



## FTS Real Time System Project: Stock Index Futures

**Question:** How are stock index futures traded?

In a recent Barron's article (September 20, 2010) titled "Futures Are the New Options" it was noted that there has been an increasing trend for investors to trade futures. The article stated: "Now nearly half of the firms in Barron's review of online brokers allow futures trading. There's more to come."

In this sequence of FTS Real Time exercises, you will learn about futures trading in theory and in practice. Although the Barron's article plays up both the leverage and speculative sides of futures trading, futures also provide a powerful tool for controlling risk. Understanding this dimension of futures trading requires understanding the theory underlying futures prices. The FTS Real Time Trading client takes you beyond just learning how to trade futures by providing a powerful interactive analytical support system designed to teach the following.

First, you will learn how futures markets work from an institutional perspective. Second, you will learn how to apply the theoretical model of futures pricing to the real world markets. Third, you will assess how well this model describes real world futures prices. Fourth, you will learn about using this model to identify and exploit arbitrage opportunities (if they exist). Finally, you will learn how to exploit your knowledge of futures markets to manage the risk of a portfolio.

In this first exercise, you will learn about the institutional details associated with futures markets in the context of the E-Mini futures defined on the S&P500 and NASDAQ 100 indexes.

**Background: Stock Index Futures Contracts**

## **Non-Tradable Underlying Asset for Future's Contracts**

Stock index futures contracts are settled to underlying stock indexes. These indexes are non-tradable indexes and examples are the S&P500 and Nasdaq 100 stocks. The S&P500 index is an index maintained by Standard and Poor's and is a value weighted index constructed from the 500 largest US public companies as selected by a committee (i.e., not a rules based selection criteria). The NASDAQ-100 index on the other hand, is a stock market index of 100 of the largest non-financial companies listed on the NASDAQ. It also differs from the S&P500 index in terms of being a "modified market value-weighted index." That is, the companies' index weights are value weighted along with certain rules capping the largest components. It can also include companies that are incorporated outside of the United States. Thus, these two indexes provide very different underlying assets for settling the futures contracts.

## **Tradable Proxy for the Stock Index**

Exchange-traded funds (ETF) provide a tradable proxy for the stock index. A stock index ETF is a portfolio that is designed to replicate or mimic a stock index. For example, the SPY is an ETF constructed to mimic the S&P 500. The QQQQ is designed to mimic the Nasdaq 100. These ETF's can be traded in real time and represent liquid tradable proxies for the non-tradable underlying indexes.

## **Stock Index Futures**

The e-mini index futures defined on the S&P 500 index have a ticker symbol "ES" and these futures are traded on the Chicago Mercantile Exchange's Globex electronic trading platform. The notional value of one contract is US\$50 times the value of the S&P 500 stock index.

The e-mini index futures defined on the Nasdaq 100 index have a ticker symbol "NQ" and these futures are traded on the Chicago Mercantile Exchange's Globex electronic trading platform. The notional value of one contract is US\$20 times the value of the Nasdaq 100 stock index.

## **Quotation Convention**

Futures quotation follows a quotation convention that quotes relative to \$1 as opposed to \$50 so the simple rule for figuring out your contractual obligation is to multiply the futures price by \$50 if it is an e-mini future defined on the S&P500 or \$20 if defined on the Nasdaq 100. The quoted Ask price for an e-mini S&P500 index future appears as an index number (e.g., 1132.00). However, if you buy at this Ask then your contractual obligation is  $\$50 * 1132.00 = \$56,600$ .

To understand how much cash is exchanged requires introducing the practice of buying on margin.

## Buying on Margin

In the FTS Real Time Client you will see contractual details:

EquityFutures	Name	Initial Long Position	Mark to Market Ticker	Initial Margin	Maintenance Margin
	E-MINI S&P 500 DEC 2010		ESZ0	0.05	0.04
	E-MINI S&P 500 MAR 2011		ESH1	0.05	0.04
	E-MINI S&P 500 JUN 2011		ESM1	0.05	0.04
	E-MINI NASDAQ 100 STK IDX DEC 2010		NQZ0	0.05	0.04
	E-MINI NASDAQ 100 STK IDX MAR 2011		NQH1	0.05	0.04
	E-MINI NASDAQ 100 STK IDX JUN 2011		NQM1	0.05	0.04

This will be current to when the trading exercise is running. It contains the name, the ticker symbol and margin information. The ticker contains both settlement month and year information. For example, NQZ0 = Nasdaq 100 e-mini futures, December settled 2010. In the above you can see that H is March and M is June.

Recall from the introduction above that futures trading provides investors with a lot of leverage. This is because the initial margin is 5% (expressed as a decimal above) and the maintenance margin is 4%. That is, to buy 1 contract only requires having cash equal to 5% of the \$ amount controlled by the contract (\$50\*S&P500 Index or \$20\*Nasdaq 100 index). However, you have to maintain at least 4% in margin cash thereafter which means that as the underlying fluctuates you will receive cash if it is a favorable fluctuation or pay more cash if it is unfavorable. Positions are marked once a day on the FTS system and if your margin account is below 4% at the time of marking cash will automatically be transferred to your margin account to bring it back to 5%. If you have at least 4% at the time of marking then no transfer is required.

What happens if I do not have enough cash?

Like the real world you are stopped from trading that security. If you completely run out of cash then you are blocked from any trading unless your instructor requests that account is reset. Thus like the real world you do not want to run out of cash and thus you should trade futures responsibly.

EquityFutures	Maintenance Margin	Underlying Asset	Cash or Script Settlement	Maturity	Interest Rate	Dividend Yield	Interest Rate Convention	Margin Type
	0.04	S&P 500 INDEX	Yes	12/17/2010 12:00:00 AM	0.00290427935691939	0.0215	Actual/360	Percentage
	0.04	S&P 500 INDEX	Yes	3/18/2011 12:00:00 AM	0.00410642511856851	0.0215	Actual/360	Percentage
	0.04	S&P 500 INDEX	Yes	6/17/2011 12:00:00 AM	0.00475576617498641	0.0215	Actual/360	Percentage
	0.04	Nasdaq-100 Index	Yes	12/17/2010 12:00:00 AM	0.00290427935691939	0.0075	Actual/360	Percentage
	0.04	Nasdaq-100 Index	Yes	3/18/2011 12:00:00 AM	0.00410642511856851	0.0075	Actual/360	Percentage
	0.04	Nasdaq-100 Index	Yes	6/17/2011 12:00:00 AM	0.00475576617498641	0.0075	Actual/360	Percentage

Additional fields in the security support are (generic example):

First, the maturity dates are provided for each contract, 12/17/2010 for the December futures.

The screenshot shows a trading software interface with the following components:

- Navigation tabs: Login to Server, Trade Securities, Asset Allocation
- Menu: User Tip, Edit, Limit Orders, Quote Window
- Search section: "Enter part of a ticker name and click Search, or double click on the ticker in the Quote or the Ticker Definition". Search input: "ESZ0". Search button: "Search".
- Order entry section: "E-MINI SP 500 DEC 2010 in US Dollar". Order type: "Buy on Margin". Quantity to Buy: "1". Submit Order button.
- Quote Table (Right):
 

	E-MINI S&P 500 DEC 2010	US Dollar	US Dollar
Position Value	2,817.50	Cash Position	997,275.06
Position	1	Cash Borrowed	0.00
Futures Obligation	-56,587.50	Credit Remaining	100,000.00
Margin Deposit	2,817.50	Borrowing Rate	0.6450%
Percentage	4.98	Lending Rate	0.1450%
Gain/Loss	-12.50	Buy VWAP	0.0000
Init. Margin Posted	2,830.00	Sell VWAP	0.0000
Margin Calls	0.00	Buy Volume	0.00
Buy VWAP	56,600.00	Sell Volume	0.00
Sell VWAP	0.00		
Buy Volume	1.00		
Sell Volume	0.00		
Contract Size	50		
Maturity Date	12/17/2010		

In the above suppose the futures price is 1132 and 1 contract is purchased. The initial margin posted is 5% of  $1132 * \$50 = \$2830$  (Init Margin Posted). The Margin Deposit is the current cash value of your initial margin deposit. In the above screen this is  $2,830 - 12.50 = \$2,817.50$  because there was a 1 tick adverse price movement since buying at the Ask and being currently valued at the last traded price. For an e-mini futures contract  $0.25 * \$50 = \$12.50$  is 1-tick. The current futures obligation in the above screen has changed by 1-tick and equals:  $\$50 * 1132 = \$56,600 - \$12.50 = \$56,587.50$ . Position equals 1 contract (long). The Percentage is a number relevant to when the position is marked to market. To avoid a margin call this percentage needs to lie between 4 & 5%. It is calculated as  $\text{Margin Deposit} / \text{Futures Obligation} = 2817.50 / 56587.50 = 4.98\%$

**Example: Margin Call**

Suppose you own 1 futures contract that you acquired when the stock index was 1132. You have entered into a legal obligation to pay \$56,600 in exchange for whatever the \$50 times the underlying index number at the time of settlement. Your initial margin is  $1132 * \$50 * 0.05 = \$2830$  and the maintenance margin is 4%. This implies that whenever your margin account falls below this 4% of \$56,600 then you will receive a margin call to bring back your position to 5% (i.e., \$2830).

So suppose the index falls during the day and closes at 1120 what is the margin call?

Your futures contract has declined in market value to:  $1120 * \$50 = \$56,000$  and when your position is marked to market this loss of \$600 is realized. As a result, you now have  $\$2830 - \$600 = \$2,230$ . This leaves the current margin at:  $\$2230 / \$56,600 = 3.98\%$  which violates the

maintenance margin of 4%. As a result, you will receive a margin call of \$600 to bring your position back to 5% (\$2830).

### **Buy VWAP**

Buy VWAP equals the buying volume weighted average price =  $\$50 \times 1132 = \$56,600$ . If you acquire a second contract at 1120 then your weighted average buy price equals:  $1 \times \$56,600 + 1 \times \$56,000 = \$112,600 / 2 = \$56,300$ .

Similarly, if you had sold short one future's contract then the Sell VWAP is the weighted average selling price.

### **Project Requirements:**

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

### **Required questions:**

- (1) At the beginning of the week make some long and short index futures trades (e.g., at least 5-trades. At the end of the week reverse the trades so you end up with only cash. Did you make a gain or loss?
- (2) For one of the contracts that you trade explain precisely the gain or loss you made for that contract. That is, how was it realized?
- (3) Did any of your contracts result in you making a margin call? If so describe what happened.

