Structure and Main Features of the RIT Market Simulator Application

Overview
The Rotman Interactive Trader is a market-simulator that provides students with a hands-on approach to learning finance. It allows students to practice decision making under uncertainty in a controlled environment where they can immediately observe the outcomes of their decisions. By being able to analyze the consequences of their decisions in different situations, students are able to learn how to make good decisions when the future is uncertain.

The RIT application is structured on a server/client basis:
- Instructors will run the RIT Server application that will allow them to choose and load the simulation case, modify the case parameters if they so wish, exercise full control of the variables governing the market, monitor the students’ decisions in real time and (optionally) push out performance reports at the end of each replication.
- Students will use the RIT Client application to connect to the RIT Server and act as participants in the simulated market; using the information in the relevant case brief and Excel support template -- which applies the relevant theory -- to guide their decisions.

The RIT Server application: running a simulation – the instructors’ view
Before class, instructors choose the case(s) and inform their students to download the RIT Case Brief(s) and any additional support material that they should read in advance. Professors also have access to the instructors’ notes contained in the RIT Case Brief - SOLUTION. The RIT cases have been developed for sequential progression for each topic, from introductory cases to more advanced cases that build on strategies mastered in the cases earlier in the sequence. Details of the case topic sequences and case summaries are outlined on the RIT webpages1. More detailed information is included in the RIT Case Briefs and background material is summarized in these RIT Notes.

Once the RIT Server has been installed on the instructor’s workstation, instructors can run the market in a few clicks2:

---

1 A detailed list of RIT cases can be found at http://rit.rotman.utoronto.ca/cases.asp
2 A set of video tutorials on how to run the market are available to RIT clients on the password protected webpage http://rit.rotman.utoronto.ca/download.asp using their login credentials. If necessary, RIT clients can retrieve those credentials from eric.kang@rotman.utoronto.ca or rit@rotman.utoronto.ca.
Open the RIT Server application by double clicking the ‘RIT Interactive Trader 2.0 Server’ icon, choose a case and load the associated server casefile, for example, RIT – H2 – Portfolio Insurance – Server Casefile.xlsx. In the password protected area of the RIT website, there is a full list of the RIT Server Casefiles, which are the Excel files that need to be uploaded on the RIT Server.

Once the server casefile has been loaded on the instructor’s workstation, students can connect to the simulated market via a network connection to the instructor’s workstation.

Once all of the students are connected, instructors can open (run) the market and start the first replication.

While the simulation is running, instructors can monitor participants’ decisions and have full control over the market. For example:

- Speed up or slow down the simulation – slowing the speed is particularly useful in order to discuss strategies when running the case for the first time;
- Pause the simulation to prevent students from interacting with the market while the instructor is explaining a particular point;
- Monitor students’ performance in order to evaluate in real time whether or not they are implementing the correct strategy; for example, bar charts and tables of students’ trades, positions in each security, P&L, etc., are available to instructors in real time;
- Advanced options are available to alter the variables of the simulation while it’s running (e.g., they can increase/decrease the liquidity in the market);
- Broadcast messages to individual students or the entire class.

When each replication of the simulation ends, instructors can display the results in different ways depending on the depth of the discussion that they would like to have with their class. For example:

- They can show the results using the RIT Server; this is the same feature as the real-time monitoring but, because the market is closed, students’ profit and losses and positions are static at the values that they had at the end of the simulation;
- They can generate individual reports for each student and push them out to students’ workstations. Reports are extremely useful as they summarize the student’s activity throughout the simulation through tables and charts that are easy to read and interpret;
- They can save an Excel file with a complete log of all of their students’ transactions, final profit and losses, time and sales, OTC transactions, etc.

Instructors can fully customize the simulations. The RIT Server Casefiles are programmed in Excel, are open source and available to all of the RIT instructors. The RIT team has developed a user guide that explains the role of each variable and how it affects the simulation. For more details please refer to the RIT - User Guide - Server Casefile Variable Description file available on the password-protected webpage of the RIT website.

The RIT Client application: making decisions in a simulated environment

Students open the RIT Client by double clicking on the ‘RIT Interactive Trader 2.0 Client’ icon and connect to the RIT case loaded by their instructor. Once connected, students will be able to take

---

3 RIT Client demo and tutorial videos can be found at [http://rit.rotman.utoronto.ca/videos.asp](http://rit.rotman.utoronto.ca/videos.asp)

4 For more details on how to connect to a simulation, please visit the RIT website at [http://rit.rotman.utoronto.ca/](http://rit.rotman.utoronto.ca/)
part in the simulation and will be able to monitor the market and implications of their own and other participants’ decisions in real-time. For example:

- Monitoring the Order Book to evaluate the liquidity available; some cases have been designed with infinite liquidity, others include liquidity risk;
- Reading available news which may be qualitative or quantitative depending on the case;
- Monitoring charts illustrating volumes and market-clearing prices

Students will also be able to monitor their own account in real-time. For example:

- Checking their position, unrealized and realized profits on each security;
- Tracking the open, filled, partially filled and cancelled orders;
- Keeping track of the inflows and outflows of money from their accounts. This feature is particularly useful to understand how some financial concepts work, e.g. marking-to-market for futures, accrued interests and coupon payments for bonds, etc.

In order to perform well in the simulation, students have to identify and manage risks and opportunities relevant for the RIT case and formulate strategies that work well across the entire range of possible outcomes. Instructors should require students to use a financial model -- built and implemented in Microsoft Excel and linked to the simulated market -- in order to help them make decisions. The ability to use RTD (real-time data) links to Microsoft Excel is one of the key features of the RIT as students can export securities’ prices, volumes, open and filled orders, etc. They are provided with all of the tools needed in order to perform valuations and risk management calculations that will help to make good decisions in the simulated stochastic (uncertain) environment.

For most RIT cases, instructors are provided with a start-up Excel support template that will provide introductory models of the relevant finance theory and, as such, suggest strategies for decisions that should be implemented for that case. These Excel support templates include RTD links to the RIT simulated market(s) associated with the corresponding RIT case. These models will not only help students process information and make decisions, e.g. identifying mispriced securities, implement a Monte-Carlo to evaluate the potential range of outcomes, etc., but also monitor their own performance, e.g. risk management effectiveness, etc.

Depending on the decision of the instructor, these Excel support templates can be distributed to the students prior to running the case as a starting point for developing their strategies. Alternatively, students can be asked to develop their own support models. If the provided Excel support templates are distributed, it is highly recommended that students be required to further develop the templates in order to demonstrate their mastery of the finance theory relevant for implementing good decisions.

How market prices are determined
One of the key features of the RIT Market Simulator is that market clearing prices are determined by orders from market participants: both students and computerized traders.

Depending on the RIT case, students are required to fulfil many different roles, for example, hedgers, arbitrageurs, speculators, analysts, etc. The RIT cases offer the possibility to simulate both

---

5 Note that the RIT Server Casefiles should never be distributed to students.
buy-side and sell-side professional roles, such as, agency trading, liability trading, algorithmic trading, fixed income trading, equity valuation, M&A, commodities trading, hedging and speculating using futures and options, volatility trading, portfolio management, risk management, etc.

Most of the cases use computerized traders to add liquidity in order to maintain reasonable market conditions (particularly when a small number of students are practicing). Computerized traders can be turned-off by the instructor or, alternatively, depending on the case, allowed to participate as noise traders, liquidity traders, options traders, and/or buy-side institutions. They can be programmed to be uninformed, in which case computerized orders are submitted randomly (according to a specified distribution) on either side of the mid-market price; or, alternatively, they can be programmed to be fully or partially informed, in which case they will push the market towards a pre-generated price path.

The ability to program computerized traders with adjustable parameters allows for a very flexible market structure. For example, liquidity can be parameterized such that students have an impact on the market when they are acting as institutional investors and have sufficient market power to cause price impact. Alternatively, in some cases liquidity risk is not a primary concern in which case the computerized traders are used to generate sufficient liquidity so that students’ actions will not have an impact on the price paths, that is, they will be price takers as in most retail investor situations.

**Institution-style Order Management and Risk Management System**

RIT provides similar order management systems as those used by major financial institutions. Students have full control over the order types including market orders and limit orders. Furthermore, RIT can accommodate sophisticated order entry systems including spread trades and transportation arbitrage trades that allow users to simultaneously submit multiple orders to capture profit opportunities. RIT also features Over-the-Counter (OTC) trades that allow market participants to negotiate and book a trade with counterparty participants off market.

The RIT application also includes a built-in risk management system similar to those used at institutional trading desks. Portfolio position margin is used to calculate both net and gross risk/exposure based on participants’ current portfolio holdings, and risk management restrictions can be strictly enforced, or limit breaches can be logged using a penalty system. For example, RIT offers a Risk Management (VaR) case which challenges students to manage their portfolio VaR exposure (subject to penalties) while allocating their funds to multiple ETFs.

**Multi-marketplace (ECN) simulations** are supported allowing cross-listed securities; and multi-venue market making, arbitrage, and liquidity risk management strategies.

**API support allowing the use of algorithms for submission of decisions**

Students are normally asked to submit their decision manually to the simulated market, using order entry screens and/or fast order entries inside the limit-order books. Alternatively, given the API support for low latency trading built into the RIT application, students can design and program algorithms to automate the entire decision and execution process for cases for which an automated strategy is appropriate. This option is useful for students to further develop their programming skills. The RIT platform provides VBA API and REST API functionality, so students can choose Excel VBA or any programming application that supports a REST API such as Matlab, Python, R, Node, or C#. API order submission speed can also be controlled by instructors.
Running an RIT Server Casefile 24/7 for students to practice prior to class

One of the unique features of the RIT application is that it allows simulations to run 24/7 so that students can remotely connect from home and practice RIT cases. This is easy to set up and only requires a computer running the relevant RIT Server Casefile 24/7 and access to that computer via a port through any firewalls.

Simulation of Financial Products

RIT allows students to experience how various financial instruments are priced and traded. Securities currently supported by RIT, and their properties, are summarized below.

Equities - Instructors can design tradable equity instruments that are either traded solely by the RIT users or also by computerized traders. Payoffs for equities such as dividends, as well as the final value of the equity, can be specified prior to the start of the case. Alternatively, instructors can set the final value of the equity security to be determined based on the last price of the period. Trading costs can be specified in different measures.

Foreign Currency - multi-currency and dynamic cash interest rates can be simulated allowing cases using forward contracts on foreign currency, money market swaps, etc.

Fixed Income - RIT supports both discount bonds and coupon bonds. Discount bonds are quoted and traded based on their price. Coupon bonds are quoted and traded based on their clean price and accrued interest is added to the transaction once a trade is made. Computerized traders can participate in fixed income markets as informed or uninformed traders.

Options - Both call and put options can be implemented in RIT cases to add speculative and hedging opportunities. Options are traded based on the equity convention of 1 contract being associated with 100 shares of the underlying. Options can be settled either in cash or in underlying shares upon expiration: in case of the cash settlement, the payoff is based on the difference between the strike price and last price of the underlying at the expiration of the contract.

Futures - Futures contracts can be traded using RIT and marked-to-market depending on the predetermined case parameters. Futures can be also linked to an underlying security for their final mark-to-market value and can be either cash-settled or physically-settled (in the underlying security) upon expiry (delivery).

Commodities - The trading and processing of physical commodities is supported by the RIT application. Students can be required to lease storage prior to purchasing physical products, and can then use different physical assets (such as pipelines, ships, refineries, production facilities, etc.) to convert or move these physical assets from one market to another. In addition to pricing, the commodity cases feature location and product arbitrage as well as speculation (news trading) and risk management.

Synthetic financial securities – RIT allows instructors to create tradable synthetic financial products since all of the RIT Server Casefiles are generated based on Excel spreadsheets. Synthetic securities from non-traditional asset classes can be designed, modelled, and traded in RIT with a particular settlement behavior.