment

The results of Equations 5 and 6 which are used to provide the rational and irrational components for the institutional and uninformed investor sentiment respectively are provided in Tables 7 and 8 below. Table 7 reports that the institutional investor sentiment is significantly related to the VIX, market risk premium, S&P 500 dividend yield and the HML. Table 8 reports that the uninformed investor is significantly related to VIX, market risk premium, dividend premium, and the risk-free rate. These results are consistent with the argument of Brown and Cliff (2004b) that investor sentiment may contain a combination of both rational and irrational components and not necessarily only noise.

**Table 7**
**Effects of Fundamentals on Institutional Investor Sentiment**

| Variable | Coefficient | Institutional |
|---|---|---|
| C | $\alpha_0$ | 69.75394*** |
| VIX | $\alpha_1$ | -0.941344*** |
| MKT_RF | $\alpha_2$ | 0.528470** |
| SMB | $\alpha_3$ | -0.056701 |
| HML | $\alpha_4$ | -0.590838* |
| SPDIVYLD_ADJ | $\alpha_5$ | -225.44170* |
| DPREM | $\alpha_6$ | -37.18267 |
| TBILL3M_ADJ | $\alpha_7$ | 10.13915 |
| RFADJ | $\alpha_8$ | -13.16050 |

| | | | |
|---|---|---|---|
| R-squared | 0.346540 | Mean dependent var | 48.15647 |
| Adjusted R-squared | 0.338703 | S.D. dependent var | 15.80564 |
| S.E. of regression | 12.85318 | Akaike info criterion | 7.958283 |
| Sum squared resid | 110191.1 | Schwarz criterion | |
| Log likelihood | -2680.900 | Hannan-Quinn criter. | 7.981563 |
| F-statistic | 44.21514 | Durbin-Watson stat | 0.327161 |
| Prob(F-statistic) | 0.000000 | | |

Note: (VIX), marker premium (MKT-RF), premium on portfolio of small stocks relative to large stocks (SMB), premium on portfolio of high-book/market stocks (HML), S&P 500 dividend yield (1st difference due unit root) (SPDIVYLD), dividend premium(DPREM), three-month T-bill interest rate (1st difference due to unit root) (TBILL3M), risk-free rate 91st difference due to unit root (RF).

**Table 8**
**Effects of Fundamentals on Uninformed Investors**

| Variable | Coefficient | Uninformed |
|---|---|---|
| C | $\alpha_0$ | 82.625550*** |
| VIX | $\alpha_1$ | -1.628582*** |
| MKT_RF | $\alpha_2$ | 1.304425*** |
| SMB | $\alpha_3$ | 0.432532 |
| HML | $\alpha_4$ | -0.854742 |
| SPDIVYLD_ADJ | $\alpha_5$ | -280.406400 |
| DPREM | $\alpha_6$ | 741.717200*** |
| TBILL3M_ADJ | $\alpha_7$ | 6.420461 |
| RFADJ | $\alpha_8$ | -39.669970** |

| | | | |
|---|---|---|---|
| R-squared | 0.315606 | Mean dependent var | 53.650890 |
| Adjusted R-squared | 0.307398 | S.D. dependent var | 26.053670 |
| S.E. of regression | 21.68257 | Akaike info criterion | 9.004119 |
| Sum squared resid | 313579.3 | Schwarz criterion | 9.064246 |
| Log likelihood | -3034.392 | Hannan-Quinn criteria. | 9.027399 |
| F-statistic | 38.44816 | Durbin-Watson statistic | 1.074852 |
| Prob(F-statistic) | 0.000000 | | |

Note: (VIX), marker premium (MKT-RF), premium on portfolio of small stocks relative to large stocks (SMB), premium on portfolio of high-book/market stocks (HML), S&P500 dividend yield (1st difference due unit root) (SPDIVYLD), dividend premium (DPREM), three-month T-bill interest rate (1st difference due to unit root) (TBILL3M), risk-free rate (1st difference due to unit root (RF).

## Rational and Irrational Investor Sentiment Model Comparison

Model V which incorporates equations 7 and 8 was intended to be used as the main model for this section. When Model V was run in EViews the model did not converge however the two restricted models discussed below did. The implication for this is that results may be

different than from the integrated model. Both restricted models share the same mean equation 7 as Model V. The large number of variables in Model V may have contributed to the lack of convergence. Given the extremely small coefficient results from the may indicate that covariance may be so small as to be interpreted by the model to be zero. Every model modification allowed in EViews was employed to try and run the model including different error distributions, back casting variations, and coefficient covariance optimizations. Even a model change using the GJR-GARCH model which is similar to the EGARCH model used, was tried with no success.

Model VI is restricted to model only the effects of rational and irrational sentiment of institutional and uninformed investors ($\hat{I}_{t-1}^{ra}$, $\hat{I}_{t-1}^{ir}$, $\hat{U}_{t-1}^{ra}$, $\hat{U}_{t-1}^{ir}$ variance variables equation 8) on the futures market returns and volatility using an EGARCH model. The asymmetric variables (Bull $\hat{I}_{t-1}^{ra}$, Bear $\hat{I}_{t-1}^{ra}$, Bull $\hat{I}_{t-1}^{ir}$, Bear $\hat{I}_{t-1}^{ir}$, Bull $\hat{U}_{t-1}^{ra}$, Bear $\hat{U}_{t-1}^{ra}$, Bull $\hat{U}_{t-1}^{ir}$, and Bear $\hat{U}_{t-1}^{ir}$ variance variables equation 8) are excluded in Model VI. The results of this model show a higher log likelihood than Model VII indicating a better fit, therefore only the results of this model are included in the results below. The results also indicate that asymmetry is not a factor in determining the effects of rational and irrational investor sentiment on volatility or returns for S&P 500 e-mini futures.

Restricted Model VI was run to obtain the results from the asymmetric effects of rational and irrational sentiment on the futures market returns and volatility. This model uses the same mean equation as Models V and VI but only incorporates the asymmetric variables (Bull $\hat{I}_{t-1}^{ra}$, Bear $\hat{I}_{t-1}^{ra}$, Bull $\hat{I}_{t-1}^{ir}$, Bear $\hat{I}_{t-1}^{ir}$, Bull $\hat{U}_{t-1}^{ra}$, Bear $\hat{U}_{t-1}^{ra}$, Bull $\hat{U}_{t-1}^{ir}$, and Bear $\hat{U}_{t-1}^{ir}$ variance variables equation 8). The results of this model showed no evidence of asymmetric effects and a lower log likelihood of 1883.754 than that of Model VI (see Table 9) and thus are not included in the results.

**Results of Rational and Irrational Investor Sentiment on Futures Market Returns**

In this sub-section the effect of rational and irrational investor sentiment on S&P 500 e-mini futures market returns are analyzed. The estimated results of Equation 7 are shown as the alpha ($\alpha$) coefficients found under Model VI in Table 9. The analysis results indicate that rational institutional investor sentiment ($\alpha_1$) affects S&P 500 e-mini futures market returns positively and significantly. These results are as expected and are similar to those found by Verma and Verma (2007) in the stock market. This indicates that fundamental analysis institutional investors do affect S&P 500 e-mini futures market returns.

Irrational institutional investor sentiment ($\alpha_2$) is shown to be positive and insignificant. While the sign is as expected for the effect of irrational investor sentiment on S&P 500 e-mini futures returns the lack of statistical significance is not. The explanation for this could be that due to the level of knowledge and experience required to be an institutional futures trader there is very little irrationality in their trading. This is different from the stock market (Verma and Verma, 2007) where futures can be used to hedge positions made in the stock market so institutional investors can take more risks and take positions similar to uninformed as they do during momentum trades (Schmeling, 2009).

Irrational uninformed investor sentiment ($\alpha_4$) is also found to be positive and significant and affect S&P 500 e-mini futures market returns. This supports the finding in the previous section where the "hold more" effect seems to exist in the futures market. These results were also similar to those found in the stock market by Verma and Verma (2007).

## Table 9

## Estimation of Future Market Rational and Irrational Investor Sentiment

| Variables | Coefficients | Model VI |
|---|---|---|
| Constant | $\alpha_0$ | -0.301720*** |
| $I^{ra}$ | $\alpha_1$ | 0.000486* |
| $I^{ir}$ | $\alpha_2$ | 6.26E-05 |
| $U^{ra}$ | $\alpha_3$ | 0.001884*** |
| $U^{ir}$ | $\alpha_4$ | 0.000537*** |
| $h_t$ | $\alpha_5$ | 11.89748*** |
| Constant | $\beta_0$ | -7.397026*** |
| Magnitude | $\beta_1$ | 0.032328*** |
| Asymmetry | $\beta_2$ | -0.015888*** |
| Persistence | $\beta_3$ | -0.037332*** |
| $I^{ra}_{t-1}$ | $\beta_4$ | -0.016159*** |
| $I^{ir}_{t-1}$ | $\beta_5$ | -0.001391 |
| $U^{ra}_{t-1}$ | $\beta_6$ | -0.011176*** |
| $U^{ir}_{t-1}$ | $\beta_7$ | -0.004313*** |
| ***Diagnostic test on standardized residuals*** | | |
| Log likehood | | 1908.879 |
| Ljung-Box Q statistic | | 2.235784 |

This table reports the results of EGARCH-in-mean models for the S&P 500 e-mini futures over the period from January 7, 1998 to December 29, 2010. The Ljung–Box Q-statistic tests for serial correlation in standardized residuals for lags up to 36. *Significance at 10% level. **Significance at 5% level. ***Significance at 1% level.

The coefficient for the variance in the mean variable ($\alpha_5$) is positive and significant similar to Model I. This indicates as it did in Model I that the variance has a positive effect on S&P500 e-mini futures returns. This also confirms the "create space" effect found in Model I. Any variables that have a positive or negative effect on the variance will have a positive effect on returns.

**Results of Investor Sentiment on Futures Volatility and Asymmetric Effects**

Continuing with the results of Model VI, coefficient $\beta_1$ "magnitude of the asymmetry effect" is positive and significant and small indicating that the asymmetric effect is not economically significant despite the statistical significance. The coefficient for the asymmetry variable of the residuals $(\beta_2)$ coefficient is negative and significant suggesting that negative shocks imply a higher next period conditional variance than positive shocks of the same sign. However, the $(\beta_3)$ coefficient "persistence of the asymmetry effect" is negative, significant, and large indicating long persistence. This implies that positive shocks will affect volatility over a prolonged period. The results of $(\beta_2)$ coefficients and $(\beta_3)$ are different than those found in Model I, this result may be due to complex changes in the errors (St. Pierre, 1998). Given that the sample encompasses a highly volatile period for returns and the rational and irrational variables are not 100% representative this may explain the difference in the signs for ($\beta_2$ and $\beta_3$) coefficients.

Model VI is also used to answer the two hypotheses 7.a and 7.c. The results indicate that for rational institutional and uninformed investor sentiments $(\beta_4)$ and $(\beta_6)$ do affect volatility negatively suggesting that rational sentiment causes a great deal of variability in stock prices. These results are different than those found in the stock market. Verma and Verma (2007) found that rational institutional and uninformed investor sentiment had no effect on volatility or stock market returns. The difference could be that in the Verma and Verma (2007) study the rational and irrational sentiment was not lagged as it is in this dissertation. When rational institutional sentiment results are paired with the results of uninformed investor sentiment this indicates that the rational institutional trader may be following uninformed traders movement to take advantage of momentum opportunities. Another possibility is that uninformed traders are

following the movements of institutional traders thus all are moving together causing volatility to rise and S&P 500 e-mini futures market returns to increase.

The result from irrational sentiment indicates that irrational institutional sentiment have negative but insignificant effect on volatility. This may be attributed to the level of expertise and knowledge needed professionally to trade S&P 500 e-mini futures hence there is little action taken by institutional investors on irrational sentiment. In summary, both irrational and rational uninformed investor sentiment has a negative effect on volatility.

The negative effect that irrational uninformed investor sentiment has on volatility and positive effect that volatility has on returns, means that irrational uninformed investor sentiment decreases volatility and indirectly increases returns. This result is in line with the predictions of De Long et al. (1990) and other noise trader models that the effect of noise trading on expected returns is through its impact on the market's formation of risk.

When results of $\beta_4$, $\beta_5$, $\beta_6$, and $\beta_7$ coefficients are combined with the results of ($\alpha_3$) coefficients they show that rational investor sentiment of both institutional and uninformed investors, as well as irrational investor sentiment of uninformed investors negatively affects volatility ($h_t$). These results are different from those in the stock market where only the irrational institutional and uninformed investor sentiment was significant. The explanation for the negative effect of rational institutional sentiment on volatility could result from some institutional investors who notice that uninformed investors are buying or selling positions and move to take advantage of a temporary price advantage. However, since this study is done with weekly data this cannot be substantiated. This explanation also fits with results of uninformed rational and irrational sentiment results ($\beta_6$ and $\beta_7$). The rational institutional investor sees any movement by uninformed investors as a contraindicating signal and reacts. Since the rational institutional

investor does not know if the uninformed investors are rational or irrational they take opposite positions regardless thus increasing liquidity and lowering volatility. These actions are similar to those described by Kyle (1985) in the futures market. Kyle (1985) also explains why $\alpha_3$ shows a positive effect on returns. Since the actions by both uninformed investors and by some institutional investors decrease liquidity they lower the spread and thus increase returns.

**Robustness Checks Rational and Irrational Investor Sentiment**

Robustness checks were run on Model VI using the bull/bear model and the excess returns model as previously explained. For robustness checks for the mean equation for Model VI show that the bull/bear model had the same signs. The same was true for the significance except the coefficient for the rational institutional investor sentiment was not significant for the bull/bear model. This indicates that the bull/bear model substantially supports the mean equation results for Model VI. The results of the excess returns model robustness check confirms the signs and significance for all the mean variables of Model VI except the rational and irrational institutional investor sentiments which were both significant and negative the opposite of the Model VI results. This may be explained by the smaller excess returns which may have provided spurious results. Use of a larger sample size could correct this, however the sample S&P 500 e-mini futures data used already extends to the beginning of the derivative offering. Including 2011 and 2012 would only exacerbate the problem.

For the variance equation, the bull/bear robustness model provided the same sign and significance results as Model VI, again substantially supporting the model. However for the excess returns model the variance results were mixed. For the EGARCH magnitude, asymmetry and persistence variables the signs of ($\beta_1$, $\beta_2$, and $\beta_3$) coefficients are opposite of Model VI though the significance was the same except for ($\beta_1$) coefficient. The results for the rational

institutional and irrational uninformed investor sentiments of the Excess Returns Model are also mixed, ($\beta_4$ and $\beta_7$) coefficients are the same. The result of ($\beta_5$) coefficient has a different sign but same significance as Model VI, but for ($\beta_6$) coefficient both the sign and significance is different from Model VI.

**Table 10**

**Estimation of Rational and Irrational Investor Sentiment Robustness**

| Variables | Coefficient | Bull/Bear Model | Excess Returns Model |
|---|---|---|---|
| Constant | $\alpha_0$ | -0.322227*** | -0.226939*** |
| $I^{ra}$ | $\alpha_1$ | 0.000514 | -0.001883*** |
| $I^{ir}$ | $\alpha_2$ | 4.32E-05 | -0.000363*** |
| $U^{ra}$ | $\alpha_3$ | 0.001831*** | 0.003393*** |
| $U^{ir}$ | $\alpha_4$ | 0.000531*** | 0.000552*** |
| $h_t$ | $\alpha_5$ | 12.88018*** | 5.383181*** |
| Bull/Bear | $\alpha_6$ | 0.005885*** | |
| Constant | $\beta_0$ | -7.322731*** | -3.607163*** |
| Magnitude | $\beta_1$ | 0.031411*** | -0.031339 |
| Asymmetry | $\beta_2$ | -0.019341*** | 0.108912*** |
| Persistence | $\beta_3$ | -0.023558*** | 0.318758*** |
| $I^{ra}_{t-1}$ | $\beta_4$ | -0.017022*** | -0.038094*** |
| $I^{ir}_{t-1}$ | $\beta_5$ | -0.001619 | 0.004883 |
| $U^{ra}_{t-1}$ | $\beta_6$ | -0.008944*** | 0.001725 |
| $U^{ir}_{t-1}$ | $\beta_7$ | -0.004021*** | -0.006634*** |
| ***Diagnostic test on standardized residuals*** | | | |
| Log likehood | | 1918.870 | 1715.029 |
| Ljung-Box Q statistic | | 4.834590*** | 1.752654*** |

This table reports the results of EGARCH-in-mean models for the S&P 500 e-mini futures over the period from January 7, 1998 to December 29, 2010. The Bull/Bear model uses a dummy variable Bull/Bear to adjust for bull and bear cycles, where 1 = a bull period and 0 = a bear period. The excess returns model uses excess returns for the dependent variable. The Ljung–Box Q-statistic tests for serial correlation in standardized residuals for lags up to 36. *Significance at 10% level. **Significance at 5% level. ***Significance at 1% level.

**VAR impulse response function results.** Figures 5(a) and (b) and 6(a) and (b) provide results for the IRFs S&P 500 e-mini futures returns based on a one-time standard deviation increase in

the rational and irrational sentiment for both institutional and uninformed investors respectively. For the institutional investor, the rational component is positive and significant during the first week but becomes significantly negative in the second week and bounces back to positive in the fourth week. The rational component of the uninformed investor (Figure 6(a)) is similar to the rational component of the institutional investor (Figure 5(a)) except that the negative period is insignificant and the response is slightly lower.

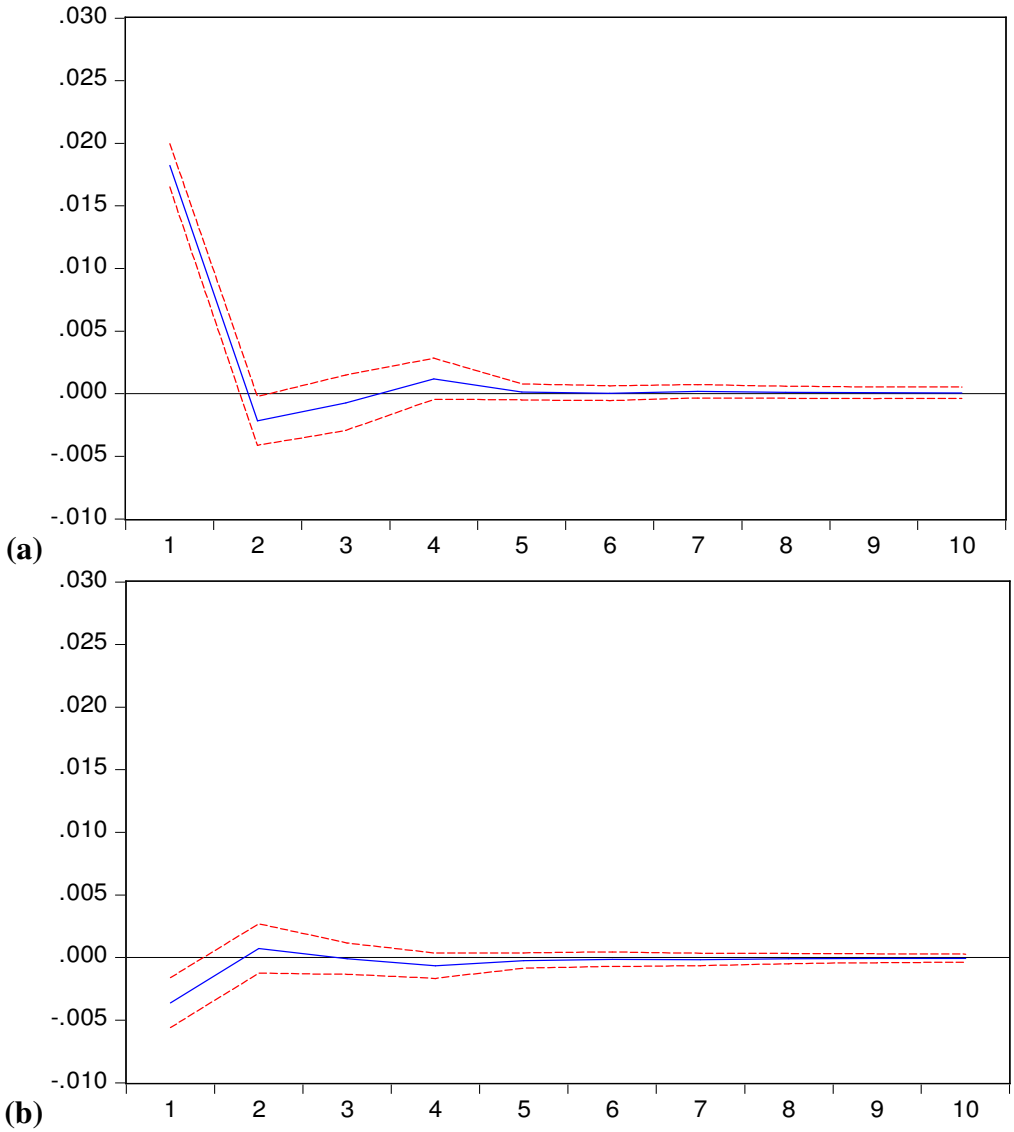


**Figure 5. Response of S&P 500 e-mini futures returns to rational and irrational sentiment for institutional investors** (a) institutional rational investor sentiment; (b) institutional irrational investor sentiment

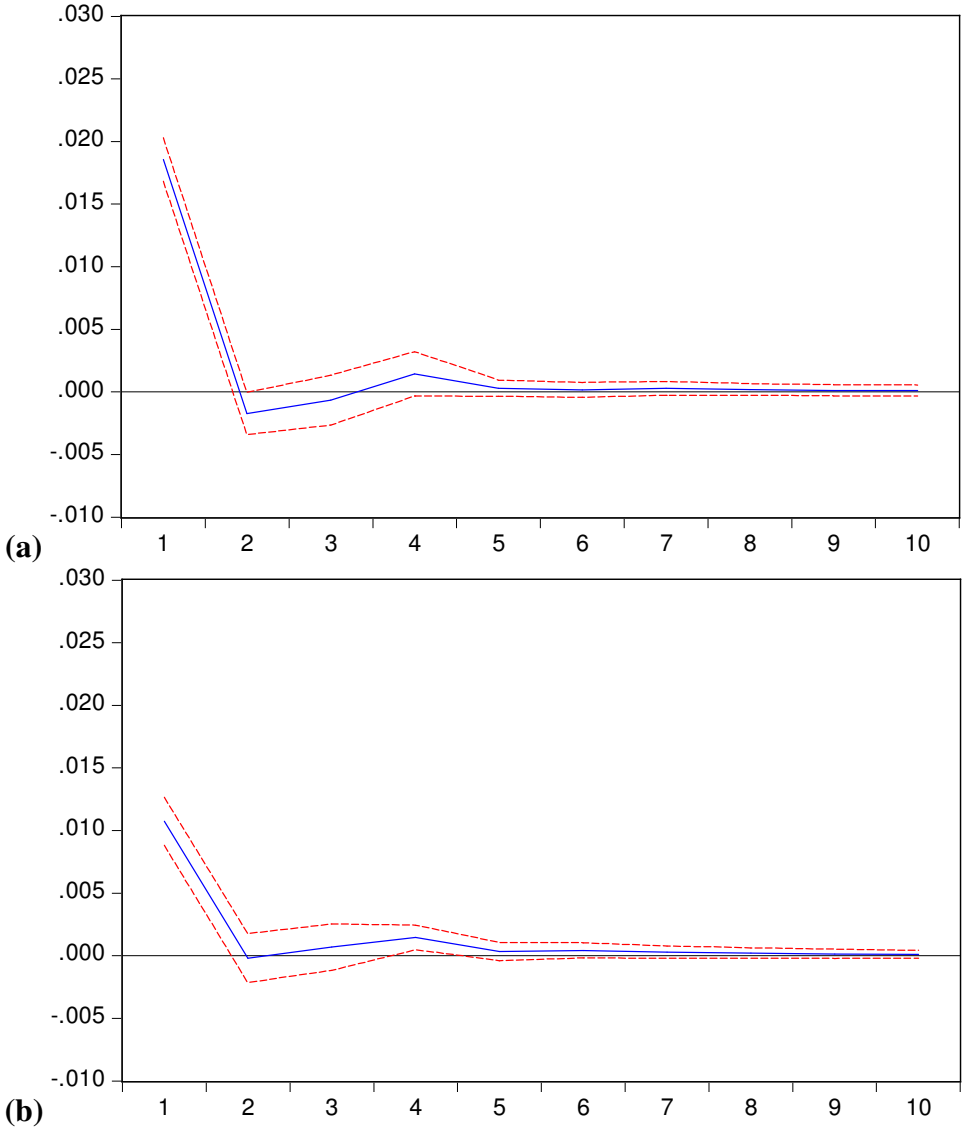


**Figure 6. Response of S&P 500 e-mini futures returns to rational and irrational sentiment for uninformed investors** (a) uninformed rational investor sentiment; (b) uninformed irrational investor sentiment. Notes: The dashed lines on each graph represent the upper- and lower-95% confidence bands. When the upper- and lower bounds carry the same sign the response becomes statistically significant.*On each graph, 'percentage returns' are on the vertical and 'horizon' is on the horizontal axis.

The VAR model result for of the rational institutional investor sentiment (Figure 5(a)) is positive and significant which confirm the results of Model VI. Result for the irrational institutional investor sentiment (Figure 5(b)) is significant and negative which is the opposite of Model VI. This may be explained by the coefficient covariance is so small the model

methodology change may affect the results. Both VAR model rational and irrational uninformed investor sentiment results (Figure 6 (a) and (b)) support Model VI. Thus, the VAR model only supports that uninformed investor sentiment affects futures market returns.

# CHAPTER VI

# CONCLUSIONS

Many studies have shown that investor sentiment affect market returns and volatility (De Long et al., 1990; Lee et al., 2002; Verma and Verma, 2007). De Long et al. (1990) was the first to theorize that uninformed (noise trader) investor sentiment effects both market returns and volatility and possibly the effects are asymmetric. Brown and Cliff (2004) suggest that both institutional and uninformed (individual) investors may respond differently to signals when forming their sentiment, but only institutional investors have enough market power to affect prices. Many of the studies regarding noise traders and returns suggest that noise traders (uninformed investors) do not trade based on fundamentals and thus are irrational and the trades of these uninformed investors move the market away from the mean and increase volatility (Black, 1986; De Long et al., 1990, Lee et al., 2002; Brown and Cliff, 2005, Verma and Verma, 2007). Brown and Cliff (2005) state that there is a bit of rationality and irrationality in all investors trading behavior and a study by Verma and Verma (2007) confirm this in the stock market.

Several studies have investigated the effects of investor sentiment on market returns in the stock market. Yet the futures market has many substantial differences which make it different from stock market such as: 1) the use and market conditions of stocks and futures securities, such as market to market in the futures market and standardization of contracts; 2) the short maturity claim on real assets of futures; 3) also futures are always leveraged, thus volatility is a greater

factor than stock securities; 4) the types of participants in the futures market; 5) limited available data sources (Gorton and Rouwenhorst, 2006). Few studies have looked at the futures market and those that have, focused on the use of investor sentiment for market prediction (Wang, 2001; Sanders et al., 2003) and did not include both institutional and uninformed investor sentiments.

The purpose of this study is to examine: 1) the effects of investor sentiment on market returns and volatility in the futures market, 2) examine whether investor sentiment imparts symmetric or asymmetric effects on futures market returns and volatility and 3) examine the effects of rational and irrational investor sentiment on futures market returns and the causal relationship between rational and irrational sentiment to determine their effects on returns and the causal nature of those effects.

Studies suggest that stock market returns and investor sentiment may act as a system (Brown and Cliff, 2004, 2005; Lee et al. (2002); Verma and Verma, 2007) as such an EGARCH-in-mean model is used to investigate the effects of investor sentiment on future market returns and volatility. This model can also investigate asymmetric effects of positive and negative sentiment changes on futures market volatilities. The futures market returns data used for this study is the S&P 500 e-mini futures. The sentiment data comes from proprietary institutional and uninformed (individual) investor sentiment surveys of futures market investors. The data is weekly and covers the period of January 1998 to December 2010.

One purpose of this study is to investigate the relative effects of institutional and uninformed investor sentiment on futures market returns and volatility based on the theories of De Long et al. (1990). The results show that like the previous investor sentiment studies in the stock market (Lee et al.2002; Verma and Verma, 2007) the futures market is also subject to the "hold more" effect proposed by De Long et.al (1990). Also, institutional investor sentiments are

found to be significant in both the futures and stock market (Verma and Verma, 2007) as proposed by Brown and Cliff (2004). However, these results are contrary to previous futures studies that found that investor sentiments do not affect returns (Wang, 2001; Sanders et al., 2003).

Yet there are some differences between the futures and stock markets. For example the De Long et al. (1990) "create space" effect where volatility positively and significantly affects futures market returns is prevalent in the futures market, while Lee et al. (2002) showed the "Friedman" effect held in the stock market. There are some other significant differences such as uninformed investor sentiment positively affects volatility and indirectly affects returns in the futures market while Verma and Verma (2007) found that uninformed investor sentiment negatively affects volatility and indirectly affects returns in the stock market.

As to asymmetric effects the results indicate that in the futures market investor sentiments do not have asymmetric effects. This is different from the investor sentiment stock market studies that shows asymmetric effects exist (Lee et al., 2002; Verma and Verma, 2007). An explanation for this is that unlike in the stock market the futures market consists of both speculators and hedgers. During bullish shocks uninformed speculators are dominant and go against the consensus of institutional investors thus providing counter trades which increase liquidity which reduces the spread and thus increase returns. The same may be true for bearish shocks where uninformed hedgers dominate also providing counter trades for institutional investors increasing futures liquidity and returns. This is similar to what was proposed by Kyle (1985). The significance of sentiment on conditional volatility implies that sentiment is an important factor when investigating risks in futures market studies.

The analyses of rational and irrational components of institutional and uninformed investor sentiment shows both uninformed rational and irrational investor sentiment affects returns both directly and indirectly through the variance. These results are similar to the findings for uninformed investor sentiment results supporting the theory of De Long et al. (1990). The results show that in the case of institutional investors only the rational sentiments affects returns which are different from the stock market studies and can be explained based on the high level of knowledge needed to be an institutional futures investor.

The sign difference from the uninformed investor sentiment in Model I and the rational and irrational investor sentiment results of Model VI may be due to speculator and hedger roles and the sentiment of those uninformed investors. In breaking the uninformed sentiments into rational and irrational components, the rational uninformed investor sentiments may represent the uninformed hedgers (rational investors being more risk adverse) trying to protect positions. The irrational uninformed investor sentiments may represent the uninformed speculators who (irrational investors are more likely to take on risk) cover the hedged positions taken by rational informed investors thus reducing volatility and increasing returns through greater liquidity as proposed by Kyle (1985). Since the data of this dissertation does not distinguish between the speculator and hedger roles this cannot be tested.

Overall this study has shown that investor sentiment is an important factor in understanding both futures market returns and volatility. This dissertation shows that the theories of De Long et al. (1990) and Brown and Cliff (2005) hold in the futures market. Also, while the mean results are similar to the stock market investor sentiment studies the main differences between the futures and stock markets seems to be how investor sentiments affect volatility and indirectly returns. Given the nature of futures is to allow investors to trade on volatility either as

speculators or hedgers it makes since that most of the differences in results from investor sentiment effects on volatility and returns in the futures and stock market are a result of volatility. The direct implication of these results is that conventional measures of temporal variation in the study of risk and return in the futures market omit an important source of information: investor sentiment.

## Future Research

This is the first study to utilize together institutional and uninformed investor sentiment to analyze returns and volatility in the futures market. The results indicate that this is a viable line of research. The current study was limited in that it only covers equity futures also these futures products were specifically developed to encourage small traders (uninformed traders) to participate in the futures market due to their low price and reduced margin requirement. This study shows that investor sentiment is a significant factor to be included in any research in futures market returns and volatility.

Additional research is needed to determine if the results of this study are confirmed with commodity futures, exchange futures, and other financial futures. Also the effect of speculators and hedger institutional and uninformed investor sentiment on returns and volatility needs to be explored. The use of investor sentiment has also been used to study liquidity in the stock market this dissertation indicates that it might be useful in the study of liquidity in the futures market. The effect of margin requirements on futures market investors sentiment is also a research topic that has been ignored. Overall, this study has shown that investor sentiment is a factor in the study of returns and volatility in the futures market, thus there are opportunities to review previous futures market return and volatility studies to see if the inclusion of investor sentiment can provide additional insight.

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# APPENDIX A

APPENDIX A

VAR RESULTS

## Appendix A.1. Institutional and uninformed investor sentiment S&P 500 VAR estimates

| | R | I | U |
|---|---|---|---|
| R(-1) | -0.058014 | 59.60926 | 77.09044 |
| | (0.04898) | (11.6702) | (35.9798) |
| | [-1.18434] | [ 5.10780] | [ 2.14260] |
| R(-2) | -0.120150 | 14.07836 | -37.69229 |
| | (0.04598) | (10.9553) | (33.7756) |
| | [-2.61289] | [ 1.28507] | [-1.11596] |
| I(-1) | -5.66E-05 | 0.784065 | 0.034832 |
| | (0.00017) | (0.04062) | (0.12522) |
| | [-0.33222] | [ 19.3044] | [ 0.27817] |
| I(-2) | -4.86E-05 | 0.013508 | 0.113470 |
| | (0.00016) | (0.03748) | (0.11556) |
| | [-0.30878] | [ 0.36037] | [ 0.98188] |
| N(-1) | 2.40E-05 | 0.104797 | 0.372366 |
| | (6.4E-05) | (0.01536) | (0.04736) |
| | [ 0.37150] | [ 6.82166] | [ 7.86200] |
| N(-2) | 0.000140 | -0.018358 | 0.299560 |
| | (6.6E-05) | (0.01561) | (0.04812) |
| | [ 2.13064] | [-1.17613] | [ 6.22490] |
| C | -0.003256 | 5.121485 | 10.46749 |
| | (0.00344) | (0.82005) | (2.52825) |
| | [-0.94593] | [ 6.24534] | [ 4.14022] |
| R-squared | 0.016903 | 0.846847 | 0.464241 |
| Adj. R-squared | 0.008086 | 0.845474 | 0.459436 |
| Sum sq. resids | 0.454995 | 25825.71 | 245477.0 |
| S.E. equation | 0.026079 | 6.213167 | 19.15545 |
| F-statistic | 1.917042 | 616.5323 | 96.61605 |
| Log likelihood | 1509.435 | -2190.514 | -2951.633 |
| Akaike AIC | -4.445074 | 6.501520 | 8.753352 |
| Schwarz SC | -4.398309 | 6.548285 | 8.800118 |
| Mean dependent | 0.000392 | 48.15647 | 53.65089 |

| | | | |
|---|---|---|---|
| S.D. dependent | 0.026185 | 15.80564 | 26.05367 |

*Notes*: The variables are institutional investor sentiment (I), noise investor sentiment (N), and returns of the S&P500 e-mini futures.

## Appendix A.2. Investor Rational and Irrational Sentiment S&P500 VAR

| | R | IRA8 | IIR8 | NRA8 | NIR8 |
|---|---|---|---|---|---|
| R(-1) | -0.059688 | 74.71727 | -10.65297 | 131.0864 | -194.2414 |
| | (0.07046) | (9.79098) | (17.1552) | (19.0115) | (42.1335) |
| | [-0.84707] | [ 7.63123] | [-0.62098] | [ 6.89512] | [-4.61014] |
| R(-2) | -0.142895 | -50.74950 | 64.94336 | -84.74136 | 10.88682 |
| | (0.05659) | (7.86252) | (13.7762) | (15.2669) | (33.8347) |
| | [-2.52529] | [-6.45461] | [ 4.71416] | [-5.55066] | [ 0.32176] |
| IRA8(-1) | -0.000937 | 0.647694 | 0.169059 | 0.346845 | -0.737528 |
| | (0.00072) | (0.10050) | (0.17608) | (0.19514) | (0.43246) |
| | [-1.29603] | [ 6.44502] | [ 0.96012] | [ 1.77746] | [-1.70542] |
| IRA8(-2) | -0.000163 | 0.303991 | -0.112751 | 0.026160 | -0.044674 |
| | (0.00074) | (0.10290) | (0.18029) | (0.19980) | (0.44279) |
| | [-0.22033] | [ 2.95436] | [-0.62539] | [ 0.13093] | [-0.10089] |
| IIR8(-1) | 4.28E-05 | -0.046576 | 0.853699 | -0.141323 | 0.216049 |
| | (0.00019) | (0.02600) | (0.04556) | (0.05049) | (0.11189) |
| | [ 0.22887] | [-1.79134] | [ 18.7394] | [-2.79925] | [ 1.93095] |
| IIR8(-2) | -0.000183 | 0.033611 | -0.061972 | 0.095565 | -0.044268 |
| | (0.00018) | (0.02459) | (0.04308) | (0.04774) | (0.10580) |
| | [-1.03234] | [ 1.36702] | [-1.43855] | [ 2.00173] | [-0.41839] |
| URA8(-1) | 0.000387 | -0.051609 | 0.079936 | 0.308041 | 0.718974 |
| | (0.00038) | (0.05273) | (0.09239) | (0.10239) | (0.22691) |
| | [ 1.01962] | [-0.97875] | [ 0.86522] | [ 3.00864] | [ 3.16857] |
| URA8(-2) | 0.000480 | 0.034694 | -0.102630 | 0.333256 | -0.163977 |
| | (0.00037) | (0.05129) | (0.08987) | (0.09960) | (0.22073) |
| | [ 1.30067] | [ 0.67638] | [-1.14193] | [ 3.34600] | [-0.74288] |
| UIR8(-1) | 3.05E-05 | 0.026603 | 0.088115 | 0.049736 | 0.549627 |
| | (8.5E-05) | (0.01180) | (0.02068) | (0.02291) | (0.05078) |
| | [ 0.35877] | [ 2.25433] | [ 4.26160] | [ 2.17058] | [ 10.8232] |
| UIR8(-2) | 0.000156 | -0.008881 | -0.022345 | 0.001668 | 0.134692 |
| | (8.6E-05) | (0.01190) | (0.02084) | (0.02310) | (0.05119) |
| | [ 1.82221] | [-0.74653] | [-1.07207] | [ 0.07223] | [ 2.63115] |
| C | 0.006047 | 3.277257 | -1.494880 | 1.461411 | 7.599312 |
| | (0.00786) | (1.09203) | (1.91340) | (2.12044) | (4.69934) |
| | [ 0.76937] | [ 3.00106] | [-0.78127] | [ 0.68920] | [ 1.61710] |
| R-squared | 0.037559 | 0.860632 | 0.758714 | 0.782480 | 0.462058 |
| Adj. R-squared | 0.020994 | 0.858233 | 0.754561 | 0.778736 | 0.452799 |
| Sum sq. resids | 0.394944 | 7625.078 | 23408.97 | 28749.00 | 141204.0 |
| S.E. equation | 0.026072 | 3.622714 | 6.347505 | 7.034340 | 15.58961 |
| F-statistic | 2.267341 | 358.7817 | 182.6929 | 209.0013 | 49.90413 |
| Log likelihood | 1324.494 | -1596.496 | -1928.512 | -1989.336 | -2460.450 |
| Akaike AIC | -4.437478 | 5.430730 | 6.552407 | 6.757891 | 8.349493 |
| Schwarz SC | -4.356028 | 5.512181 | 6.633857 | 6.839341 | 8.430943 |
| Mean dependent | -0.000163 | 48.45348 | -0.404382 | 54.36318 | -0.559131 |
| S.D. dependent | 0.026350 | 9.621588 | 12.81242 | 14.95435 | 21.07472 |

Note: returns of the S&P500 futures (RN), institutional investor rational sentiment (IRA), institutional investor irrational sentiments, uninformed investor rational sentiment (URA), uninformed investor irrational sentiment (UIR), constant (C), number of lags is in parenthesis ().

# BIOGRAPHICAL SKETCH

Kenneth Steven Lovell obtained his Doctor of Philosophy in Business Administration with emphasis in finance from the University of Texas-Pan American in Edinburg, Texas in 2013. He has been a lecturer of finance at the University of Texas-Pan American since 2007. His prior degrees of Masters (1998) and Bachelors (1978) degrees in Business Administration were obtained at Sam Houston State University in Huntsville, TX. Mr. Lovell has over 20 years of business experience. He has provided consulting services to companies such as General Motors, Disney Corp, and others in negotiations of strategic supply chain agreements. His other experience includes management experience with American Airlines, international experience with EDS (now Hewlett Packard) in Asia Pacific as lead contract negotiator and manager based in Australia. Mr. Lovell worked in other management positions for Amoco (now BP) in South America, Europe, and Africa.

Mr. Lovell currently is a finance Instructor at University of Texas-Pan American in Edinburg, Texas. His research interests are in Behavioral Finance, Risk Management and Financial Planning. He has published as lead author in Global Business and Finance Review. He currently resides in Edinburg, TX.