FTS Real Time System Project: Applying the Cost of Carry Model to Infer Information from Stock Index Futures' Prices

Question: What information can we infer from stock index futures prices if we apply the cost of carry model to stock index futures?

You may have observed that frequently financial market reporters announce, that based upon futures prices, they expect that the market will open higher, lower or mixed. By working through this exercise you will understand precisely how these types of predictions are made.

Stock Index Futures Small Group Project: Objectives

The objective of this project is to apply the cost of carry model to estimate the price of a stock index future and then use this model to reverse engineer information from actual futures prices using futures defined on the S&P500 and Nasdaq 100 indexes.

You will approach this question in two steps. First, is to become acquainted with the cost of carry model for futures pricing. This will identify the relevant inputs that you need to estimate for this model. This first step is covered in the third stock index futures project. Second, once you become acquainted with how the model applies to these real world markets you will then apply this knowledge to reverse engineer the actual futures markets to infer information from the actual market prices.

1. Cost-of-Carry model

Refer to RTFTS Stock Index 3 project titled: Application of the Cost of Carry Model to Stock Index Futures.

2. Reverse Engineering the Cost of Carry Model

Once you understand how to apply the cost-of-carry model you can then use this model to infer information from observed futures prices. The FTS real time client provides you with a comprehensive support system to do this.

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		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 above support system applies the cost of carry model. You can control the input parameters via the Parameter menu item in the FTS Real Time Client by entering in your personal estimates for the "Risk Free Rate" and the "Div Yield." You should use annual compounding convention with a Actual/360 day count convention.

The last set of columns provides you with the implied numbers from reverse engineering market prices. Each implied field has been found by holding the other fields fixed and using the market price to infer the current field.

For example, the implied underlying is what is implied from the current futures price. In the above example, taken after the close of the NYSE exchange, you can see that the implied underlying index value (e.g., DEC 2010 S&P500 index contract) is slightly lower (1,124.67) than the closing index value (1125.59). This is what financial journalists use to forecast the opening day's prices.

A Note of Backwardation:

In the current low interest rate environment it is possible that the financial cost of carry is less than your forecast dividend yield. If this is the case, the predicted futures price will exhibit a phenomenon that is called "backwardation." Backwardation arises when the arbitrage free futures' prices are predicted to be smaller than the underlying spot price. For the case of stock index futures this is expected to occur whenever the dividend yield is larger than the financial cost of carry.

In the above sample screen the S&P500 index futures currently exhibit backwardation.

Project Requirements:

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

Required questions:

(1) In your own words what is the cost-of-carry model and in practice how did your team estimate the inputs to this model?

(2) Given your answer to (1) on about three days between 8-9am before the opening bell at 9:30AM use the cost of carry model to forecast what you expect the market index for the S&P500 and Nasdaq 100 to open around. Record the price immediately after the markets open at 9:30AM. How does your forecast compare with the actual prices you observe?

(3) How does your estimate for the dividend yield compare to the implied market values?

(4) For the case of the e-mini futures defined on the S&P 500 and the Nasdaq 100 index do you *currently* observe backwardation or not? Is this predicted (why or why not)?

(5) During different trading days collect a sample of at least 15 observations for the underlying index value and the futures prices for each of the contracts. You can collect at different times of the day during trading hours for the NYSE. Compute the mean of absolute deviations (i.e., absolute value of the difference between the futures price and the predicted futures price at the time you recorded). You should use the analytical support in the FTS Real Time Client to make your observations: (e.g., record Actual Mkt Price and the Implied Price at exactly the same point in time during the trading day.)

(6) Given your data recorded in part (2) comment on the accuracy of the cost-of-carry model across the two indexes (S&P500 and Nasdaq 100) as well as across different times to maturity. Do any patters occur – such as is one index on average more accurate than the others and also is one maturity more accurate than another?

(7) Given your answer to (3) in general how accurate would you rate the cost of carry model?

(8) Discuss whether or not you can increase the accuracy of the cost of carry model for each index by adjusting your inputs?

(9) Given your answers to each part summarizes what differences, if any, you have observed when you apply the cost-of-carry model to e-mini futures defined on the S&P500 index and the Nasdaq 100 index?