



FTS Real Time System Project: Are there Exploitable Arbitrage Opportunities with Stock Index Futures

Question: Given your understanding of index futures prices and the cost-of-carry model for futures pricing, can you make money by trading e-mini index futures and their underlying ETF proxies?

Stock Index Futures Small Group Project: Objectives

The objective of this project is to build upon the earlier projects where you learned how to apply the cost of carry model to estimate the price of a stock index future and refine your use of the cost of carry model when applied to the e-mini futures defined on the S&P500 and Nasdaq 100 indexes. The objective of this project is to apply this knowledge to test the assumption that the real world prices are arbitrage free.

In this assignment you will construct an approximate replicating position by taking a position simultaneously in the futures and the underlying ETF's. In the real world a perfect replication is not possible because the ETF only approximates the performance of the underlying index. That is, you face basis risk. But the question that remains is whether in the presence of basis risk and transaction costs (for example, the bid/ask spread), whether pricing differences and exploitable opportunities exist in the e-mini stock index futures and ETF markets.

A Note on Basis Risk:

Basis risk in finance is the risk that arises whenever the tradable underlying for a derivative contract is only correlated to the underlying used for settlement. Whenever this correlation is less than 100% there exists basis risk. In this current assignment basis risk arises because the SPY and QQQQ are less than perfectly correlated to the S&P500 and Nasdaq 100 indexes.

Basis is defined as the amount by which the two prices differ:

Basis = Spot price of hedged asset - Futures price of contract

And basis risk is the volatility of the basis.

To what degree the ETF and the index it mimics are correlated is an empirical question. You are encouraged to explore this question using Excel. In the FTS Real Time Client you have access to recent end of day prices for each of the derivative contracts in the trading exercise. This lets you run statistical analyses in Excel to assess the correlation among the contracts. In addition, in Yahoo finance you have access to a large amount of historical price data for the ETF's (SPY, QQQQ) and the respective indexes (S&P500, Nasdaq 100). The Yahoo prices will allow a comprehensive examination of basis risk to be conducted.

To do this you should first download the price history to Excel (Yahoo supports this directly), convert to returns ((End-of-Period Price - Beginning Period Price)/Beginning Period Price), and using the correlation or regression functions in Excel.

Cost-of-Carry model Applied to Create a Replicating Position

Mathematically this model is presented in one of three forms that differ in terms of the unit of measure for its inputs:

$$\begin{aligned} F &= S(1+(r+c-d)T) && \text{for simple interest rates} \\ F &= S e^{(r+c-d)T} && \text{for continuous compounding rates} \\ F &= S (1+r+c-d)^T && \text{for discrete time compounded rates} \end{aligned}$$

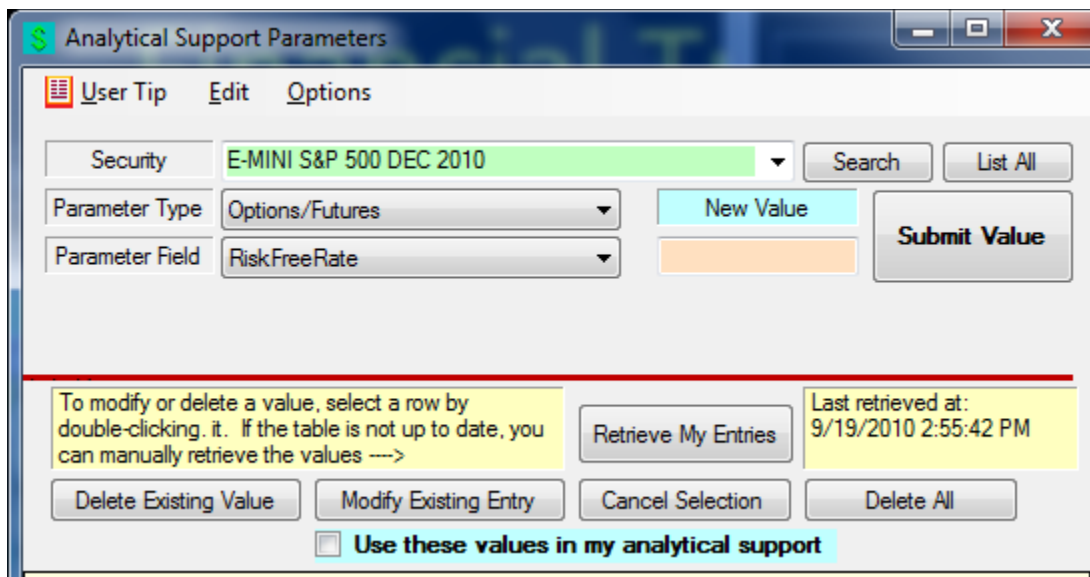
Where F is the future price, S is the spot index price, r is the risk-free rate (financial carry cost), c is the cost of carry arising from physical storage, d is the dividend yield and T is the time to maturity. For stock index futures $c=0$.

You should use the interactive support system provided in the FTS Real Time Client to identify and implement your trading strategy.

		Actual					Implied				
	Convention	Mkt Price	Underlying	Basis	Risk Free	Div Yield	Price	Underlying	Risk Free	Div Yield	
E-MINI S&P 500 DEC 2010	Actual/360	1,119.5000	1,125.5900	6.0900	0.2904%	2.1500%	1,120.4150	1,124.6700	-0.0385%	2.4789%	
E-MINI S&P 500 MAR 2011	Actual/360	1,114.7500	1,125.5900	10.8400	0.4106%	2.1500%	1,115.8010	1,124.5300	0.2239%	2.3367%	
E-MINI S&P 500 JUN 2011	Actual/360	1,106.5000	1,125.5900	19.0900	0.4756%	2.1500%	1,111.4020	1,120.6250	-0.1030%	2.7286%	
E-MINI NASDAQ 100 STK IDX DEC 2010	Actual/360	1,952.2500	1,955.8300	3.5800	0.2904%	0.7500%	1,953.6080	1,954.4710	0.0096%	1.0308%	
E-MINI NASDAQ 100 STK IDX MAR 2011	Actual/360	1,952.5000	1,955.8300	3.3300	0.4106%	0.7500%	1,952.5110	1,955.8190	0.4095%	0.7512%	
E-MINI NASDAQ 100 STK IDX JUN 2011	Actual/360	1,861.2500	1,955.8300	94.5800	0.4756%	0.7500%	1,951.7900	1,865.1030	-5.6739%	6.8995%	

The interactive Parameters menu item allows you to override the default inputs with your personal inputs.

Step 1: Click on the Parameter menu item:



Step 2: Select the futures contract you wish to work with and enter you values in the text box below “New Value” then click on submit Value.

Step 3: You can toggle between using your inputs and the FTS inputs by checking/unchecking beside the “Use these values in my analytical support.”

Constructing the Replicating Position

In each of the above equivalent forms, the left hand side is the derivative contract and the right hand side identifies the synthetic or replicating position using the spot markets. You trading strategy attempts to simultaneously buy low and sell high.

Example

Suppose $F < S e^{(r+c-d)T}$

Now you would attempt to buy the future and sell the equivalent amount of the ETF and vice versa if the F is greater than the right hand side.

Project Requirements:

All projects should contain a cover sheet that list the full name of each team member.

Required questions:

- (1) Describe operationally how you identified and implemented trades that were designed to buy low and simultaneously sell high.
- (2) Provide the results of trading activity.
- (3) Given 1) and 2) discuss the main question asked in this assignment. That is, are there exploitable opportunities in the e-mini futures/ETF markets?