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Before

progressing, it is important to explain what S&P 500 futures are. S&P 500 futures, offered on the CME exchange, are contracts which participants can use to buy or sell the S&P 500 index at a future settlement date. When the settlement date arrives, any gains or losses on existing contracts are settled with cash through the exchange. Unlike other futures contracts, like gold, wheat, or oil, the seller does not need to deliver the underlying instrument, stocks. For more information and current futures prices, please visit the CME. S&P 500 futures contracts are typically very liquid, allowing investors and traders an effective way to speculate or hedge with the S&P 500 index. Equally important, and unlike the cash market, the futures contracts trade almost all hours of the day and night. This provides investors with around the clock transparency on how the equity market is responding to news released while the cash market is closed. For example, important news that comes out of China or Europe is immediately reflected in the U.S. futures market. Because of different market hours between cash and futures, it is not always accurate to glance at a gain or loss in futures to see where the S&P 500 index might open the next day.

Using Futures to Indicate the Market Open

To better understand why the change in futures can be misleading, there are two points to consider. The first one is that the day session of the futures market temporarily closes at 4:15 pm eastern time, fifteen minutes later than the cash market. If the futures contract declines 25 points

between 4:00 and 4:15 on Monday afternoon but early Tuesday morning is shown as up 25 points, the expected change in the cash market should be zero, not 25 points. Futures are closed for the weekend but re-open at 6:00 pm on Sunday nights. The difference between the hours of operation for cash and futures is one reason for this reconciliation process on a day-to-day basis. The second consideration is the pricing mechanics between the cash index and the futures contract due to the index cash price, time, dividends, and the cost of borrowing. This is known as cash and carry. Cash and carry, allows us to calculate if an arbitrage opportunity exists between the cash index and the futures contract. For example, can I buy the S&P 500 index and sell futures at the same time and make a guaranteed risk-free profit? To assess whether the futures price is out of line with the cash price, we need to calculate what is known as fair value. Fair value for futures is the price at which there is no arbitrage opportunity. Calculating the fair value for the S&P futures requires four pieces of data:

1. Cash S&P 500 price
2. Cost of borrowing for the period
3. Dividends
4. Number of days before the futures contract settles

To explain the fair value calculation, assume we want to buy the cash index and sell the futures contract. In doing this trade we would incur a borrowing or opportunity cost as we need to borrow it we have in hand. Offsetting the borrowing ceive.

Cash Price	2659
Cost of Borrowing	2.00%
Dividend Yield	4.30%
Day Count	68
$[2659 * (4.30\% * (68/360))] - [2659 * (2.00\% * (68/360))]$	
= -11.55	

The cash and carry formula above

multiplies the S&P 500 cash price times the dividend yield and then subtracts the cost of borrowing. Both the borrowing cost and dividend yield account for the 68 days between today and the futures settlement date. Currently, based on the data above, we estimate the fair value for the futures contract is -11.55 less than the cash price. As of writing this, when cash and futures are both open, futures should trade about 11.55 points below the cash index. Please keep in mind the difference between cash and fair value will change as the four factors in the equation change.

Putting it all together

Given how easy it is to arbitrage S&P 500 futures and the cash index, futures generally trade very close to fair value. *Note: Exceptions to this rule include times of extreme volatility and poor liquidity.*

With the results of the calculation above, we can take the prior close of the S&P 500 cash index, subtract the fair value differential (11.55) to get a baseline futures value. Next, subtract the current futures value from the baseline value, and you have the correct indication of where the S&P 500 index should be trading. For instance, if futures are trading at 2600 and cash last closed at 2575, then the cash market should open at 2611 for a gain of 36 points (2611 - 2575). Had futures gained 20 points between 4:00 and 4:15 after the prior close, the futures market would only show a gain of 16 points. The difference between cash and futures fair value is usually constant and determined heavily by the number of days until futures settlement. In today's environment, the differential is volatile as dividend yield has risen sharply due to lower

prices. Over time we expect that dividend yields will fall as dividends are cut, and the fair value difference will gravitate toward 2-5 points as is more typical.