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VIX® as a stock market sentiment indicator

Bachelor's thesis

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1 INTRODUCTION

The Chicago Board Options Exchange¹ introduced the Volatility Index® (VIX®, hereafter VIX) in 1993. Since then, VIX has been considered a popular barometer as well as measure of investor sentiment and implied market volatility. VIX is built to be a general touchstone of the market's estimate of implied volatility of the S&P 500 Index (hereafter the ticker symbol, i.e SPX) over the coming 30 trading days (Becker et al. 2009, p. 1034). The volatility is the standard deviation of stock returns. VIX is a key sign of market expectations of near future volatility transmitted by SPX option prices (CBOE 2009b). This index is hosted by Standard & Poor's and it includes 500 capitalization weighted large-cap common stocks actively traded in the United States. SPX is a good proxy for the U.S. market as a whole since it generalizes the market well. Furthermore, SPX is broad by including widely held stocks representative of financial, industrial and technological firms. (Standard & Poor's 2009)

Option traders need a perception and an expectation of the underlying asset price's volatility in order to value options. The expected volatility implied by option prices should state a market's best prediction of an asset's near-term, i.e. the next 30-day period volatility (Becker et al. 2007). VIX is interpreted in the way that high value corresponds to a more volatile market in the near-future. Since the risk level is higher, options are more costly, which can be used to cover the risk from volatility. Typically, VIX goes high when the macro-driven environment is not running well or also fast increase in stock values can raise the volatility and in that way reflect to VIX. In addition VIX is a successful market timing indicator. (Hill, Rattray 2004, p. 3) The Volatility Index is a flexible and powerful risk management and trading tool – it is considered as the benchmark for the U.S. stock market's implied volatility. For example this is shown in that VIX is regularly featured in the Wall Street Journal, Barron's and other leading financial publications, as well as business news on Bloomberg TV, CNBC and CNN/Money, where VIX is often called as the "fear index". There are also other indexes and products similar to VIX but more specific, such as for far-term, near-term and for different industries.

¹ More information can be found from: <http://www.cboe.com/>

Most financial decision-making models tend to fail in factoring fundamentals of human nature, i.e. emotions such as fear and greed, but VIX is one indicator that offers support in this field. Therefore, the purpose of this paper is to investigate how VIX works as a stock market sentiment indicator. Firstly, the theoretical base of VIX and implied volatility as well as its measurement is represented. Then, it is discussed how they work as indicators of market sentiment and returns. This is followed by a discussion how VIX can be used in timing the market actions. Then, there is a comparison section in which VIX is related to the S&P 500 index realized returns between the years 1990-2009. These statistics are analyzed in how VIX signals have worked. Lastly, there are the conclusions.

2 FOUNDATION OF VIX

VIX® was introduced to the world in 1993 by CBOE to be an indicator of the market sentiment. Before September 22, 2003, VIX was known as “VXO”; ten years after its publication in 1993, CBOE with Goldman Sachs updated VIX to reflect a new way to estimate expected volatility. After the renewal of the methodology it was called VIX. Old and new VIX values are highly correlated. The new VIX continues to be popularly used by financial theorists, contrarians, technical analysts, risk managers and volatility traders alike. It is calculating the expected volatility of SPX by averaging the weighted prices of SPX puts and calls options over a wide range of strike prices. This new methodology transformed VIX from an abstract concept into a practical standard for trading and hedging volatility. There is a variety of other indicators than VIX, for example CBOE calculates several other volatility indexes, but VIX is being the most recognized and leading barometer of investor sentiment and market volatility relating to key stock indexes. (CBOE 2009b)

2.1 Transformation from VXO to VIX

In 2003, CBOE made three changes in order to improve and update VIX so it would reflect markets expectations better:

1. VXO used only at-the-money options – the new VIX has no assumption of market level by restrictions of options strike prices, it is being calculated using a wide range of strike prices in order to incorporate information from the

volatility skew (at-the-money options are options in which the exercise price is equal to the stock price).

2. The original VXO used implied volatility from an option-pricing model to reckon expected volatility. The new VIX has no requirement for an option pricing model, it uses a more freshly developed formula to derive expected volatility explicitly from the prices of a weighted strip of options.
3. When the original VXO was based on S&P 100 Index (OEX) option prices, the new VIX uses options on the S&P 500 Index, which is the main United States stock market benchmark. The S&P 500 Index is a widely recognized benchmark and the reference point for the performance of many stock funds.
4. The new VIX is calculated using all nearby and second nearby SPX options; it uses all non-zero option bids at all strikes, so it is much less sensitive to individual option prices. (CBOE)

The option concept of moneyness refers to the potential profit or loss from the immediate exercise of an option. There exists three different terms to moneyness: an option could be *in-the-money*, *out-of-the-money*, or *at-the-money*. For example a put option is *in-the-money* if the stock price goes below the exercise price. Consequently, if the put had an exercise price for instance price of €55, for a stock that is worth €60, the put would be €5 *out-of-the-money*. And when the exercise price is equal to the stock price, the put would be *at-the-money*. (Kolb, Overdahl 2007, p. 331) According to research done by Hsu and Murray (2007, p. 370) both puts and calls at a given distance from at-the-money become more expensive when VIX increases and less expensive when VIX decreases.

VXO was changed into VIX because the new methodology provides a more precise, viable and solid measure of expected market volatility according to CBOE. Even though the new VIX is simpler, it yet provides more valid measure of expected volatility. This is because it pools information from option prices over a broad range of strike prices and thereby capturing the whole volatility skew, rather than the old VXO caught just the volatility implied by at-the-money options. (CBOE) CBOE introduced the new VIX in late 2003 to match variance swap pricing, but the results of predicting are only slightly better than in the old VIX. This hints that the forecasting power of the index comes mainly from overall volatility levels, rather than skew, i.e.

the relative prices of put options versus call options. (Chadwick) The formula of the new VIX derives from the market expectation of volatility straight from index option prices rather than an algorithm that requires backing implied volatilities out of an option-pricing model. Actually it can be calculated, back-calculated and replicated by anyone with access to options prices (Hill, Rattray 2004, p. 12). Despite these changes, the fundamental nature of VIX remains the same. Index option prices are weighted average of options with a constant maturity of 30 days to expiration, and it is still calculated continuously in real-time throughout the trading day. Even though VXO value differs, this difference should be meagerly and yet still the new VIX responds to market moves very much alike as the original, i.e. it tends to increase during stock market declines and decrease when the market stabilises. However, as a general warning it does not imply that future results will be similar. (CBOE)

2.2 Historical values of VIX and S&P 500 Index

One of the most valuable attributes of VIX is the existence of nearly 20 years of historical prices. This wide data set offers investors useful information on how option prices have behaved in response to diverse market conditions. (CBOE)

Table 1 shows how VIX has fluctuated during its nearly twenty years history.

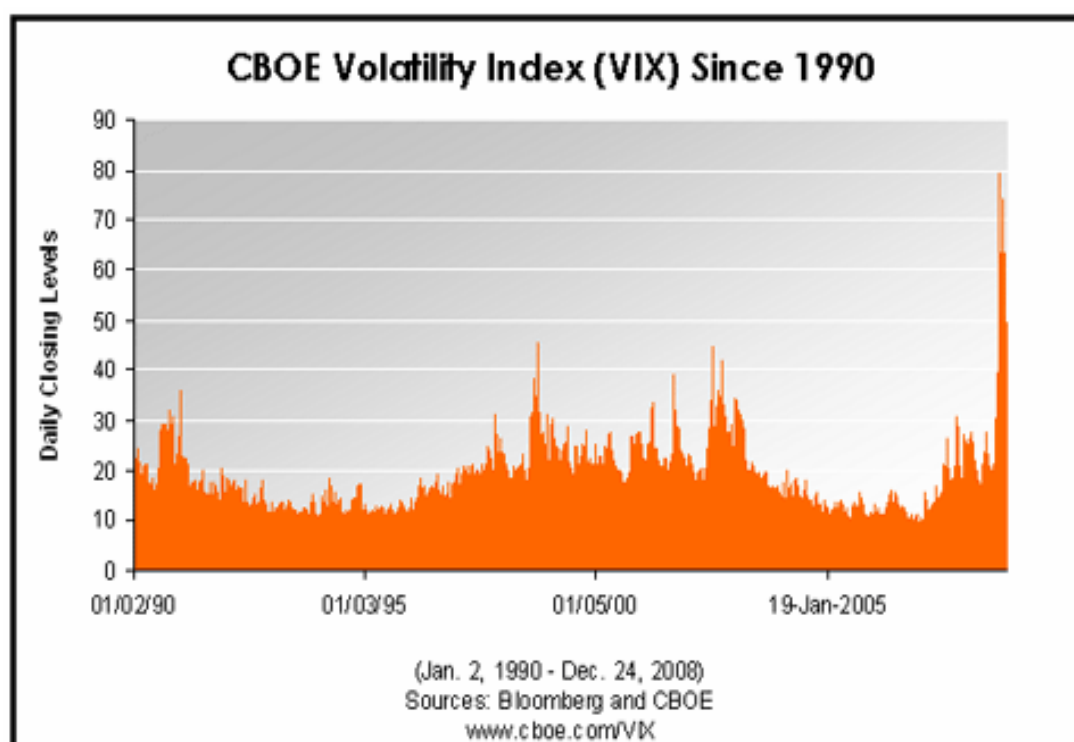
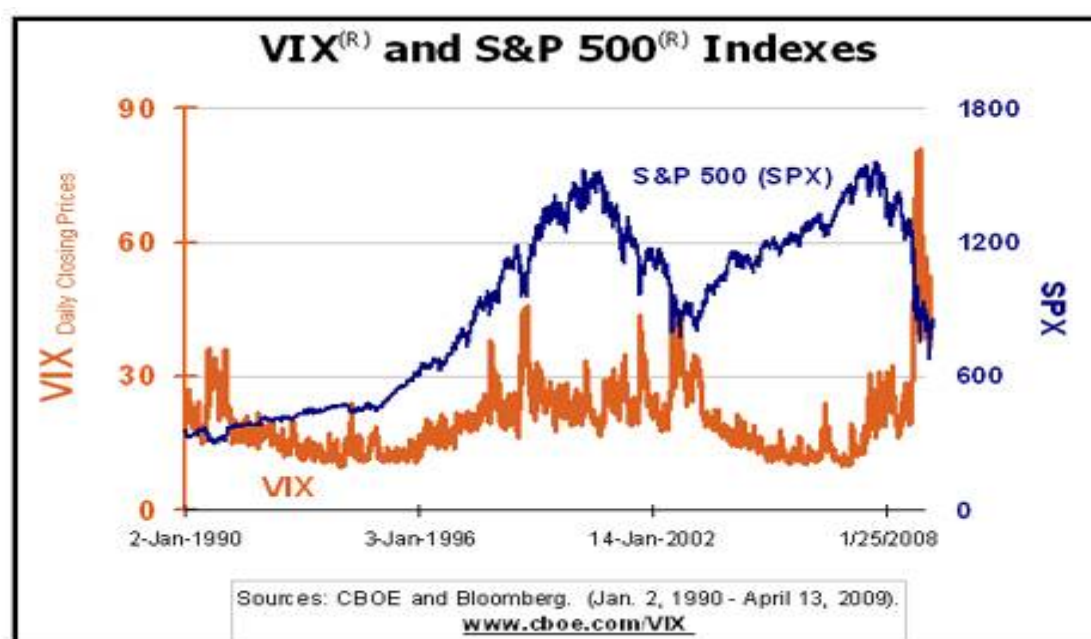


Table 1: VIX since 1990 (CBOE)

When implied volatility by VIX is compared to SPX it shows clear correlation. Table 2 indicates that clear peaks in implied volatility measured by VIX are signals of great buying opportunities of stocks that for example have steady earnings. High readings of VIX are signs of panic sales. From Table 2 can be seen the late 90s Asia's currency crisis and the fall of Long Term Capital Management company. In the early 2000s uncertainty rose sharply consequent to the ICT bubble burst, the terrorist attack 9/11 and this was followed by the middle east conflicts.

**Table 2: VIX and SPX 1990 – 2009 (CBOE)**

According to the academic literature there is a robust link between high expected returns and high conditional volatility (Giot 2005, p. 99), and this link will be explained in next section.

2.3 Logic behind the fear index

VIX is a market-determined forecast of near-future implied volatility by options measures. When the future returns are feared to be low the stock market goes into sell off mode. Since VIX is derived from such a wide index as SPX it gives a good approximation of the whole implied volatility of the United States' stock market. VIX belongs to the technical analysis area, which predicts the future tendencies by

studying the past market data. When the market is relatively volatile, jump activity occurs in the stock curves and large discontinuous jumps in the SPX are expected. (Becker et al. 2009, p.1035).

VIX reflects the concern about the stock market rather than an estimate of future volatility. This implicit argument is as follows: when people are nervous, they rush to buy options, like put options on the SPX to protect their portfolios against the potential stock market decline in the horizon. This protective position is more desirable when stockholders are worried. Additionally, call options are also more desirable when investors are worried, since buying them provides upside possibilities but does not have big downside risk associated with owning stocks. Only the capital invested in options will be lost if the vision turns out to be wrong. This extra demand for both puts and calls bids pushes up their prices and premiums paid. If the price of an option rises and other inputs of the model (time to maturity, dividends, interest rates and stock index level) remain *ceteris paribus*, then the volatility that is calculated as implicit in the option premium must be higher. (Arak 2006)

Bolotowsky (2007) draws lines at 15 and 30 points; when VIX exceeds this upper line, it indicates that the market is really nervous. When VIX is however below 15 points, it implicates that the market is in a steady state and the options are less expensive because of lower expected volatility. It should be kept in mind that these borders are a personal perspective of the author but are also recognized by other market experts. In general, investors are driven and motivated by the two extremes: fear and greed. These two primary forces driving markets never change. When investors' fear is dominant compared to the greed they start to buy put-options because they want to hedge their portfolios in case of possible decline of markets. High VIX points can be interpreted that investors are willing to pay higher prices in order to buy options on the SPX. That is an indication on how much investors are willing to pay for insurance. And the more put-options are purchased the higher VIX arises. The more the investors and traders alike are afraid, the higher points VIX gets. VIX is used a lot by contrarians, i.e. investors who prefer the strategy to walk against the trends. The strategy works in a classic way by buying low and selling high – the best time to buy is when VIX explodes. When VIX goes for example below 10 points, these contrarians start selling stocks for short because contrarians interpret

that markets are being overly confident, and this is going to be changed in near future. When the market trend is at downturn, but the VIX has not gone up, the contrarians interpret the situation so that the downturn will be predominate until the VIX leaps higher. This would be the time to start buying stocks in a sale. VIX has been historically a successful signal for an entry into or out of stocks – it helps to plot the next move in a sense whether or not the current market sentiment is excessively bullish or bearish. The conventional financial theory assumes that markets behave rationally, and not accounting for the emotional aspect of the market leads to wrong conclusions of entry and exit points. (Bolotowsky 2007)

Under the functionality of VIX lies the assumption that the investors' fears of a crash could be perceived in SPX option prices that are reflecting investors' concerns. However, markets in general tend to overreact - this is probably true for implied volatility as well because a part of the volatile volatility is psychological. (Shefrin 2002, p. 285)

2.4 Calculation of VIX

In VIX the price of each underlying SPX option reflects the market's expectation of future volatility – oscillation either up or down. VIX can be interpreted that the value of it is the expected movements in the SPX in the next 30-day bout on an annualized basis. For example if VIX is 15 points it means that in next 30-day period SPX is expected to fluctuate up or down 4.33%. Like traditional indexes, VIX uses rules for selecting component options and a formula to calculate index values. SPX is calculated using the prices of its component stocks. It employs rules that govern the selection of component securities and a formula to calculate index values.

VIX is comprised of options, with the price of each option reflecting the market's expectation of future volatility. VIX also employs rules for selecting component options and a formula to calculate index values. These components are near- and next-term put and call options, usually in the first and second SPX contract months. Alleged "near-term" options must have at least one week to expiration. This requirement is made to minimize pricing anomalies that might occur close to expiration. When the near-term options have less than a week to expiration, VIX

formula drops out these expired options and takes new ones to replace from the second and third SPX contract months. (CBOE 2009a)

The generalized formula according to CBOE (2009, p. 3) in the calculation of VIX is:

$$\sigma^2 = \frac{2}{T} \sum_i \frac{\Delta K_i}{K_i^2} e^{RT} Q(K_i) - \frac{1}{T} \left[\frac{F}{K_0} - 1 \right]^2$$

WHERE:

σ is $VIX/100 \rightarrow VIX = \sigma * 100$

T Time to expiration

F Forward index level derived from index option prices

K_0 First strike below the forward index level F

K_i Strike price of i^{th} out-of-the-money option: a call if $K_i < K_0$ and a put if $K_i > K_0$: both put and call if $K_i = K_0$

ΔK_i Interval between strike prices – half the difference between the strike on either side of K_i

$$\Delta K_i = \frac{K_{i-1} - K_{i+1}}{2}$$

(Note: ΔK for the lowest strike is simply the difference between the lowest strike and the next higher strike. Likewise, ΔK for the highest strike is the difference between the highest strike and the next lower strike.)

R Risk free interest rate to expiration

$Q(K_i)$ The midpoint of the bid-ask spread for each option with strike K_i

2.5 VIX works – why is that

There are following reasons according to Connors (2002, p. 47) why VIX signals work:

1. In long-term mean-reverting feature of volatility; periods of low volatility will be followed by periods of high volatility and vice-versa. When VIX begins its mean reverting, it is accompanied by a market rally, either bullish or bearish.
2. In short-term auto-correlation feature of volatility; this means that if implied volatility raises today, the probability that it will rise even more tomorrow is greater.
3. Dynamic feature of volatility; most of the traders fail to see that VIX is a dynamic measure - not static. This means that VIX as a dynamic indicator reflects very recent market action.
4. Statistical tests by Connors (2002) prove that VIX is able to tell when market top or bottom is in place.

3 IMPLIED VOLATILITY

There is growing importance for predicting asset volatility and modeling implied volatility as a rational forecast of future realized volatility among modern finance. When the market economy is functioning well and option contracts are actively traded, these contracts express the market's view of the relevant prices for those contracts. Market solves the volatility of the option by option pricing model – this yield as the implied volatility, a forward looking measure.(Giot 2005, 92)

According to Hill (2004, p. 6) there are three special characteristics of implied volatility:

1. It tends to be mean-reverting, which means that implied volatility eventually moves back towards the mean or average. This is why it is in later sections (4.1 and 4.2) compared to moving average.
2. It is commonly negatively correlated to stock prices.
3. It is positively correlated to uncertainty and risk increase and can then remain high for a while.

As VIX is a prediction of near-future implied volatility and its information is readily available, it should not allow for the possibility of timing profits. If market participants are rational, it is surprising that extremely high levels of VIX may signal attractive buying opportunities. In such a market situation, fear is dominant compared to greed. Furthermore, it is wise to use VIX as a size and style rotation tool. This is based on the observation that high values of VIX frequently correspond to market bottoms and seem to indicate “oversold” markets. The term “oversold” market is a technical analysis term and refers to a market which is in decline to an unreasonable level. In this kind of market turmoil traders can take long positions in anticipation of an increase after VIX is high. These long positions could be lead to large corporations and value stocks because they earn high returns after VIX is high. Furthermore, VIX is handy in risk management and gives incentives to investors seeking safer portfolios after increased implied volatility. Positive relationship between VIX and future portfolio returns has been drawn, and this would be consistent with a negative volatility risk premium. Finally, behavioral finance concludes that investor sentiment may affect stock returns differently, i.e. depending on their size and book-to-market value characteristics. (Banerjee et al. 2007, pp. 3183-3185)

3.1 Value of implied volatility

There has been a lot of energy put into empirical studies concerning the information content of implied volatility, starting with observations that implied volatility is a better predictor of future realized return volatility than is past realized return volatility (Whaley 2003: pp. 1179-1181). In an option pricing framework, there is only one input that can not be directly observed by market participants, i.e. volatility. Other inputs such as the call or put feature, time to maturity and strike price, are agreed-upon characteristics, and the risk-free interest rate is determined by the market, also the dividend payment is fairly easy to agree upon. Computing the price of the option, the expected volatility is the unknown input over the option’s life. (Giot 2005, p.92) If it is assumed that the option market is efficient and the valuation model is correctly specified, all relevant conditioning information are compacted into the option price. This way implied volatility predictors should be superior volatility forecasters (Fleming 1998).

The original Black-Scholes model (1972) was derived under the assumption that volatility is constant, but since that we have learned that volatility is actually not constant. In fact, there exists such a phenomenon as the volatility smile that refers to the fact that implied volatility varies with an option's strike price and maturity, contrary to the assumptions of the Black-Scholes model. (Nelken 1997, p. 65) Since then, a number of direct investigations of this phenomenon have been ensued. In a later section "4.2 Interpreting the signals of VIX", Chadwick (2006) test whether implied volatility really has the signaling power it is credited with. The test is correlated to VIX's relative level to subsequent moves in SPX.

It has been discovered that implied volatility is more highly correlated with concurrent and subsequent realized volatility than historical volatility. It has been stated that the cross-sectional implied volatility has become more informative over time. This is based on the increasing standard deviation, which is a measure of variability. In a regression both implied volatility and historical volatility are included as independent variables, these regressions show that historical volatility is insignificant. It can be said that the economic significance of implied volatility appears to be an upwardly biased estimate of index options' future volatility. Also asymmetry in the relation between expected volatility and stock returns has been documented; the increase in expected volatility corresponding to a negative stock market return is larger than the decrease in expected volatility corresponding to a similar size positive return. (Whaley 2003, pp. 1179-1181)

The interesting fact is that all SPX implied volatilities are higher than historical volatility; this is an effect of trading activity in index options is largely buyer-initiated. It is a well known strategy of institutional investors to buy SPX puts for portfolio insurance. Unfortunately in cases like this, however, there are no natural counterparties to these trades, so market makers have to step in to absorb the imbalance. Therefore, ever larger positions are taken in a particular option series. Thus the price of hedging these positions goes higher as the position increases; the market maker must raise prices. Since the institutional investors prefer *out-of-the-money* puts and it conveys into higher implied volatilities in *out-of-the-money* puts than *at-the-money* puts. It is stated that movements in the implied volatilities of SPX option and stock option series are robustly correlated with their net buying pressure,

where net buying pressure is specified as the total index-equivalent contract volume executed at the ask price less the total index-equivalent contract volume executed at the bid price. (Whaley 2003, pp.1187-1188)

3.2 Future portfolio returns and implied volatility

Estimation of the future returns from stocks is one of the greatest challenges of security analysis. VIX is an indicator that signals returns on broad stock market indices. This section goes through besides the theory also empirical evidence.

3.2.1 Theoretical background

Significant effort has been put to research the relationship between volatility and return, and the results field is incoherent. While most studies focus on the contemporaneous relationship between realized volatility and the risk premium, testing the theoretical implication of the Capital Asset Pricing (CAP)-Model that there would be a positive relationship between the size of a premium and the level of volatility. The CAP-Model predicts that stock prices will fall as expected volatility rises (Banerjee et al. 2007, p. 3185). Furthermore, it is suggested that leverage can induce an inverse relationship between stock returns and changes in future volatility: when stock prices fall relative to bond prices, leverage increases and causes expected volatility to increase. In other words it is in a line that VIX movement is inverse related to contemporaneous stock market return. Nonetheless, the relationship between implied volatility and future returns is left without statement or given only limited statements (Fleming et al. 1995, p. 275) and the future returns are the interesting part Banerjee et al. (2007) focus on. Their hypothesis contends that VIX possesses information content in forecasting future market returns (Banerjee et al. 2007, p. 3185).

3.2.2 Empirical evidence

When SPX excess returns from the 30-day and 60-day period are regressed on the VIX variables, the results show significantly positive coefficients on the VIX level at the 5% significance level. This is not surprising and is consistent with prior finding related to VIX and future returns and the vision of a significant negative volatility risk premium mentioned above. According to Banerjee et al. (2007) firms that have high

book-to-market ratio incline to have larger returns than low book-to-market ratio firms, while small firms beat large firms. The relationship between returns and the correlated risks, i. e. betas, vary depending on the size and book-to-market value ratio. Results of research also suggest that market states based on directional movement or volatility levels do not make a difference. Finally, Banerjee et al. (2007) examined the value of VIX information and how much VIX contributes to returns. The results state that VIX information makes a meaningful economic contribution to returns. Prior research of the effect of VIX levels on the stock market index returns found a positive relationship. Banerjee et al. (2007) made important extensions to this. They found that VIX variables prominently affect returns for most portfolios, and the relationship is stronger for portfolios that have higher beta values. The overall results suggest that VIX may be a priced risk factor, although the weaker relation for lower beta portfolios suggests the possibility of market inefficiency. And one has to be cynical when considering the efficiency of the markets. (Banerjee et al. 2007, pp. 3191-3198) Although a true arbitrage opportunity means a positive riskless return, a statistical arbitrage opportunity means a historical pattern, which is reasonably interpreted as indicative of the future - this allows a return in excess of the efficient market return for the same amount of risk. This implies market inefficiency or a mispricing, which is presumably removed over time by arbitrageurs. But one has to note that the extrapolation from past events is itself a source of risk. (Hsu & Murray 2007, p. 375)

3.3 Option market connections to the stock market

Early evidence in the research area of stock market versus option market indicates that price changes in the option market tend to lead those in the stock market. It is concluded that closing option prices contain information that is not yet contained in closing stock prices. Additionally, it is claimed that it takes up to one day for the stock market to adjust. The stock market is lacking behind in information content from the option market. The view that suggests that better informed traders prefer stock option contracts because the extreme leverage provided by stock options stands by these results. Some criticism has been also stated to this: the stock market closes ten minutes before the close of the options market. The results could be disseminated information into the marketplace between closing times in the two markets. But when

taken the latest results of this research area, the results suggest that it is actually the stock market that leads in prices compared to the options market. This is because the stock market trading is more active than options that are in fact less frequently traded than stocks. The lead can be as much as 30 minutes or more, but the lead disappears when quote midpoints are used, since the option market makers condition quotes on the prevailing stock price and, when the stock price changes, the quotes on all option series are updated automatically by an option valuation model. It also needs to be noted that different dynamics drive the volatility of index options compared to that of equity options. These two can often be uncorrelated. [(Whaley 2003, pp. 1195-1196)

Stocks are generally difficult to borrow; rates on borrowed stock are generally negative. These circumstances cause that the implied volatilities of puts will exceed those of calls since the market makers are faced with remarkable costs when shorting stocks to hedge short put positions. (Whaley 2003, p. 1198)

4 VIX STRATEGIES

This section discusses how to utilize the VIX's information. This information is accompanied by Chadwick's (2006) technical analysis. As mentioned before, a high VIX value heralds rallies while low VIX signals caution as shown in Table 3.

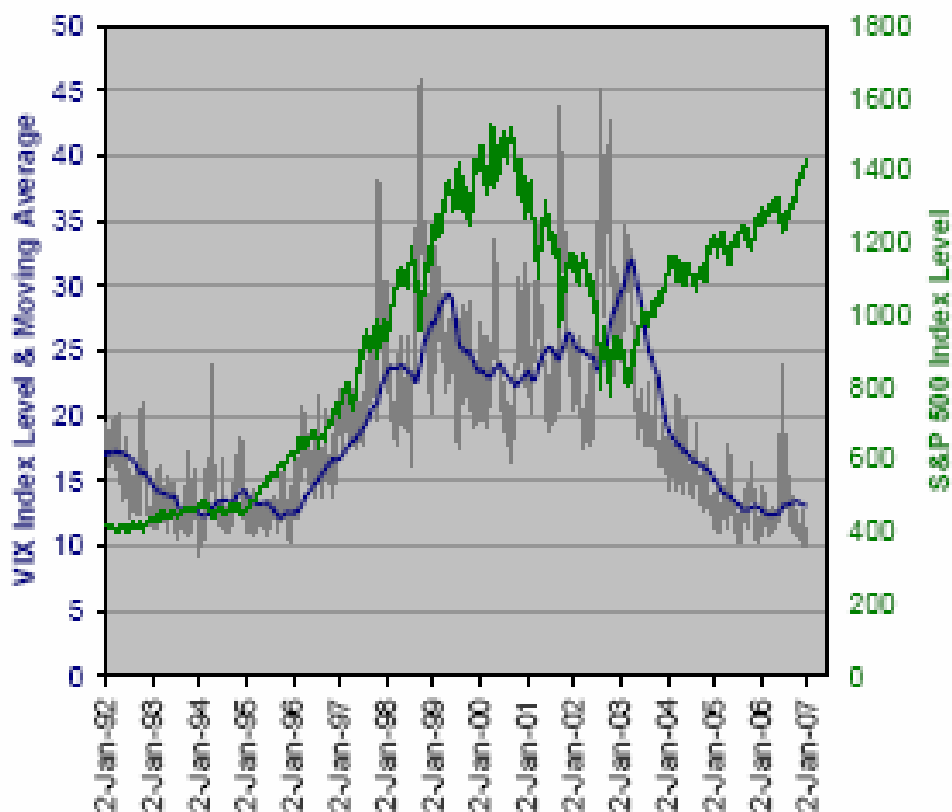
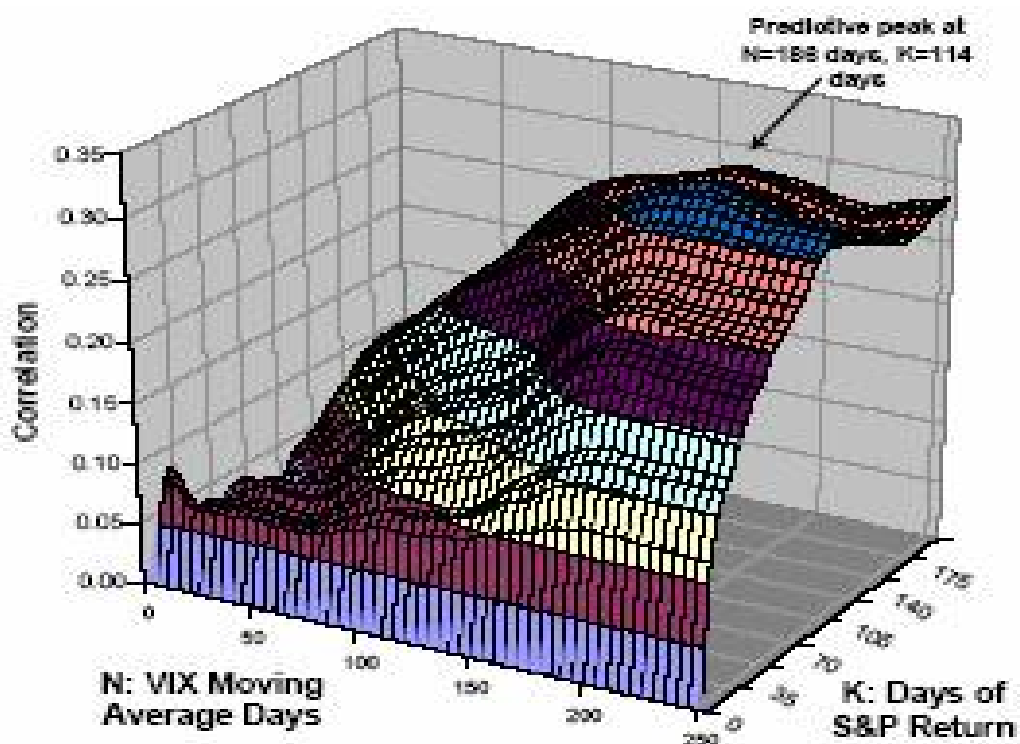


Table 3: VIX Index level & Moving average and S&P 500 Index level (1992-2006) (Chadwick 2006)

Chadwick's (2006) backtesting have shown the ratio of VIX to its 186-day moving average (moving average smoothes out short term fluctuations and highlights longer trends or cycles) about 10% predictive power over the SPX five month returns. When it comes to predicting short-term moves, the signal is weaker and low reading of VIX rather means buying put options than selling stocks (Chadwick 2006). This is also supported by Hsu & Murray (2007) that short-term changes in the VIX do not correctly predict changes in the actual realized volatility.

4.1 VIX predicting SPX moves

According to the test of Chadwick (2006), VIX is best at predicting medium-term moves. The correlation of VIX relative to VIX moving average trading days versus subsequent days SPX return was tested by the author. The highest degree of VIX's linear forecast power between 1990 and 2006 (CBOE has calculated VIX afterwards between the years 1990 and 1993) occurred using a 186 trading moving average for VIX, predicting 114 trading days out on SPX. Nonetheless, the Table 4 shows that the results were strong for any given day of SPX return and VIX moving average days within a month or



two.

Table 4: Correlation of VIX level relative to VIX days moving average versus subsequent days S&P 500 return (Chadwick 2006)

Even though short predictive periods are less effective, the guidance they provide is in the same direction as for longer periods. In a technical analysis' point of view it is often the re-crossing of the moving average and not the initial crossing that is used as a signal. Certainly, it is also recommended to use other inputs and indicators along as well. The lack in information content short-swing prediction could be compensated by the increased number of trading opportunities. In fact, the best

results Chadwick (2006) found in backtested trading strategies using only a 4-day horizon.

4.2 Buy weakness and sell strength

Referring to Chadwick (2006), VIX is a better signal of five month rallies than of selloffs; still both signals have a merit as timing indicators. Furthermore, the linear regressions the author made are stating that when VIX's trend is slightly below its moving average SPX usually does virtually nothing, rather than falling as traditional wisdom predicts. But what is clear is that the biggest drops in SPX happen when VIX is low. In overall a mildly low VIX is not a reliable sign of a coming decrease, but it might indicate it. Actually only very few of SPX's sharp drops took place while VIX was high. Since a low VIX is obviously also a direct indicator of low option prices, because volatility raises the prices of options, the opportunity raises to switch into protective puts and calls. During low VIX periods it makes sense to use options to take advantage of the asymmetric dispersion of returns that occur. (Chadwick 2006)

High or very high VIX levels indicate "oversold market". When large implied volatility levels occur, forward-looking returns for long position in the underlying stock index should be attractive. While the market being bullish and VIX is low there is less fear in the market and therefore less need for portfolio managers to purchase puts. If the rise in VIX implicates generally investors' fear, then the sale of options is potentially profitable. If nonetheless, the rise in VIX reflects an increase in anticipated volatility, then such selling is not potentially profitable. This is because if investors' fear raises option premiums, there might be opportunities to make profit in selling index options and hedge them at such times. In other light; if expected volatility is raising option premiums and volatility turns out to be high, the selling and hedging index options strategy when VIX rises would not end up being profitable. High option premiums demanded by market participants reflect the fact that volatility is anticipated to be high for that stock index over the option's life. (Arak 2006, pp. 14-16) Evidence suggests that positive forward-looking returns are to be expected for long positions in the stock index triggered by high levels of VIX, but one must wait for exceptionally high levels of VIX to get very attractive positive forward-looking returns (Giot 2005, p.

99). The statistics show that the stock market does not go in one direction; otherwise the market would rise forever or drop to zero (Connors 2005, p. 43).

Optimal timing for buying and selling moments are impossible to locate no matter what is the indicator – this is facing the reality. Otherwise it is pushing luck. One should distribute the timing also especially when the market sentiment is uncertain, unless one has better view and information than other market participants. And this implicates that the market is not efficient. But the VIX is one of the best market-timing indicators available for short-term traders (Connors 2002, p. 47).

There can never be enough data to estimate the future returns, especially using the long prediction horizons that have worked best for VIX. Chadwick (2006) announced in December 2006 that VIX is as an indicator alive and well and it would be a time to be cautious as the VIX was around 20% below its 186-day moving average. This prediction that Chadwick (2006) made was correct, protective actions such as selling short, buying puts or VIX futures were needed indeed. The SPX peaked 9 months after this statement and started its steep decline that was one of the toughest declines in the history of stock markets and at the same time VIX hit all time high. (Chadwick 2006)

5 CRITICISM OF VIX

The studies of VIX providing incremental information are rather inconsistent. While some of them suggest that this is the case, some states that VIX is not running with an information gap compared to model-based forecastings (MBF) together. Individual MBF lacks in information compared to VIX but VIX is a combination of different elements.

5.1 Does VIX provide incremental information of market state ?

According to Becker et al. (2007) it appears as though VIX does not contain any economically important information incremental to that contained in model-based forecasts. They add that VIX is useful for forecasting purposes, i.e. combining useful elements from a range of volatility forecasting models. VIX does, however, not reflect any more information than the ones captured in MBFs. These characteristics of

volatility captured by MBF are such as the long-run mean and speed of as well as mean reversion in volatility. VIX by itself is not giving enough information to make decisions about the market sentiment.

VIX is often found to be a superior forecast relative to any single model. This is, however, not a surprise since it combines a wide range of available information captured in different volatility forecasts. When comparing VIX relative to individual MBF it is clear that VIX does in fact contain information incremental to that contained in individual MBF. Becker et al. (2007, pp. 2536-2548) decomposed the information contained in VIX. Their empirical results show that, if a wide range of models based volatility forecasts are perceived, VIX does not contain any information regarding future volatility not captured by these forecasts. Yet

5.2 Trading the unexpected

The relationship between VIX and implied volatility can be easily overstated and for instance, volatility is often a function of the market sector. Different markets have different risk levels, and hereby volatility is for example higher in the technology sector than in the utility sector. But anyhow, there exist other broad-based implied volatility measures than VIX that are counted for narrower market sections – such as DJIA, Nasdaq-100, Russell 2000. Furthermore there are commodity and currency volatility indexes. Generally it is recommended to include other analysis to VIX and make as well a fundamental analysis. VIX signals confirmed with other traders own choice timing signals can give a healthy edge in SPX markets and increase the odds that the trade will be successful. (Connors 2002, p. 47)

6 COMPARISON OF VIX AND SPX HISTORICAL VALUES

In this section VIX is compared against SPX returns between the years 1990 to 2009, the period from which VIX offers data (in Table 5 VIX is drawn in blue and SPX in red). It can be seen from Table 5 that in the long run the equity market navigates with the core fundamentals like valuation and earnings while short-term prices are more likely affected by the fear and greed. So as it can be seen from Table 5 at short-term these psychological characteristics what VIX measures, have more importance than strategic fundamentals.

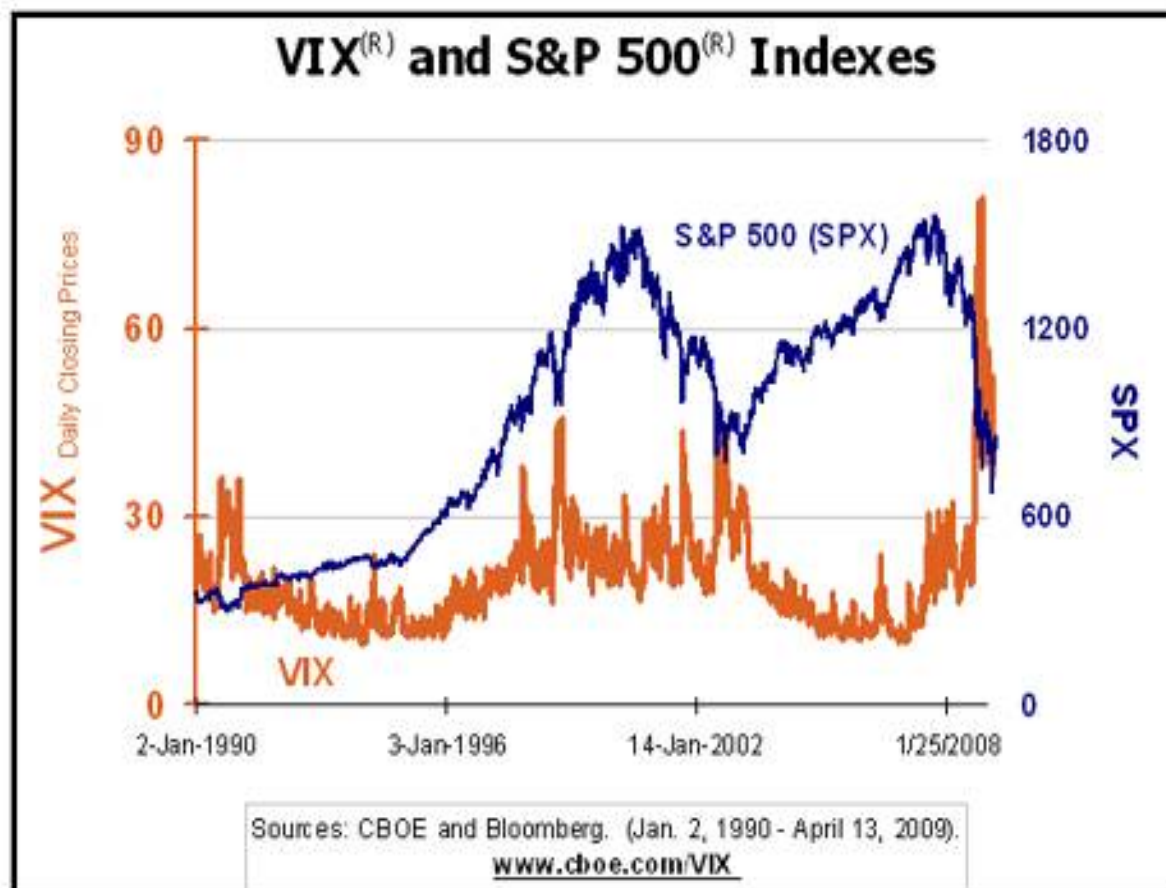


Table 5: VIX daily closing prices and SPX from 01/01/1990 to 04/06/2009 (CBOE)

The violent stock market crash in late 2008 can be seen in the VIX graph as record peaking levels. This turmoil melted SPX down till the levels of year 1997. As can be seen from the graph, the five years from 2003 up to 2008 were years of steady growth in SPX and also other major indices; it takes long for markets to come to the boiling point of greed. During these years VIX stayed between values 10 and 32, and according the logic of VIX when the implied volatility has been steadily at reasonable levels for long there is going to be a considerable jump in the level of volatility. For contrarians VIX has been giving signals to buy put options and make other hedging actions. In the end of the year 2008 the VIX acutely climbed to the peak of its history. Considering VIX this was an outstanding buying opportunity of stocks or indices that act similar to SPX. In relation to SPX VIX has been able to predict incisively most of the fluctuation and particularly the sharp declines of SPX. Clear peaks in VIX over the level of 30 resulted in a historical view always a profitable upward trend in SPX. As for VIX, it is possible that it exceeds 40 both during bull and bear markets. While markets are being bearish, VIX can peak several times while stock prices decline.

The times of low volatility have had a lot less predicting power but especially long periods of relatively low VIX values are an indicator for extreme caution and alert. On the side of fundamental market analysis VIX looks like to be a trader's best friend to time actions.

7 CONCLUSIONS

VIX is a measure of how much does it cost to insure and hedge against SPX losses. Over the relatively short history of VIX it looks like it has been signaling well the near-future fluctuations of SPX and giving a considerable advantage in timing market actions. Contrarians and short-time traders can see high implied volatility as an opportunity raising its head. Additionally, the market tends to overreact and VIX is a measure of this since it gives signals how to utilize the market movements. When utilizing these movements one needs to still make good pickings and choosing the survivors of turmoil by using also fundamental analysis along with technical. Nonetheless, when VIX is high the opinions of future directions are uncorrelated among market participants. Some traders see the bottom while some are taking the direction to the stock mountain peak. But the market raising needs more elements than high VIX values – the bottoms are usually seen when there is faith no more. Historically in the last twenty years VIX has been accurate to pinpoint market tops and bottom in medium-term bases. In the last two years VIX has been bouncing wildly and has been difficult to interpret. During these two years VIX hit its historic high of 89.53 on October 24, 2008 on concerns about the financial turmoil launched by subprime crisis. At the moment the macroeconomic outlook is foggy for the rest of the year 2009, so market could do another peak above 40.

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