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Volatility Case

OVERVIEW

The Volatility Trading Case gives participants the opportunity to generate profits by implementing options strategies to trade volatility. The underlying asset of the options is a non-dividend-paying Exchange Traded Fund (ETF) called RTM that tracks a major stock index. Participants will be able to trade shares of the ETF as well as 1-month and 2-month call/put options at 10 different strike prices. Information including the ETF price, options prices, and news releases will be provided. Participants are encouraged to use the provided information to identify mispricing opportunities and construct options trading strategies accordingly.

KEY OBJECTIVES

- Build a model to forecast the future volatility of the underlying ETF based on known information and given forecast ranges. Participants should use this model with an options pricing model to determine whether the market prices for options are overvalued or undervalued. They should then trade the specific options accordingly.
- Use Greeks to calculate the portfolio exposure and hedge the position to reduce the risk of the portfolio while profiting from volatility differentials across options.
- Seek arbitrage opportunities across different options and different expiries using calendar spreads.

There will be 8 independent heats with two team members participating in each heat. Please note that only two team members shall trade to represent the team for all heats. Each heat consists of two sub-heats, each running for 5 minutes, resulting in a total duration of 10 minutes, and representing two months of calendar time.

- Number of trading heats: 8
- Number of sub-heats: 2 periods per heat
- Trading time per heat: 600 seconds (10 minutes)
- Calendar time per heat: 2 months (40 trading days)

News will be released during each heat.

- ✓ Data retrieval via RIT API will be enabled.
- ✓ Order submission using the RIT API will be enabled.
- ✗ RIT VBA Links will be enabled on only 72 machines (we strongly suggest using Python instead)

We recommend students refrain from using VBA. Throughout the competition, participants are required to exclusively use Python. This decision is based on Microsoft licensing restrictions, which prevent us from having locally installed versions without individual licensing obligations. To ensure uniformity in tool usage (Python) among all participants, Excel will not be available on computers outside the lab due to licensing challenges. Consequently, all computers for the competition will be equipped with Python.

Support Scripts - Python and MATLAB - MathWorks

The Volatility case includes decision support tools written in Python and MATLAB. Be aware that both Python and MATLAB scripts are basic and you need to develop them to support your trading strategy.

Click below to download the Python scripts in three zip compressed folders:

- One script file for the Volatility case.
- One delta model builder file for the Volatility case.
- One delta model advanced file for the Volatility case.

Support Tool Python Scripts
Click Here to Download

Click below to download the MATLAB scripts in one zip compressed folder:

- One sample script file in MLX format.
- One sample script file in text format.

Support Tool MATLAB - MathWorks
Click Here to Download

The Rotman International Trading Competition provides a unique dynamic trading environment for students to test their classroom knowledge against realistic case studies from industry. MathWorks is providing free access to MATLAB based computational finance products used by industry for financial

modeling and analysis. Our goal is to help students engage in a rewarding and fulfilling experience that will help them prepare for a career in finance. MathWorks provides complimentary software for this competition.

Click Here

TEAM ROLES

In this case, each team member will have a Trader role:

ABCD-1: Role of Trader #1
ABCD-2: Role of Trader #2

Volatility Trading Case: Any two team members may represent the team in this case in the two roles.

MARKET DYNAMICS

Participants will be able to trade RTM and 40 separate options contracts on RTM at the beginning of the case. All options are European, so early exercise is not allowed. After the first period ends, the one-month expiration options will no longer be tradable as they expire.

Starting Option Prices for One-month Expiration				
Call Price	**Call Ticker**	**Strike Price**	**Put Ticker**	**Put Price**
$5.09	RTM1C45	45	RTM1P45	$0.09
$4.18	RTM1C46	46	RTM1P46	$0.18
$3.34	RTM1C47	47	RTM1P47	$0.34
$2.58	RTM1C48	48	RTM1P48	$0.58
$1.92	RTM1C49	49	RTM1P49	$0.92
$1.38	RTM1C50	50	RTM1P50	$1.38
$0.95	RTM1C51	51	RTM1P51	$1.95
$0.63	RTM1C52	52	RTM1P52	$2.63
$0.40	RTM1C53	53	RTM1P53	$3.40
$0.24	RTM1C54	54	RTM1P54	$4.24

Starting Option Prices for Two-month Expiration				
Call Price	**Call Ticker**	**Strike Price**	**Put Ticker**	**Put Price**
$5.33	RTM2C45	45	RTM2P45	$0.33
$4.51	RTM2C46	46	RTM2P46	$0.51
$3.76	RTM2C47	47	RTM2P47	$0.76
$3.08	RTM2C48	48	RTM2P48	$1.08
$2.47	RTM2C49	49	RTM2P49	$1.47

$1.95	RTM2C50	50	RTM2P50	$1.95
$1.51	RTM2C51	51	RTM2P51	$2.51
$1.15	RTM2C52	52	RTM2P52	$3.15
$0.86	RTM2C53	53	RTM2P53	$3.86
$0.63	RTM2C54	54	RTM2P54	$4.63

All securities are priced by market-makers who will always quote a bid-ask spread of 2 cents (i.e. $49.99 * $50.01 for the RTM, or $4.17 * $4.19 for the RTM1C46). The bids and asks are for very large quantities (there are no liquidity constraints in this case).

The price of RTM follows a random-walk and the path is generated using the following process:

$P_{RTM,t} = P_{RTM,t-1} * (1+r_t)$ *where* $r_t \sim N(\mu_t, \sigma_t)$

The price of the stock is based on the previous price multiplied by a return that is drawn from a normal distribution with an initial drift of $\mu_t = 11\%$ and standard deviation (volatility) of $\sigma_t = 24\%$ (on an annualized basis). Drift reflects how the market responds to any shock affecting the underlying security, potentially leading to biasedness in asset prices. Meanwhile, volatility measures the fluctuations in price movements.

The trading period is divided into 8 weeks, with $t = 1 \ldots 75$ being week one, $t = 76 \ldots 150$ being week two, and so on. At the beginning of each week, the mean (μ_t) and the volatility (σ_t) values will shift, and the new values will be provided to participants. In addition, at the middle of each week (e.g. $t = 38$) an analyst estimation of next week's mean and volatility value will be announced.

Sample News Release Schedule		
Time	**Week**	**Release**
1	Week 1	The realized volatility of RTM for this week will be 20%
1	Week 1	The delta limit for this sub-heat is 10,000
38	Week 1	The annual volatility of RTM is expected to be between 27-30% and the drift to be between 7-12% in next week
76	Week 2	The realized volatility of RTM is 29% and the drift is 10%
…	…	…
526	Week 8	The realized volatility of RTM is 26% and the drift is 6%

Stock price biasedness resulting from drift can influence implied volatility bias in options through the market's perception of future price movements. If there is a consistent bias in the stock price, meaning that the market tends to consistently overestimate or underestimate the potential price changes, it can impact the implied volatility embedded in option prices. When there is an implied volatility bias, it suggests that participants may have certain expectations about the future level of price fluctuations that differ from what actually occurs. This bias can impact the pricing of options, leading to potential mispricing opportunities.

The observed and tradable prices of the options will be based on a computerized market-maker posting bids and offers for all options. The market maker will price the options using the Black-Scholes model. It is important to note that the case assumes a risk-free rate of 0%. The volatility forecasts made by the market maker are uninformed and therefore will not always accurately reflect the future volatility of RTM. Mispricing will occur, creating trading opportunities for market participants. These opportunities could be between specific options with respect to other options, specific options with respect to the underlying, or all options with respect to the underlying.

This case focuses on trading volatility without being exposed to price changes of the underlying security. RTM. Participants are, therefore, required to manage their portfolio's delta exposure. Recognizing the transaction costs and impracticality of perfect delta hedging (i.e. keeping the portfolio's delta at zero at all times), the RITC scoring committee will allow the portfolio's delta to be different from zero. However, it is required to stay between the – *delta limit* and + *delta limit*. Please note that the *delta limit* is an integer number greater than 1,000, which will be announced at the beginning of the case via a news release in RIT. For example, the following news could be released: "The *delta limit* for this heat is 5,000, and the penalty percentage is 0.5%". According to that news, any participant with a portfolio delta greater than 5,000 will be penalized at the penalty percentage of 0.5% according to the penalties explained below.

For every second that a participant exceeds the limit (+/- *delta limit*), s/he will be charged a penalty according to the following formula:

$$Penalty\ at\ second\ t = \begin{cases} \left(\left|\Delta_{p,t}\right| - delta\ limit\right) \times p & if\ \ \left|\Delta_{p,t}\right| > delta\ limit \\ 0 & if\ \ \left|\Delta_{p,t}\right| \leq delta\ limit \end{cases}$$

Where:

Δ_p,t is the portfolio's delta at time t, and p is the penalty percentage.

Penalties will be applied at the end of each heat but will not be included in the P&L calculation in RIT. Participants must design a model that calculates the penalties using the RIT API and helps to make optimal decisions by managing delta exposure.

TRADING LIMITS AND TRANSACTIONS COSTS

Each participant will be subject to gross and net trading limits specific to the security type as specified below. The gross trading limit reflects the sum of the absolute values of the long and short positions across all securities in each security type. The net trading limit reflects the sum of long and short positions such that short positions negate any long positions. Trading limits will be enforced, and participants will not be able to exceed them.

Security Type: RTM ETF
Gross Limit: 50,000 Shares
Net Limit: 50,000 Shares

Security Type: RTM Options
Gross Limit: 2,500 Contracts
Net Limit: 1,000 Contracts

The maximum trade size will be 10,000 shares for RTM and 100 contracts for RTM options, restricting the volume of shares and contracts transacted per trade to 10,000 and 100, respectively. Transaction fees will be set at $0.02 per share traded for RTM and $2.00 per contract traded for RTM options. As with standard options markets, each contract represents 100 shares (purchasing 1 option contract for $0.35/option will actually cost $35 plus a $2 commission and will settle based on the exercise value of 100 shares).

POSITION CLOSE-OUT

Any outstanding position in RTM will be closed at the end of trading based on the last-traded price. There are no liquidity constraints for the options nor RTM. All options will be cash-settled based on the following upon expiration:

Call Option Payout = *max* {0, *S* – *K*}
Put Option Payout = *max* {0, *K* – *S*}

where:

S is the last price of RTM;
K is the strike price of the option.

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Location and operating hours

Lab operating hours
Monday to Friday, from 9:00 AM to 5:00 PM

Lab location
105 St. George St., 2nd floor, room 290

Graduate Rotman students access
24/7 access using the fob

Undergraduate Rotman students access
Monday to Friday, from 9:00 AM to 5:00 PM

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2024-01-08

Website designed and built by Bachir Chehab