A Test Using Option Information as a Predictor of Stock Index:

Evidence from India Market

by

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requirements for the degree of Master of Finance

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Abstract

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The purpose of this paper is to examine the prediction model developed by Bhuyan and Chaudhury (2001) on forecasting future stock index values with the data from India market. The sample pool including option and index data from February 2004 to December 2011. The hypothesis test shows that the difference between predicted index value and actual future index value is not significant. The regression results also show that the future stock index values are well explained by the prediction model.

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Chapter 1

Introduction

1.1 Purpose of the study

Trading in the financial market mainly involves information and market expectation. In an efficient market, the stock price reflects the current related information and the investors' expectations of future events. Traders with better expectations of future securities' information will more likely earn excess return. Individual investors who lack time and information to analyze securities can obtain information from informed traders. Having access to market expectations and considering the advice of informed traders are very important for individual investors.

Many methods have been developed to predict the movement of the future stock market, such as fundamental analysis, technical analysis, and technological methods. Fundamental analysts evaluate the company behind the stocks. They forecast the future stock price using various performance ratios. Technical analysts look for patterns of stock price movements from historical data and then use these patterns to predict future price. Technical methods use computers to monitor many indicators of price movements. Nevertheless, people hold different opinions about the same stock.

The purpose of this paper is to examine the efficiency of using option market information in predicting the movement of future stock index. Specifically, this paper uses the data from India market to examine the prediction model developed by Bhuyan and Chaudhury

(2001) in their paper "Trading on the Information Content of Open Interest: Evidence from the US Equity Options Market."

This paper uses open interests and exercise prices to forecast the future stock index values, following Bhuyan and Chaudhury's (2001) prediction model. The results are compared with the actual index values in several macroeconomic backgrounds including boom, recession, and reluctant market.

1.2 Background

This paper focuses on the India option market and stock index value. Reasons for choosing the India financial market in this project are as follows.

First, India's stock and derivative markets are active in the world financial market. Based on the data from the World Federation of Exchanges (2011), the trading volume in the India stock market and open interest in the index option market are both ranked in the world top 10. Its stock index values in the last 10 years also shows a representative pattern for empirical study.

The graph shows that the stock index values can be separated into four distinct patterns: a steady increase before 2007, a sharp drop in 2008, a dramatic climb during 2009, and a reluctant period after that. These patterns make testing the prediction model in several market conditions easy.

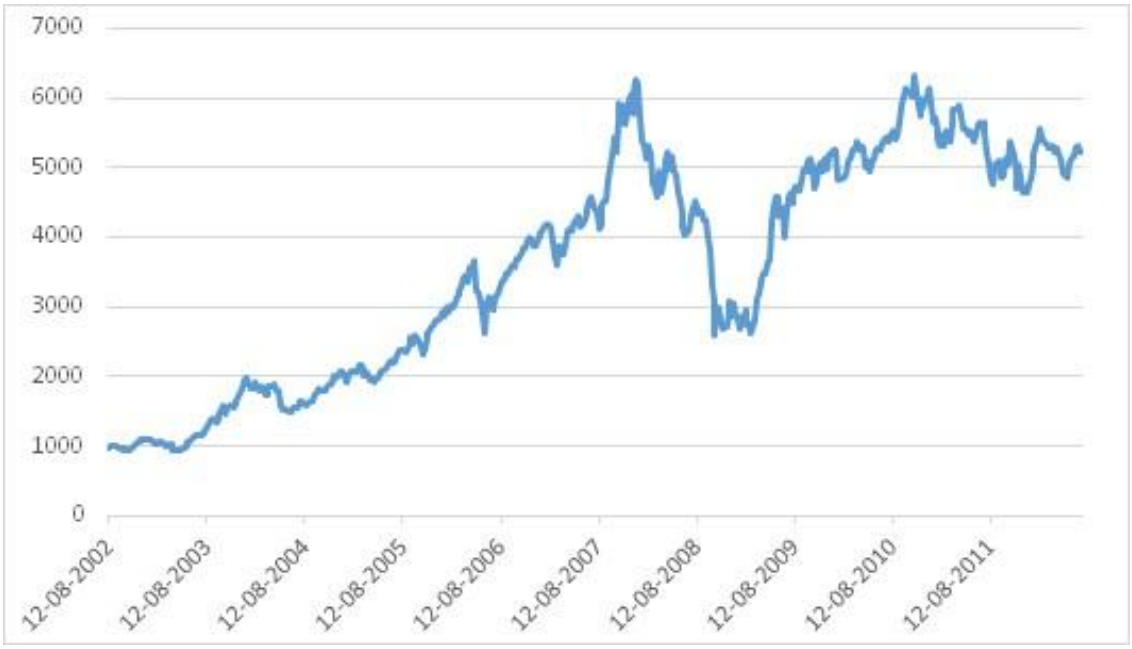

Figure 1
S & P CNX NIFTY index value (Source: Yahoo Finance, 2012)

Second, incomplete markets make informed traders possible to gain abnormal returns, and these informed traders are more likely to trade in option markets than trade in stock markets. Despite the latest ongoing innovation in financial markets, the markets remain incomplete, which give the informed trader the chance to earn extra money. In a strong form of market efficiency, the stock price reflects all the information in the market, whether public or private. In this market condition, regardless of the amount of research or information holding, all the investors, even the informed traders, cannot gain abnormal return. However, the problem of asymmetric information has not been eliminated. The strong form market efficiency does not hold; thus, informed investors can still obtain benefits from their non-public information in a public market.

The option market is the one chosen by informed traders to access for future profit (Mayhew, Sarin, and Shastri, 1995). This suggestion is supported by John, Koticha, and

Subrahmanyam's (2000) findings. They analyze the effect of option trading on the behavior of informed traders. Their findings show that option trading, with or without margin requirements, improves the informational efficiency of stock prices, thus enabling informed traders to gain larger profits in the option market.

Recently, Aragon and Martin (2007) show that informed traders choose to hold options rather than stocks and suggest that option markets are important for informed traders. These reasons explain why this paper uses option market activities to follow the activities of informed traders.

1.3 Need for study

The contribution of this paper is summarized as follows. First, only a few studies have used open interest and exercise price on the same maturity as key variances to predict future security prices on the maturity day. These studies examine the ability of these two variables to predict the future price of single stock and commodity futures. However, to this writer's knowledge, this study is the first to examine Bhuyan and Chaudhury's prediction model based on the stock index. Hopefully, this paper will confirm the success of this prediction model in terms of forecasting the stock index.

Second, this paper avoids time-period bias and data mining bias by covering relatively longer periods of time and including different financial market trends. A time-period bias occurs when a study focuses on short periods of time and covers limited macroeconomic conditions. Thus, some investment studies appear to work over a specific period of time

but do not work in other periods of time. When these same studies cover much longer periods of time, the conclusions will be different. Most previous applications are based on a period of several months; thus, they do not prove that the prediction is applicable in different market conditions. By separating the index data into four distinct movement patterns, this paper can test the prediction model in different situations and determine the advantages and limitations of the prediction model.

1.4 Statement of problem

This paper will test on the prediction model to see whether it can successfully forecast future stock index values or not. If the prediction model is accurate, the difference between predicted index value and the actual index value should be equal to zero.

Chapter 2

Literature Review

Previous studies show some great improvements in and support for this topic. In 1973, Fischer Black and Myron Scholes introduced an option pricing model in their paper entitled "The Pricing of Options and Corporate Liabilities." This model is known today as the Black-Scholes model, which is a standard model for option pricing and is widely used in the calculation of jointly implied stock prices and implied standard deviations. Following the Black-Scholes framework, option is a redundant asset. Nevertheless, many studies have shown the non-redundant characteristics of option.

2.1 Informed trader in the option market

As mentioned in the introduction, informed traders are more likely to trade in option markets. Thus option markets contain future information about the underlying assets.

Many studies have been done on option trading and underlying asset price. However, most of them are based on the assumption that the market is a complete market. They assume that the derivatives are redundant and therefore not traded in equilibrium. In reality, informed traders trade in the market, and most of them trade in the derivative market.

Black (1975) first suggests that informed traders are induced by the higher leverage available in the option market to trade options rather than stocks. Moreover, unlike equity

position, which gives investors full risk of downside stock price, the option can limit its payoff by exercise price (Corrado and Truong, 2009).

In their recent research, Aragon and Martin (2007) examine the data of stock and option holding of 250 hedge fund investment advisors from 1995 to 2005. After calculating the annualized risk-adjusted returns of the monthly reported holding, they find a relationship between higher return and the number of out-of-the-money options. The results support the suggestion of Black that informed traders choose holding options rather than stocks.

Informed traders are not only involved in events such as mergers and acquisitions and quarterly financial related statements but also in holding information that can dramatically influence the market trend. The most significant event is the September 11 attack. Many studies show that a few days before the attack, some abnormal activities in the option markets are observed. Poteshman (2001) found that the option market activities before the terrorist attack show an unusually high input volume. Calculating the put-call trading volume ratios of American Airlines (AMR) and United Airlines (UAL) for a four-day period before September 11, he finds that the trading volumes of put option are extremely high at that time. In particular, the ratio of UAL reached the highest number of 105.42 on September 6.

	AMR				UAL			
Volume Statistic	9/5/2001	9/6/2001	9/7/2001	9/10/2001	9/5/2001	9/6/2001	9/7/2001	9/10/2001
PutCall	0.75	0.68	0.73	7.07	7.40	105.42	15.21	1.66

Table 1
Put-Call trading ratio (Poteshman, 2002)

Chesn ey, Crameri, and Mancini (2010) also find that companies such as AMR, UAL, and Boeing are targets of informed trading activities before the attack. The open interest of

put option during that period is statistically high, and the total gains from these put options reached USD16 billion.

2.2 Leading effect in the option market

After comparing the option information implied stock prices with the observed stock prices, Manaster and Rendleman (1988) find that the option information implied stock prices contain information on equilibrium stock prices that is not fully reflected in the observed stock prices. Their work reveals a leading effect in the option market.

Based on their study, they reject the hypothesis that implied stock price is equal to the current observed stock price and contains no future stock price information. They conduct an ex ante test and an ex post test on the implied and observed stock price. The results show that both tests support the argument that implied stock price from the option market contains information about the future stock price. However, they are unable to determine the usefulness of this leading effect in the option market for investors to earn abnormal return.

In his work "Asymmetric Information and Options," Kerry Back (1993) confirms the occurrence of this effect and links option trading volume to stock prices. In his paper, he describes a market in which an option appears to be redundant. However, the option market still affects the underlying asset price because it affects the flow of information. Every time an option is traded, the volatility of the underlying asset turns stochastic as the result of the information flow changes.

Based on their bi-directional causality test on daily data from eight firms on CBOE (Chicago Board Options Exchange) in the first quarter of 1996, Diltz and Kim (1996) support the findings of Manaster and Rendleman. Moreover, they find evidence both for the stock market leading the option market and the option market leading the stock market.

The limitation of these studies is that they use close price. However, in many countries, the stock market and the option market are not closed at the same time. In these countries, the option market usually closes later than the stock market. This practice enables some new information to come into the option market when stock market is closed, thus making the option market reflect the information ahead of the stock market.

Easley and O'Hara's (1998) paper entitled "Option volume and stock prices: Evidence on where informed traders trade" and O'Connor and Matthew's study (1999) discuss the relationship between trading volume and stock prices by using intraday data in the stock market and the option market. They create an asymmetric information model in which informed traders may trade in the option or equity market and separate the trading volume into two different categories: positive and negative. Positive trading volume includes the volume for all long call and short put options trade, whereas negative trading volume includes the volume for all long put and short call options trade. In this model, all the data are aggregated over five-minute intervals. O'Connor and Matthew's subjects for the study comprise 19 firms sampled at five-minute intervals over a two-month period. He uses the error correction model framework to investigate lead/lag effects. After analyzing the relationship between trading volume and stock prices, he finds that both positive and negative trading volumes in option market can be used to predict future stock prices.

Their research method solves the three major problems of the previous studies. First, by using intraday data at a five-minute interval, he successfully avoids the bias from the non-simultaneous closing time of the option market and the equity market. Second, Easley and O'Hara's work provides significant information on the leading effect in the option market, as previous studies only use the daily close price data. Finally, instead of simulating a trading strategy and comparing the result from these two markets, their study focuses mainly on the lead/lag phenomenon in the option market and the equity market.

However, readers should be aware of the short period of time involved and the limited number of firms included in their research.

2.3 The prediction model

The previous studies examine the lead/lag relationship between the option market and the individual stock prices. This paper takes a step further by examining the possibility of using the prediction model provided by Bhuyan and Chaudhury (2001) to forecast the movements of the future stock index.

The idea that stock index movements can be predicted by option market information is backed by several studies that examine the hypothesis that put and call prices contain information on the future returns of the underlying asset. The value of the relative prices is derived from the put–call parity relationship for index options and applied to a three-year sample of option transactions. Finucane (1991) shows that a direct relationship exists between index options implied price and underlying stock index.

The basic assumption in Bhuyan and Chaudhury's model is that investors take an option position based on their expectation about the future stock price. This expectation is based on both public and private information at that time. In their paper, they use daily closing data on the CBOE options of 30 stocks based on the data collected from February to July of 1999 to investigate whether options open interest contains information that can be used for a relatively long-term trading forecast.

Option Month	February	March	April	May
Actual Up (% of Total)	49(41%)	64(53%)	36(30%)	42(35%)
Actual Down (%of Total)	71(59%)	56(47%)	84(70%)	78(65%)
Predicted Up (% of Total)	42(35%)	48(40%)	35(29%)	53(44%)
Predicted Down (%of Total)	78(65%)	72(60%)	85(71%)	67(56%)

Table 2
Actual movement of the number of stocks and the predicted stock movement
(Bhuyan and Chaudhury, 2001)

In their sample, they use option exercise price and open interest, which predict future stock price, so that investors can generate better returns compared with those in the S & P's 500. Their study proves that using the information of options on a single stock to predict the future stock price will benefit investors. Their comparative performance results indicate the impressive trading advantage of predictions based on the distribution of options open interest. This advantage seems pervasive and does not seem to come at the cost of a significantly higher risk.

Moreover, their findings also support the studies of Easley and O' Hara (1987) and John, Koticha, and Subrahmanyam (2000) about option that cannot be considered a redundant derivative. More importantly, their model is the first prediction model that uses open interest and exercise price to forecast a future stock movement successfully. Based on their work, Fodor, Krieger, and Doran (2010) further confirm the changes in put and call open interest levels that have predictive power for future equity markets. This prediction model was also used by Mukherjee and Mishra (2006) in their study on the effect of open interest and exercise price on forecasting future cash market movements.

Chapter 3

Data and Methodology

3.1 Data source and selection

This paper uses the S & P CNX NIFTY Index (NIFTY) and related option data collected from the National Stock Exchange of India Limited (NSE) and Yahoo Finance. These data are reliable, representative, and accessible. The daily NIFTY Index data have been available on Yahoo Finance since August 12, 2002. The daily option trading data have been available on NSE since June 2001.

NSE is a stock exchange located in Mumbai, India, which is experiencing fast growth. In 2011, the new listing in the NSE by market capitalization is USD 82,249,000.30 million (World Federation of Exchanges, 2011).

Exchange	Market capitalization of new listings
NYSE Euronext (US)	154,795.80
Shenzhen SE	146,026.50
Shanghai SE	104,919.10
Hong Kong Exchanges	104,224.20
NASDAQ OMX	102,271.20
London SE Group	87,996.30
National Stock Exchange India	82,249.30
MICEX	59,527.00
Singapore Exchange	53,135.10
BME Spanish Exchanges	48,992.60

Table 3
Top 10 new listings in exchange by market capitalization (USD millions)
(World Federation of Exchanges, 2011)

NIFTY is one of the most important indexes in the NSE that reflects the true movement of the Indian stock market. The index includes the largest and most liquid securities in India. It contains the top 50 companies listed in the NSE, which captures approximately

65% of the market capitalization. The index has been trading since1996, and it widely used as a benchmark for index funds and index-based derivatives. (S & P CNX NIFTY Index Methodology, 2011).

The data used in this paper are the daily index and option data collected from February 2004 to December 2011, a total of 90 months of the data available. European options comprise all option trading in NSE, indicating that the option will only be exercised on the maturity date. This paper uses option data collected two weeks before the maturity date to predict the index movement on the option maturity date.

3.2 Prediction model

This section defines the variables used in Bhuyan and Chaudhury's prediction model. This model choose the option information from current time t that have the same maturity time T, and use those information to prediction the underlying assets prices on the maturity day. For the options at same maturity, there is a full range of exercise prices included, and each one has its own open interest. The variables are defined as follows:

Exercise price of call option at maturity date T on the time t is Xi.

Open interest of call option at maturity date T with exercise price Xi is Oi.

Exercise price of put option at maturity date T on the time t is Xj.

Open interest of put option at maturity date T with exercise price Xj is Oj.

The idea behind the prediction model is that, if investors are holding information that favors the future stock market, they will hold more out-of-the-money options; otherwise, they will hold in-the-money options. The weight of each exercise price at maturity T is defined as its open interest divided by the total number of the open interest at maturity T, which is $\frac{Oi}{\sum Oi}$ and $\frac{Oj}{\sum Oj}$.

By calculating the weighted average of exercise prices, the model obtains an estimation of the future index movement. The call option information based estimated index value at time T is S_T^c, the put option information based estimated index value at time T is S_T^p, and the call and put option information based estimated index value at time T is S_T.

Where

$$S_T^c = \sum Xi * \frac{Oi}{\sum Oi} \quad \text{(Equation 3.2.1)}$$

$$S_T^p = \sum Xj * \frac{Oj}{\sum Oj} \quad \text{(Equation 3.2.2)}$$

$$S_T = \frac{\sum XiOi + \sum XjOj}{\sum Oi + \sum Oj} \quad \text{(Equation 3.2.3)}$$

The results should closely reflect the market index movement using these models, especially the combined put and call predictor models.

3.3 Methodology

By using the prediction model above, this paper tests the accuracy of the estimation results. First, the relationship between the estimation value and the actual index value is represented by Equation 3.3.1:

$$IDXt = \alpha + \beta * St + \varepsilon t \quad \text{(Equation 3.3.1)},$$

Where

IDXt= the actual index value on option maturity date t;

α = intercept of the equation for estimation at time t;

β = slope of the equation for estimation at time t;

St = the estimated index value at time t; and

ε t= error term.

The regression is presented using STATA. To perform the simple linear regression, four assumptions are considered as regards the error term:

The expected value of the random error equals zero: $E(\varepsilon)=0$.

The variance of the random error equals zero: $var(\varepsilon)=\sigma 2$.

The covariance between any random errors εi and ε j equals zero: $cov(\varepsilon i, \varepsilon j)=0$.

The values of e are normally distributed with their mean: $\varepsilon – N(0, \sigma 2)$.

Second, a t-test is used to test the hypothesis that the estimation is equal to the actual index value. The difference between the estimation value and the actual index value is calculated, diffst.

$$diffst=St - IDXT \quad \text{(Equation 3.3.2)},$$

Where

St = the estimated index value of the option maturity date at time t; and

IDXT = the actual index value of the option maturity date.

The null hypothesis is stated as H0: diffst=0. The alternative hypothesis is stated as Ha: diffst≠0. If we accept the null hypothesis, the market will be efficient. If we reject the null hypothesis, no difference will exist between the estimated value and the actual index value.

Chapter 4

Result and analysis

4.1 Estimated index value

The estimated index values are calculated using the prediction model. Chart 4.1 shows that the estimated value is close to the actual index value.

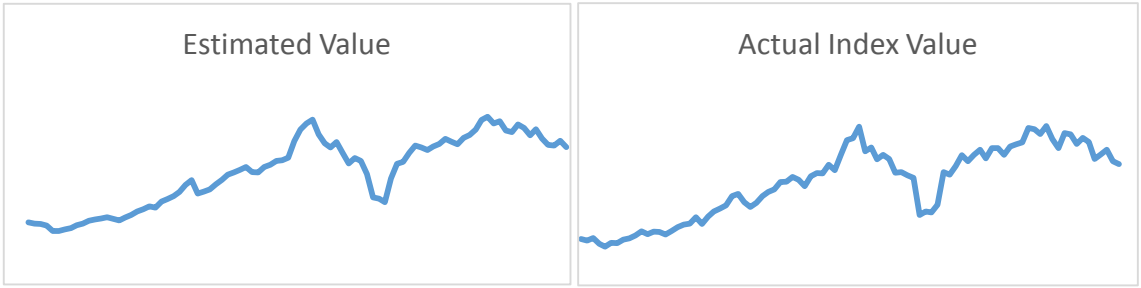

Figure 2
Estimated index value and actual value

The graphs show that the estimated value is smoother than the actual index value. The investors in the derivative market are not sensitive to the small market fluctuation. The results of the regression of Equation 3.3.1 also illustrate the positive relationship between these two values.

Source	SS	df	MS
Model	167795771	1	167795771
Residual	5619770.61	88	63861.0296
Total	173415542	89	1948489.23

Number of obs	90
F(1, 88)	2627.51
Prob > F	0.0000
R-squared	0.9676
Adj R-squared	0.9672
Root MSE	252.71

IDX	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
stc	.9468765	.0184723	51.26	0.000	.9101667	.9835863
_cons	149.6513	78.45141	1.91	0.060	-6.254424	305.557

Table 4
Regression result of the call option predictor and the actual index value

Source	SS	df	MS	Number of obs =	90
				F(1, 88) =	2362.18
Model	167187185	1	167187185	Prob > F =	0.0000
Residual	6228357.18	88	70776.7861	R-squared =	0.9641
				Adj R-squared =	0.9637
Total	173415542	89	1948489.23	Root MSE =	266.04

IDX	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
st	.9955742	.0204841	48.60	0.000	.9548663	1.036282
_cons	81.13661	84.05061	0.97	0.337	-85.89632	248.1695

Table 5
Regression result of the put option predictor and the actual index value

Source	SS	df	MS	Number of obs =	90
				F(1, 88) =	2516.87
Model	167557072	1	167557072	Prob > F =	0.0000
Residual	5858469.39	88	66573.5158	R-squared =	0.9662
				Adj R-squared =	0.9658
Total	173415542	89	1948489.23	Root MSE =	258.02

IDX	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
stp	1.040941	.0207489	50.17	0.000	.9997074	1.082176
_cons	17.94118	82.62504	0.22	0.829	-146.2587	182.1411

Table 6
Regression result of the combined option predictor and the actual index value

The results of the regression are also close because the three predictors are very close. The results represent a solid and positive relationship between the predictors and the index value. All the variables are statistically significant based on the F and t values. The R-squared number, in which all three predictors are greater than 0.96, also supports the finding that the actual index value can be explained by the predictors. Moreover, the coefficients of the predictors are close to 1, namely, 0.9468, 0.9955, and 1.04.

4.2 Hypothesis test

This sector contains five parts. Each part includes a hypothesis test covering different market conditions. There will be tests on overall stage, steady growth stage, recession stage, rapid recover stage and fluctuated stage.

This hypothesis only tests the combined option predictor because the three predictors, namely, call option-based predictor, put option-based predictor, and combined option predictor are close to each other.

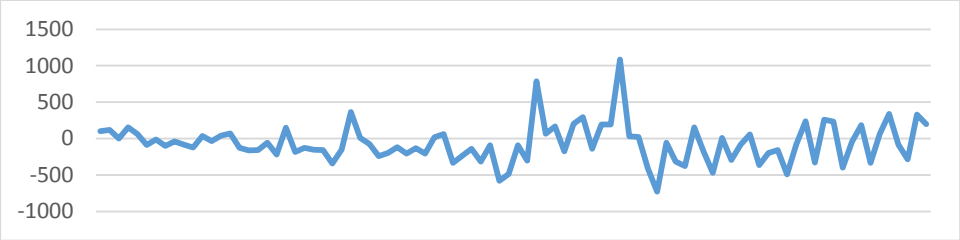

Figure 3
Difference between the estimated value and the actual index value

Variable	Obs	Mean	Std. Dev.	Min	Max
difst	90	-64.01733	264.6104	-728.9446	1084.241

Table 7
Summary of difst

4.2.1 T-test covering the four market conditions

Note that the null hypothesis is stated as H0: diffst=0, and the alternate hypothesis is stated as Ha: diffst≠0.

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
difst	90	-64.01733	27.89239	264.6104	-119.4389	-8.595751

mean = mean(difst) t = -2.2952
Ho: mean = 0 degrees of freedom = 89

Table 8
T-test covering the four market conditions

The result shown in Table 8 is not good for the predictor. We reject the null hypothesis that the difference between the estimated value and the actual index value is zero because 0 is not in the 95% confidence interval. However, both the negative mean value and the graph of the difference between the estimated value and the actual index value show that investors in the derivative market are conservative about the future stock index value. This conservative attitude makes the estimated value relatively smaller than the actual number.

This conservative attitude can be caused by the great recession in 2007 and 2008. After the recession, the investors underestimate the stock index value. The many negative values on the right side of Figure 3 support this idea. To confirm this idea using statistical method, I drop the data collected after November 2009 and recalculate the variable summary and the t-test again.

The results are presented in Table 9 and Table 10.

Variable	Obs	Mean	Std. Dev.	Min	Max
difst	66	-61.70542	266.976	-728.9446	1084.241

Table 9
Summary of difst after reduction

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
difst	66	-61.70542	32.86248	266.976	-127.3363	3.925479

mean = mean(**difst**) t = **-1.8777**
Ho: mean = **0** degrees of freedom = **65**

Table 10
T-test covering the four market conditions after reduction

Sixty-six observations remain in the data pool, and the results of the t-test do not reject the null hypothesis that diffst=0. Thus, the estimated value is equal to the actual index value at a 5% significant level. After the recession, the investors become more conservative about the stock market and underestimate the values of the future stock index.

4.2.2 T-test at the steady growth stage

The data pool at this stage includes data collected from February 2004 to November 2007. A total of 47 observations are included.

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
difst	47	-103.8849	24.5186	168.0911	-153.2383	-54.53151

mean = mean(**difst**) t = **-4.2370**
Ho: mean = **0** degrees of freedom = **46**

Table 11
T-test at the steady growth stage

The null hypothesis that diffst is equal to 0 is rejected. Based on the 95% confidence interval, the estimated value underestimates the future stock index.

4.2.3 T-test at the recession stage

The data pool at this stage includes data collected from December 2007 to January 2009. A total of 12 observations are included.

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
difst	12	199.3477	113.3534	392.6678	-50.1415	448.8369

mean = mean(**difst**) t = **1.7586**
Ho: mean = **0** degrees of freedom = **11**

Table 12
T-test at the recession stage

The null hypothesis that diffst is equal to 0 is not rejected. The estimated index value is equal to the actual index value.

4.2.4 T-test in the rapid recover stage

The data pool at this stage includes data collected from February 2009 to October 2009. A total of seven observations are included.

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
difst	7	-244.5563	114.2228	302.2052	-524.0495	34.93691

mean = mean(**difst**) t = **-2.1410**
Ho: mean = **0** degrees of freedom = **6**

Table 13
T-test in the rapid recover stage

The null hypothesis that diffst is equal to 0 is not rejected. The estimated index value is equal to the actual index value.

4.2.5 T-test at the rapid recovery stage

The data pool at this stage includes data collected from November 2009 to December 2011. A total of 25 observations are included.

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
difst	25	-74.56032	51.76703	258.8352	-181.4022	32.28158

mean = mean(**difst**) t = **-1.4403**

Ho: mean = **0** degrees of freedom = **24**

Table 14
T-test at the rapid recovery stage

The null hypothesis that diffst is equal to 0 is not rejected. The estimated index value is equal to the actual index value.

Although the null hypothesis in three of the four economic conditions is not rejected, note that, after separating the data pool into four conditions, a number of observations are largely reduced. The results also show that investors in the option market are overconfident during the recession period. Thus, they become conservative afterwards.

Chapter 5

Conclusion

This paper uses the prediction model developed by Bhuyan and Chaudhury (2001) to estimate stock market index value from option information in India financial market. It also examine the relationship between the estimated value and the actual index value. The data used are collected from February 2004 to December 2011. A total of 90 observations are included. This paper also tests the estimated value under different economic conditions to examine if it can be useful in different environments. Overall, this paper tests if the prediction model is useful in predicting future index value.

The predicted index value is close to the actual index value. Although the estimated values do not exactly point out the actual values and are usually conservative about the future numbers, the regression result of Equation 3.3.1 confirms that the future index value can be explained by the estimated value. The results from our hypothesis test also show that the difference between the estimated value and the actual future value can be statistically zero in most of the economic conditions. These results support the idea that investors can use this prediction model to catch the market expectation about the future stock index.

This finding supports the findings of Easley and O' Hara (1987) and John, Koticha, and Subrahmanyam (2000) that option cannot be a redundant derivative and can predict the equity market value. This prediction model not only forecasts the future individual stock price and the cash market movement, as proven by Krieger and Doran (2010) and Mukherjee and Mishra (2006), but also forecasts the future index value.

This paper has its limitations. Although data for a relative period are used, only 90 observations are found. Moreover, after dividing the data into four market conditions, the observations decrease further. Whether this prediction model works in a larger data pool and at a different date before the maturity remains to be seen.

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Appendix: Results from the prediction model

Maturity Date	Stock Index on Prediction Day	Stock Index on Maturity	Estimated Index Number
26-02-2004	1858.30	1765.80	1867.47
25-03-2004	1716.65	1704.45	1823.84
29-04-2004	1889.55	1808.95	1808.28
27-05-2004	1543.85	1586.40	1742.43
24-06-2004	1512.05	1470.75	1534.72
29-07-2004	1598.10	1618.70	1531.73
26-08-2004	1609.20	1610.75	1597.78
30-09-2004	1726.15	1745.50	1643.33
28-10-2004	1779.75	1800.10	1759.08
25-11-2004	1892.05	1901.05	1817.37
30-12-2004	2045.15	2059.80	1938.26
27-01-2005	1925.30	1955.00	1988.81
24-02-2005	2061.90	2055.30	2022.26
31-03-2005	2015.40	2035.65	2075.37
28-04-2005	1948.55	1941.30	2011.40
26-05-2005	1990.85	2074.70	1949.74
30-06-2005	2183.85	2220.60	2060.52
28-07-2005	2230.50	2319.10	2161.53
25-08-2005	2388.45	2354.55	2299.80
29-09-2005	2476.50	2611.20	2391.58
27-10-2005	2395.45	2352.90	2504.54
24-11-2005	2603.95	2635.00	2452.60
29-12-2005	2835.25	2821.95	2696.52
25-01-2006	2809.20	2940.35	2787.61
23-02-2006	3022.20	3062.10	2904.36
30-03-2006	3247.15	3418.95	3075.63
27-04-2006	3573.50	3508.10	3355.27
25-05-2006	3388.90	3177.70	3540.88
29-06-2006	2994.75	2997.90	3005.43
27-07-2006	3023.05	3156.15	3081.80
31-08-2006	3370.40	3413.90	3172.46
28-09-2006	3553.05	3571.75	3375.82
26-10-2006	3677.80	3677.55	3557.80
30-11-2006	3945.45	3954.50	3748.72
28-12-2006	3833.50	3970.55	3840.88
25-01-2007	4109.05	4147.70	3940.02
22-02-2007	4146.20	4040.00	4056.93
29-03-2007	3875.90	3798.10	3860.79
26-04-2007	3997.65	4177.85	3844.20
31-05-2007	4204.90	4295.80	4059.50
28-06-2007	4267.40	4282.00	4143.26
26-07-2007	4562.10	4619.80	4303.16
30-08-2007	4114.95	4412.30	4319.87
27-09-2007	4747.55	5000.55	4420.53

25-10-2007	5351.00	5568.95	5082.29
29-11-2007	5519.35	5634.60	5542.65
27-12-2007	5766.50	6081.50	5776.74
31-01-2008	5033.45	5137.45	5924.35
28-02-2008	5191.80	5285.10	5351.02
27-03-2008	4573.95	4830.25	4997.73
24-04-2008	4958.40	4999.85	4822.99
29-05-2008	5025.45	4835.30	5037.34
26-06-2008	4504.25	4315.85	4609.95
31-07-2008	4433.55	4332.95	4192.42
28-08-2008	4283.85	4214.00	4405.44
25-09-2008	4038.15	4110.55	4302.89
29-10-2008	3065.15	2697.05	3781.29
29-01-2009	2713.80	2823.95	2853.82
26-02-2009	2789.35	2785.65	2807.04
26-03-2009	2807.15	3082.25	2672.55
28-05-2009	4210.90	4337.10	3608.16
25-06-2009	4251.40	4241.85	4184.04
30-07-2009	4523.75	4571.45	4257.46
24-09-2009	4965.55	4986.55	4610.38
29-10-2009	4988.60	4750.55	4903.88
26-11-2009	4989.00	5005.55	4830.54
31-12-2009	5178.40	5201.05	4731.10
25-02-2010	4887.75	4859.75	4870.26
25-03-2010	5245.90	5260.40	4965.05
29-04-2010	5269.35	5254.15	5172.52
27-05-2010	4947.60	5003.10	5059.08
24-06-2010	5274.85	5320.60	4954.86
29-07-2010	5441.95	5408.90	5213.00
26-08-2010	5540.20	5477.90	5319.37
30-09-2010	5959.55	6029.95	5537.63
28-10-2010	6101.50	5987.70	5910.62
25-11-2010	5998.80	5799.75	6039.28
30-12-2010	5980.00	6101.85	5773.75
27-01-2011	5711.60	5604.30	5865.04
24-02-2011	5546.45	5262.70	5497.61
31-03-2011	5522.40	5833.75	5434.92
28-04-2011	5884.70	5785.45	5742.05
26-05-2011	5428.10	5412.35	5596.07
30-06-2011	5320.00	5647.40	5312.24
28-07-2011	5541.60	5487.75	5555.15
25-08-2011	4944.15	4839.60	5179.40
29-09-2011	4923.65	5015.45	4933.82
25-10-2011	5037.50	5191.60	4905.14
24-11-2011	4934.75	4756.45	5088.01
29-12-2011	4733.85	4646.25	4843.18