Rotman School of Management
UNIVERSITY OF TORONTO

Rotman
INTERACTIVE TRADER

bp

MathWorks

Prodigy
Finance

Rotman
MASTER OF FINANCIAL
RISK MANAGEMENT

CITADEL | Securities

S&P GLOBAL
MARKET INTELLIGENCE

Case Package

Rotman
INTERNATIONAL TRADING COMPETITION 2020

Table of Contents

About RITC

A WARM WELCOME FROM THE ROTMAN COMMUNITY

The Rotman International Trading Competition (RITC) is a one-of-a-kind event hosted annually at the Rotman School of Management at the University of Toronto, in the heart of one of North America's largest financial centres. RITC, now in its 17th year, is the world's largest simulated market challenge, and brings together teams of students and faculty advisors representing over 50 top universities across the world. Unlike remote electronic trading competitions, RITC offers students, faculty, and sponsors the invaluable experience of connecting in intellectually stimulating environments with many of the smartest students from around the globe.

The competition is predominantly structured around the Rotman Interactive Trader (RIT) platform, an electronic exchange that matches buyers and sellers in an order-driven market on which decision cases are run. The cases represent various scenarios for risks and opportunities with a focus on specific investment, portfolio or risk management objectives. Participants will be challenged to handle a wide range of market environments.

This case package provides an overview of the content of the 2020 Rotman International Trading Competition. Each case has been specifically tailored to cover topics taught in university level classes and simulate real-life decision situations. We are thrilled to present RITC 2020 for you!
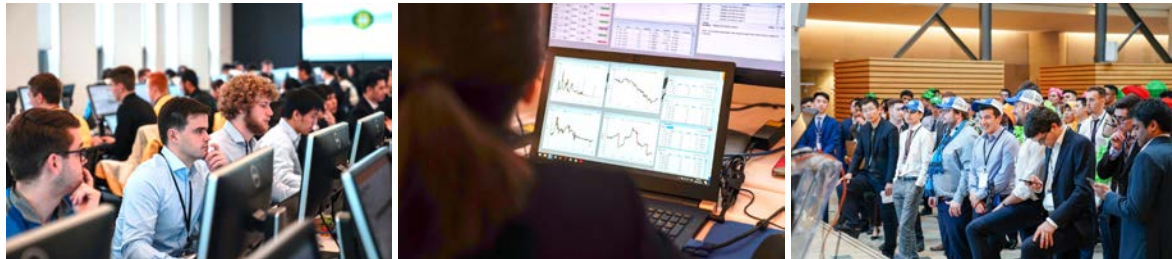
SEE YOU IN TORONTO!

Important Information

PRACTICE SERVERS

Select practice servers will be made available starting January 29th. Further information on release dates can be found below and more information will be posted as it becomes available on the RITC website.

Case Name	Release Date
Liquidity Risk Case	Wednesday, January 29th by 11:59pm EST
Citadel Securities Algo Trading Case	Wednesday, January 29th by 11:59pm EST
MATLAB Volatility Trading Case	Thursday, January 30th by 11:59pm EST
BP Commodities Case	Friday, January 31st by 11:59pm EST
Electricity Trading Case	Friday, January 31st by 11:59pm EST

Practice servers will operate 24 hours a day, 7 days a week until 11:00pm EST on Thursday, February 20th. Information on how to download and install the RIT v2.0 Client is available on the RIT website: http://rit.rotman.utoronto.ca/software.asp.

The following table details the server address and ports available for RITC practice environments:

Case Name	Server Address	Port
Liquidity Risk Case	flserver.rotman.utoronto.ca	16600
BP Commodities Case	flserver.rotman.utoronto.ca	16605
MATLAB Volatility Trading Case	flserver.rotman.utoronto.ca	16610
Electricity Trading Case	flserver.rotman.utoronto.ca	16615
Citadel Securities Algo Trading Case Server 1	flserver.rotman.utoronto.ca	16620
Citadel Securities Algo Trading Case Server 2	flserver.rotman.utoronto.ca	16625
Citadel Securities Algo Trading Case Server 3	flserver.rotman.utoronto.ca	16630
Citadel Securities Algo Trading Case Server 4	flserver.rotman.utoronto.ca	16535

To log in to any server port, except for the BP Commodities Case and the Electricity Trading Case, you can type in any username and password to automatically create an account if it does not already exist. If you have forgotten your password, or the username appears to be taken, simply choose a new username and password to create a new account. For the BP Commodities Case and the Electricity Trading Case, your team's login information will be sent to you prior to the release of the practice case.

Multiple server ports have been provided for the Citadel Securities Algo Trading Case to allow teams to trade in either populated or unpopulated environments. For example, if you are testing

your algorithm and there are seven other algorithms running, you may want to move to a different port where there is less trading.

Please note that the case structure on practice servers and during the competition will be the same but market dynamics may be different depending on the participants' trading behaviour. Price paths will also be different during the competition. In addition, market parameters during the competition may be adjusted to better account for over 100 live traders.

The BP Commodities Case, the MATLAB Volatility Trading Case, and the Electricity Trading Case on the practice servers will include different sets of news and price paths. This means that a server file with a different set of news and price paths will be randomly selected to run on the practice server for each of the above cases. The Liquidity Risk Case and the Citadel Securities Algo Trading Case will have new, randomized sets of security paths each time they are run on the practice server.

We will be running two "special" practice sessions for the BP Commodities Case and the Electricity Trading Case. All teams are invited to connect at the same time: the first session is on Wednesday, February 5th at 10:00am EST; the second session is on Friday, February 7th at 2:00pm EST. Teams wishing to participate in these practice sessions are encouraged to connect to **port 16605** for the BP Commodities Case and the Electricity Trading Case at the above mentioned times. For each practice session, we will be running three iterations of the case.

Additionally, all teams are invited to connect at the same time to **port 16605** to trade *all* competition cases except for the Quant Outcry Case during two additional practice sessions: the first session is on Tuesday, February 11th at 1:00pm EST; the second session is on Saturday, February 15th at 5:00pm EST. We will be running one iteration of each case.

ADDITIONAL SUPPORT FILES

The following support files will be provided on the RITC website
(http://ritc.rotman.utoronto.ca/casefiles.asp?n=1):

- The "Performance Evaluation Tool" for the Liquidity Risk Case will be released on January 29th.
- The Citadel Securities Algo Trading Case Base Algorithm and other relevant support will be released on January 29th.
- The "Penalties Computation Tool" for the MATLAB Volatility Trading Case will be released on January 30th.
- A tutorial for the Social Outcry Case and Quantitative Outcry Case will be released on February 5th.

Other documents may be posted. If so, participants will be notified via email.

SCORING AND RANKING METHODOLOGY

The Scoring and Ranking Methodology document will be released prior to the start of the competition on the RITC website. An announcement will be sent out to participants when the document is available.

COMPETITION SCHEDULE

This schedule is subject to change prior to the competition. Participants can check on the RITC website for the most up-to-date schedule. Each participant will also receive a personalized schedule when s/he arrives at the competition.

TEAM SCHEDULE

Participants must submit a team-schedule by Saturday, February 8th at 11:59pm EST. This schedule specifies which team members will participate in which RITC events and each team member's role in the BP Commodities Case and the Electricity Trading Case. It is the team's responsibility to organize and schedule appropriately so that conflicts (for example, simultaneously trading 2 cases) are avoided. Schedules submitted by the above deadline are considered final and substitutions following that date will not be permitted except under extreme circumstances. Further instructions on how to submit your team schedule will be sent via email. Each participant must participate in at least two different cases.

COMPETITION WAIVERS

Each participant is required to sign a competition waiver prior to his/her participation at RITC. Waivers will be e-mailed to you (to be signed and returned via email by Saturday, February 8th at 11:59pm EST).

QUESTIONS

Please send any questions to ritc@rotman.utoronto.ca. To ensure the fair dissemination of information, responses to your questions will be posted online for all participants to see under the FAQ section of the RITC website.

Case Summaries

SOCIAL OUTCRY

The opening event of the competition gives participants their first opportunity to connect with sponsors, faculty members, and other teams in this fun start of the Rotman International Trading Competition. Participants will be trading against each other and against experienced professionals from the industry, trying to make his/her case against professors, and showcasing his/her outcry skills by making fast and bold trading decisions based on select news information.

BP COMMODITIES CASE

The BP Commodities Case challenges the ability of participants to trade in a closed supply and demand market for crude oil. Natural crude oil production and its use, coupled with regulatory compliance in the form of carbon credits, will form the framework for participants to engage in trade to meet their objectives. The case will test each participant's ability to understand sophisticated market dynamics and optimally perform his/her role, while stressing teamwork and communication. The case will involve crude oil production, refinement, storage, as well as trading its synthesized physical products and carbon credits.

MATLAB VOLATILITY TRADING CASE

The MATLAB 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.

CITADEL SECURITIES ALGO TRADING CASE

The Citadel Securities Algo Trading Case is designed to challenge participants' programming skills by developing algorithms using RIT API to automate trading strategies and react to changing market conditions. Throughout the case, these algorithms will submit orders to profit from arbitrage opportunities and private tender offers. Due to the high-frequency nature of the case, participants are encouraged to develop algorithms that can adapt to rapid changes in market dynamics using their selected programming languages.

ELECTRICITY TRADING CASE

The Electricity Trading Case provides the opportunity for participants to work in a role-based team environment to engage in an electricity trading market controlled by a strict regulatory policy. Participants are required to forecast supply and demand for electricity, and execute strategies accordingly while reacting to prevailing market events. Each team will participate in a closed supply and demand market for electricity by producing it using power plant assets and distributing it to customers, and will also have access to a forward market. Through the full cycle of electricity markets, participants will need to dynamically formulate their role-based strategies and optimally perform trade executions.

QUANTITATIVE OUTCRY CASE

The Quantitative Outcry Case challenges participants to apply their understanding of macroeconomics to determine the effect of news releases on the world economy as captured by the Rotman Index ("RT100"). The RT100 Index is a composite index reflecting global political, economic, and market conditions. Participants will be required to interpret both quantitative and qualitative news, analyze the impact of the news on the RT100 Index, and react by trading futures contracts on the index.

LIQUIDITY RISK CASE

The Liquidity Risk Case challenges participants to put their critical thinking and analytical abilities to test in an environment that requires them to evaluate the liquidity risk associated with tender offers. Participants will be faced with multiple tender offers throughout the case. This will require quick judgments on the profitability, subsequent acceptance and execution, or rejection, of each offer. Profits can be generated by taking advantage of price differentials between market prices and prices offered in the private tenders. Once any tender has been accepted, participants should aim to efficiently close out their large positions to maximize returns and minimize liquidity and market risks.

Social Outcry Case

OVERVIEW

The objective of the Social Outcry Case is to allow participants to interact ("break the ice") and to recognize how far financial markets have evolved technologically. The Social Outcry will be an exciting way for participants, professors, and sponsors to interact with one another as well as a great preparation for the Quantitative Outcry Case. Participants will be ranked individually based on their profits at the end of the case. Participants' performance in the Social Outcry Case will not count towards their final scoring in RITC.

DESCRIPTION

Each participant will start the session with a neutral futures position. Participants are allowed to go long (buy) or go short (sell). All trades will be settled at the closing spot price and the trading heat for the Social Outcry Case will be 30 minutes.

MARKET DYNAMICS

Participants will trade futures contracts on an index, the RT100. The futures price will be determined by the market's transactions while the spot price will follow a stochastic path subject to influence from qualitative news announcements displayed on a screen. News announcements will be displayed one at a time, and each news release will have an uncertain length and effect. Favourable news will result in an increase in the spot price while unfavourable news will cause a decrease in the spot price. These reactions may occur instantly or with lags. Participants are expected to trade based on their interpretation and expectation of market reactions to the news information.

TRADING LIMITS AND TRANSACTION COSTS

There are no trading commissions for the Social Outcry Case. Participants are allowed to trade a maximum of 5 contracts per trade/ticket. The contract multiplier of RT100 futures is $10. There are no limits to the net position that participants can have.

RULES AND RESPONSIBILITIES

The following rules apply throughout the Social Outcry Case:
- Market agents are RITC staff members at the front of the outcry pit collecting tickets.
- Once parties have verbally committed to a trade, they are required to transact.
- All tickets must be filled out completely and legibly, and verified by both parties. Illegible tickets will be ignored by the market agents!

- Both transacting parties are responsible for making sure that the white portion of the ticket is received by the market agent. Both trading parties must walk the ticket up to the market agent for the ticket to be accepted. The transaction will **not** be processed if the white portion is not submitted or is damaged.
- Only the white portion of the ticket will be accepted by the market agent; trading receipts (pink and yellow portions) are for the participants' records only.
- RITC staff reserve the right to break any unreasonable trades.
- Any breaches of the above stated rules and responsibilities are to be reported to RITC Staff immediately.
- All communications must be done in English.

POSITION CLOSE-OUT AND CASE SCORING

Each participant's trades will be settled at the close of trading based on the final spot price. The ranking is based on the total profit and loss (P&L) from the trading session. There are no commissions or fines in the Social Outcry Case.

Example:
Throughout the trading session, one participant has made the following trades:

Buy 2 contracts @ 998
Sell 5 contracts @ 1007
Buy 1 contract @ 1004

The market closed with the spot price at 1000. The P&L for this participant is calculated as follows:

2 long contracts @ 998
$P\&L: (1000 - 998) * 2 * \$10 = \$40$

5 short contracts @ 1007
$P\&L: (1000 - 1007) * (-5) * \$10 = \$350$

1 long contract @ 1004
$P\&L: (1000 - 1004) * 1 * \$10 = -\$40$

The participant has made a total P&L of $350.

COMPLETE TRANSACTION AND OUTCRY LANGUAGE EXAMPLE

To find the market, participants simply yell "What's the market". If someone wants to make the market on the bid side, s/he can answer "bid 50" meaning s/he wants to buy at a price ending with 50 (e.g. 950 or 1050), whichever is closest to the last trade. If someone wants to make the market on the ask side, s/he will yell "at 50" meaning s/he wants to sell at a price ending with 50 (e.g. 950 or 1050), whichever is closest to the last price. Note that so far, no quantity has been declared; only two or three digits representing price are required when calling the bid or ask. To complete a trade, someone willing to transact at that price can simply answer "bought two" to the person selling. The seller's response must then be: "sold two" (or any other quantity below 2, but not 0, at the seller's discretion). Please note that the "market maker" (participant announcing the price) gets to decide the quantity traded up to a maximum of the quantity requested by the "market taker" (participant taking the price). **The maximum limit on size per contract is 5**. After the negotiations are complete, the buyer and seller will fill out a trade ticket which must be given to the ticket taker, who will accept the white portion of the ticket to properly submit the trade.

A complete transaction could run as follows:

Trader 1	"What's the market?"
Trader 2	"Bid 70, at 72" or "70 at 72", (bid 1070, ask 1072, this trader wants to buy and sell)
Trader 3	"At 71" (the new market is 1071)
Trader 1 to Trader 3	"Bought 5" (s/he wants to buy 5 contracts at 1071)
Trader 3 to Trader 1	"Sold 3" (Although trader 1 wanted to buy 5 contracts, trader 3 only wants to sell 3 contracts so trader 1 must accept the three contracts).
Trader 1 or Trader 3	He/she fills out the trade ticket with initials from both trader 1 and trader 3. The white portion of the ticket is submitted to the market agent by **both** traders (both traders walk the ticket up to the front of the trading floor to the market agent). Trader 1 (Buyer) keeps the yellow portion of the ticket and trader 3 (Seller) keeps the pink portion of the ticket.

There will be a brief outcry tutorial and demonstration before the Social Outcry on the first day of the competition. In addition, a tutorial for the Social Outcry Case and the Quantitative Outcry Case will be released on the RITC webpage on February 5th.

BP Commodities Case

OVERVIEW

The BP Commodities Case challenges the ability of participants to trade in a closed supply and demand market for crude oil. Natural crude oil production and its use, coupled with regulatory compliance in the form of carbon credits, will form the framework for participants to engage in trade to meet their objectives. The case will test each participant's ability to understand sophisticated market dynamics and optimally perform his/her role, while stressing teamwork and communication. The case will involve crude oil production, refinement, storage, as well as trading its synthesized physical products and carbon credits.

DESCRIPTION

The BP Commodities Case will comprise 2 heats with 4 team members competing together for their assigned heat (half of the teams will compete in the first heat and the other half in the second heat). Each heat will consist of four 16-minute independent sub-heats, each representing two months, or 40 trading days. Each sub-heat will involve six tradable securities and four assets. Order submission using the RIT API will be disabled. Data retrieval via Real-time Data (RTD) Links and the RIT API will be enabled.

Parameter	Value
Number of trading sub-heats	4
Trading time per sub-heat	16 minutes (960 seconds)
Calendar time per sub-heat	2 months (40 trading days)
Maximum order size	5 contracts
Mark-to-market frequency	Daily (24 seconds)

TEAM ROLES

In this case, each team member will have 1 of 3 specific roles:
1. Producer (one per team)
2. Refiner (one per team)
3. Trader (two per team)

Example:
Team ROTMAN will have 4 trader-IDs (ROTMAN-1, ROTMAN-2, ROTMAN-3, ROTMAN-4), and roles have been assigned according to the list below.

Trader-ID	Role
ROTMAN-1	Producer
ROTMAN-2	Refiner
ROTMAN-3 and ROTMAN-4	Trader

The team will determine the role of each member. Please remember to submit each member's role in the team schedule by **Saturday, February 8th, at 11:59pm EST** as specified in the "Important Information" section above. If a team misses this deadline, roles will be randomly assigned by RITC staff.

Producer

The producer has access to an oil rig that can extract Crude Oil (hereafter referred to as production of Crude Oil) and also to storage facilities that can store Crude Oil. The production of Crude Oil requires a lease cost for an oil rig and the purchase of corresponding units of Carbon Credits. The oil rig lease cost is $32,000 per day but may fluctuate throughout the case because of external factors. Producers are required to have corresponding units of Carbon Credits when producing Crude Oil in order to satisfy regulatory requirement for emissions of carbon dioxide or carbon dioxide equivalents.

Rotman Carbon Allowance (RCA) is a Carbon Credit contract traded in a spot market. Each contract contains 1,000 Assigned Amount Units (AAUs, hereafter referred to as units) of Carbon Credits that allow an entitlement to emit one tonne of carbon dioxide or carbon dioxide equivalent per unit. For every barrel of Crude Oil production, 0.5 tonnes of carbon dioxide is emitted.

Producers will be provided with a weekly allocation of RCA at the beginning of each week, but may decide to purchase additional Carbon Credits in order to have enough units to produce Crude Oil.

Producers will be provided with a total storage capacity of 20,000 barrels for Crude Oil at the beginning of each sub-heat at no cost. However, in the event that a producer exceeds his/her storage limit or leases a storage unit again by clicking on "Lease" in the "Assets" tab on the RIT Client, he or she will be forced to lease additional storage for the remainder of the sub-heat at a

more expensive distressed storage cost (see "Market Dynamics" below for more detailed information).

Refiner

The refiner has access to two separate facilities: New Refinery (N-Refinery) and Old Refinery (O-Refinery). The New Refinery is more efficient and costs $25/barrel while the Old Refinery costs $40/barrel. The New Refinery turns four barrels of Crude Oil into two barrels of Heating Oil and two barrels of RBOB Gasoline whereas the Old Refinery turns eight barrels of Crude Oil into four barrels of Heating Oil and four barrels of RBOB Gasoline. RBOB Gasoline and Heating Oil are traded in gallons, where **one barrel equals 42 gallons**.

Each refinery asset has a refinery time and a refinery lease time; a refinery time is how long the refinery process takes and a refinery lease time is how often refiners are 'charged' with the lease price. The New Refinery has a refinery time of 84 seconds and a refinery lease time of 120 seconds and the Old Refinery has a refinery time of 108 seconds and a same refinery lease time of 120 seconds. Note that leasing additional refineries will be disabled when the remaining time in the sub-heat is less than the refinery time.

Refiners will also need to make sure that they have enough units of Carbon Credits prior to running the refinery facilities. They will be provided with a weekly allocation of Carbon Credits but may decide to purchase additional Carbon Credits in order to have enough units prior to refining Crude Oil. For every barrel of Crude Oil refined through the New Refinery, one tonne of carbon dioxide is emitted whereas one and a half tonnes of carbon dioxide are emitted for every barrel of Crude Oil refined through the Old Refinery.

Refiners will receive news impacting the prices of RBOB Gasoline and Heating Oil, and will have to evaluate the impact of these news items in order to decide which refinery, if any, is profitable to operate.

The RBOB Gasoline price will be mainly affected by news items related to market demand. These news items will need to be evaluated by refiners in order to determine their impact and how the future RBOB Gasoline price might change in response to the news.

The primary driver of Heating Oil prices will be fluctuations in temperature, since demand for Heating Oil will increase as expected temperatures fall. Hence, the price impact of changes in temperature will be estimated based on the simplified equation below:

$$P_{HO} = E_{HO} + \frac{\Delta_{HO}}{\sigma_{HO}}$$

Where,

P_{HO} is the final close out price for Heating Oil;

E_{HO} is the expected price for Heating Oil;

Δ_{HO} is the weekly temperature change;

σ_{HO} is the standard deviation of the temperature change.

The expected price of Heating Oil will start at $3.00/gallon. News regarding the weather will be released on a weekly basis. Furthermore, it is possible for Heating Oil prices to be also affected by external shocks affecting market demand and supply. These external shocks must be evaluated by refiners in order to determine their impact and to estimate future Heating Oil prices.

Refiners will need to accurately determine the profitability of running their refineries by evaluating the prices of their inputs (Crude Oil and Carbon Credits) as well as their future outputs (Heating Oil and RBOB Gasoline).

Refiners will be provided with a total storage capacity of 20,000 barrels for Crude Oil at the beginning of each sub-heat at no cost. However, in the event that a refiner leases a storage unit by clicking on "Lease", he or she will be forced to lease additional storage for the remainder of the sub-heat at a more expensive distressed storage cost (see "Market Dynamics" below). Heating Oil and RBOB Gasoline do not require storage.

Traders

Traders have access to Crude Oil markets as well as Heating Oil and RBOB Gasoline futures markets. During the trading period, Traders will receive institutional orders from overseas clients who wish to buy or sell Crude Oil. Traders act as the "shock absorbers" for the market. They balance the supply and demand, and help markets achieve equilibrium by filling up their storage tanks when Crude Oil prices are very low and by selling Crude Oil back to the market when prices are relatively high.

Traders will be provided with a total storage capacity of 20,000 barrels for Crude Oil at the beginning of each sub-heat at no cost. However, in the event that a Trader leases a storage unit by clicking on "Lease", he or she will be forced to lease additional storage for the remainder of the sub-heat at a more expensive distressed storage cost (see "Market Dynamics" below).

In addition, Traders have access to the Carbon Credits spot market and are required to participate in the auction process for Carbon Credits. On a weekly basis, they will be required to provide a bid for a set quantity of Carbon Credits through a *blind, reserve-auction* process. Any traders who bid higher than the hidden reserve price will win the set quantity of Carbon Credits at the price that they bid. Traders may then decide to sell the Carbon Credits in the market.

MARKET DYNAMICS

Producers, Traders, and Refiners will be able to trade the securities according to the table below.

Commodities

Securities	Description	Contract Size	Accessibility	Shortable
CL	Crude Oil Spot	1,000 Barrels	Producer, Refiner, Trader	No
RB	RBOB Gasoline	42,000 Gallons	Refiner	No
HO	Heating Oil	42,000 Gallons	Refiner	No
HO-2F	Month 2 futures contract for HO	42,000 Gallons	Trader	Yes
RB-2F	Month 2 futures contract for RB	42,000 Gallons	Trader	Yes
RCA	Rotman Carbon Allowance	1,000 AAUs	Producer, Refiner, Trader	No

Participants will be able to utilize the following assets, which are required for storing and refining Crude Oil.

Assets*	Description	Capacity (Barrels)	Cost	Conversion Period
CL-PRODUCTION	Production Asset for Crude Oil	4,000	$32,000 per day	0.25 trading days
CL-STORAGE	Storage for Crude Oil	10,000	Endowed storage: Free**	N/A
N-REFINERY	New Refinery to Process Crude Oil	4,000	$100,000 per 5 trading days	3.5 trading days
O-REFINERY	Old Refinery to Process Crude Oil	8,000	$320,000 per 5 trading days	4.5 trading days

* hold up to 10,000 barrels.

**All starting endowments of storage are free. Subsequent storage leased (due to overproduction or the use of the "Lease" button) will be charged at a lease price of $500,000 per storage unit, which can hold up to 10,000 barrels.

Industry-specific news will be released to participants based on their roles. Producers will receive reports of their production and storage facilities (which are subject to changes throughout the case). The lease prices may also fluctuate, influencing the production cost of Crude Oil.

Refiners will receive news information on the RBOB Gasoline and Heating Oil markets, and they must use this information to forecast future prices. Traders will receive "The International Tender Report" which describes the expected institutional orders activity.

The interaction between the different market participants (producer, refiner, and traders) within each team, including their profit maximization objectives, will largely influence the overall profits of each team. Therefore, participants should optimize the dynamics between each member.

The following is a simplified example of the case:
Traders successfully submit a bid for 6 contracts of RCA at $20/unit. Traders are then able to sell 2 contracts of RCA to producers and 4 contracts of RCA to refiners in the market for $30/unit.
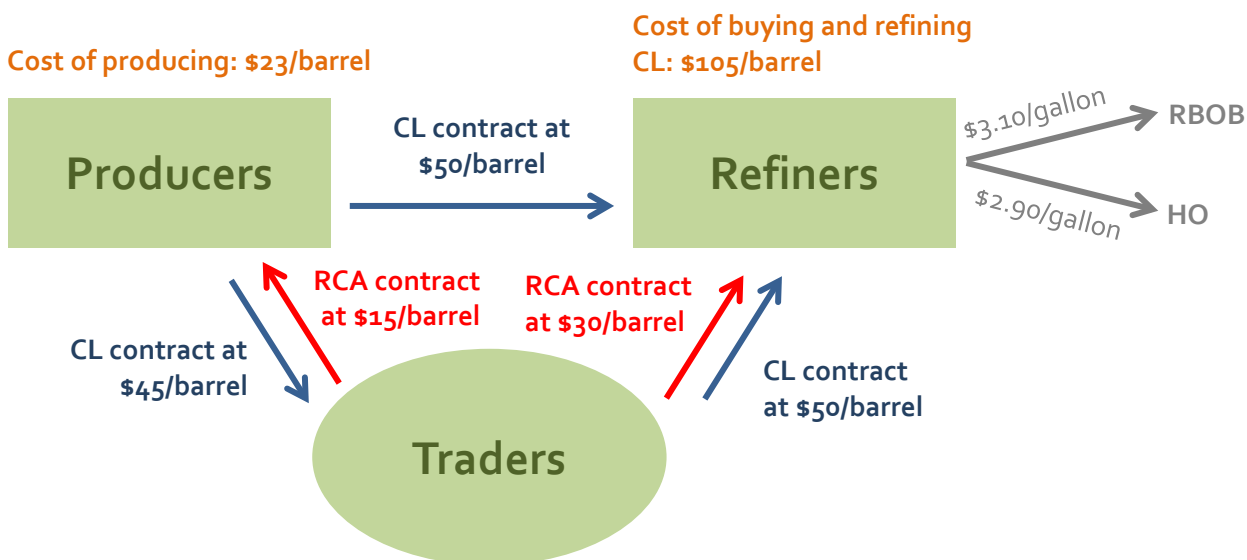
Producers operate the production asset and use 2 contracts of RCA to produce 4,000 barrels of Crude Oil. The production asset costs $8/barrel to lease (assuming a single extraction in the day) and a per-barrel cost for RCA is $15/barrel. Producers sell 2 contracts of Crude Oil to traders at $45/barrel and 2 contracts of Crude Oil to refiners at $50/barrel.

Refiners buy 4 contracts of Crude Oil, agreeing to buy 2,000 barrels of Crude Oil from the producers and 2,000 barrels of Crude Oil from traders at a price of $50/barrel each. In this scenario, refiners choose to operate the New Refinery which requires a lease cost of $25/barrel and 4 contracts of RCA. The per-barrel cost of RCA for the New Refinery is $30/barrel. Refiners are able to sell RBOB and HO at the current market price of $3.10/gallon and $2.90/gallon, respectively. Converting these values into barrels, we get: 42,000 * $3/gallon = $126,000 per 1,000 barrels, or $126/barrel.

Profit generated by each team member (per barrel):
- Traders: (price of RCA contract sold[1] – cost of buying RCA[1]) + (price of CL contract sold – cost of buying CL) = ($22.5 - $15) + ($50 - $45) = $13.50
- Producers: price of CL contract sold - cost of producing oil per barrel = $47.50 – ($8 + $15) = $24.50
- Refiners: value of refined products - cost of buying and refining oil = $126 – ($50 + $25 + $30) = $21

---

[1] Converted per barrel based on the total output of 8,000 barrels

Cost of producing: $23/barrel

Producers

CL contract at $50/barrel

Cost of buying and refining CL: $105/barrel

Refiners

$3.10/gallon → **RBOB**

$2.90/gallon → **HO**

RCA contract at $15/barrel

RCA contract at $30/barrel

CL contract at $45/barrel

CL contract at $50/barrel

Traders

TRADING/POSITION LIMITS AND TRANSACTION COSTS

Each participant will be subject to trading/position limits. Separate limits will be maintained for Crude Oil (CRUDE), RBOB/HO Products (PRODUCT), and Carbon Credits (RCA). Trading limits will be strictly enforced and participants will not be able to exceed them by trading. However, production and refining assets can and will cause limit breaches if they are not managed properly, resulting in a penalty of $25,000 per contract over each gross and net limit.

The maximum trade size will be 5 contracts, restricting the volume of the contracts transacted per trade to 5. The maximum trade size applies to all tradable securities.

POSITION CLOSE OUT

All futures positions will be marked-to-market every 24 seconds with any profits and losses reflected in the traders' cash balance by the mark-to-market operation.

Each security position, except Crude Oil and Carbon Credits, will be closed out at the last traded price. Crude Oil will be closed out at $30/barrel and Carbon Credits will be closed at $50/unit regardless of the market price.

KEY OBJECTIVES

Objective 1

Design a model to calculate the effect of news releases on the prices of Crude Oil, Heating Oil, and RBOB Gasoline. Using information gathered from news releases and trading data, track the supply and demand of oil throughout the simulation to determine optimal storage usage and trading strategies.

Objective 2

Maximize profits as a team of producers, refiners, and traders by communicating private news information with each other.

Note: Since this simulation requires a large number of participants in order to establish supply/demand, practice sessions for this case will be organized and held at specified times (please refer to the "Important Information" section above). After the practice sessions are completed, this practice case will be running on a loop for model calibration purposes ("trading skillfully" cannot be practiced unless there are 20+ users online).

MATLAB Volatility Trading Case

OVERVIEW

The MATLAB 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.

DESCRIPTION

There will be 2 heats and teams will allocate 2 team members for each heat. Each participant may compete in only one of the 2 heats. Each heat will consist of 5 independent sub-heats, with each sub-heat representing two months of calendar time.

Parameter	Value
Number of trading sub-heats	5
Trading time per sub-heat	600 seconds (10 minutes)
Calendar time per sub-heat	2 months (40 trading days)

News will be released during each sub-heat. Order submissions using the RIT API will be underlined enabled. Data retrieval via Real-time Data (RTD) Links and the RIT API will also be enabled.

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
$5.04	RTM1C45	45	RTM1P45	$0.04
$4.09	RTM1C46	46	RTM1P46	$0.09
$3.20	RTM1C47	47	RTM1P47	$0.20
$2.40	RTM1C48	48	RTM1P48	$0.40
$1.71	RTM1C49	49	RTM1P49	$0.71
$1.15	RTM1C50	50	RTM1P50	1.15
$0.73	RTM1C51	51	RTM1P51	$1.73
$0.44	RTM1C52	52	RTM1P52	$2.44
$0.24	RTM1C53	53	RTM1P53	$3.24
$0.13	RTM1C54	54	RTM1P54	$4.13

Starting Option Prices for Two-month Expiration

Call Price	Call Ticker	Strike Price	Put Ticker	Put Price
$5.18	RTM2C45	45	RTM2P45	$0.18
$4.31	RTM2C46	46	RTM2P46	$0.31
$3.51	RTM2C47	47	RTM2P47	$0.51
$2.79	RTM2C48	48	RTM2P48	$0.79
$2.16	RTM2C49	49	RTM2P49	$1.16
$1.63	RTM2C50	50	RTM2P50	1.63
$1.19	RTM2C51	51	RTM2P51	$2.19
$0.85	RTM2C52	52	RTM2P52	$2.85
$0.59	RTM2C53	53	RTM2P53	$3.59
$0.39	RTM2C54	54	RTM2P54	$4.39

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 $4.08*$4.10 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:

$$P_{RTM,t} = P_{RTM,t-1} * (1 + r_t) \ where \ r_t \sim N(0, \sigma_t)$$

The price of the stock is based on the previous price multiplied by a return that is drawn from a normal distribution with a mean of zero and standard deviation (volatility) of $\sigma_t = 20\%$ (on an annualized basis).

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 volatility value (σ_t) will shift and the new value will be provided to participants. In addition, at the middle of each week (e.g. $t = 38$) an analyst estimate of next week's 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 realized volatility of RTM for next week will be between 27-30%
76	Week 2	The realized volatility of RTM for this week will be 29%
…	…	…
526	Week 8	The realized volatility of RTM for this week will be 26%

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 <u>uninformed</u> 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.

The focus of this case is 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 but it is required to stay between $-delta\ limit$ and $+delta\ limit$. Please note that $delta\ limit$ is an integer number greater than 1,000 that 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 sub-heat is 5,000". According to that news, any participant that has a portfolio delta greater than 5,000 will be penalized 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:

$$Penalty\ at\ second\ t = \begin{cases} \left(\left|\Delta_{p,t}\right| - delta\ limit\right) \times 0.005 & if\ \left|\Delta_{p,t}\right| > delta\ limit \\ 0 & if\ \left|\Delta_{p,t}\right| \leq delta\ limit \end{cases}$$

Where, $\Delta_{p,t}$ is the portfolio's delta at time t

Penalties will be applied <u>at the end</u> of each sub-heat but **will not be included** in the P&L calculation in RIT. Participants will be provided with an Excel tool[2], the "Penalties Computation Tool", that will allow them to calculate the penalties using their results from the practice server.

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	Gross Limit	Net Limit
RTM ETF	50,000 Shares	50,000 Shares
RTM Options	2,500 Contracts	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.

---

[2] The "Penalties Computation Tool" will be released on January 30th.

KEY OBJECTIVES

Objective 1
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.

Objective 2
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.

Objective 3
Seek arbitrage opportunities across different options and different expiries using calendar spreads.

Citadel Securities Algo Trading Case

OVERVIEW

The Citadel Securities Algo Trading Case is designed to challenge participants' programming skills by developing algorithms using RIT API to automate trading strategies and react to changing market conditions. Throughout the case, these algorithms will submit orders to profit from arbitrage opportunities and private tender offers. Due to the high-frequency nature of the case, participants are encouraged to develop algorithms that can adapt to rapid changes in market dynamics using their selected programming languages.

DESCRIPTION

There will be 4 heats with 1 team member competing in each heat. Any team member may represent the team in any one or all of the heats. Please note that as the Citadel Securities Algo Trading Case will run simultaneously with the other RITC cases, teams are responsible for submitting a "Team Schedule" that ensures their Algo trader will be free to trade in the allotted time. For more information on the "Team Schedule", please see the "Important Information" section above. Each heat will consist of three 5-minute sub-heats each representing one month of trading. Each team will be trading with up to 14 other teams at a time.

Parameter	Value
Number of trading heats	4 preliminary heats + 1 final heat
Number of trading sub-heats	3
Trading time per sub-heat	300 seconds (5 minutes)
Calendar time per sub-heat	one month of trading

Order submission using the RIT API will be enabled. Data retrieval via Real-time Data (RTD) Links and the RIT API will also be enabled. **All trades must be executed by a trading algorithm**. Participants will not be allowed to trade manually through the RIT Client once the sub-heat begins

(but they will be allowed to manually use the RIT Client to use Converters – see "Market Dynamics" section below). Between heats, participants are allowed to modify their algorithms in response to prevailing market conditions and competition from the algorithms of other teams. They will have 2 minutes between each sub-heat to alter their algorithms. A base template algorithm will be provided[3] to participants and can be directly modified for use in the competition. However, participants are encouraged to create their own algorithms. It is strongly recommended that all teams have a working version of their algorithm available on a USB or storage device.

MARKET DYNAMICS

This case involves five securities with the following details.

Ticker	CAD	USD	BULL	BEAR	RITC
Security type	Currency	Currency	Stock	Stock	ETF
Quote currency	CAD	CAD	CAD	CAD	USD
Starting Price	n/a	n/a	$10	$15	$25
Fee/share (Market orders)	n/a	n/a	$0.02	$0.02	$0.02
Rebate/share (Limit/Passive orders)	n/a	n/a	$0.01	$0.01	$0.01
Max order size	2,500,000	2,500,000	10,000	10,000	10,000

The base currency in this case will be CAD. Therefore, USD will be quoted in a direct exchange rate as the number of CAD required to buy 1 USD.

Participants will be able to trade two stocks denominated in CAD and one ETF denominated in USD with varying levels of volatility and liquidity. This dynamic exposes participants to the basics of market microstructure in the context of algorithmic trading. In equilibrium, the ETF pricing will reflect the following sum of the two stocks traded, subject to periodic shocks to its price. In other words, in equilibrium, the CAD-converted price of the RITC ETF will be the sum of prices of both BULL and BEAR stocks since the ETF is equally weighted.

$$P_{RITC,USD} * USD = P_{BULL,CAD} + P_{BEAR,CAD}$$

Participants will also receive private tender offers for the ETF. Since the decision time to accept or reject a tender offer is very short, participants should build an algorithm to evaluate the profitability of a tender offer to make a decision to accept it or not. Once a tender offer is accepted,

---

[3] The "Base Algorithm" will be released on January 29th on the RITC website.

a participant's algorithm should also unwind the positions at a profit while managing the market price impact of trades.

In addition, there will be two Converters [4] available to facilitate a conversion between the underlying stocks and the ETF. Participants should consider using these Converters as an alternative approach to manage the liquidity risk associated with submitting orders directly to the market. Please note that these Converters can only be used by human traders: you will be able to use them from the RIT Client manually but your algorithm will not be able to use them automatically through the API.

Converters	Description	Convert From	Convert To	Cost
ETF-Creation	ETF creation from underlying stocks	10,000 BULL stocks and 10,000 BEAR stocks	10,000 units of RITC	$1,500 USD/use
ETF-Redemption	ETF redemption to underlying stocks	10,000 units of RITC	10,000 BULL stocks and 10,000 BEAR stocks	$1,500 USD/use

TRADING/POSITION LIMITS AND TRANSACTION COSTS

Each trader will be subject to gross and net trading/position limits during trading in each sub-heat. The gross limit reflects the sum of the absolute values of the long and short positions across all securities, and the net limit reflects the sum of long and short positions such that short positions negate any long positions. Trading/position limits will be strictly enforced and participants will not be able to exceed them. Each position in the stocks will be counted towards trading/position limits with a multiplier of one, while each position in the ETF will be counted with a multiplier of two. For example, if you long 100 shares of any stocks, your gross and the net limits will increase by 100. If you buy 100 shares of RITC, your gross and net limits will increase by 200 (100 shares * multiplier of two).

The maximum trade size will be 10,000 shares per order for both stocks and the ETF. Transaction fees will be set at $0.02 per share for each stock and the ETF on all market orders filled. A rebate of $0.01 per share for each stock and the ETF will be provided for all submitted limit orders that are filled.

POSITION CLOSE-OUT

Any non-zero position of stocks will be closed out at the end of trading based on the last traded price while the ETF will be closed out at the fair value which is the sum of the component stock prices converted to CAD.

---

[4] The two Converters are available from the "Assets" tab on the RIT Client.

KEY OBJECTIVES

Objective 1

Create an algo model using the provided template to identify the profitability of private tender offers and execute trades accordingly while managing liquidity risk and market risk. Consider utilizing ETF-Creation and ETF-Redemption Converters as an alternative approach to mitigate liquidity risk when working a private tender offer.

Objective 2

Build a trading algorithm that identifies arbitrage opportunities between underlying stocks and the ETF. Consider trading CAD and USD in order to hedge the currency exchange rate exposure.

Electricity Trading Case

OVERVIEW

The Electricity Trading Case provides the opportunity for participants to work in a role-based team environment to engage in an electricity trading market controlled by a strict regulatory policy. Participants are required to forecast supply and demand of electricity, and execute strategies accordingly while reacting to prevailing market events. Each team will participate in a closed supply and demand market for electricity by producing it using power plant assets and distributing it to customers, and will also have access to a forward market. Through the full cycle of electricity markets, participants will need to dynamically formulate their role-based strategies and optimally perform trade executions.

DESCRIPTION

The Electricity Trading Case will comprise 2 heats with 4 team members competing together for their assigned heat (half of the teams will compete in the first heat and the other half in the second heat). Each heat will consist of four 15-minute independent sub-heats, each representing 5 trading days. Order submission using the RIT API will be disabled. Data retrieval via Real time data (RTD) links and the RIT API will be enabled.

Parameter	Value
Number of trading sub-heats	4
Trading time per sub-heat	15 minutes (900 seconds)
Calendar time per sub-heat	5 trading days during the first week of August

TEAM ROLES

In this case, each participant will have 1 of 3 specific roles:

- Producer (one per team)
- Distributor (one per team)
- Trader (two per team)

Example:

The team ROTMAN will have 4 trader-IDs (ROTMAN-1, ROTMAN-2, ROTMAN-3, ROTMAN-4), and roles have been assigned according to the list below.

Trader-ID	Role
ROTMAN-1	Producer
ROTMAN-2	Distributor
ROTMAN-3, ROTMAN-4	Trader

The team will determine the role of each member. Please remember to submit each member's role in the team schedule by **Saturday, February 8th at 11:59pm EST** as specified in the "Important Information" section above. If a team misses this deadline, the roles will be randomly assigned between the team members by competition staff.

Producers

The Producers own a solar power plant and a natural gas power plant. Each day, Producers will decide how much electricity to produce the next day. For example, day 3 starts at minute 6:01 (6 minutes and 1 second in the simulation); Producers have to decide by the end of day 3 (by minute 9:00 in the simulation) how much electricity to produce over day 4 (which starts at minute 9:01 in the simulation). The decision is made on day 3 and electricity will be produced and delivered the day after (day 4).

Producers will have access to the electricity forward and spot markets. There is one security traded on each market, ELEC-F on the forward market and ELEC-dayX on the spot market. ELEC-F is a forward contract written on the commodity ELEC-dayX with a <u>contract size of 500 MWh</u>[5] and delivery over the next day (day X). For example, if a Producer sells 1 contract of ELEC-F today (day 1), the Producer will have to deliver 500 MWh of electricity (ELEC-day2) to the counterparty the next day (day 2). ELEC-dayX is the electricity spot, where "X" is the day in the simulation. For example, ELEC-day2 is electricity spot on day 2, ELEC-day3 is electricity spot on day 3, etc. ELEC-dayX can be traded on the spot market on each respective day; <u>1 contract of ELEC-dayX is equal to 100 MWh</u>.

Since electricity cannot be stored, and it has to be disposed[6] in case it is not delivered, Producers should sell the electricity by the end of the day it is produced, either with a forward contract from sale of the previous day, or on the spot market during the day it is produced. For example, if on day 1 the Producers decide to produce 2,000 MWh of ELEC-day2, they will have to deliver 2,000 MWh of electricity on day 2. They can sell 3 contracts of electricity on the forward market on day 1 so that, on day 2, they will deliver 1,500 MWh of ELEC-day2 (recall that each ELEC-F contract size is 500 MWh). On day 2, Producers can also sell 500 MWh of ELEC-day2 spot (which is 5 contracts of ELEC-day2). Combining the 1,500 MWh delivered through the forward contract with the 500 MWh traded spot, the Producers ensured they did not have any excess MWh of electricity that they had to dispose. If they are able to sell only 1,500 MWh of electricity on the forward market and they did not make any trades on the spot market, Producers will have produced 500 MWh more than they sold and they will have to dispose the excess electricity spot on Day 2 (ELEC-day2) of 500MWh.

The solar power plant generates electricity every day depending on how many hours of sunshine there will be during the day. That is, it is possible to produce more electricity using the solar power

---

[5] MWh (megawatt per hour) is the unit of measure of electricity.

[6] Disposing electricity means that Producers will be forced to dump the electricity and will not be able to carry it over to the next day. It's equivalent to selling the electricity for $0.

plant when there are no clouds. The following equation shows the amount of electricity produced by the solar power plant in relation to the number of hours of sunshine:

$$ELEC_{solar} = 6 \times H_{day}$$

where
$ELEC_{solar}$ is the number of contracts of electricity produced by the solar power plant over the day;
H_{day} is the number of hours of sunshine over the day.

There is no cost for producing electricity using the solar power plant.

Producers cannot shut down the solar power plant but they will be provided with weather forecasts of how many hours of sunshine are expected the following day. Hence, they will be able to forecast how much electricity will be produced by the solar power plant. The weather forecasts received on day 1 will provide information about the weather on day 2. There will be an initial report at the beginning of each day followed by an update at 12:00pm each day (1 minute and 30 seconds after the start of the day in the simulation) and then there will be the final update in the evening (30 seconds before the end of the day in the simulation). The final update will provide Producers with the correct estimates of the number of hours of sunshine the next day. In other words, in the evening, Producers will know exactly how many hours of sunshine there will be the next day.

Producers will have to decide whether to utilize the natural gas power plant based on the expected solar output and the expected demand for electricity. Indeed, if there is strong demand for electricity, Producers can make additional profits by utilizing the natural gas power plant and selling the electricity on the ELEC-F or ELEC-dayX spot market.

In order to produce electricity using the natural gas power plant, Producers have to buy natural gas spot (NG) and then use the natural gas power plant to transform it into electricity. Each NG contract is for 100MMBtu (million British Thermal Unit). The natural gas power plant is able to convert 800 MMBtu into 100 MWh (that is 8 contracts of NG into 1 contract of ELEC-dayX, where X is the following day). For example, Producers can buy 8 contracts (800 MMBtu) of NG on day 1 and then lease and use the natural gas power plant on day 1. On day 2, they will receive 1 contract (100MWh) of ELEC-day2. There is no cost for the Producers to operate this facility. Producers will decide to operate the natural gas power plant today but the electricity will be delivered the day after since it takes time to convert natural gas into electricity.

In addition, the Ministry of the Environment and Climate Change (MECC) has developed policies that discourage Producers from producing more than they are able to sell. Indeed, for each contract of electricity (ELEC-dayX) that is not delivered by the end of day X and needs to be disposed, the MECC will charge a fee of $20,000. The fee will be collected by MECC at the end of each day. For example, if on day 1 a Producer has decided to produce 20 contracts (2,000 MWh) of ELEC-day2 (by combining the solar and natural gas power plants production) but only 3 contracts

(1,500 MWh) of ELEC-F were sold on day 1 and no ELEC-day2 spot was sold over day 2, there is an excess of 5 contracts (500 MWh) of ELEC-day2 and MECC will charge $100,000 (=5 contracts x $20,000/contract) over day 2.

Distributors

Distributors carry the electricity from the Producers to their customers (individual consumers and families). Distributors are able to sell electricity for $70/MWh to the customers but they have to buy the electricity from either the forward or the spot market.

Distributors have seen that, historically, the demand for electricity from customers during the month of August is strongly correlated with the temperature. When the temperature is high, consumption of electricity is also high because air conditioning systems tend to be turned on for longer periods of time due to the higher/longer demand for AC. Similarly, when temperatures are lower than average, the consumption of electricity is also lower than average.

Distributors have developed the following model to forecast the consumption of electricity by customers based on the average temperature over the day:

$$ELEC_{customers} = 200 - 15 \times AT + 0.8 \times AT^2 - 0.01 \times AT^3$$

where
$ELEC_{customers}$ is the number of contracts of electricity demanded by the Distributors' customers;
AT is the average temperature (in degrees Celsius) expected next day;
AT^2 is AT to the power of 2 and AT^3 is AT to the power of 3.

Distributors will receive news during the case. This news contains the weather forecasts and will provide information about the expected average temperature for the next day. The weather forecasts received on day 1 will provide information about the weather on day 2. There will be an initial report at the beginning of each day followed by an update at 12:00pm each day (1 minute and 30 seconds after the start of the day in the simulation) and then there will be the final update in the evening (30 seconds before the end of the day in the simulation). The final update will provide Distributors with the correct estimates of the average temperature for the next day. In other words, in the evening Distributors will know exactly what the average temperature will be the next day.

Distributors will have to buy electricity in the ELEC-F or ELEC-dayX markets in order to provide it to their customers. Distributors are strongly encouraged not to buy more electricity than what is needed to satisfy their consumers; otherwise, for each contract of electricity in excess that has to be disposed, they will be charged by the Ministry of the Environment and Climate Change (MECC) the same fee that is applied to the Producers.

In addition, the contractual agreement between the Distributors and their customers includes a clause that will charge a penalty to the Distributors in case they do not meet the demand for

electricity from the customers. For example, if the total electricity demanded by the customers is 3,000 MWh (30 contracts) and the Distributors are only able to buy 2,500 MWh (25 contracts) from the ELEC-F and ELEC-dayX markets, there will be 500 MWh (5 contracts) of excess demand for which they will be charged a penalty. The penalty will be calculated according to the following formula at the end of each day:

$$penalty = \$20,000 * ED = \$20,000 * 5 = \$100,000$$

where
ED is the excess demand (expressed in number of contracts) which is the difference between demand for electricity from customers and the electricity that the Distributors bought in the ELEC-F and ELEC-dayX markets.
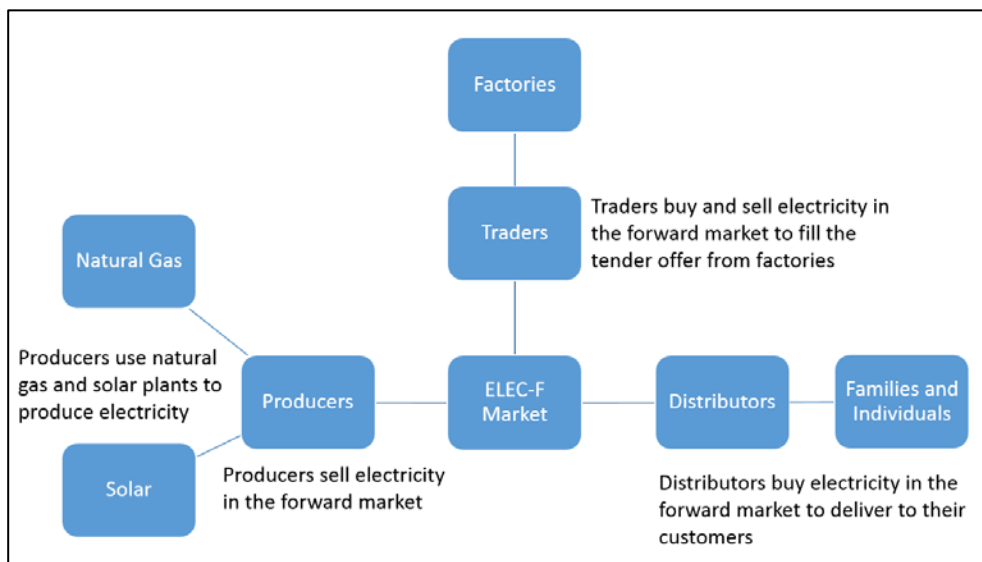
Traders
During the trading period, Traders will receive institutional orders from some clients who wish to buy or sell large quantities of electricity for the following day. These clients are large factories that intensively use electricity and find it more convenient to buy from the Traders rather than the Distributors. Traders act as the "shock absorber" for the market. They balance the supply and demand and help markets achieve equilibrium. Traders have access to the ELEC-F and ELEC-dayX markets.

Traders will receive "The Factory Tender Report" which describes the expected institutional orders activity via News.

The interaction between different market participants, including their profit maximization objectives and teamwork, is what will largely influence the overall profits of each team. Thus, participants have to optimize the dynamics of each role.

The chart below will summarize the three roles that we have described above.

MARKET DYNAMICS

Producers, Distributors, and Traders will be able to trade the securities according to the table below:

Security	Description	Contract Size	Accessibility	Shortable
ELEC-dayX	Electricity spot on day "X"	100 MWh	Producers, Distributors, Traders	No
ELEC-F	Forward for delivery of electricity the day after	500 MWh	Producers, Distributors, Traders	Yes
NG	Natural Gas spot	100 MMBtu	Producers	No

Producers will be able to utilize the following assets:

Asset	Description	Ratio	Conversion Period
NG_POWER_PLANT	Power plant for the production of electricity using natural gas	From 800 MMBtu to 100 MWh	End of day
SOLAR_POWER_PLANT[7]	Solar Panels for the production of electricity	$6 \times H_{day}$	End of Day

Producers will be limited to using 10 natural gas power plants at a time. The natural gas power plant can convert, at maximum, 80 contracts of NG to 10 contracts of ELEC-dayX. Producers can decide to convert less than 80 NG contracts into ELEC-dayX.

The electricity spot market

The electricity spot market is a market where the prices are controlled by the Regulatory Authority for Electricity (RAE). RAE is an independent entity that regulates, controls and monitors the electricity market. Since electricity cannot be stored and has to be delivered immediately, RAE sets the electricity prices and all market participants will be forced to trade at those prices imposed by the authority.

The RAE will issue a "Price and Volume Bulletin" every day with the forecasted prices for the next day that have been calculated using the expected state of the electricity system, the Producers' offers, and the Distributors' and Traders' demand. The RAE will also have information on the

---

[7] Please note that the solar power plant will produce electricity every day, which will be distributed as endowment to the Producers in RIT Client. The solar power plant cannot be controlled by Producers and it will not be available in the RIT Client under the module "Assets".

volume of electricity that will be available the next day and will provide this information to the participants. An example "Price and Volume Bulletin" is provided below:

"Given the expected supply and demand in the market, the Regulatory Authority for Electricity board expects that the price for tomorrow will be between $10.00 and $25.00.

There will be 200 contracts available in the entire ELEC market, 100 contracts for buying and 100 contracts for selling. There is a total of 28 Producers, 28 Distributors and 56 Traders in the market.

Please note that the RAE will charge a bid-ask spread of 1 cent."

The RAE issues 2 bulletins per day. The second one will be more accurate than the former since the RAE will have more information to evaluate the supply and demand at noon.

Note that, in the example above, there are only 100 contracts available for buying and 100 contracts available for selling on the spot market. Once participants have bought/sold all the contracts available in the ELEC-dayX market, they will not be able to change their ELEC-dayX position. Participants will be penalized for any open position of ELEC-dayX according to the fines explained above and in the section "POSITION CLOSE OUT" below.

Participants are encouraged to buy/sell electricity on the forward market by trading the security ELEC-F. Waiting until the next day to trade ELEC-dayX on the spot market is much riskier because the volume available to buy/sell will be limited. If participants have any excess electricity in their accounts by the end of the day, they will have to dispose of it.

Please also note that there will be an ELEC-dayX spot market for days 2 through 5 only, as no electricity is produced for delivery on day 1. On day 5, it is possible to produce electricity for day 6 and it is also possible to buy ELEC-F for delivery of electricity on day 6; the settlement of any outstanding position of ELEC-day6 is discussed in the section "POSITION CLOSE OUT" below.

The following is a simplified example of the case:
Assume that on day 1 Producers knew that they would produce 1,500MWh (15 contracts) of electricity for day 2 using the solar power plant (there is no cost for producing electricity using the solar power plant) and also decided to produce 2000 MWh (20 contracts) of electricity using the natural gas power plant at a cost of $14.875/MWh. The average cost for the 3,500 MWh (35 contracts) of electricity produced is $8.5/MWh [=(1,500MWh x $0 + 2,000MWh x $14.875)/(1,500MWh + 2,000MWh)].

On day 1, Distributors have bought 2 contracts (1,000 MWh) of ELEC-F from the Producers and 5 contracts (2,500 MWh) of ELEC-F from the Traders at a price of $40/MWh. Traders initially bought 5 contracts (2,500 MWh) of ELEC-F from the Producers for $25/MWh.

Profit generated by each member (per MWh).

Producers:

Average Selling Price per MWh $= \frac{1000\text{MWh} \times \$40 + 2500\text{MWh} \times \$25}{3500\text{MWh}} \approx \$29.286$
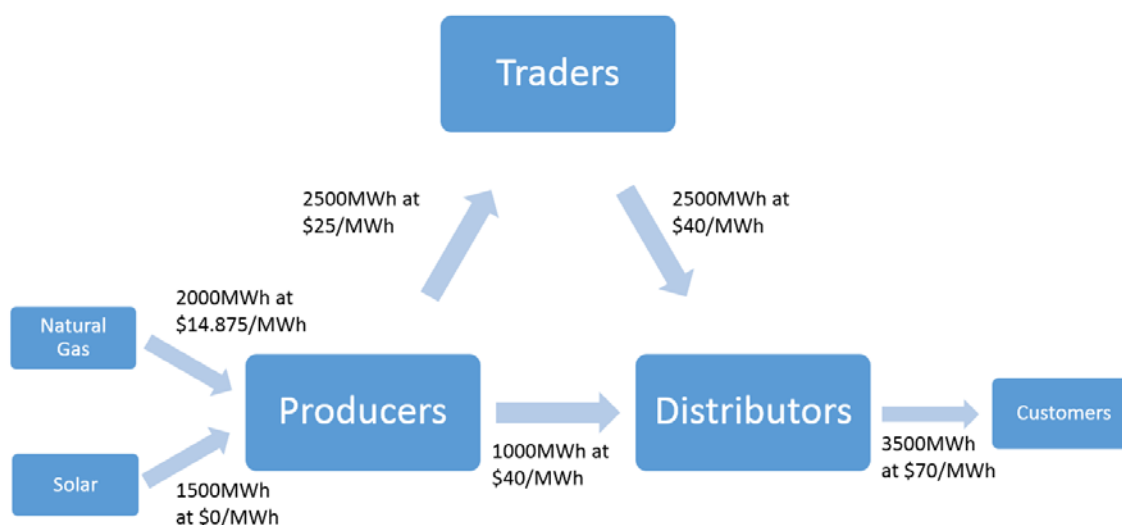
Profit = Average Selling Price per MWh – average cost per MWh = $\$29.286 - \$8.50 = \$20.786$

Distributors:

Profit = Selling price to customers - cost of buying electricity = $\$70 - \$40 = \$30$

Traders:

Profit = Selling price to Distributors – cost of buying electricity = $\$40 - \$25 = \$15$

In the example above, participants were able to trade electricity exclusively on the forward market and they did not need to do any spot transactions. If any of them had an open position of ELEC-day2 at the beginning of day 2, they could trade ELEC-day2 spot in order to close their position. The price at which they could trade will be imposed by the Regulatory Authority for Electricity as explained above.

The following is an example with a spot transaction.

Assume that on day 1 Producers knew that they would produce 1,500 MWh (15 contracts) of electricity for day 2 using the solar power plant (there is no cost for producing electricity using the solar power plant) and also decided to produce 2,000MWh (20 contracts) of electricity using the natural gas power plant at a cost of $14.875/MWh. The average cost for the 3,500 MWh of electricity produced is $8.5/MWh [=(1,500MWh x $0 + 2,000MWh x $14.875)/(1,500MWh + 2,000MWh)].

On day 1, Distributors bought 2 contracts of ELEC-F (each contract is for 500MWh so Distributors bought 1,000 MWh of electricity) from the Producers at a price of $40/MWh. Traders did not buy or sell any ELEC-F contract.

At the end of day 1, Producers will have 2,500MWh of unsold electricity (3,500 MWh produced – 1,000MWh sold to Distributors). At the beginning of day 2, the Regulatory Authority for Electricity declares that the price for ELEC-day2 for the day will be $20/MWh. To avoid penalties, the Producers will sell the remaining 2500MWh of ELEC-day2 at the spot price of $20/MWh.

Profit generated by each member (per MWh).

Producers:

Average Selling Price per MWh = $\frac{1000\text{MWh} \times \$40 + 2500\text{MWh} \times \$20}{3500\text{MWh}} \approx \$25.71$

Profit = Average Selling Price per MWh – average cost per MWh = $\$25.71 - \$8.50 = \$17.21$

Distributors:

Profit = Selling price to customers – cost of buying electricity = $\$70 - \$40 = \$30$

Traders' profits are zero because they did not trade.

TRADING LIMITS AND TRANSACTION COSTS

The maximum trade size will be 10 contracts for the security ELEC-F and 80 contracts for the security NG. Producers, Distributors and Traders will be allowed to have at maximum a net position of 300 contracts of ELEC-dayX. Producers will be allowed to have at maximum a net position of 80 contracts of NG. Producers, Distributors and Traders will be allowed to have at maximum a net position of 60 contracts of ELEC-dayX.

There are no transaction costs to trade ELEC-F and NG. The ELEC-F market will allow participants to submit only rounded integer quotes.

POSITION CLOSE OUT

Each outstanding position of ELEC-day2 through ELEC-day5 will be closed out at a distressed price of $0 at the end of days 2 through 5 respectively. The fee of $20,000/contract from the Ministry of the Environment and Climate Change will be applied to all long positions of ELEC-day2 through ELEC-day5 at the end of days 2 through 5 respectively. A penalty of $20,000/contract will also be applied to all short positions of ELEC-day2 through ELEC-day5 at the end of days 2 through 5 respectively.

At the end of the case (end of day 5), any outstanding positions in ELEC-day6 will be closed at the final RAE price announced during day 5. No fines will be applied to long or short positions of ELEC-day6.

KEY OBJECTIVES

Objective 1:

Design a model to calculate the effect of news releases on the supply and demand for electricity. Use this information to make a decision on the optimal level of production of electricity (for Producers' role), the optimal quantity to be delivered to customers (for Distributors' role) and the optimal trader activity to fill the tender offers from factories (for Traders' role).

Objective 2:

Maximize profits as a team of Producers, Distributors, and Traders by communicating and sharing private news information with each other.

Note: Since this simulation requires a large number of participants in order to establish supply/demand, practice sessions for this case will be organized and held at specified times (please refer to the "Important Information" section above). After organized practice sessions are completed, cases will be run iteratively for model calibration purposes ("trading skillfully" cannot be practiced unless there are 20+ users online).

Quantitative Outcry Case

OVERVIEW

The Quantitative Outcry Case challenges participants to apply their understanding of macroeconomics to determine the effect of news releases on the world economy as captured by the Rotman Index ("RT100"). The RT100 Index is a composite index reflecting global political, economic, and market conditions. Participants will be required to interpret both quantitative and qualitative news, analyze the impact of the news on the RT100 Index, and react by trading futures contracts on the index.

DESCRIPTION

There will be 2 heats with 4 team members competing for the entire heat. The 4 team members will comprise 2 analysts and 2 traders who will rotate positions for the second heat. Team members acting as traders in the first heat must act as analysts in the second heat and vice versa. Each heat will last 30 minutes and represent six months of calendar time. Traders will be trading futures contracts on the RT100 Index.

Parameter	Value
Number of trading heats	2
Trading time per heat	30 minutes
Calendar time per heat	6 months (2 quarters)

The Fleck Atrium (downstairs) in the Rotman Building will serve as the trading pit for traders, while analysts of each team will share a desktop in the Rotman Finance Lab (upstairs). Analysts will have access to detailed news releases, while traders in the pit will only have access to news headlines. It will be the role of analysts to quantify the impact of news releases on the RT100 Index and communicate this impact to the traders who will be required to react and trade according to the analysts' instructions.

As analysts and traders will be on separate floors separated by windows, it is essential for teams to develop non-verbal communication strategies. **Electronic devices are not permitted during this case.**

MARKET DYNAMICS

The value of the RT100 Index is determined by the quarterly changes in GDP, in $ billions, of the following 6 economies: **Canada, the United States, China, Brazil, Germany, and South Africa.** Each country's GDP contributes to a percentage of the RT100 Index.

The initial level of RT100 is 1,000 at t=0. The RT100 Index is quoted in units and the futures contracts are written on the RT100 Index. The contract multiplier for RT100 futures is $10. Therefore, 1 futures contract is worth $10*RT100 Index. If the RT100 Index is at 995 and a trader owns 1 long future contract, his/her position will be worth $9,950 (= $10*995).

Economic statistics for each of the countries are collected and released throughout the case as news items on RIT Client, and will determine the exact trading level of the RT100 Index at the midpoint and at the end of the trading period (15 minutes and 30 minutes of the simulation, equivalent to 3 months and 6 months in calendar time). There is no exchange rate risk (all values are expressed in the same currency).

The value of the RT100 Index at t=15 minutes is calculated by the following formula:

$$RT100_{Value\ at\ t=15} = 1000 + Canada_{(Actual\ Q1\ GDP-Previous\ Q1\ GDP)} + USA_{(Actual\ Q1\ GDP-Previous\ Q1\ GDP)} + \cdots$$
$$+ South\ Africa_{(Actual\ Q1\ GDP-Previous\ Q1\ GDP)}$$

In other words, every $1 billion of actual year-over-year GDP increases will cause a 1 point increase in the RT100 Index. Conversely, every $1 billion of actual GDP shortfalls will cause a 1 point decrease in the RT100 Index.

The quarterly GDP of each country is composed of aggregate production in three independent sectors: Manufactured Goods, Services, and Raw Materials. At the beginning of the case, estimates for the aggregate quarterly GDP of each country and sector will be released to analysts as news items on RIT Client. Throughout the quarter, news releases will provide estimates and information that will allow analysts to construct expectations for each country and each sector.

The following is a sample series of data for Q1 Canada:
- Canadian Q1 GDP last year was $100 billion. This year in Q1, the market expects manufactured goods of $30 billion, services of $60 billion, and raw materials of $10 billion.
- General workers protest hits the Canadian manufacturing sector, causing minor production delays.
- Strong global commodities prices lift raw materials output across the globe by as much as 10%.
- New policies cause $7 billion increase in services spending.
- RELEASE – Canadian Manufacturing for Q1: $28 billion
- RELEASE – Canadian Services for Q1: $67 billion
- RELEASE – Canadian Raw Materials for Q1: $11 billion

The sum of the independent sectors, and thus the resulting Q1 Canadian GDP, is $106 billion. This is $6 billion above last year's Q1 GDP of $100 billion and would cause the RT100 Index to increase by 6 points. This, in addition to the effects of the other 5 countries, will determine the RT100 Index at the 15-minute mark (and then at the 30-minute mark).

TRADERS' ROLES

Traders are responsible for interpreting the signals from the analysts located in the Rotman Finance Lab and trading futures on the RT100 index by using trading tickets. Traders will have to find other market participants who are willing to act as counterparties to complete their trades. For detailed examples of trading tickets and how to make trades, refer to the Tutorial to be released on the RITC website on February 5th.

In addition to the traders from each team, there will be RITC Liquidity Providers in the trading pit, providing liquidity by quoting both bid and ask prices throughout the case. Traders are also responsible for keeping track of their position and communicating it to their analysts.

ANALYSTS' ROLES

Analysts are responsible for interpreting the detailed news they receive on the RIT Client and communicating their findings to the Traders in the Fleck Atrium. Analysts are also responsible for submitting analyst estimate forms (refer to the Cash Bonuses section below for details) and making spot trades.

Spot Trades

In addition to the transactions executed by traders in the Fleck Atrium, analysts in the Rotman Finance Lab are allowed to make up to 2 spot trades per heat, with a maximum of 50 contracts in each spot trade, using trading tickets. The spot trades will be executed at the current spot price of the RT100 Index posted on the screen in the Fleck Atrium and on the RIT in the Rotman Finance Lab. The spot contract has a contract multiplier of $10. Therefore, if an analyst owns 1 spot contract when the RT100 Index is at 1,023, his/her position will be worth $10,230 (= $10*1,023).

The spot trades allow each team to have an opportunity to close out their positions in a timely manner. Moreover, while the futures market will be driven by trader activity, the spot market is based on the actual economic indicators realized; thus, there may be arbitrage profit opportunities arising from inefficiencies in the two markets (the futures market and the spot market). These trades are added to the aggregate futures position of the team. The soft and hard trading restriction limits discussed further below also apply to the spot trades made by analysts in the Rotman Finance Lab.

CASH BONUSES

Analyst Estimates

Throughout each trading heat, analysts will be required to submit a point estimate of where they believe the RT100 Index will settle at the 15 and 30 minute marks. These estimates are due by the 10 and 25 minute marks, respectively (i.e. 5 minutes before the end of the quarter). These time limits will be tracked solely based on the time shown on the RIT and on the screen in the Fleck Atrium. Participants should refrain from using external devices (online timers, cell phones,

watches, etc.) to track the time limits. Analysts will be graded based on their prediction accuracy of their estimates, and bonus cash will be allocated to the teams with the most accurate estimates.

Counterparties

At the end of the case, all submitted tickets will be reviewed and each team will be given a counterparty score based on the number of different trading counterparties they transacted with throughout the case. Teams will be awarded bonus cash based on the number of different counterparties with which they transacted.

Bonus Cash Calculations

Each team will be ranked based on its performance and split into quintiles for each of the 2 bonus calculations. The top quintile for each bonus pool will be assigned a 5% bonus, the second 4%, and so on until the last quintile, which is assigned a 1% bonus. The 2 last placed teams are assigned a 0% bonus. Bonuses are never negative, and they are applied at the end of the heat based on the absolute value of the team's profits and losses throughout the heat.

TRADING LIMITS AND TRANSACTION COSTS

Each team has a starting position of 0 contracts, a soft trading limit of 200 contracts, and a fixed hard trading limit of 500 contracts on their net positions. On a best-efforts basis, each team will be notified as it approaches its soft and hard limits. If a team exceeds its soft limit, it will be charged a fine proportional to how much they exceed the soft limit. The amount by which a team exceeds the initial soft limit adds to their new soft limit. The fine for going above the soft limit is $50 per contract.

For instance, if Team A's net position is at 220, they will be charged a fine of $50*20 = $1,000 (they have exceeded their soft limit of 200 by 20 contracts). For Team A, 220 is now the new soft limit. This means that, as long as Team A's position remains below 220, there will be no additional fines. If Team A bought more and had a new net position of 280, then they would be charged an additional fine of $50*60 = $3,000 which is the difference between the new net position and new soft limit. If a team does not exceed its soft limit, it will not be charged any fines.

Any team that exceeds the hard limit of 500 in any heat will be automatically disqualified from the heat. They will be given a rank equal to that of last place for that heat. In addition, there is a zero tolerance policy with regards to electronic communication. Any trader or analyst seen by an RITC staff member using a cell phone or any other electronic device to communicate with team members during the trading heats will be immediately disqualified from the heat. RITC staff will be positioned throughout the trading pit in the Fleck Atrium and in the Rotman Finance Lab to monitor this.

Each futures transaction has a maximum volume of 20 contracts per trade if a trade is done between traders from different teams. If a trade is done between a trader and an RITC

Liquidity Provider, each futures transaction has a maximum volume of 5 contracts per trade. As mentioned above, Analysts in the Rotman Finance Lab are also allowed to make up to 2 spot trades during each heat, with up to 50 contracts in each trade.

Each contract will be charged a brokerage commission of $1 per contract.

POSITION CLOSE-OUT

Each team's position will be settled at the end of the trading session by closing out their remaining positions at the final spot price.

TRADING P&L CALCULATION EXAMPLE

Trading P&L will be calculated in a similar fashion to the Social Outcry Case (with the addition of trading fines as described below). Trading P&L will then be modified by all bonuses (Analyst Estimates and Counterparties).

The following is an example of a P&L calculation:

- Bought 5 RT100 Index futures at 1,000
- Sold 5 RT100 Index spot contracts at 1,100
- The team is ranked at the top quintile for the bonus pool of <u>Analyst Estimates</u> and the third quintile for <u>Counterparties</u>

$$Profit\ Before\ Bonuses = (1,100 - 1,000) \times \$10 \times 5 - \$1^8 \times 10$$
$$= \$4,990$$
$$Bonuses = |\$4,990| \times 5\% + |\$4,990| \times 3\%$$
$$= \$399.20$$
$$Total\ P\&L = \$4,990.00 + \$399.20$$
$$= \$5,389.20$$

The following is an example when a trader has a negative P&L:

- Bought 5 RT100 Index futures at 1,000
- Sold 5 RT100 Index spot contracts at 900
- The team is ranked at the top quintile for the bonus pool of <u>Analyst Estimates</u> and the third quintile for <u>Counterparties</u>

$$Profit\ Before\ Bonuses = (900 - 1000) \times \$10 \times 5 - \$1 \times 10$$
$$= -\$5,010$$
$$Bonuses = |-\$5,010| \times 5\% + |-\$5,010| \times 3\%$$
$$= \$400.80$$
$$Total\ P\&L = -\$5,010.00 + \$400.80$$
$$= -\$4,609.20$$

---

[8] Brokerage commission of $1 per contract traded – explained in Trading Limits and Transaction Costs – there have been 10 contracts traded in this example, 5 to buy and 5 to sell.

KEY OBJECTIVES

Objective 1

Traders can generate profits by interpreting news headlines and going long on positive news and short on negative news. Traders are also encouraged to trade with many different counterparties to capitalize on the bonus structure.

Objective 2

Analysts should track news releases and attempt to accurately estimate the value of the RT100 Index in order to develop a profitable trading strategy and communicate it efficiently to the traders. Additionally, the analysts should submit their index estimates in a timely manner and develop effective communication methods with the traders to quickly communicate trading strategies.

Note that a tutorial for the Social Outcry Case and the Quantitative Outcry Case will be released on the RITC webpage on February 5th.

Liquidity Risk Case

OVERVIEW

The Liquidity Risk Case challenges participants to put their critical thinking and analytical abilities to test in an environment that requires them to evaluate the liquidity risk associated with tender offers. Participants will be faced with multiple tender offers throughout the case. This will require quick judgments on the profitability, subsequent acceptance and execution, or rejection, of each offer. Profits can be generated by taking advantage of price differentials between market prices and prices offered in the private tenders. Once any tender has been accepted, participants should aim to efficiently close out their large positions to maximize returns and minimize liquidity and market risks.

DESCRIPTION

There will be two heats with two team members for each heat. Each participant may compete in only one of the two heats. A total of four team members will compete in the overall case. Each heat will consist of five 10 minute sub-heats. Each sub-heat will be independently traded and will represent one month of calendar time. Each sub-heat will have a unique objective and could involve up to four stocks with different volatility and liquidity characteristics.

Parameter	Value
Number of trading sub-heats	5
Trading time per sub heat	600 seconds (10 minutes)
Calendar time per sub heat	1 month (20 trading days)

Tender offers will be generated by computerized traders and distributed at random intervals to random participants. Participants must subsequently evaluate the profitability of these tenders when accepting or bidding on them. Order submission using the RIT API will be disabled. Data retrieval via Real-time Data (RTD) Links and the RIT API will be enabled.

MARKET DYNAMICS

There are five sub-heats per heat, each with unique market dynamics and parameters. Potential parameter changes include factors such as spread of tender orders, liquidity, and volatility. Market dynamics and parameter details regarding each sub-heat will be distributed prior to the beginning of the sub-heat, allowing participants to formulate trading strategies. Details for an example sub-heat with two stocks, RITC and COMP, is shown below.

	RITC	COMP
Starting Price	$10	$25
Commission/stock	$0.01	$0.02
Max Order Size	10,000	15,000
Trading Limit (Gross/Net)	250,000/150,000	250,000/150,000
Liquidity	High	Medium
Volatility	Medium	High
Tender Frequency	Medium	Low
Tender Offer Window	30 seconds	15 seconds

During each sub-heat, participants will occasionally receive one of three different types of tender offers: private tenders, competitive auctions, and winner-take-all tenders. Tender offers are generated by the server and randomly distributed to random participants at different times. Each participant will get the same number of tender offers with variations in price and quantity. No trading commission will be paid on tender offers.

Private Tenders are routed to individual participants and are offers to purchase or sell a fixed volume of stocks at a fixed price. The tender price is influenced by the current market price.

Competitive Auction offers are sent to all participants at the same time. Participants will be required to determine a competitive, yet profitable, price to submit for a given volume of stocks from the auction. Any participant that submits an order that is better than the base-line reserve price (hidden from participants) will automatically have his/her order filled, regardless of other participants' bids or offers. If accepted, the transactions will occur at the price that the participant submitted.

Winner-Take-All Tenders request participants to submit bids or offers to buy or sell a fixed volume of stocks. After all prices have been received, the tender is awarded to the participant with the single highest bid or single lowest offer. The winning price, however, must meet a base-line reserve price (hidden from participants). If no bid or offer meets the reserve price, then the trade will not be awarded to anyone (e.g. if all participants bid $2.00 for a $10.00 reserve price stock, nobody will win).

CALCULATION OF THE PROFIT OR LOSS OF TRADERS

The prices generated by RIT for this case follow a random-walk process using a return drawn from a normal distribution with a mean of zero. That is, at any point in the case simulation, the probability that the price will go up is equal to the probability that the price will go down. This means that participants cannot predict the future price of the stocks without "taking a bet". Therefore, the RITC scoring committee will consider trading stocks for reasons other than reducing

the exposure associated with accepting a tender offer to be equivalent to speculating (taking a bet) on the price movement. These types of trades will be flagged as "speculative trades".

Participants will have time to think about the tender offer before they choose to accept it or decline it and the time may be different for each security. For example, one may receive a tender offer at time $t = 0$ and will have until $t = 30$ to decide whether to accept or decline. Any trades for that security made by a participant during this time without accepting or declining the tender offer will be considered as "*front-running*"[9] since the participant had the advance knowledge of a pending institutional order. The RITC scoring committee will flag these trades as "front-running trades".

This case is designed to only reward participants for identifying, accepting, and closing out[10] tender offer positions at a profit, while managing liquidity risk and execution risk. Any other strategy will not be considered. In particular, the total profit of each participant[11] will be categorized into two parts: "profits from tender offers" and "profit from speculation"; the latter category includes the profits that are a result of speculative trades and/or front-running trades.

Profits from tender offers are the profits (or losses) gained from efficiently closing out the position from accepted tenders into the market. Profits from speculation are profits (or losses) generated through trades that are not associated with tenders (speculative trades or front-running trades). An "Adjusted P&L" will be calculated based on the following formula:

$$Adjusted \ P\&L \ = \ P/L \ From \ Tenders \ + \ Min(0, P/L \ From \ Speculation)$$

Participants will be **ranked and scored** based on their $Adjusted \ P\&L$.

For example, consider a participant who has made $10,000 from tenders and $50,000 from speculation, the total profit is $60,000 ($= \$10,000 + \$50,000$) but the $Adjusted \ P\&L$ will only be $10,000 $[= \$10,000 + min(0, \$50,000)]$. In another example, consider a participant who has made $35,000 from tenders and lost $20,000 from speculation ($Profit \ From \ Speculation = -\$20,000$); the total profit is $15,000 ($35,000 - \$20,000$) and it is equal to the $Adjusted \ P\&L$ $[\$15,000 = \$35,000 + min(0, -\$20,000)]$. Any losses from speculation <u>will be included </u>while profits from speculation will **not** be included.

The $Adjusted \ P\&L$ will be calculated by the RITC scoring committee at the end each sub-heat and will **not** be included in the P&L calculation in RIT. However, participants will be provided with an

---

[9] Front-running is the unethical and illegal practice of trading a security for your own account while taking advantage of the information contained in the pending orders from your institutional clients.

[10] "Closing out" a position means that a participant is executing a trade that is the opposite of the current position in order to eliminate the exposure.

[11] Total profit of each participant is the profit (or loss) that you can observe in the RIT Client at the end of a sub-heat.

Excel tool [12], the "Performance Evaluation Tool", that will allow them to calculate their *Adjusted P&L* while practicing.

TRADING LIMITS AND TRANSACTION COSTS

Each participant will be subject to gross and net trading limits as specified in the case description distributed prior to each sub-heat. The gross trading limit reflects the sum of the absolute values of the long and short positions across all stocks, while the net trading limit reflects the sum of long and short positions such that short positions negate any long positions. Trading limits will be strictly enforced and participants will not be able to exceed them.

The maximum order size and commissions will be specified in the case description distributed prior to each sub-heat. See the table above for an example.

POSITION CLOSE-OUT

Any open position will be closed out at the end of each sub-heat based on the last traded price. This includes any long or short position open in any security. Computerized market makers will increase the liquidity in the market towards the end of trading to ensure the closing price cannot be manipulated.

KEY OBJECTIVES

Objective 1
Evaluate the profitability of tender offers by analyzing market liquidity. Participants should accept tenders that are expected to generate positive profits while rejecting unattractive tender offers.

Objective 2
Submit competitive, yet profitable, bids and offers for competitive auction and winner-take-all tenders to maximize potential profits while managing liquidity and market risk.

Objective 3
Use a combination of limit orders, market orders, and marketable limit orders to mitigate liquidity and price risks from holding open positions. There is a chance that the market may move away from your transaction prices, so maintaining large open positions may result in losses.

---

[12] The "Performance Evaluation Tool" will be uploaded on the RITC website on January 29th.

Copyright © Rotman School of Management, University of Toronto   Rotman International Trading Competition 2020 | 48