Fall 2009 FTS Real Time Trading Exercises

The FTS Real Time Trading Exercises have two basic goals:

- *To introduce the current real world financial markets into your course*
- *Let your students learn concepts you teach "by doing"*

Relevant Courses

Finance

- *Finance 101*
- *Investments*
- *Options and Futures*
- *International Finance*
- *Fixed Income*
- *Corporate Finance*
- *Valuation*

Accounting

- *Financial Statement Analysis*
- *Valuation*
- *Accounting for Trading*

Macro Economics

- *Covering the Federal Reserve Bank and the FOMC (Federal Open Market Committee)*

Classroom Experience

The FTS team includes professors with many years of teaching experience, and we provide ongoing academic support to help you integrate your course with the trading exercise. Our system is a state of the art educational trading platform with powerful analytics designed for learning. Our back office services provide a seamless connection between technology and your classroom. This lets you focus on teaching while we focus on delivering the technology. All trades settle at real time prices. Students can plan out trades by using an comprehensive set of order types including limit and stop orders which the system automatically monitors continuously and executes without delay if the criteria is met. In addition, a comprehensive set of reports and powerful interactive analytical support systems are available to both you and your students, as shown at the end of this document.

Learning by Doing

The system provides a comprehensive and powerful real time analytical support system. This system is completely interactive which allows students to plan out and implementing their own overrides at any

time and from any location. If working in teams then all team members have immediate access no matter where they are located in the world. A major learning advantage associated with this system is that students immediately observe the impact of changing an input in the support system. This could be "by how much do optimal portfolio weights change if we re-assess the beta or the volatility of a stock?" or "if we revise our estimate of the financial cost of carry how does this influence the predicted price of an equity future?" The FTS Real Time System lets students answer these and many other questions when working with the real world trading client. Furthermore, the learning by doing is extended to include current and often real time information available on the web with these powerful analytical support system.

Classroom Tip: Our advice is to focus on a few markets as opposed to a large number. After all, you do not expect that your students will become experts on managing hundreds of securities in a portfolio in one semester!

Innovative Tip: One professor divides their class into sub groups where each sub group is assigned to a subset of markets (e.g., DJIA, Forex, Fed Funds, Options, Stock Index Futures, etc.). Weekly market reports keep the entire group in touch with the aggregate activity of these sub group as well as providing students with important communication experience in the writing and delivery of market briefs to a group.

2009 RTFTS Cases

Summary of cases:

- DJIA Stock Case
- Stock Index Options
- Stock Index Futures
- Foreign Exchange
- Foreign Exchange and Currency Futures
- Interest Rate Futures (e.g., Eurodollar, Federal Funds)
- Volatility Index Futures and Options
- Exchange Traded Funds Cases
- International cases upon request

FTS Back Office Services: Overview

The FTS back office service eliminates the overhead associated with running real world projects. For each project in this write-up the FTS back office provides comprehensive computing and academic support to the instructor throughout the project's duration. This lets you focus on teaching your class without worrying about the operational details associated with running a project.

Your students log in over the internet to the FTS servers using the FTS Real Time Client to manage their trading position. Trades are processed in real time using real time prices so that students cannot game the system. Trading is institutionally correct with respect to the real world market microstructure and the system is designed to teach students how financial markets work including different order types (e.g., market, limit, stop etc.,), trading rules (e.g., margin purchases, short sales, initial margins, maintenance margins etc.,) and different types of support systems including technical analysis, fundamental analysis and security valuation, modern portfolio theory, as well a comprehensive analytical support system designed to reinforce standard curricula.

All record keeping, trading support, accounting reports and performance reporting is handled automatically by the FTS system and can be accessed at any time by your students. This lets students focus upon interpreting and mastering the important learning objectives associated with the tasks as opposed to being burdened with excessive record keeping demands. Further, each instructor can retrieve comprehensive summary statistics for their entire class at any time which allows easy evaluation of current performances.

Stock Case: DJIA Case (S&P500 index, DJIA index plus all 30 DJIA stocks)

This is the most popular of the real time cases and has been used for a variety of small group projects. Sample projects are as follows including the major learning objectives associated with each project and specific questions posed in the assignment. *Detailed assignments for some of these projects are included at the end of this document.*

Project A (Finance/Investments Course): How securities are traded, order types, market microstructure and trading mechanisms. Sample questions may ask about the differences between order types, and how margin and short sale deposits work.

Project B (Finance/Investments or Financial Accounting Courses): Market efficiency, technical and fundamental analysis. Sample questions include following macroeconomic and company specific events and monitoring price reactions; describing technical indicators; using fundamental analysis (e.g. dividend models or free cash flow to equity models) to determine the assumptions about growth rates and discount rates that justify the market price and whether these assumptions are reasonable.

Project C (Investments Course): Applying modern portfolio theory and related concepts. These concepts include naïve diversification, Markowitz diversification, beta and single index models. Sample questions range from describing the differences between performance and risk measures (e.g., Sharpe Ratio, Treynor's measure, Jensen's alpha, Information (appraisal ratio), M^2, VAR), to different ways of calculating beta, to efficient portfolio construction with constraints using Excel's Solver. This project can also be done using the exchange traded funds (ETF) cases.

Project D (Valuation Course and Corporate Finance): Intrinsic value (valuation models (1-stage and 2-stage abnormal growth models, dividends and Free Cash Flow to Equity), Cost of Equity Capital. Sample questions would ask whether techniques of fundamental analysis can identify undervalued stocks.

Derivative Cases: Options and Futures

Risk management has seized the center stage in the global economy of today. The FTS derivative cases are designed to both introduce students to this important class of markets as well provide them with unique experience with respect to the positive roles played by derivative markets in today's global economy.

The cost of carry model for arbitrage free pricing is an ongoing theme in the derivative cases (both options and futures). For example, in a stock index futures case students learn how to apply this model to the real world by assessing important inputs such as the financial cost of carry, and dividends. The real time FTS system provides powerful interactive support for both of these carry costs including access to current information that would normally only found in a high end real world trading room. For option cases static replication gives way to dynamic replication and the FTS options real time analytical support that includes the standard "Greeks" including volatility and hedging parameters.

The money market derivative cases cover both Federal Fund Futures as well as Eurodollar Deposit Futures. These case allow students to learn how to bootstrap out Libor yield curves. In addition, students can learn about "monetary policy" which the Federal Reserve Act of 1913 gave the Federal Reserve responsibility. Students can assess from personal experience the performance of the FOMC (Federal Open Market Committee) for influencing target federal fund rates.

Suggested projects include:

Stock Index Futures : Replication and the cost of carry model, how is it implemented and used for hedging general market risk, and basis risk management.

Option Cases: Option Trading Strategies, option pricing, the option "Greeks", managing risk using options

Eurodollar Futures Cases: Bootstrapping a Libor yield curve, financial cost of carry, and how the international money markets work including quotation and day-count conventions.

Federal Fund Futures: Students learn how the three tools of monetary policy--open market operations, the discount rate, and reserve requirements influence the actual and expected supply of and demand for balances that depository institutions hold at Federal Reserve Banks via it's impact upon the federal funds rate.

General Cases

When the federal funds target rate changes or is expected to change, a sequence of events are triggered that impact other markets such as short-term interest rates, foreign exchange rates, long-term interest rates and in fact the economy at large. The real time FTS system lets students observe and learn about this important chain of events from personal experience using the powerful set of analytical support provided. So for example, in a general case that includes a range of derivative markets, forex, treasury and selected ETFs' allow this to happen.

Valuation Cases: Accounting and Finance

The fundamental dividend model underlies all textbook treatments of intrinsic stock values. However, actually implementing this model is hard. Between finance and accounting there are three major approaches adopted to implementing the standard dividend model of stock values. In finance the Free Cash Flow approach is popular and in Accounting two popular approaches are the Residual Earnings and Price-Earnings Ratio Approaches. All three approaches are available in the FTS Real Time Client. In addition, Merton's model for valuing distressed firms is also provided.

Free Cash Flow Approach to Valuation: This implements the basic dividend model by assessing "economic dividends" in terms of Free Cash Flows. Students can work in teams on assessing the intrinsic value of a pair of stocks so that collectively the class has assessed the intrinsic value of a much larger set of stocks for which modern portfolio theory can then be applied to.

Residual Earnings Approach to Valuation: In a financial accounting course the nuances of accrual accounting can be applied to the problem of implementing the dividend model. In this approach the implementation anchors intrinsic value on book value and then adjusts for extra value resulting from forecast residual earnings.

Price Earnings Ratio Approach to Valuation: In contrast to anchoring intrinsic value on book value (a stock concept) this approach anchors on a "flow concept" --- capitalized earnings. It then adjusts for extra value resulting from forecast earnings approach.

Merton's Approach to the Valuation of a Distressed Firm: In today's economy some business entities appear to trade at positive values when their assessed intrinsic value would suggest they have a non positive value! These are also the same firm's whose likelihood of being a going concern have been revised sharply downwards. As a result, they have an assessed shorter life and from a valuation perspective they are more likely to be trading at their option value. The FTS real time client lets students assess the option value of a stock if the firm is judged to be a distressed firm.

Sample Student Support Screens:

This screen shows the student a summary of their current position:

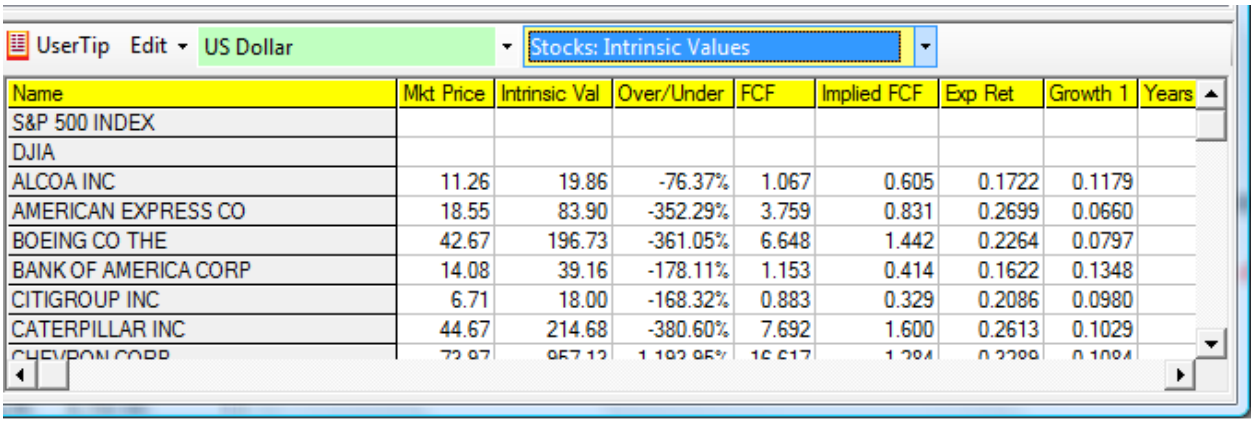
UserTip Edit US Dollar All

Currency	Amount	Borrowed	Credit Left	Buy VWAP	Sell VWAP	Buy Volume	Sell Volu
US Dollar	949,213.31	0.00	50,000.00	0.00	0.00	0.00	
Stocks	Position	Last	Last Value	Weight	Avg Cost	Total Cost	Gain/Lo
ALCOA INC	490	10.07	4,934.30	11.07	10.29	5,042.73	-10
AMERICAN INTL GROUP INC	210	1.54	323.40	0.73	2.91	611.10	-28
AMERICAN EXPRESS CO	133	17.99	2,392.67	5.37	22.69	3,017.77	-62
BOEING CO THE	110	40.15	4,416.30	9.91	42.30	4,653.00	-23
BANK OF AMERICA CORP	275	12.89	3,544.75	7.95	16.15	4,440.75	-89
CATERPILLAR INC	-40	42.53	-1,701.06	-3.82	43.77	-1,750.80	4

The following screen shows analytics, including the computation of portfolio weights of the students position and those that maximize the Sharpe ratio (shown as Weights*) with and without short selling:

		Value	Beta	Volatility	Exp Return	Sharpe	Treynor	Jensen	M2
Overall Position		44,267.34	1.1568	0.0406	0.0980	2.1769	0.0765	0.1848	0.13
Weight* (SS)			0.4740	0.0188	0.0728	3.3607	0.1336	0.1028	0.05
Weight* (no SS)			0.5777	0.0208	0.0766	3.2245	0.1162	0.1153	0.05
Eq Weighted			1.0384	0.0347	0.0936	2.4215	0.0810	0.1706	0.11
Name	Benchmark	Value	Beta	Volatility	Exp Return	Weight	Weight* (SS)	Weight* (no SS)	
S&P 500 INDEX	S&P 500 INDEX	0.00	1.0000	0.0287	0.0928	0.00			
RUSSELL 2000	S&P 500 INDEX	0.00	1.0000	0.0525	0.0928	0.00			
NASDAQ 100 INDEX	S&P 500 INDEX	0.00	1.0000	0.0346	0.0928	0.00			
DOW JONES 30 INDUSTRIALS	S&P 500 INDEX	0.00	1.0000	0.0290	0.0928	0.00			
ALCOA INC	S&P 500 INDEX	3,977.12	1.2400	0.1913	0.1010	0.09	0.0020	0.0001	
AMERICAN INTL GROUP INC	S&P 500 INDEX	156.27	1.6000	0.1545	0.1143	0.00	0.0004	0.0000	
AMERICAN EXPRESS CO	S&P 500 INDEX	1,159.33	1.5600	0.1025	0.1128	0.03	0.0018	0.0000	
BOEING CO THE	S&P 500 INDEX	4,416.30	1.5000	0.0795	0.1106	0.10	0.0057	0.0000	

The next screen shows the support based on a 2 stage free cash flow to equity model. A very important part of the analytical support system is that students can enter and save their own values for any of the parameters used by any of the support. This allows them to see how the inputs affect the values calculated by the support system and also perform 'as-if' analysis.



Name	Mkt Price	Intrinsic Val	Over/Under	FCF	Implied FCF	Exp Ret	Growth 1	Years
S&P 500 INDEX								
DJIA								
ALCOA INC	11.26	19.86	-76.37%	1.067	0.605	0.1722	0.1179	
AMERICAN EXPRESS CO	18.55	83.90	-352.29%	3.759	0.831	0.2699	0.0660	
BOEING CO THE	42.67	196.73	-361.05%	6.648	1.442	0.2264	0.0797	
BANK OF AMERICA CORP	14.08	39.16	-178.11%	1.153	0.414	0.1622	0.1348	
CITIGROUP INC	6.71	18.00	-168.32%	0.883	0.329	0.2086	0.0980	
CATERPILLAR INC	44.67	214.68	-380.60%	7.692	1.600	0.2613	0.1029	
CHEVRON CORP	72.97	957.12	1,193.95%	16.617	1.284	0.2289	0.1084	

Option Case: S&P500 Index, SPY ETF and Selected Index Options (Puts and Calls)

This case permits a range of option related projects to be constructed. A comprehensive real time option support system is provided which includes the option Greeks and Implied Volatility information.

Project A (Options Course or Finance/Investments): Market Microstructure and how option markets work. Sample questions may ask about the differences between order types, how margin and short sale deposits work, how options are settled and exercised.

Project B (Options Course or Finance/Investments: Testing the Efficient Market's Hypothesis using option trading strategies. A sample question would be to evaluate the performance of various option trading strategies, e.g. volatility trades.

Project C (Options Course): Hedging with options. This could range from using the "Greeks" (calculated in real time by the system) to minimum variance hedging using options in presence of basis risk.

Project D (Options Course): Understanding volatility. Our **Volatility Index (VIX) Options and Futures** case lets students learn about the VIX index and implement volatility trading strategies directly.

Sample Student Support Screen

Underlying	Position	Beta	Port Delta	Port Gamma	Port Vega	Port Theta				
S&P 500 INDEX	0	1.00	0.0000	0.0000	0.0000	0.0000				
Beta-Weighted			0.0000	0.0000	0.0000	0.0000				
	Mkt Price	Underlying	Contracts	Size	Imp Vol	Delta	Gamma	Vega	Theta	Intri
SPX DEC 2010 C 950.000	157.00	879.66	0	100	0.4135	0.5137	0.0007	464.3183	-40.0517	
SPX DEC 2010 C 850.000	194.50	879.66	0	100	0.4203	0.5865	0.0007	446.2476	-37.5040	
SPX DEC 2010 C 900.000	152.28	879.66	0	100	0.3676	0.5323	0.0008	461.3780	-34.1394	
SPX MAR 2009 C 850.000	75.00	879.66	0	100	0.3784	0.6001	0.0025	157.8015	-127.0839	
SPX MAR 2009 C 860.000	69.00	879.66	0	100	0.3734	0.5747	0.0025	160.2042	-127.7679	
SPX MAR 2009 C 870.000	68.00	879.66	0	100	0.3980	0.5500	0.0024	161.8840	-138.6127	
SPX MAR 2009 C 880.000	70.00	879.66	0	100	0.4388	0.5304	0.0022	162.7659	-154.8258	
SPX MAR 2009 C 890.000	60.00	879.66	0	100	0.4046	0.5029	0.0024	163.3238	-143.1152	
SPX JUN 2009 C 850.000	99.00	879.66	0	100	0.3727	0.5848	0.0017	230.8734	-82.6575	
SPX SEP 2009 C 850.000	122.00	879.66	0	100	0.3899	0.5816	0.0013	283.7747	-67.6919	

Futures Case: S&P500 Index, SPY ETF and Current E-Mini Futures

This case permits a range of futures related projects to be constructed.

Project A (Futures or Finance/Investments Courses) : How futures markets work, including marking to market, initial and maintenance margins. Sample questions could include tracking how the margin accounts fluctuate with futures positions.

Project B (Futures or Finance/Investments Courses): Testing the Efficient Market's Hypothesis using technical analysis. Various futures related trading strategies could be tested on the system, and a sample question would be to assign a strategy and ask for an evaluation of how it was designed to work and how it performed.

Project C (Futures or Derivatives Courses): Hedging using futures in presence of basis risk. A simple question would be to hedge equity risk on one underlying asset; a more complex project could be to use a small set of futures to hedge the risk of a portfolio of stocks.

Project D (Futures and Investments Course): Index fund investing and moving along the Capital Market Line using futures. The question here could focus on the use of leverage and the resulting risk-return tradeoff.

Sample Student Support Screen

UserTip Edit US Dollar Equity Futures: Analytics

		Actual					Implied			
	Convention	Mkt Price	Underlying	Basis	Risk Free	Div Yield	Price	Underlying	Risk Free	Div Yiel
E-Mini S&P500 March	Actual/360	877.0000	879.5800	2.5800	0.5125%	3.1600%	874.4698	882.1249	1.8233%	1.849
E-Mini S&P500 June	Actual/360	868.0000	879.5800	11.5800	0.8232%	3.1600%	869.8741	877.6849	0.3720%	3.611
E-Mini Nasdaq100 March	Actual/360	1,191.2500	1,191.7900	0.5400	0.5125%	0.8600%	1,190.8810	1,192.1590	0.6535%	0.719
E-Mini Nasdaq100 June	Actual/360	1,185.2500	1,191.7900	6.5400	0.8232%	0.8600%	1,191.5830	1,185.4560	-0.3021%	1.985
ETF SPY March	Actual/360	86.8400								
ETF SPY June	Actual/360	86.4700								
ETF QQQ March	Actual/360	29.7400	29.2800	-0.4600	0.5125%	0.8600%	29.2577	29.7627	8.0191%	-6.646
ETF QQQ June	Actual/360	29.0000	29.2800	0.2800	0.8232%	0.8600%	29.2749	29.0050	-1.1651%	2.848

Spot Currency Markets

This case is designed to introduce your students to currency markets including the language of the currency markets (American, European, Direct and Indirect quotation conventions.

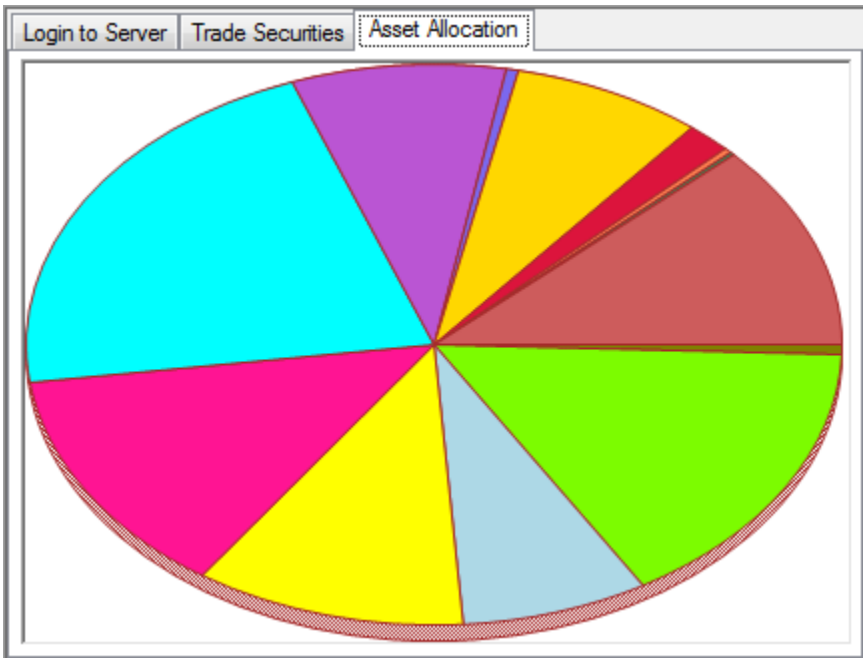
Project A (Finance and International Finance): Market Microstructure and the how the currency markets work.

Project B (Finance and International Finance): Testing the Efficient Market's Hypothesis using technical and fundamental support including central bank projections.

Sample Student Support Screens include showing the value in the base currency (here, US Dollars) as well as their asset allocation in real time:

UserTip Edit Global

Currency	Value	Base Value
Global Value		7,559,668.90
US Dollar	1,000,058.13	1,000,058.13
Euro	1,000,416.75	735,492.37
Yen	100,005,840.00	1,074,753.75
Canadian Dollar	1,000,694.56	828,663.93
Aussie Dollar	1,000,694.56	1,405,667.32
Switzerland Franc	1,000,416.75	904,863.20
Czech Koruna	1,000,694.56	50,954.46
Great Britain Pound	1,000,694.56	688,993.79
Hong Kong Dollar	1,000,694.56	129,051.94



International Finance: Covered and Uncovered interest rate parity

This case is designed to introduce your students to currency markets including the language of the currency markets (American, European, Direct and Indirect quotation conventions.

Project A: Market Microstructure and the how the currency futures markets work.

Project B: Testing the Efficient Market's Hypothesis using technical and fundamental support including central bank projections and carry trading.

Project C: Hedging currency risk using futures. This project gets students to implement the cost of carry model and performance reports are provided by the FTS system.

Interest Rate Futures

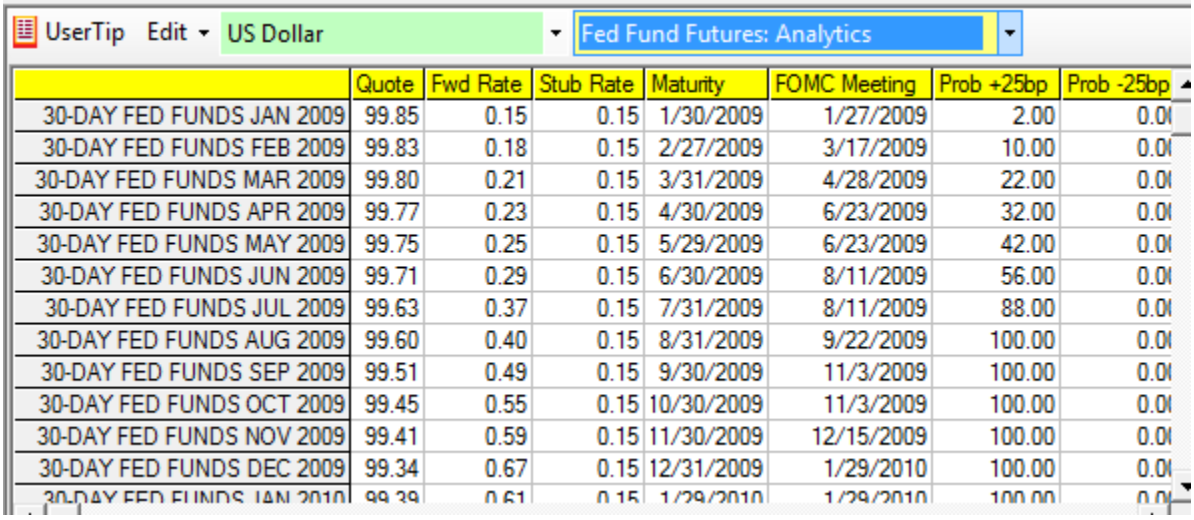
Real Time Bootstrapping of the Libor yield curve from Eurodollar futures

UserTip Edit US Dollar Deposit Futures: Analytics

	Quote	Fwd Rate	Maturity	Stub Rate	Implied Rate
ED Futures March 2009	98.97	1.04	3/16/2009	0.44	0.77
ED Futures June 2009	98.92	1.08	6/15/2009	0.77	0.88
ED Futures September 2009	98.80	1.20	9/14/2009	0.88	0.97
ED Futures December 2009	98.65	1.35	12/14/2009	0.97	1.05
ED Futures March 2010	98.52	1.49	3/15/2010	1.05	1.13
ED Futures June 2010	98.30	1.71	6/14/2010	1.13	1.22
ED Futures September 2010	98.13	1.87	9/13/2010	1.22	1.30
ED Futures December 2010	97.91	2.10	12/13/2010	1.31	1.40
ED Futures March 2011	97.79	2.21	3/14/2011	1.40	1.49
ED Futures June 2011	97.67	2.33	6/13/2011	1.49	1.58
ED Futures June 2012	97.41	2.60	6/18/2012	1.76	1.83
ED Futures June 2013	97.26	2.75	6/17/2013	1.99	2.04
ED Futures June 2014	96.97	3.04	6/16/2014	2.18	2.23
ED Futures June 2015	96.74	3.26	6/15/2015	2.37	2.42
ED Futures June 2016	96.64	3.36	6/13/2016	2.54	2.59
ED Futures June 2017	96.58	3.42	6/19/2017	2.71	2.75
ED Futures September 2017	96.59	3.42	9/18/2017	2.75	2.79
ED Futures September 2018	96.57	3.43	9/18/2018	2.89	2.93

Federal Funds Futures and Probability of Federal Fund interest changes.

Sample Student Support Screen



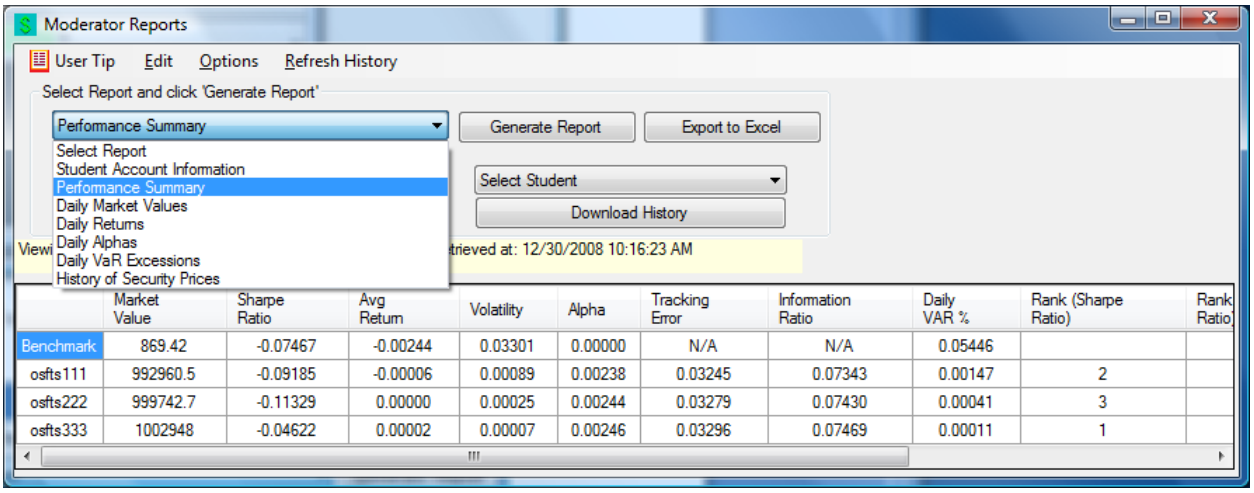
	Quote	Fwd Rate	Stub Rate	Maturity	FOMC Meeting	Prob +25bp	Prob -25bp
30-DAY FED FUNDS JAN 2009	99.85	0.15	0.15	1/30/2009	1/27/2009	2.00	0.0
30-DAY FED FUNDS FEB 2009	99.83	0.18	0.15	2/27/2009	3/17/2009	10.00	0.0
30-DAY FED FUNDS MAR 2009	99.80	0.21	0.15	3/31/2009	4/28/2009	22.00	0.0
30-DAY FED FUNDS APR 2009	99.77	0.23	0.15	4/30/2009	6/23/2009	32.00	0.0
30-DAY FED FUNDS MAY 2009	99.75	0.25	0.15	5/29/2009	6/23/2009	42.00	0.0
30-DAY FED FUNDS JUN 2009	99.71	0.29	0.15	6/30/2009	8/11/2009	56.00	0.0
30-DAY FED FUNDS JUL 2009	99.63	0.37	0.15	7/31/2009	8/11/2009	88.00	0.0
30-DAY FED FUNDS AUG 2009	99.60	0.40	0.15	8/31/2009	9/22/2009	100.00	0.0
30-DAY FED FUNDS SEP 2009	99.51	0.49	0.15	9/30/2009	11/3/2009	100.00	0.0
30-DAY FED FUNDS OCT 2009	99.45	0.55	0.15	10/30/2009	11/3/2009	100.00	0.0
30-DAY FED FUNDS NOV 2009	99.41	0.59	0.15	11/30/2009	12/15/2009	100.00	0.0
30-DAY FED FUNDS DEC 2009	99.34	0.67	0.15	12/31/2009	1/29/2010	100.00	0.0
30-DAY FED FUNDS JAN 2010	99.39	0.61	0.15	1/29/2010	1/29/2010	100.00	0.0

Exchange Traded Funds Cases

We offer two ETF cases. The first has 13 sector ETF's (the DOW Jones US Sector Funds) while the second has 45 international ETF's. Both these allow for projects with realistic, but still manageable, ivestment opportunities. In particular, the portfolio theory project is well suited to these cases.

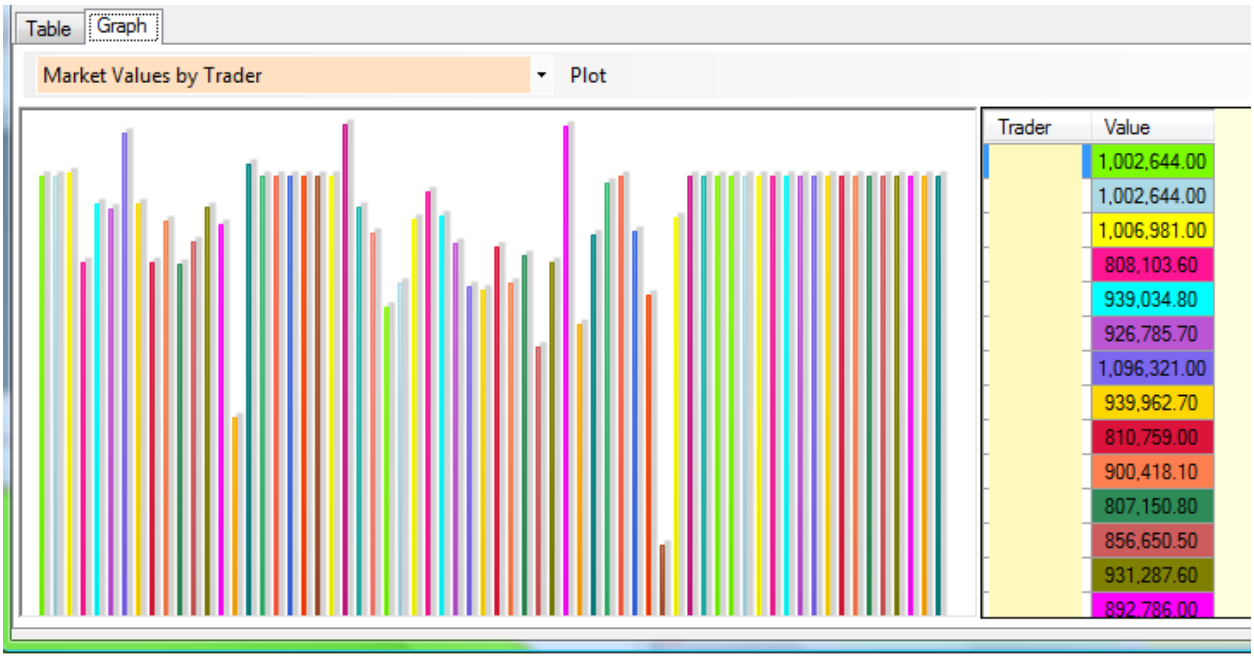
Reports Available to the Instructor/Moderator

The moderator reports menu item download the performance of each student in your section, and allows you to generate a variety of reports. These reports are available to you at any time; simply log in using your moderator trading name and password.

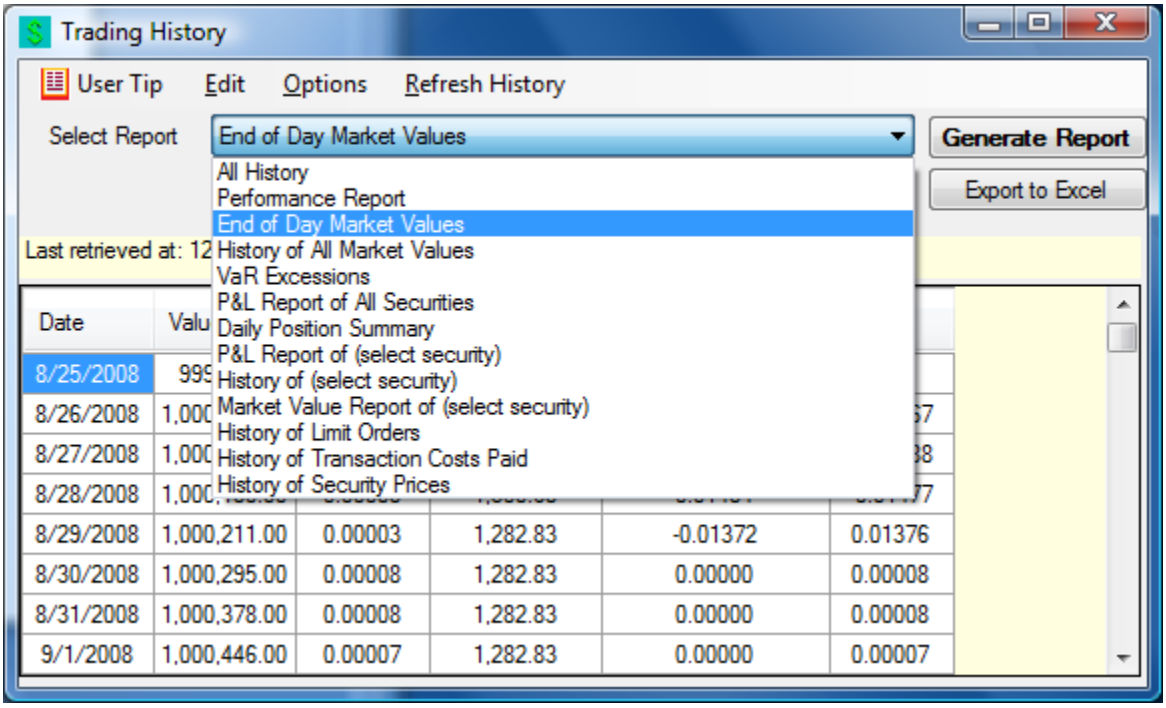


	Market Value	Sharpe Ratio	Avg Return	Volatility	Alpha	Tracking Error	Information Ratio	Daily VAR %	Rank (Sharpe Ratio)	Rank
Benchmark	869.42	-0.07467	-0.00244	0.03301	0.00000	N/A	N/A	0.05446		
osfts111	992960.5	-0.09185	-0.00006	0.00089	0.00238	0.03245	0.07343	0.00147	2	
osfts222	999742.7	-0.11329	0.00000	0.00025	0.00244	0.03279	0.07430	0.00041	3	
osfts333	1002948	-0.04622	0.00002	0.00007	0.00246	0.03296	0.07469	0.00011	1	

A sample graphical display of student market values, available to you anytime, is shown next (we have hidden the names of the traders since this is taken from an actual run).



You can also download the history of any student in your section, and that gives you access to all student reports, which include:



FTS DOW School Case (DJIA Stocks) Project: How Securities Are Traded

Question: How are stocks traded in the secondary markets?

Stocks are first issued in a "Primary Market," for example through an IPO (initial public offering). Once issued, they are traded in "Secondary Markets." These include organized exchanges such as the New York Stock Exchange (NYSE) and over-the-counter (OTC) markets. In any of these markets, buyers and sellers negotiate a price through a process called *price discovery* and then trade at the negotiated price. For example, on the NASD, price discovery is initiated by dealers who post bids and offers. On the NYSE, price discovery is initiated by investors, but orders above a certain size are matched by a specialist who can also trade on their personal account. Other markets, referred to as third and fourth markets, trade exchange listed securities and are pure order driven markets, where price discovery is initiated by investors and all matching of buyers and sellers is via an electronic network.

Common to these markets are various order types. The two most popular are **market orders**, and **limit** orders. Market orders are "buy" or "sell" orders for a specified quantity at the best currently available prices (the highest current bid and the lowest current ask). In a **limit order** traders specify both the price and quantity they want to trade. A buy order is executed if the ask drops to the price, and a sell order is executed if the bid rises to the price. A variation known as a **stop order** lets traders lock in profits or limit losses on existing positions.

Two other important institutional details are known as **short sales** and **buying on margin**. Short sales allow traders to sell securities they do not currently own. To sell short, a trader is required to borrow the securities from a broker and then sell the borrowed security; when they cover their short position, the shares have to be returned. When buying on margin a trader borrows money from a broker to buy the stock. Interest is charged on the loan, and has to be repaid when the stock is sold. If the value of the stock falls sufficiently, the broker can make a margin call, which requires the trader to either deposit more money or sell the stock.

The FTS Real Time Client allows you to implement these orders using real world institutional details. Limit and stop orders are automatically monitored by the system in real time and all positions are marked-to-market twice daily; the marking to market can trigger off automatic cash transfers to cover margin calls. All the accounting is performed automatically for you and the details of this accounting are available at any time via the "Reports" menu item.

In this project you will learn how stocks are traded in the secondary markets and the details of these order types using the DJIA stocks. To keep things interesting you will first form a simple price view for three stocks in the DJIA index. A view is simply whether you expect a particular stock to increase or decline in price. You can form your view in any way, e.g. thinking about short term economic trends, looking at some price charts, or even just flipping a coin if nothing else leads to a prediction. In practice,

traders use many methods to develop their views, including technical analysis, news, and fundamental analysis. In this project, it does not matter whether your view is correct.

Given your price view for the three stocks, complete the following five steps:

1. On day 1 implement the following trades for the three stocks: Cash Purchase, Margin Purchase and Short Sal, each for at least 100 shares in each stock.
2. After 5 days (or longer), close out the transactions implemented on day 1. That is, reverse your trades by conducting a Cash Sale, Margin Sale and Short Cover respectively so you are now left with no stocks either short or long.
3. Your cash account has now either increased or decreased over this time period. In this step, reconcile how the transactions above changed your total cash. Pay particular attention to interest paid on margin and short sale accounts and any margin calls.
4. Next, implement a limit order/stop order strategy. Given your price view of three stocks, implement the following three trades: Limit Cash Purchase, Limit Margin Purchase and a Limit Short Sale. After you observe your limit orders have been executed then you should also put on the following "Stop Loss" trades – Stop Cash Sale, Stop Margin Sale and Stop Short Cover. If you want to you can enter all these at the same time.
    - Note: For part 4 you should track recent price changes for the three stocks so that your limit orders are placed at prices that have a reasonable chance of being executed. Your goal for a limit order is to purchase or sell at a better price than is currently available. Your goal for a stop (loss) order is to sell or cover a previous sale at a price that is worse than the current price – hence the term "stop loss." Of course the "stop loss" may imply stopping the loss of a profit if prices have moved in your favor!
5. After you have successfully completed step 4 you have again cashed out of the three trades. Again your cash has either increased or decreased relative to what it was at the beginning of step 4. In this step you are required to reconcile how your transactions in step 4 changed your total cash.

After completing the above 5 steps, you will have gained important experience and understanding of order types and how they are implemented and executed.

FTS DOW School Case (DJIA Stocks) Project: Technical Analysis

Question: What is the profitability of technical analysis and how does this relate to the weak form of the efficient market hypothesis?

Irwin and Park (Journal of Economic Surveys, 2007) documented the following: *"Among a total of 95 modern studies, 56 studies find positive results regarding technical trading strategies, 20 studies obtain negative results, and 19 studies indicate mixed results. Despite the positive evidence on the profitability of technical trading strategies, most empirical studies are subject to various problems in their testing procedures, e.g. data snooping, ex post selection of trading rules or search technologies, and difficulties in estimation of risk and transaction costs."*

In this project you will test the weak form of the efficient market hypothesis (EMH) under conditions that do not suffer from these deficiencies, by completing the following five steps:

1. Identify a short term technical trading strategy that you are interested in testing out using any subset of the Dow Jones Industrial Index (DJIA) stocks (see below for an example).
2. Identify stocks from the DJIA stocks that currently generate buy or sell signals given your trading strategy (i.e., are in the market relative to your trading strategy)
3. Implement your technical trading strategy using the Real Time FTS Client. This step controls against the deficiencies raised above in relation to existing technical analysis studies because the strategy is implemented *ex ante* using the real time prices in a manner that you cannot manipulate after the event.
4. Analyze your trading strategies using the reporting capabilities of the real time FTS Client; you can perform further analysis using the "export to Excel" feature of the FTS Real Time Client.
5. Answer the following question: How profitable was your technical trading strategy when implemented ex ante using the FTS Real Time Client over the time period tested? Is this result consistent or inconsistent with the weak form of the efficient markets hypothesis? Note: You should first define what the weak form of the EMH is and then compare your realized trading results with what you predict under the weak form of the efficient market hypothesis.

Example: There are many technical trading strategies. For this exercise, you should review and assess whether or not a strategy is currently in the market with respect to some subset of the DJIA stocks. Some strategies are always in the market. For example, a simple strategy that is always in the market buys and sells when the n-day moving average crosses over the slower moving (n+m)-day moving average. This is always in the market because whenever one trade is exited (say a long position is sold) a new opposite trade is initiated (a short position is taken in the same security). Examples of this strategy may contrast the n=100 to the n+m=350 day averages, or in a short term form the n=7-to the n+m=25-trading day moving averages. You can compute these averages for any stock at different financial web sites (the FTS real time client provides automatic links to several popular sites). Even better, you can download historical data and compute the strategy yourself in a spreadsheet.

FTS DOW School Case (DJIA Stocks) Project: Efficient Markets with Public Information

Question: What is the profitability of trading on public information and how does this relate to the semi-strong form of the efficient market hypothesis?

Public information comes in many forms including economy wide information that affects all stocks, firm specific information that affects an individual stock and its competitors. The semi-strong form of market efficiency can be assessed relative to public information by studying both forecasts and realizations of events. When testing sources of public information, you must be careful to guard against biases that arise from data snooping, ex post selection and manipulation of information, ignoring transaction costs and risk.

The objective of this project is to become acquainted with some of these issues using the FTS DOW School case. You will test the semi-strong form of the efficient market hypothesis (EMH) under conditions that do not suffer from the biases listed above. To do so, complete the following five steps:

1. Identify a source of public information that you are interested in testing using any subset of the DJIA stocks. Be careful to identify whether this source is firm specific or economy wide, and whether or not it involves a forecast and/or a realization of an event.
2. Form a short term view for your subset of stocks and translate this view into a trading strategy.
3. Implement your trading strategy using the Real Time FTS Client. This may include exploiting both limit and stop order capabilities of the FTS Real Time client. This step controls against the biases raised above, because your strategy is implemented *ex ante*.
4. Analyze your trading strategies using the reporting capabilities of the real time FTS Client including additional analysis using Excel and the data export capabilities of the FTS Real Time Client.
5. Answer the following question: How profitable was your trading strategy when implemented over the time period tested? Is this consistent or inconsistent with the semi-strong form of the efficient markets hypothesis? Note: You should first define what the semi-strong form of the EMH is and then compare your realized trading results along important predicted dimensions of this hypothesis. Although you are constrained by the time horizon of the project you should consider the nature and speed of the market adjustment, whether or not the short term market reaction is consistent with your view and how to assess whether a risk adjusted return was earned.

Example:

A good starting place is to work from the pre-assigned links in the FTS Real Time Client by double clicking on any of the stock tickers to check current firm specific events and forecasts and then extend your search by using key words like “Economic Calendar, Forecasts” using a search engine or other sources you have access to. You will soon be immersed in a very large amount of public information.

FTS DOW School Case (DJIA Stocks) Project: Portfolio Diversification

Note: this project requires use of Excel's Solver

Question: How do you create a diversified stock portfolio?

Advice given by most financial advisors is to not put all your eggs in one basket, i.e. to diversify, meaning that you hold several different stocks. The reasoning behind this is simple; if you hold one stock or very few stocks, you can either do very well and very poorly. By diversifying, you can reduce the chances of extreme outcomes, and thus reduce the risk of your portfolio; of course, you typically also affect the return you expect to get. How much you diversify typically depends on your risk aversion; the more you dislike risk, the more you would like to diversify.

Modern portfolio theory provides a technique for both measuring risk and return and determining the best way to diversify. In this project, you will learn to use Excel's Solver to create an "optimal" diversified portfolio. The details of modern portfolio theory are described in most investments textbooks, and will not be given here; instead, we will focus on the implementation, though we will need the following terminology.

Background

Let w_i denote the proportion of your money invested in stock i. So if your total investment is $1m, you hold 1000 shares of stock i, and the price of stock i is 25, then $w_i = 0.025$, i.e. you have invested 2.5% of your money in stock i. w_i is also called a *portfolio weight*. Since there is a direct relationship between the number of shares and the weight, once you have determined the weight, you can easily calculate the number of shares you must hold (given the price and the total investment).

Let $E(r_i)$ denote the expected return from stock i. This is usually measured annually, so $E(r_i)=10\%$ means you expect the stock to return 10% over the year. There are many ways to estimate the expected return; stock analysts use techniques involving historical data, fundamental analysis, and scenario analysis. Values based on the CAPM are provided by the FTS Real Time Client, though you can override them via the "Parameters" menu item. Given the portfolio weights, the expected return of the portfolio is:

$$ER(w) = \sum_i w_i E(r_i)$$

Finally, we need to describe risk. Modern portfolio theory uses the variance of returns as a measure of risk (or equivalently, the standard deviation, which is also referred to as volatility). To calculate the risk of a portfolio, you also need the covariances between stock returns. In notation, let σ_{ij} denote the

covariance between the returns of stocks i and j, so σ_{ii} is the variance of the return of stock i. Then, given the portfolio weights, the variance of the portfolio return is:

$$\sigma^2(w) = \sum_i \sum_j w_i w_j \sigma_{ij}$$

The FTS Real Time Client calculates all the covariances for you. The portfolio selection problem is to find weights that minimize the variance subject to some constraints. The first is that the sum of the weights equals 1; this simply means that you invest all the money you have allocated to stocks. The second is that the expected return from the portfolio equals your desired return. Beyond that, you can impose more conditions. For example, you may restrict short selling, either completely, which says $w_i \geq 0$. Or you may require that you will not invest more some amount in any one stock; this says $w_i \leq 0.1$. Common constraints for this case, which has 30 stocks, would be that you do not invest more than 15% in any one stock, and if there is no short selling, that you invest at least 2% in every stock.

Project

The objective of this project is to learn to apply modern portfolio theory by constructing portfolios, implementing the recommended portfolio, and tracking its performance over time. This is done by completing the following steps, and includes learning how to use Solver to calculate the portfolio weights.

1. From the RT Client, select "Covariances and Returns" in the Analytics area (at the bottom right); you will see your portfolio weights and the expected returns and covariances of all the stocks. In the Edit menu of the Analytics area, select "Export to Excel." This will transfer the data into an Excel spreadsheet.
2. Decide on a target expected return. This could be a number you pick, e.g. 7%, or you could be guided by the past return of an index such as the S&P500, or the yield on Treasury bonds.
3. Choose what constraints you want to impose. You may want to consult your investments text (e.g. the chapter on Optimal Risk Portfolios in the text by Bodie, Kane, and Marcus) for suggestions.
4. In your spreadsheet, implement the formulas for calculating the portfolio's expected return and variance. You may want to use the SUMPRODUCT function in Excel as well as its matrix multiplication functions.
5. Run Solver, define the objective (which is to minimize the variance) and the constraints (the two basic constraints plus additional constraints you chose), and calculate the portfolio weights. Note that if your constraints are unreasonable, there may not be a solution.
6. Implement your trading strategy using the Real Time FTS Client. This means that you have to take the weights and using current prices, calculate the number of shares of each stock to buy (or sell).
7. Wait a week. At that point, your actual portfolio weights will have changed because stock prices will have changed. You now have to decide whether you want to "rebalance" your position.

This means buying or selling to get back to the weights you had originally calculated. Or you may want to repeat steps 1-6 again since some of the return and covariance estimates may have changed. Note that the decision to rebalance is not that simple, since buying and selling stocks will incur a transaction cost; so if your weights are not too far from where they should be, you may want to wait to rebalance.

8. After a few weeks, answer the following questions: What was the risk and return of your portfolio over the time horizon? Did it conform to what was expected? Did you have to rebalance frequently? You should calculate the realized return, the volatility of your returns, and the Sharpe ratio for your portfolio, and compare these to the S&P 500.