

## Futures Markets: Introduction to the Pricing of Futures Contracts

### Cash-and-Carry Arbitrage

One technique arbitrageurs use to trade between the futures and spot markets is called the cash- and-carry strategy. This strategy involves buying the underlying asset of a futures contract in the spot market and holding [carrying] it for the duration of the arbitrage.

Basic Steps: (1) Buy the underlying asset

(2) Go Short the futures contract on the underlying asset

(3) Deliver into the futures contract with the asset purchased in (1)

Essentially you are locking in an implied rate of return based on the difference between today's price of the underlying asset and the price you will be paid when delivering into the contract several months later. If this implied rate [repo rate] is greater than the current market interest rate [borrowing rate] for the term of the futures contract then arbitrage exists.

For purposes of illustration assume that there exists an S&P 1 contract that consists of 1 share of BRKB stock.

Example of Cash-and-Carry Arbitrage: Suppose that on February 21, 2012 you notice that BRKB stock is trading at \$79/share. However there is a S&P 1 futures contract for delivery one year from now priced at \$97. For simplicity assume that BRKB will continue to pay no dividends, and there are no transactions costs in getting in and out of the futures and spot markets. Under these circumstances you could:

(1) Buy one share of BRKB for \$79

(2) Short one S&P 1 contract for \$97

(3) Hold onto your 1 share of BRKB from transaction (1) and then deliver it into your short futures contract



Buy 1 BRKB =====Hold onto the 1 BRKB share=====→ Deliver 1 BRKB share

Short one S&P 1 futures contract =====→ into the futures contract

- \$79 =====→ \$97

Profit = \$18

Rate of Return on the Cash and Carry =  $\$18/\$79 = .22785$  or 23% [implied repo rate]

If you are using a clearing corporation to back up fulfillment of this trade and there is virtually no risk of default, then you earn what is the equivalent of a T-bill [or discounted paper return]. This type of cash and carry investment is called a **synthetic T-Bill** because its cash flows mirror that of a T-Bill.

You have essentially made a **synthetic loan** because you have lent money at \$79 in order to receive a future payment one year from now of \$97.

Now, suppose you can borrow money to initially buy the one share of BRKB at a rate of 5%. Under these circumstances, your cash and carry synthetic lending rate is 23% against a borrowing rate to do the trade of 5%. Your riskless profit will be 23% - 5% or 18% which is sometimes referred to as a pure arbitrage play. So, whenever the

Cost to carry Synthetic Loan Rate > Cost of Borrowing

A cost to carry pure arbitrage opportunity will exist.

Note though that the very existence of this arbitrage play will set in motion market forces to reduce your arbitrage profit. Buying shares of BRKB will cause prices to rise from \$79. Selling the S&P 1 futures contract will cause the price of the contract to decline from \$97. At some point the price of BRKB shares may be 80 and the S&P 1 for future delivery may adjust to \$84. and when that happens the cash and carry rate of return will be:

$$[\$84. - \$80]/\$80 = .05 \text{ or } 5\%$$

at which time there will be no arbitrage possibility, since your borrowing rate equals the synthetic loan rate.

Some Terminology: The **rate of return on a cash and carry arbitrage transaction** is referred to as the **implied repo rate**. To determine whether anything is to be gained from an arbitrage play, you need to have the implied repo rate > cost of borrowing.

### **Reverse Cash- and- Carry Arbitrage**

**A reverse cash-and-carry arbitrage is the exact opposite to a cash-and –carry transaction.** Instead of buying the underlying security because it is underpriced, you sell it short [because it is overpriced], take the proceeds and go long a futures position on the underlying security. Before the futures position expires you close out the position by taking delivery and returning the borrowed shares you were short.