APPENDIX III
HOW ARBITRAGE WORKS

Introduction

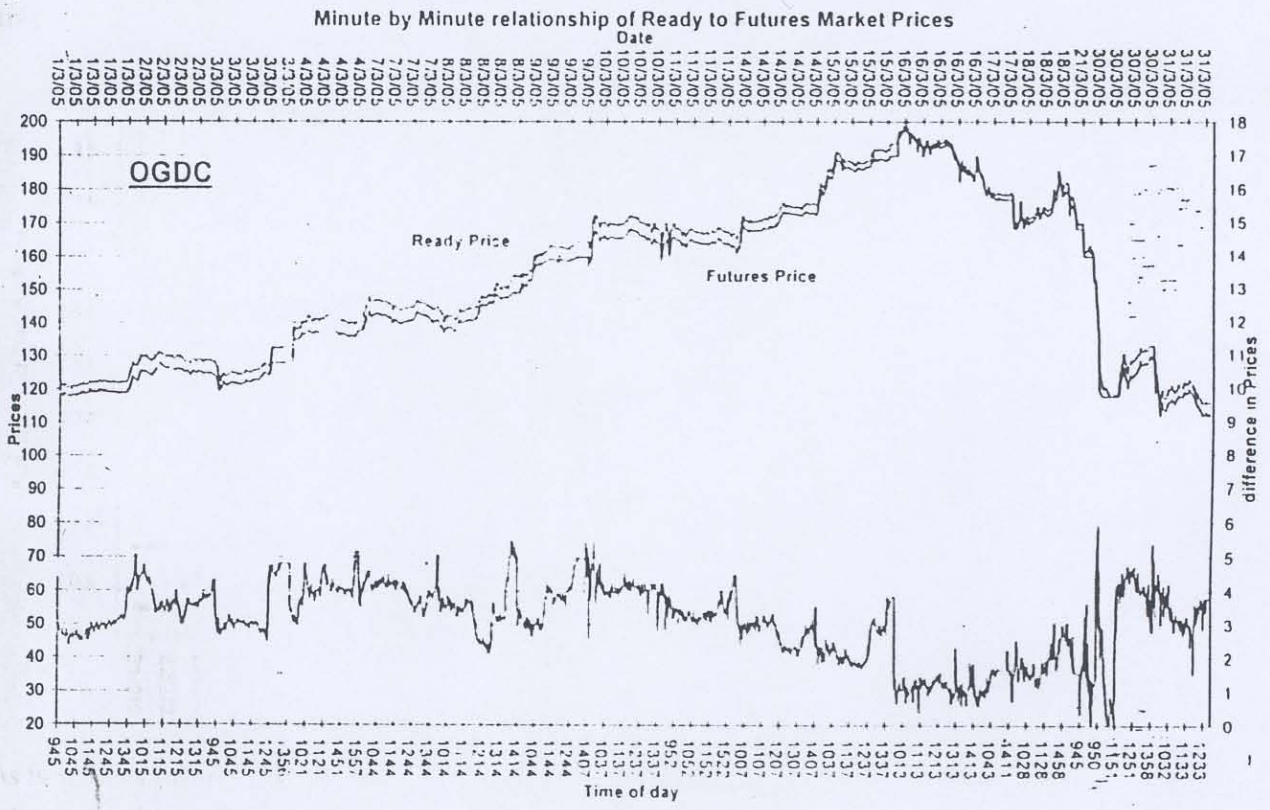
This appendix explains how index arbitrage works and identifies impediments to arbitrage efficiency.

Index Arbitrage Mechanics

Arbitrage activity between a Ready Market share (say OGDC) and its counter-part futures scrip is determined by the link in the prices of the futures to the share price.

How does it work? (Using OGDC trading in March 2005 as an example)

The following Graph depicts the Ready and Futures prices for the period 1st to 31st March 2005



As can be readily seen the difference between the futures price to the ready price regularly exceed Rs2 and was as high as Rs 5, well above the so called "fair value"

Fair value is determined in accordance with the concept of the cost of carry, or the finance required to buy a scrip and sell its future.

The OGDC futures fair value is based upon the following cost-of-carry relation.

$$F^* = S(1 + r - d)$$

where F^* is the OGDC futures fair value

S is the OGDC ready price

r is the risk less rate of interest over the time period until maturity of the OGDC futures contract

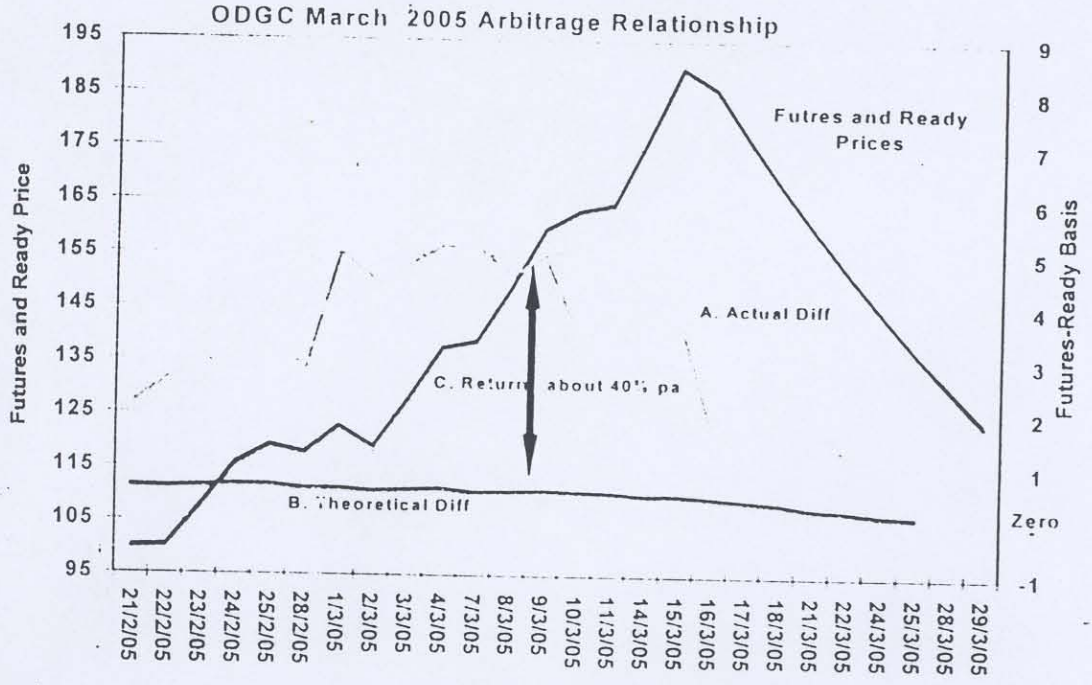
d is the dividend yield over the time period until maturity of the OGDC futures contract

This relationship means the OGDC futures fair value should equal to the cost of carrying the a OGDC share, that is, the interest cost, r, of tying up funds in the share less the dividend yield, d, on the share if it is paid before the futures contract expires. In the situation where the futures price equals the share price, profitable arbitrage opportunity does not exist.

But if the futures price is above the futures fair value, arbitrageurs sell OGDC futures and buy the OGDC shares, theoretically driving the price of the OGDC futures down and the price of OGDC shares up.

On the other hand, if the futures price is below the futures fair value, arbitrageurs buy OGDC futures and sell the OGDC shares, driving the price of the HSI futures up and the prices of HSI constituent stocks down.

The following graph depicts the daily closing prices of OGDC shares and futures for March 2005. It also highlights the relationships a little more clearly than the first minute by minute graph.



As is shown on the graph, the difference in futures prices to ready prices can lead to arbitrage returns of above 40% annualised return. For example on the 7th March 2005, based on 8% market interest rate, and ignoring dividends the calculations would be as follows:

	OGDC
Expiry of futures	25/03/2005
Current date	7/03/2005
Interest Rate	8%
Share Price	138.50
Fair Value	139.05
Futures Price	143.65
Profit Potential	4.60
Simple return	3%
Annual return	67.39%

At the expiry of the futures contract the arbitrageur delivers the bought OGDC shares to satisfy the delivery required by selling the OGDC futures and collects the cash profit.