







# “Choosing the right options trading strategy: Risk-return trade-off and performance in different market conditions”

<b>AUTHORS</b>	Shivaprasad S. P.  Geetha E.  Raghavendra  Kishore L.  Rajeev Matha 
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Raghavendra, Kishore L., Rajeev Matha,  
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Shivaprasad S. P., Research Scholar,  
Department of Commerce, Manipal  
Academy of Higher Education, India.

Geetha E., Associate Professor,  
Department of Commerce, Manipal  
Academy of Higher Education, India.  
(Corresponding author)

Raghavendra, Professor, Associate  
Dean, VIT-AP School of Business, VIT-  
AP University, India.

Kishore L., Assistant Professor-Sr. Scale,  
Department of Commerce, Manipal  
Academy of Higher Education, India.

Rajeev Matha, Research Scholar,  
Department of Commerce, Manipal  
Academy of Higher Education, India.



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Shivaprasad S. P. (India), Geetha E. (India), Raghavendra (India),  
Kishore L. (India), Rajeev Matha (India)

# CHOOSING THE RIGHT OPTIONS TRADING STRATEGY: RISK-RETURN TRADE-OFF AND PERFORMANCE IN DIFFERENT MARKET CONDITIONS

## Abstract

The investment decisions are subjected to risk and return of the financial asset. Options strategies help employ a suitable strategy to balance the risk-return trade-off. The study analyzes the risk-return trade-off of the long straddle, long strangle, long call butterfly (LCB), short straddle, short strangle, and short call butterfly (SCB) strategies. Moreover, it measures the impact of strategy risk and options premiums on strategy return using panel data analysis. Additionally, the study evaluates the performance of options strategies using the excess returns to risk approach under neutral and volatile market conditions. This paper considered companies of top-six sector indices of the National Stock Exchange from 2009 to 2020 and collected data of 18,720 option contracts and 3,744 observations for each strategy (22,464 observations). The study revealed that risks of long straddle and long strangle strategies have a positive impact, and options premiums negatively influence their payoff. ATM call premiums positively affect LCB payoff, while OTM and ITM call premiums positively influence SCB payoff. However, the risks of butterfly strategy did not influence its payoff. The risk of short straddle and short strangle strategies negatively influenced the payoff and were considered riskier strategies. Moreover, short straddle and short strangle strategies enhanced excess returns under both market conditions. The results would help the investors in choosing the appropriate strategy by analyzing the impact of risk on the payoff and the ability to enhance excess returns to the risk of various options strategies to incorporate in their investment.

## Keywords

equity market, derivatives market, options, straddle strategy, strangle strategy, butterfly strategy, risk-return trade-off, panel data analysis

## JEL Classification

C33, G11, G32

## INTRODUCTION

The investment decisions in the financial markets are subjected to risk and uncertainty (Scholes, 1996; Rusnáková et al., 2015). Consequently, prior researchers and financial analysts developed several models such as Modern Portfolio Theory (Markowitz, 1952), Capital Asset Pricing Model (Treynor, 1961, 1962), and Single index model (Sharpe, 1963) to determine the risk and return relationship in the investment decisions. However, it is observed that individual investors are prone to tremendous losses on equity investment due to market volatility (Bauer et al., 2009; Kumar Meher et al., 2021). Therefore, investors seek suitable risk reduction strategies (Antonakakis et al., 2020; Guo, 2000). Options are such derivative instruments that help the investors to minimize the risk in investment and maximize the returns. Therefore, adopting appropriate option strategies is essential to balance the risk-return trade-off (Fontanills, 2005; Madan & Sharaiha, 2015; Samuel, 2018).

Options contracts are not extensively traded because of a lack of exposure to trading strategies and information on applying suitable strategies under different market conditions (Chen & Leung, 2003; Chong, 2004; Broadie et al., 2007). Nevertheless, literature on options has focused mainly on option pricing (Larikka & Kanninen, 2012) and hedging (Kavussanos & Visvikis, 2008; Elices & Giménez, 2013). However, limited attention has been directed to studying the effectiveness and relevance of options strategies from the retail investors' perspective (Bauer et al., 2009; Goltz & Lai, 2009; Sheu & Wei, 2011). Available studies have analyzed the relationship between performance, risk, and return on covered call strategies (Mugwagwa et al., 2012; Niblock & Sinnewe, 2018) but are limited on the straddle (Chen & Leung, 2003; Broadie et al., 2007; Gao et al., 2018), strangle (Qiu, 2020), and butterfly strategies (Hong et al., 2018; Basson et al., 2018).

Existing studies on risk and return comparison of straddle and strangle strategies have obtained contradictory results and provided limited information on the comparison of options strategies on their risk-return trade-off relations. For example, Aguilera and López-Pascual (2013) opined that each options strategy offers a different level of risk and return relationship. However, it is observed that the impact of strategy risk and various option premiums on strategy payoff is not studied extensively in the equity segment from the investors' perspective (Timková & Šoltés, 2019; Fullwood et al., 2021). Therefore, this paper has directed a further inquiry to study the impact of risk and option premiums on returns of different options strategies to help investors make informed decisions.

This study contributes to the literature in two ways. First, it examines the risk-return trade-off of options strategies by applying panel regression analysis and measures the degree of relationship of risks associated with the strategy returns. This study is the first to measure the impact of strategy risk and options premiums on strategy payoff of options strategies with Indian equity options data by applying the panel regression approach. Hence, the paper identifies the strategy that enhances the highest return at a given unit of risk. Second, the study evaluates the excess return produced over the risk-free rate and compares it with standard deviation and beta in neutral and volatile market conditions. The outcome of this approach assists in identifying the strategies that enhance additional return for taking such risk over the risk-free rate and take informed decisions in their investment.

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## 1. LITERATURE REVIEW

Kavussanos and Visvikis (2008) and Elices and Giménez (2013) discussed the valuation of option contracts. Black and Scholes (1973), Mercurio and Vorst (1996), Larikka and Kanninen (2012), and Dixit et al. (2019) analyzed option pricing while Ahn et al. (1999), Aguilera and López-Pascual (2013), and Bajo et al. (2015) investigated option hedging. Studies in the context of options strategies emphasize the performance, risk, and return relationship of the covered call, covered put, collar, and synthetic long call strategies that are investigated as a hedging strategy to protect the investment in an underlying asset. Whaley (2002), Mugwagwa et al. (2012), Diaz and Kwon (2017), Niblock and Sinnewe (2018), and Kedžo and Šego (2021) found superior risk-adjusted returns using the covered call strategy. At the same time, Leggio and Lien (2002) and Hoffmann and Fischer (2012)

observed a negative relationship between risk and return of covered call strategies. Bartonova (2012) and Israelov and Klein (2016) opined that collar strategy covers a 65% chance of loss and exhibits the best return-risk ratios. In contrast, Fernandes et al. (2016) applied a collar strategy as a risk-mitigating mechanism. Besides, the studies on covered call and collar strategy have shown that hedging risk can be minimized by employing these strategies in options trading.

In addition to hedging strategies, straddle, strangle, and butterfly options strategies can be applied to manage risk and enhance the return of an unhedged underlying asset. Few noteworthy studies have analyzed straddle strategy which is a combination of a call and a put option, with a long position for long straddle and short position for short straddle with the same exercise price and maturity date to get the advantage of significant

volatility experienced by the security (Guo, 2000; Goltz & Lai, 2009). Guo (2000) investigated the performance of volatility trading strategies. It was observed that delta-neutral and straddle trading generated significant positive returns. Coval and Shumway (2001) examined the expected option return from S&P 500 index and compared it with ATM (at-the-money) straddle returns. The study observed average negative returns for the straddle strategy. Chen and Leung (2003) found significant trading profits using straddle strategies when transaction costs are considered. However, their study suggested exploring these strategies empirically in the equity segment.

Further, Chong (2004) explained the profitability of the straddle strategy using currency options and reported that profits of the straddle strategy were not significant to the forecasted volatility. While Broadie et al. (2007) studied the significance of option straddle returns and compared the option straddle returns with the historical option returns computed using option pricing models. They found significant positive returns for the straddle strategy. Though Chong (2004) and Broadie et al. (2007) found contradictory results, Goltz and Lai (2009) observed less impact of risk on straddle strategy return. They opined that the straddle strategy does not capture volatility risk premium. In addition, Sheu and Wei (2011) investigated the effectiveness of long straddle and short straddle strategies based on volatility forecasts on the Taiwan stock market. They found that straddle strategies achieve positive average monthly return before the options' final settlement. Thus, studies on straddle strategy have exhibited contradictory results.

Recently Samuel (2018) examined the influence of option-implied beta on option returns using the straddle strategy. However, the results showed a positive influence and significant monthly returns on stock options. Arguing this, Gao et al. (2018) analyzed the properties of straddle strategy returns using index options and found significant negative returns. However, it was opined that the straddle strategy experiences high returns three days before an earnings announcement. In contrast, Guo et al. (2020) and Fullwood et al. (2021) found a positive relationship between straddle returns and normalized volatility spread using

currency options. Bangur (2020) proposed a new angled short straddle strategy and compared its performance with the short straddle strategy. The proposed strategy has shown more profitability, a higher success rate, and lower risk than the short straddle strategy.

In addition to this, studies have also analyzed strangle strategies that combine OTM call (out-of-the-money) and put option, with a long position for long strangle and a short position for short strangle. It is constructed to take advantage of very high levels of volatility experienced by the security (Gordiaková & Lalić, 2014; Qiu, 2020; Bhat, 2021). Chaput and Ederington (2003) studied the effectiveness of different option strategies on the Chicago Mercantile Exchange's market on euro-dollar currency options. They found that straddles and strangles are the most effective and actively traded combinations. Chang et al. (2010) indicated that individual investors realize the volatility information using the strangle strategy over the straddle strategy.

Gordiaková and Lalić (2014) analyzed the performance of long strangle strategy in a volatile market and found that vanilla options are more appropriate in a volatile market. Qiu (2020) observed that American strangle options enhance positive returns when an underlying asset experiences high volatility. Overall results asserted that strangles are more suitable than straddles during volatile market conditions, whereas the study presents contradictory results against Gordiaková and Lalić (2014). Bhat (2021) suggested that short straddle and short strangle strategies yield significant returns to the seller of the option before considering the transaction costs. Kownatzki et al. (2021) examined option straddle and strangle strategies as risk management and opined that straddle and strangle strategies are effective in risk management.

According to Basson et al. (2018), the butterfly strategy is a non-directional options strategy designed to obtain limited profit with limited risk. A long call butterfly strategy is constructed by selling 2 ATM calls and by taking a long position in ITM (in-the-money) and OTM call option whereas, a short call butterfly strategy is a combination of call options with 2 ATM call options in a long

position and short positions in ITM and OTM options (Basson et al., 2018). Maris et al. (2007) observed that volatility strategies showed the ability to generate profit only when the accuracy of the volatility is high. However, Harvey and Whaley (1992) argued that volatility trading strategies do not produce an abnormal return when transaction costs are considered. Thus, findings on the risk and return relationship of the straddle, strangle, and volatility strategies are inconclusive. Studies have focused on covered call, straddle, strangle, and other volatility strategies; but are restricted to the currency and index options. Furthermore, it was noted that studies had not analyzed the risk-return trade-off from the investors' perspective. Hence, this study attempts to address the research gap by investigating the impact of risk and various option premiums on strategy payoff and evaluating selected options strategies' performance under different market conditions.

## 2. METHODOLOGY

This study considers stock options data of companies of the top six National Stock Exchange (NSE) sector indices<sup>1</sup> for twelve years from 2009 to 2020. Data involves 18,720 option contracts, including 3,744 observations for each options strategy (22,464 observations). The study considers one-month stock option contracts and assumes that contracts are bought on the beginning day of each month and held till expiry. The strike prices, option premiums, and underlying asset value on the beginning and expiry day were obtained.

The returns of selected option strategies are calculated using the necessary equations being derived from Guo (2000), Goltz and Lai (2009), Basson et al. (2018), and Samuel (2018).

Absolute return from long straddle strategy is calculated by:

$$AR_{Long\ straddle} = ns \cdot \left[ |S_{i,T} - X_i^A| - (C_t^A + P_t^A) \right], \quad (1)$$

$$\text{where, } ns = \frac{100}{(C_t^A + P_t^A)}, \quad |S_{i,T} - X_i^A|, \quad (2)$$

is the absolute value of the stock price at expiration and ATM call and put strike prices, and  $C_t^A$  and  $P_t^A$  are ATM call and put premiums on the beginning day.

Absolute return from short straddle strategy can be calculated by:

$$AR_{Short\ straddle} = -ns \cdot \left[ |S_{i,T} - X_i^A| + (C_t^A + P_t^A) \right]. \quad (3)$$

Absolute return from long strangle strategy is calculated by:

$$AR_{Long\ strangle} = ns \cdot \left[ |S_{i,T} - X_i^O| - (C_t^O + P_t^O) \right], \quad (4)$$

$$\text{where, } ns = \frac{100}{(C_t^O + P_t^O)}, \quad |S_{i,T} - X_i^O|, \quad (5)$$

is the absolute value of the stock price at expiration and OTM call and put strike prices, and  $C_t^O$  and  $P_t^O$  are OTM call and put premiums on the beginning day.

Absolute return from short strangle strategy is given by:

$$AR_{Short\ strangle} = -ns \cdot \left[ |S_{i,T} - X_i^O| + (C_t^O + P_t^O) \right]. \quad (6)$$

Absolute return from long call butterfly strategy can be expressed as:

$$AR_{LCB} = ns \cdot \left[ \left( |S_{i,T} - X_i^A| \right)^2 + \left( |S_{i,T} - X_i^I| \right) + \left( |S_{i,T} - X_i^O| \right) - \left( (C_t^A)^2 - C_t^I - C_t^O \right) \right], \quad (7)$$

where,

$$ns = \frac{100}{\left( (C_t^O + C_t^I) - C_t^A \right)^2}, \quad (8)$$

$$\left( |S_{i,T} - X_i^A| \right)^2 + \left( |S_{i,T} - X_i^I| \right) + \left( |S_{i,T} - X_i^O| \right),$$

are sum of the absolute value of the stock price at expiration and ATM, ITM, OTM call strike prices, and  $C_t^I$  and  $P_t^I$  are ITM call and put premiums on the beginning day.

<sup>1</sup> Sectoral indices considered for the study are the Nifty Bank Index, Nifty Auto Index, Nifty Pharma Index, Nifty IT Index, Nifty PSU Bank Index, and Nifty Private Bank Index, representing 62.83% of the overall indices.

Absolute return from short call butterfly is given by:

$$AR_{S,t+1} = -ns \cdot \left[ \left( |S_{i,T} - X_i^A| \right)^2 + \left( |S_{i,T} - X_i^I| \right) + \left( |S_{i,T} - X_i^O| \right) + \left( C_t^I + C_t^O \right) - \left( C_t^A \right)^2 \right], \tag{9}$$

where,  $ns = \frac{100}{\left( C_t^A \right)^2 - \left( C_t^O + C_t^I \right)}$ . (10)

The main objective of the study is to examine the impact of strategy risk and various option premiums on strategy payoff of option trading strategies. First, the stationarity of the data has been verified using the Augmented Dickey-Fuller test (ADF) proposed by Dickey and Fuller (1979, 1981). After verifying the stationarity of the data panel, regression analysis was done.

Further, three months treasury bill rate is proxied as the risk-free interest rate. The excess returns to risk are estimated by taking a risk premium generated for an additional unit of risk. Excess returns to risks are measured using two approaches, i.e., excess returns to standard deviation and excess return to beta. First, the standard deviation and beta of a strategy returns are calculated. The study estimates Positive Excess Returns Success Rate for each strategy by considering some strategies that showed positive excess returns to the total number of strategies. The market conditions are classified as neutral and volatile market conditions based on volatility levels calculated as monthly volatility spread between S&P Nifty 50 implied volatility (IV) and realized volatility (RV) indexed over the total sample period (Niblock & Sinnewe, 2018).

$$VS_t = IV_t - RV_t. \tag{11}$$

If  $VS_t > 0.036$ , it is considered as high volatility or volatile market condition, and  $VS_t < 0.036$  is considered as low volatility or neutral market condition (Niblock & Sinnewe, 2018).

First, the Pooled Ordinary Least Squares (POLS) model is applied to determine the influence of independent variables on the dependent variable. Then, Pesaran (2004) CD test and Breusch and Pagan (1980) LM test are applied to identify heteroskedasticity in pooled regression models. Next, if there is a presence of heteroskedasticity in the POLS models, Fixed Effects Models (FEM) and Random Effects Models (REM) are applied. Finally, the Hausman test is conducted to determine the appropriate model between fixed effects and random effects.

### 3. RESULTS

Table 1 reports the results of descriptive statistics and the two approaches of the study. In addition, the results of the risk-return trade-off and the performance of options strategies in neutral and volatile market conditions are presented.

Table 1 represents the descriptive statistics of payoffs of selected option strategies. SCB, short straddle, and short strangle strategies have shown mean payoff of INR 1.66, INR 4.44, and INR 4.40, whereas LCB, long straddle, and long strangle strategies have been observed -INR 1.66, -INR 4.44, and -INR 4.40. Short straddle and short strangle strategies have shown higher average payoffs of INR 4.44 and INR 4.40. High standard deviation is ob-

**Table 1.** Descriptive statistics of option strategies payoffs

Descriptive	Long call butterfly payoffs	Short call butterfly payoffs	Long straddle payoffs	Short straddle payoffs	Long strangle payoffs	Short strangle payoffs
Mean	-1.66	1.66	-4.44	4.44	-4.40	4.40
Std. error mean	0.381	0.381	1.53	1.53	1.46	1.46
Median	-2.07	2.07	-7.60	7.60	-7.60	7.60
Standard deviation	23.3	23.3	93.4	93.4	89.3	89.3
Minimum	-460	-263	-679	-1938	-564	-1,928
Maximum	263	460	1938	679	1,928	564
Shapiro-Wilk W	0.482	0.482	0.678	0.678	0.647	0.647
Shapiro-Wilk p	< .001	< .001	< .001	< .001	< .001	< .001

Note: The coefficients are calculated at a 5 percent significance level.

**Table 2.** Augmented Dickey-Fuller test results

Test statistic	Long call butterfly payoffs	Short call butterfly payoffs	Long straddle payoffs	Short straddle payoffs	Long strangle payoffs	Short strangle payoffs	ITM call premium	ATM call premium	OTM call premium	ATM put premium	OTM put premium
ADF Fisher test statistic	631.766*	631.766*	610.007*	610.007*	243.359*	243.359*	146.626*	73.981*	108.942*	116.362*	117.070*

Note: The asterisk (\*) represents statistical significance at a 5% level of significance.

served for long and short straddle strategy payoffs with a variation of INR 93.4. Shapiro-Wilcoxon test was used to check the normality of the data. The test hypothesized as  $H_0$ : The data are normally distributed. The p-value of the test statistics is not significant at a 5% level of significance. Hence, data is not normally distributed ( $H_1$ ).

Table 2 exhibits the results of ADF. This test is applied to verify the stationarity of the data. The null hypothesis of the ADF test is  $H_0$ : Data of selected option strategies payoffs and various option premiums are not stationary. The test statistics of the ADF test are significant at a 5% significance level. Thus, data of option strategies payoffs and various option premiums are stationary at level.

### 3.1. Risk-return trade-off

The results of panel regression models are demonstrated in Tables 3, 4, and 5. Initially, the POLS regression approach is applied to examine the impact of option premiums and underlying risk on the option strategy payoffs. The appropriateness or heteroskedasticity in a regression model of the POLS regression results have been verified using the

cross-sectional dependence test such as Pesaran CD and Breusch-Pagan LM tests. The tests hypothesized as  $H_0$ : There is no cross-sectional dependence in the models. The p-value of the test statistics is less than 0.05. Hence, hypotheses are rejected at a 5% level of significance. It infers the presence of cross-sectional dependence in the models. Alternatively, there is a need to test fixed or random effects for all the models. Hence, FEM and REM are applied.

Further, the Hausman test is conducted to identify the appropriate model. The null hypothesis can be stated as  $H_0$ : REM is appropriate. The Durbin-Watson test results indicated the absence of autocorrelation and F-statistics of the F-test found to be significant at a 5% level of significance for all models.

The results of the risk-return trade-off of LCB and SCB strategies are exhibited in Table 3. The Hausman test results revealed that the REM is more appropriate than the FEM. OTM call and ITM call premiums have a significant negative influence on the payoff of LCB strategy. This showed that one-rupee changes in OTM and ITM call premium influences the payoff of LCB strategy by  $-0.394$  rupee and  $-0.999$  rupee. Whereas one rupee increase in OTM and ITM call

**Table 3.** Panel regression analysis for LCB and SCB strategies

Variables/Panel data regression models	LCB			SCB		
	POLS	Fixed	Random	POLS	Fixed	Random
Strategy risk	0.006	-0.054	-0.009	-0.006	0.054	0.009
ATM call premiums	0.718*	0.715*	0.718*	-0.718*	-0.715*	-0.718*
OTM call premium	-0.394*	-0.391*	-0.394*	0.394*	0.391*	0.394*
ITM call premium	-0.997*	-1.004*	-0.999	0.997*	1.004*	0.999
C	6.156*	7.131*	6.386*	-6.156*	-7.131*	-6.386*
R-squared	0.5959	0.5949	0.5958	0.5959	0.5949	0.5958
F-statistic	1378.581*	192.608*	1375.624*	1378.581*	192.608*	1375.624*
Durbin-Watson stat	1.700	1.725	1.725	1.700	1.725	1.725
Breusch-Pagan LM test	544.434*			544.434*		
Pesaran CD test	9.627*			9.627*		
Hausman test	Chi-Sq (4) – 7.267 Probability value – 0.1224			Chi-Sq (4) – 7.267 Probability value – 0.1224		

Note: The asterisk (\*) represents statistical significance at a 5% level of significance.

premium impacts the payoff of SCB strategy by an increase of 0.394 rupees and 0.999 rupees, respectively. Hence, there is a significant positive influence on the payoff of SCB strategy. LCB and SCB strategy risk does not influence LCB and SCB strategy payoff. ATM call premiums have a significant positive influence on payoff of LCB strategy (0.718) and a negative influence on SCB strategy payoff (-0.718). This can be explained as an additional one rupee change in the ATM call premiums leading to 0.718 rupee change in the payoff of LCB strategy while -0.718 rupee change in SCB strategy payoff. The R-squared value of 0.5958 infers that 59.58% variation in the payoff of long call and short call strategies is explained by the strategy risk, ITM call premium, OTM call premium, and ATM call premiums.

Thus, the REM equation for LCB and SCB strategy is given by:

$$\begin{aligned}
 & \text{Long call butterfly payoff}_{it} = \\
 & = 6.386 - 0.009\text{Strategy risk}_{it} + \\
 & + 0.718\text{ATM call premiums}_{it} - \\
 & - 0.394\text{OTM call premiums}_{it} - \\
 & - 0.999\text{ITM call premium}_{it},
 \end{aligned} \tag{12}$$

$$\begin{aligned}
 & \text{Short call butterfly payoff}_{it} = \\
 & - 6.386 + 0.009\text{Strategy risk}_{it} - \\
 & - 0.718\text{ATM call premiums}_{it} + \\
 & + 0.394\text{OTM call premiums}_{it} + \\
 & + 0.999\text{ITM call premium}_{it}.
 \end{aligned} \tag{13}$$

Table 4 demonstrated the results of panel regression models of long straddle and short straddle strategies. The Hausman test has confirmed that the REM is more appropriate than the FEM. For long straddle strategy, strategy risk positively influences long straddle payoff (2.285), whereas ATM call and put premiums negatively influence long straddle payoff (-0.711 and -1.047). This indicates that an additional one-unit increase in the risk of long straddle strategy leads to 2.285 rupees increase in long straddle payoff. In contrast, a one rupee increase in ATM call and put premiums decreases long straddle payoff by -0.711 rupee and -1.047 rupee. While for short straddle strategy, ATM call and put premiums have a positive influence on short straddle payoff. This can be interpreted as one rupee increase in ATM call and put premiums leading to 0.711 rupees and 1.047 rupee increase in the short straddle payoff. However, short straddle risk negatively impacted short straddle payoff by -2.285 rupees. The R-squared value has explained a 57.15% variation in the long straddle and short straddle strategy payoff by risk, ATM call, and put premiums.

Thus, the REM equation for long straddle and short straddle strategy is given by:

$$\begin{aligned}
 & \text{Long straddle payoff}_{it} = \\
 & - 3.111 + 2.285\text{Strategy risk}_{it} - \\
 & - 0.711\text{ATM call premium}_{it} - \\
 & - 1.047\text{ATM put premium}_{it},
 \end{aligned} \tag{14}$$

**Table 4.** Panel regression analysis for long straddle and short straddle strategies

Variables/Panel data regression models	Long straddle			Short straddle		
	POLS	Fixed	Random	POLS	Fixed	Random
Strategy risk	2.285*	2.282*	2.285*	-2.285*	-2.282*	-2.285*
ATM call premium	-0.711*	-0.698*	-0.711*	0.711*	0.698*	0.711*
ATM put premium	-1.047*	-1.040*	-1.047*	1.047*	1.040*	1.047*
C	-3.111*	-3.803*	-3.111*	3.111*	3.803*	3.111*
R-squared	0.5715	0.5740	0.5715	0.5715	0.5740	0.5715
F-statistic	1662.758*	178.785*	1662.758*	1662.758*	178.785*	1662.758*
Durbin-Watson stat	1.995	2.007	2.007	1.995	2.007	2.007
Breusch-Pagan LM test		942.693*			942.693*	
Pesaran CD test		15.969*			15.969*	
Hausman test		Chi-Sq (3) = 1.088 Probability value = 0.780			Chi-Sq (3) = 1.088 Probability value = 0.780	

Note: The asterisk (\*) represents statistical significance at a 5% level of significance.



$$\begin{aligned}
 \text{Short straddle payoff}_{it} &= \\
 &= 3.111 - 2.285 \text{Strategy risk}_{it} + \\
 &+ 0.711 \text{ATM call premium}_{it} + \\
 &+ 1.047 \text{ATM put premium}_{it}.
 \end{aligned} \tag{15}$$

$$\begin{aligned}
 \text{Short strangle payoff}_{it} &= \\
 &= 11.011 - 2.105 \text{Strategy risk}_{it} + \\
 &+ 0.721 \text{OTM call premium}_{it} + \\
 &+ 1.035 \text{OTM put premium}_{it}.
 \end{aligned} \tag{17}$$

Panel regression results of long strangle and short strangle strategies are exhibited in Table 5. The Hausman test revealed that the FEM is more appropriate than the REM. OTM call and OTM put premium have shown significant negative influence on long strangle strategy payoff and positive influence on the payoff short strangle strategy. This result indicates that an additional increase in OTM call and put premium causes a decrease in long strangle payoff by -0.721 rupee and -1.035 rupee, while increasing short straddle payoff by 0.721 rupee and 1.035 rupee. The straddle risk has a significant negative influence on short strangle payoff and a positive influence on long strangle payoff. An additional increase in strategy risk impacts -2.105 rupee change in the short strangle payoff, whereas a +2.105 rupee change in the long strangle payoff. The R-squared has explained 57.40% variation in long strangle and short strangle strategy payoff, explained by strategy risk, OTM call, and put premiums.

Thus, the FEM equation for long strangle and short strangle strategy is given by:

$$\begin{aligned}
 \text{Long strangle payoff}_{it} &= \\
 &-11.011 + 2.105 \text{Strategy risk}_{it} - \\
 &-0.721 \text{OTM call premium}_{it} - \\
 &-1.035 \text{OTM put premium}_{it},
 \end{aligned} \tag{16}$$

### 3.2. Excess returns to risk

Tables 6 and 7 display the excess returns to standard deviation of options strategies in neutral and volatile market conditions. The short strangle strategy has shown the highest average excess return of 3.888% and 3.434% for each unit of risk taken under neutral and volatile market conditions. Short straddle and SCB strategies have shown average positive excess returns (1.137% and 0.031% in neutral market condition and 0.837% and 0.132% in volatile market condition) along with short strangle strategy. While, long straddle (-1.636% and -1.316%), long strangle (-4.676% and -4.188%), and LCB strategies (-0.19% and -0.33%) have shown negative excess returns under both market conditions. The maximum deviation in excess return to standard deviation was observed for long strangle strategy under neutral (14.607%) and volatile (13.318%) market conditions. Maximum and minimum excess returns to standard deviations are observed in short strangle (413.53% and 155.78%) and long strangle (-477.06% and -180.05%) strategy under neutral and volatile market conditions. Positive excess returns success rates are calculated to identify the percentage of positive excess returns produced by strategies under both market conditions. Short strangle (65.05% and 61.07%), SCB (65.94% and 68.67%), and short straddle strate-

**Table 5.** Panel regression analysis for long strangle and short strangle strategies

Variables/Panel data regression models	Long strangle			Short strangle		
	POLS	Fixed	Random	POLS	Fixed	Random
Strategy risk	2.077*	2.105*	2.079*	-2.077*	-2.105*	-2.079*
OTM call premium	-0.758*	-0.721*	-0.756*	0.758*	0.721*	0.756*
OTM put premium	-1.076*	-1.035*	-1.074*	1.076*	1.035*	1.074*
C	-8.491*	-11.011*	-8.653*	8.491*	11.011*	8.653*
R-squared	0.5499	0.5550	0.5499	0.5499	0.5550	0.5499
F-statistic	1523.413*	165.481*	1521.158*	1523.413*	165.481*	1521.158*
Durbin-Watson stat	1.969	1.987	1.988	1.969	1.987	1.988
Breusch-Pagan LM test	845.975*			845.975*		
Pesaran CD test	13.015*			13.015*		
Hausman test	Chi-Sq (3) - 16.712 Probability value - 0.0008			Chi-Sq (3) - 16.712 Probability value - 0.0008		

Note: The asterisk (\*) represents statistical significance at a 5% level of significance.

**Table 6.** Excess returns to standard deviation in neutral market condition

Descriptive	Long straddle (SD)	Long strangle (SD)	LCB (SD)	Short straddle (SD)	Short strangle (SD)	SCB (SD)
N	2678	2678	2678	2678	2678	2678
Mean	-1.636	-4.676	-0.19	1.137	3.888	0.031
Std. error of mean	0.071	0.282	0.071	0.064	0.248	0.068
Median	-0.97	-1.88	-0.345	0.57	1.51	0.285
Std. deviation	3.694	14.607	3.666	3.318	12.816	3.542
Skewness	-2.849	-16.623	3.869	1.064	16.258	-6.138
Minimum	-73.34	-477.06	-60.92	-56.33	-27.8	-99.88
Maximum	55.58	24.5	98.77	54.29	413.53	52.78
Positive excess returns success rate (%)	35.70	31.25	33.16	58.36	65.05	65.94

**Table 7.** Excess returns to standard deviation in volatile market condition

Descriptive	Long straddle (SD)	Long strangle (SD)	LCB (SD)	Short straddle (SD)	Short strangle (SD)	SCB (SD)
N	1066	1066	1066	1066	1066	1066
Mean	-1.316	-4.188	-0.33	0.837	3.434	0.132
Std. error of mean	0.128	0.408	0.143	0.122	0.361	0.136
Median	-0.635	-1.45	-0.38	0.285	1.095	0.33
Std. deviation	4.19	13.318	4.666	3.978	11.802	4.454
Skewness	6.226	-6.736	-3.977	-7.661	6.208	2.449
Minimum	-25.69	-180.05	-72.23	-79.72	-73.43	-41.34
Maximum	78.95	72.49	40.54	21.62	155.78	65.65
Positive excess returns success rate (%)	39.31	35.46	30.86	54.41	61.07	68.67

gies (58.36% and 54.41%) have shown the highest positive excess returns with more than 50% success rates whereas, long straddle, long strangle and LCB strategies have shown lower success rates under neutral and volatile market condition.

Tables 8 and 9 report the excess return to beta of the strategies in neutral and volatile market conditions. Long straddle (0.553%), long strangle (0.208%), short straddle (0.527%), and short strangle (0.262%) strategies have shown positive average excess returns to beta in neutral market condition whereas, LCB and SCB strategies

have shown the highest average excess returns to beta of 0.57% and 0.521% respectively under volatile market condition. The long strangle strategy has shown maximum deviation in excess returns beta under both market conditions (20.649 and 20.627). The SCB strategy has shown the highest positive excess return success rate of 52.35%; other strategies have also shown more than 50% success rates under neutral market conditions, while LCB (51.31%) and SCB (51.22%) strategies have shown success rates of more than 50% when compared to other strategies under volatile market condition.

**Table 8.** Excess returns to beta in neutral market condition

Descriptive	Long straddle (beta)	Long strangle (beta)	LCB (beta)	Short straddle (beta)	Short strangle (beta)	SCB (beta)
N	2678	2678	2678	2678	2678	2678
Mean	0.553	0.208	-0.071	0.527	0.262	-0.116
Std. error of mean	0.328	0.399	0.261	0.294	0.355	0.252
Median	0.295	0.36	0.31	0.42	0.515	0.34
Std. deviation	16.955	20.649	13.532	15.209	18.378	13.033
Skewness	-4.443	-0.139	-0.353	-5.559	-0.135	-0.463
Minimum	-451.91	-88.05	-90.36	-419.25	-76.35	-84.71
Maximum	307.58	85.04	61.77	259.99	72.14	70
Positive excess returns success rate (%)	51.83	51.72	52.13	52.24	51.68	52.35

**Table 9.** Excess returns to beta in volatile market condition

Descriptive	Long straddle (beta)	Long strangle (beta)	LCB (beta)	Short straddle (beta)	Short strangle (beta)	SCB (beta)
N	1066	1066	1066	1066	1066	1066
Mean	-0.572	-1.01	0.57	-0.482	-0.805	0.521
Std. error of mean	0.43	0.632	0.459	0.395	0.567	0.443
Median	-0.575	-0.72	0.265	-0.18	-0.78	0.245
Std. deviation	14.038	20.627	14.971	12.909	18.507	14.478
Skewness	-0.15	-0.091	0.407	0.007	-0.034	0.381
Minimum	-84.61	-70.93	-61.75	-68.87	-65.33	-66.62
Maximum	80.11	75.95	63.13	80.89	67.12	67.12
Positive excess returns success rate (%)	47.37	47.47	51.31	48.78	47.94	51.22

## 4. DISCUSSION

The results of the influence of strategy risk and options premiums on strategy payoff and performance of options strategies in different market conditions are discussed in this section. The descriptive statistics showed that short straddle, short strangle, and SCB strategies enhance positive payoffs. This finding is consistent with Guo (2000) and Chen and Leung (2003). While negative payoffs are observed for long straddle and long strangle and LCB strategies (Coval & Shumway, 2001; Goltz & Lai, 2009). This can be explained by the fact that strategies with a short position in options receive premiums as a part of income. The risk-return trade-off analysis has reported the influence of various strategy risks over the strategy payoff. For LCB and SCB strategies, the study found that strategy risk does not influence strategy payoff. Moreover, the study supports the findings of Basson et al. (2018): butterfly strategy enhances limited profit with limited risk. However, premiums received on call options sold during the construction of butterfly strategy impacted positively the butterfly strategy payoffs (Basson et al., 2018).

Long straddle and short straddle strategy risk significantly influences their payoff. Besides, the results showed that long straddle risk positively influences the payoff (Samuel, 2018; Fullwood et al., 2021). While premiums paid for the options bought under the long straddle strategy negatively influence payoff. Hence, the risk is limited to the premiums paid, and payoff is unlimited under this strategy (Guo et al., 2020). However, this finding is inconsistent with Chong (2004) and Gao et al. (2018), who argue that ATM premiums are costlier and will lead to negative returns if options bought expire without exercising.

Similarly, the risk of short straddle strategy negatively influences the short straddle payoff. Thus, the study results argue that the short straddle strategy is riskier than the long straddle strategy. This finding is consistent with Goltz and Lai (2009) and Bangur (2020). In opposite, this study results opine that selling options under a short straddle strategy may lead to unlimited risks and enhance limited rewards (Bangur, 2020).

Similar results have been observed for the strangle strategy where the risk significantly influences its payoff. However, the study found that short strangle risk has a negative influence on the payoff. This influence is because OTM call and put options are sold during strategy construction, leading to unlimited risks with limited profits (Qiu, 2020; Bhat, 2021). On the contrary, the risk of long strangle strategy tends to limit risk as options are bought during construction (Qiu, 2020). Thus, the study findings confirm that the short strangle strategy is riskier than the long strangle strategy. Moreover, Chaput and Ederington (2003) and Kownatzki et al. (2021) supported the applicability of straddle and strangle strategy as a risk management mechanism.

From the excess returns to risk perspective, the study measured the performance of options strategies under neutral and volatile market conditions using two methods, i.e., excess returns to standard deviation and excess return to beta. The ideal concept of constructing a short straddle, short strangle, and SCB strategy is to earn potential profits when a stock is experiencing low volatility (Basson et al., 2018; Bangur, 2020; Bhat, 2021). The results of excess

returns to standard deviation have exhibited positive average excess returns under neutral market conditions supported the rationality of construction of these strategies. The study results support the findings of Basson et al. (2018), Bangur (2020), and Bhat (2021).

However, this study contradicts the results of the long straddle, long strangle, and long call butterfly strategies against the rationality of construction that have exhibited negative excess returns in volatile market conditions (Guo, 2000; Goltz & Lai, 2009). The study found that the short strangle strategy has enhanced maximum excess return with higher deviation. The short straddle strategy has produced a comparatively lower positive excess return than the short strangle with lower deviation under both market conditions. These results support Chang et al. (2010), Qiu (2020), and Kownatzki et al. (2021). Based on the positive excess returns success rate results, the study decides the successful strategy that generated the highest percent-

age of positive returns over 12 years. Research findings exhibited the highest positive excess returns success rate for SCB and short strangle strategies under both market conditions.

Further, the excess returns to beta results showed mixed results by showing positive excess returns for the long straddle, long strangle, short straddle, and short strangle strategies under neutral market conditions. The study found that butterfly strategies have not exhibited positive excess returns under neutral market conditions. However, literature argued that butterfly strategies enhance low returns with limited risk in all market conditions (Basson et al., 2018). The long strangle and short strangle strategies have shown positive excess returns along with higher standard deviation when compared to other strategies (Chang et al., 2010; Qiu, 2020). All strategies in neutral market conditions and butterfly strategies in volatile market conditions showed a positive excess returns success rate of more than 50%.

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## CONCLUSION

The purpose of the study was to measure the influence of option strategy risk and various option premiums on options strategy payoff by using panel regression analysis. Further, it aimed to evaluate the performance of options strategies in neutral and volatile market conditions using the excess returns to risk approach that estimates the excess positive returns generated per unit of risk taken under both market conditions. The risk-return trade-off has identified that long straddle and long strangle strategies have a significant positive influence between risks and returns. In contrast, LCB and SCB strategy risk does not influence LCB and SCB strategy payoff. The second study approach has evaluated the performance of options strategies using excess return to standard deviation and excess returns to beta. The study results found that short straddle, short strangle, and SCB strategies effectively produce excess returns under both market conditions. It was found that short straddle and short strangle strategies are riskier than long straddle and long strangle strategies. The study recommends SCB strategy for risk-aversion investors, which has exhibited low risk and low return under both market conditions.

The study highlighted the importance of understanding risk-return trade-offs and the performance of options strategies in neutral and volatile market conditions in the Indian derivatives segment. The results of this study would help the investors decide the appropriate strategy by analyzing the risk and return comparison of options strategies and their performance under neutral and volatile market conditions to incorporate these strategies in their investment planning. In addition, more studies are essential in deciding the risk-return trade-off on other option strategies by considering other sectors' information.

This study is limited to comparing risk-return trade-off and performance evaluation of six option strategies on companies of the top six sector indices of NSE. Future research should be focused on employing these strategies to Nifty 50, Junior Nifty 50 companies, and options instruments.

## AUTHOR CONTRIBUTIONS

Conceptualization: Shivaprasad S.P., Geetha E, Raghavendra, Kishore L, Rajeev Matha.

Data curation: Shivaprasad S.P., Kishore L, Rajeev Matha.

Formal analysis: Shivaprasad S.P., Geetha E, Raghavendra, Kishore L, Rajeev Matha.

Funding acquisition: Geetha E, Kishore L.

Investigation: Shivaprasad S.P., Geetha E, Raghavendra, Kishore L, Rajeev Matha.

Methodology: Shivaprasad S.P., Raghavendra, Kishore L, Rajeev Matha.

Project administration: Geetha E, Raghavendra.

Resources: Shivaprasad S.P., Geetha E, Rajeev Matha.

Software: Shivaprasad S.P., Geetha E.

Supervision: Raghavendra, Kishore L.

Validation: Shivaprasad S.P., Geetha E, Raghavendra, Kishore L.

Writing – original draft: Shivaprasad S.P., Geetha E, Raghavendra, Kishore L, Rajeev Matha.

Writing – review & editing: Shivaprasad S.P., Geetha E, Raghavendra, Kishore L, Rajeev Matha.

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