# Trading Derivatives on the NGX

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Objective: To understand the short selling strategy and how to facilitate it with securities borrowing and lending

- The NGX market
- NGX index futures
- Who will use the index and individual stock futures contracts?
- Trading applications:
    - Directional
    - Basis trading
- Portfolio management applications
    - Equitisation: The challenge of being fully invested and how using futures solves that problem
    - Hedging
    - Asset allocation
    - Creating a synthetic exposure and Index Funds
- Foreign based investor strategies: Gaining exposure to the Nigerian equity market through synthetic exposures

# The NGX Market
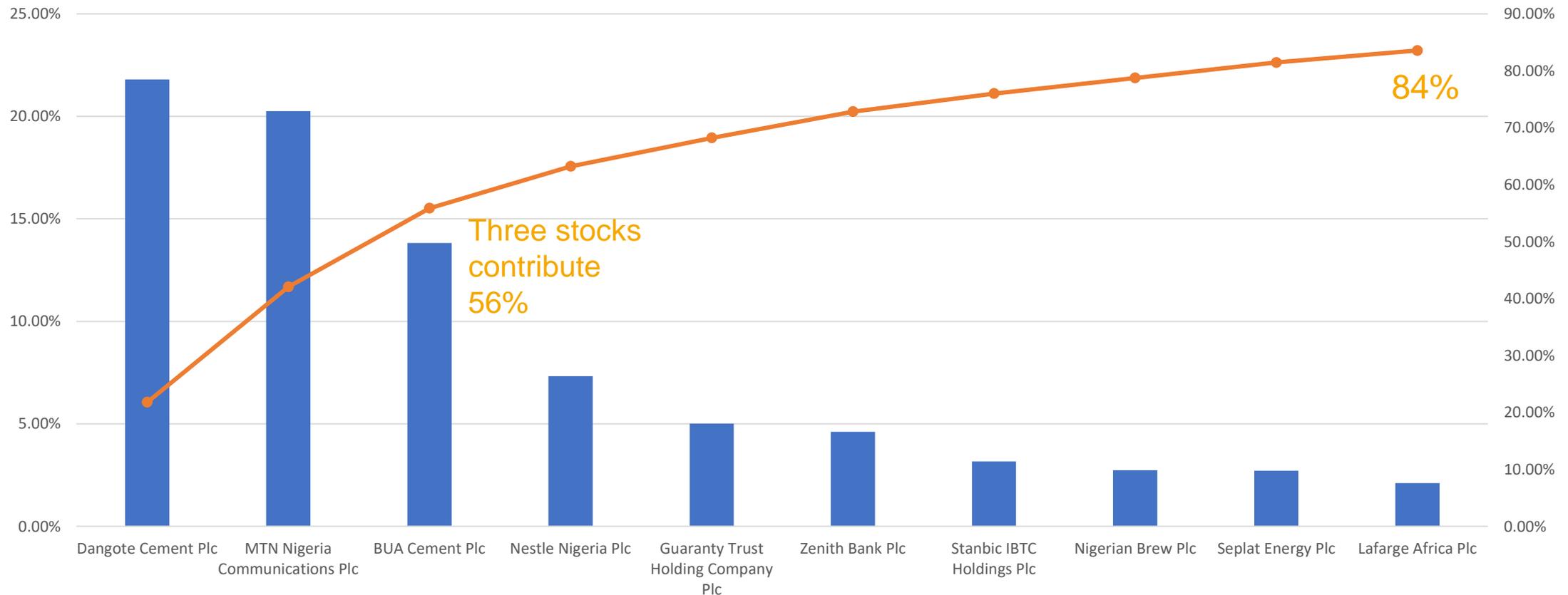
# The NGX Index Complex

- NGX have created a number of indices, including:
  - NGX All Share Index
  - NGX Premium
  - NGX 30
  - NGX Pension
  - Plus, a range of sectoral indices

An adjusted market cap weighted **price index** tracking the top **30** companies in terms of market capitalization and liquidity

An adjusted market cap weighted **total return index** tracking the top **40** companies in terms of market capitalization and liquidity
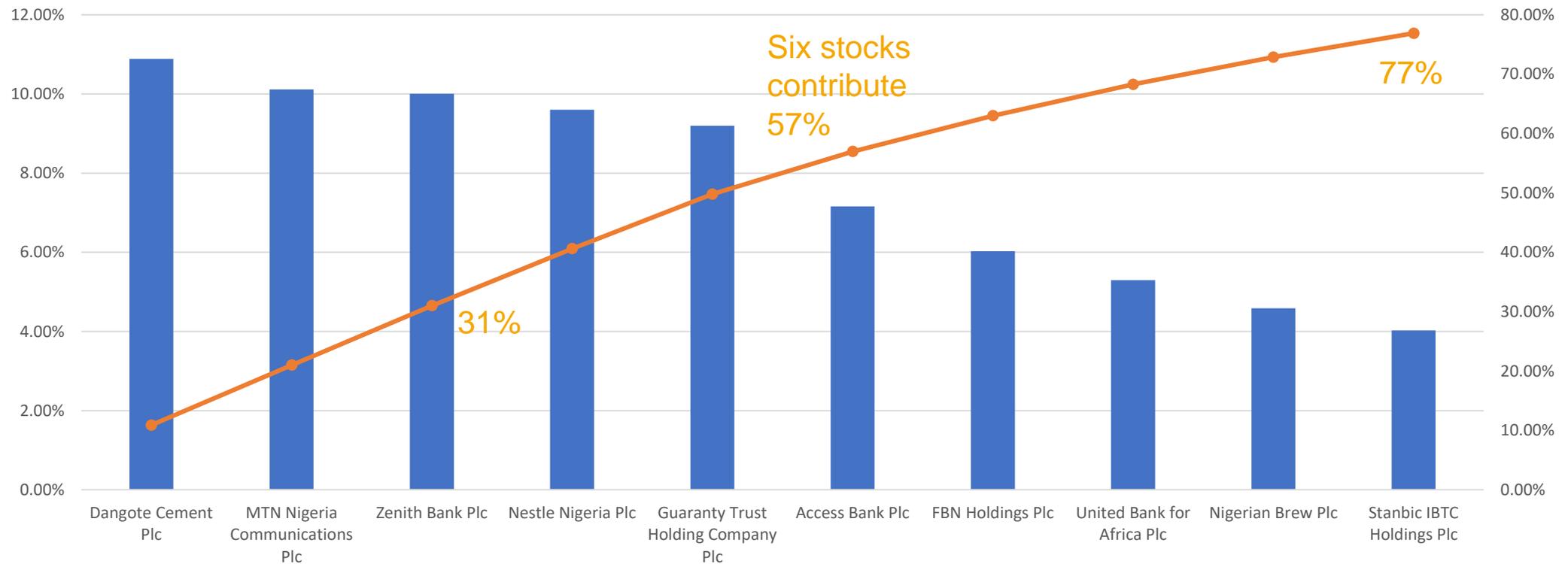
# The NGX 30 Index: Concentration



Top 10 Constituents by Market Capitalization (by %) as at 04-Aug-2021

Three stocks contribute 56%

84%

# The NGX Pension Index: Concentration

## Top 10 Constituents by Market Capitalization (by %)



Six stocks contribute 57%

77%

31%

Dangote Cement Plc, MTN Nigeria Communications Plc, Zenith Bank Plc, Nestle Nigeria Plc, Guaranty Trust Holding Company Plc, Access Bank Plc, FBN Holdings Plc, United Bank for Africa Plc, Nigerian Brew Plc, Stanbic IBTC Holdings Plc

# Sectoral Breakdowns

## NGX 30



Legend: Industrial Goods, Financial Services, ICT, Consumer Goods, Oil & Gas, Conglomerates, Agriculture

- Industrial Goods 38%
- Financial Services 21%
- ICT 20%
- Consumer Goods 14%
- Oil & Gas 3%
- Conglomerates 2%
- Agriculture 2%

## NGX Pension



Legend: Agriculture, Conglomerates, Construction/Real Estate, Consumer Goods, Financial Services, ICT, Industrial Goods, Oil & Gas

- Financial Services 47%
- Consumer Goods 19%
- Industrial Goods 13%
- ICT 10%
- Oil & Gas 5%
- Agriculture 2%
- Conglomerates 2%
- Construction/Real Estate 2%

# Sectoral Breakdowns

## NGX 30



Industrial Goods
Financial Services
ICT
Consumer Goods
Oil & Gas
Conglomerates
Agriculture

Oil & Gas 3%
Conglomerates 2%
Agriculture 2%
Industrial Goods 38%
Consumer Goods 14%
ICT 20%
Financial Services 21%

## NGX Pension



Oil & Gas 5%
Agriculture 2%
Conglomerates 2%
Construction/Real Estate 2%
Industrial Goods 13%
ICT 10%
Consumer Goods 19%
Financial Services 47%

Agriculture
Conglomerates
Construction/Real Estate
Consumer Goods
Financial Services
ICT
Industrial Goods
Oil & Gas

Quite a marked difference in sectoral weightings …..

# The Vagaries of the Capping Factor

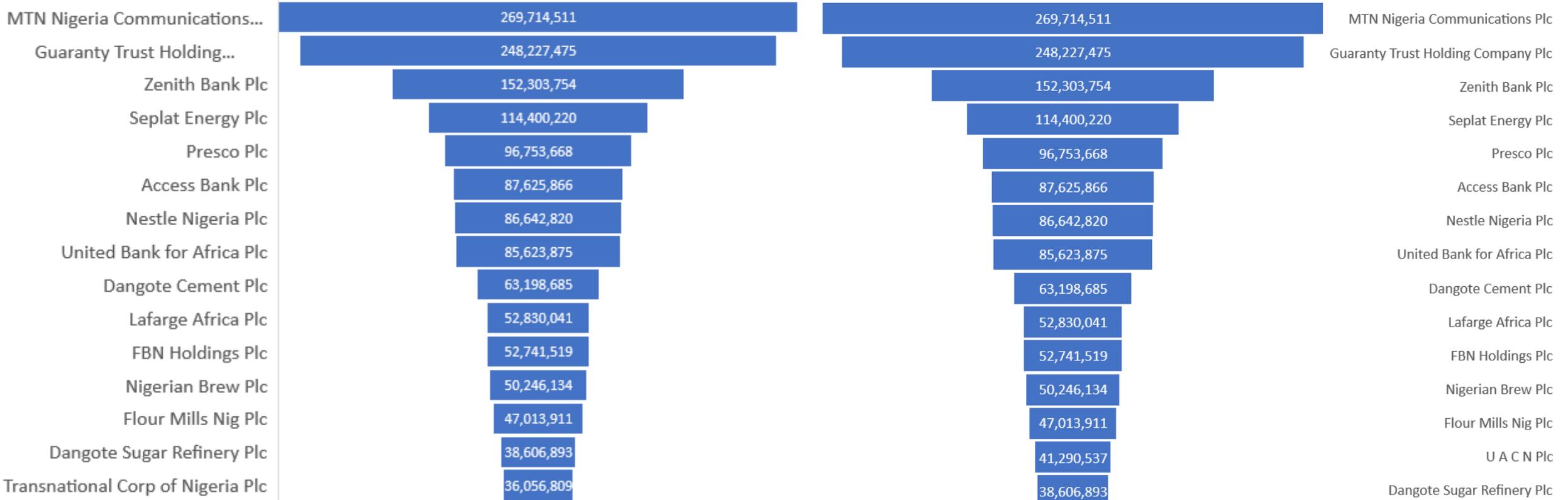| | 08-Apr-21 | 31-Aug-21 | % Change |
|---|---|---|---|
| Total NGX 30 Market Capitalization | 15,985,732,977,144 | 16,591,150,654,347 | 3.79% |
| Total NGX Pension Market Capitalization | 4,842,244,613,779 | 5,147,896,633,777 | 6.31% |

| Company | Dangote Cement Plc | | | | Lafarge Africa Plc | | | |
|---|---|---|---|---|---|---|---|---|
| Ticker | DANGCEM | | | | WAPCO | | | |
| Sector | Industrial Goods | | | | Industrial Goods | | | |
| Shares in issue | 17,040,507,405 | | | | 16,107,795,496 | | | |
| | 08-Apr-21 | 31-Aug-21 | | | 08-Apr-21 | 31-Aug-21 | | |
| Price per share | 215.00 | 243.00 | | | 21.00 | 22.00 | | |
| NGX 30 Capping Factor | 0.7777087422 | 0.8697112898 | 11.83% | | 1.0563457429 | 1.0126392169 | -4.14% | |
| NGX Pension Capping Factor | 0.1218761496 | 0.1350318621 | 10.79% | | 0.2555055075 | 0.1986016829 | -22.27% | |
| Market Capitalization | 3,663,709,092,075 | 4,140,843,299,415 | | | 338,263,705,416 | 354,371,500,912 | | |
| NGX 30 Adj Market Capitalization | 2,849,298,589,659 | *17.82%* | 3,601,338,166,607 | *21.71%* | 357,323,425,201 | *2.24%* | 358,850,479,173 | *2.16%* |
| NGX Pension Adj Market Capitalization | 446,518,757,512 | *9.22%* | 559,145,781,288 | *10.86%* | 86,428,239,722 | *1.78%* | 70,378,776,446 | *1.37%* |
| Change in price | | 13.02% | | | | 4.76% | | |
| Percentage Change in NGX 30 Weighting | | 21.78% | | | | -3.24% | | |
| Percentage Change in NGX Pension Weighting | | 17.79% | | | | -23.40% | | |

Index weight

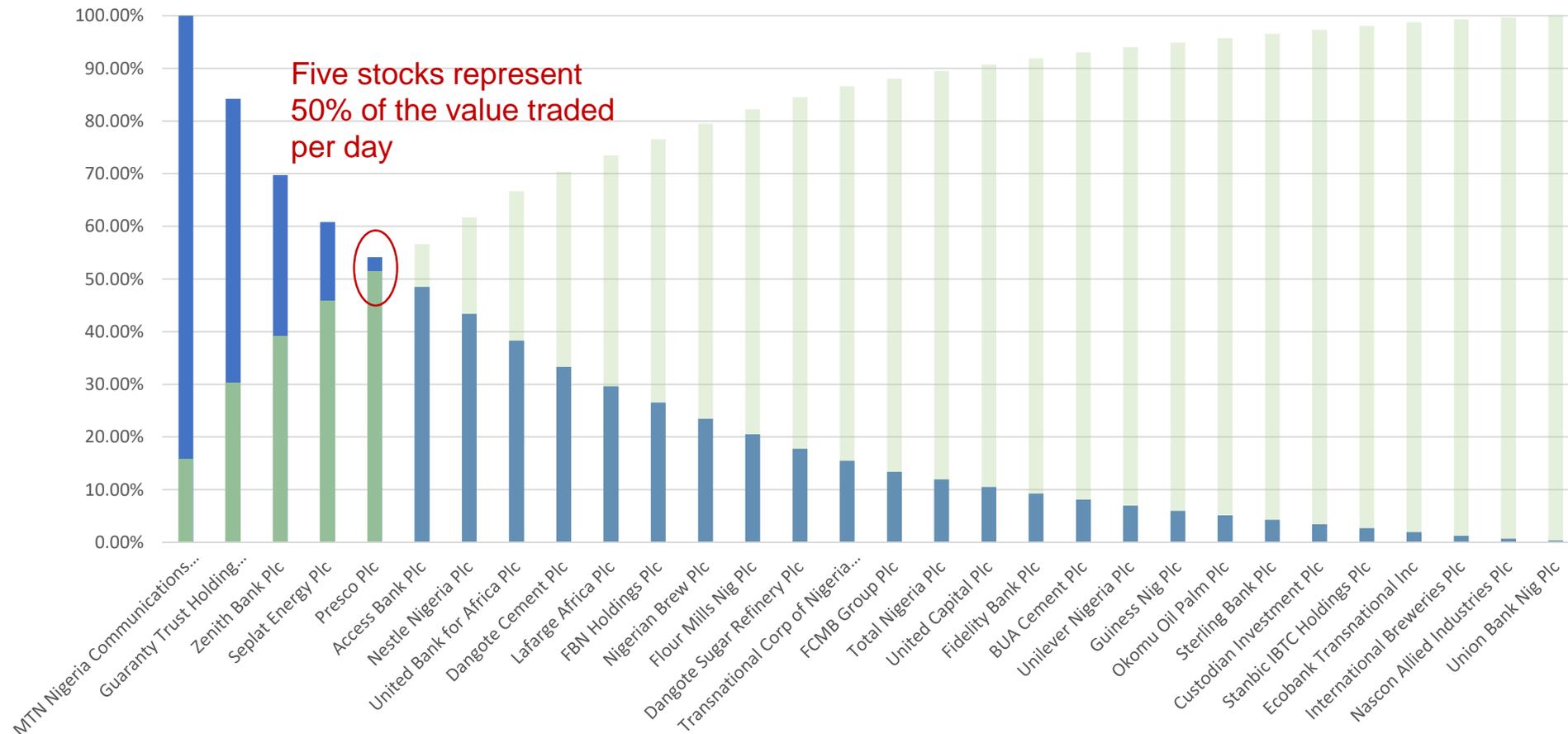# Top15 Stocks: Average Daily Volume Traded 27-Jly to 04-Aug-21

## NGX 30 Index Constituents

| Company | Volume |
|---|---|
| MTN Nigeria Communications... | 269,714,511 |
| Guaranty Trust Holding... | 248,227,475 |
| Zenith Bank Plc | 152,303,754 |
| Seplat Energy Plc | 114,400,220 |
| Presco Plc | 96,753,668 |
| Access Bank Plc | 87,625,866 |
| Nestle Nigeria Plc | 86,642,820 |
| United Bank for Africa Plc | 85,623,875 |
| Dangote Cement Plc | 63,198,685 |
| Lafarge Africa Plc | 52,830,041 |
| FBN Holdings Plc | 52,741,519 |
| Nigerian Brew Plc | 50,246,134 |
| Flour Mills Nig Plc | 47,013,911 |
| Dangote Sugar Refinery Plc | 38,606,893 |
| Transnational Corp of Nigeria Plc | 36,056,809 |

## NGX Pension Index Constituents

| Company | Volume |
|---|---|
| MTN Nigeria Communications Plc | 269,714,511 |
| Guaranty Trust Holding Company Plc | 248,227,475 |
| Zenith Bank Plc | 152,303,754 |
| Seplat Energy Plc | 114,400,220 |
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| FBN Holdings Plc | 52,741,519 |
| Nigerian Brew Plc | 50,246,134 |
| Flour Mills Nig Plc | 47,013,911 |
| U A C N Plc | 41,290,537 |
| Dangote Sugar Refinery Plc | 38,606,893 |

# Another Perspective

### Cumulative Contribution to ADV by Value (in Naira) for NGX 30
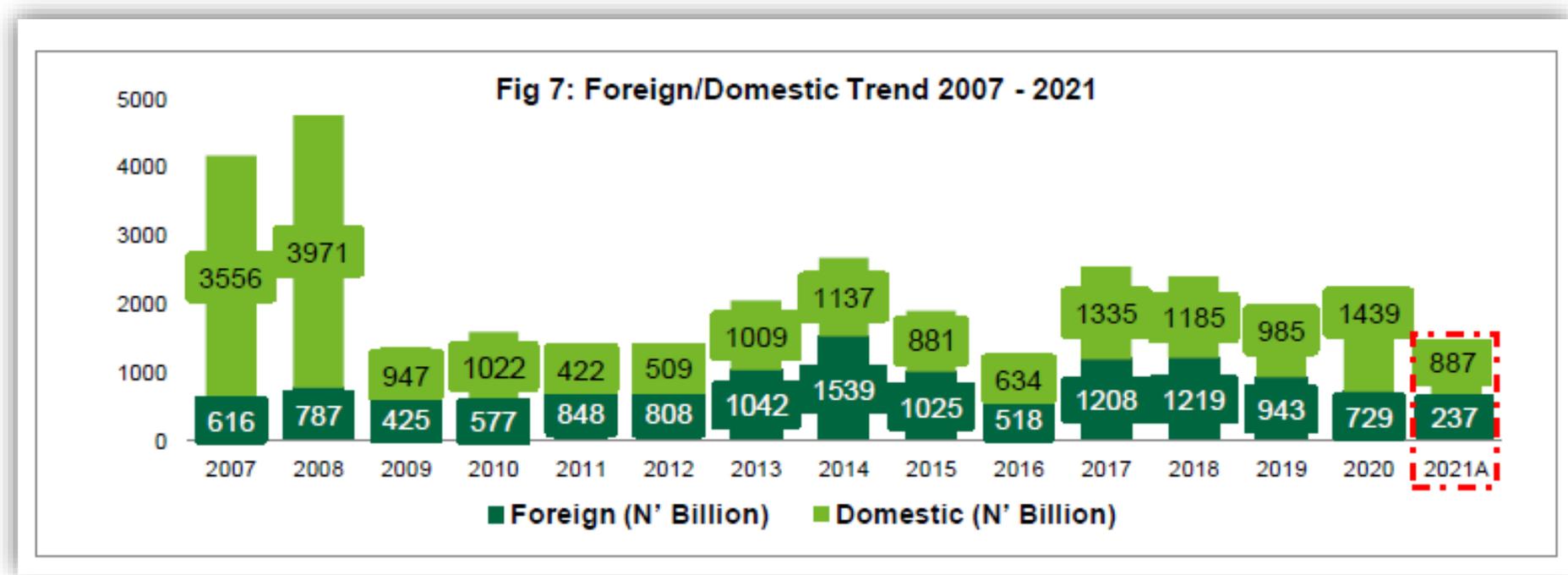
Five stocks represent
50% of the value traded
per day

# Foreign Investor Participation on NGX

- An established foreign investor base will be instrumental in delivering greater liquidity



Jan - July 2021

Foreign ₦'Billion · Domestic ₦'Billion

21%
79%



Jan - July 2020

Foreign ₦'Billion · Domestic ₦'Billion

39%
61%
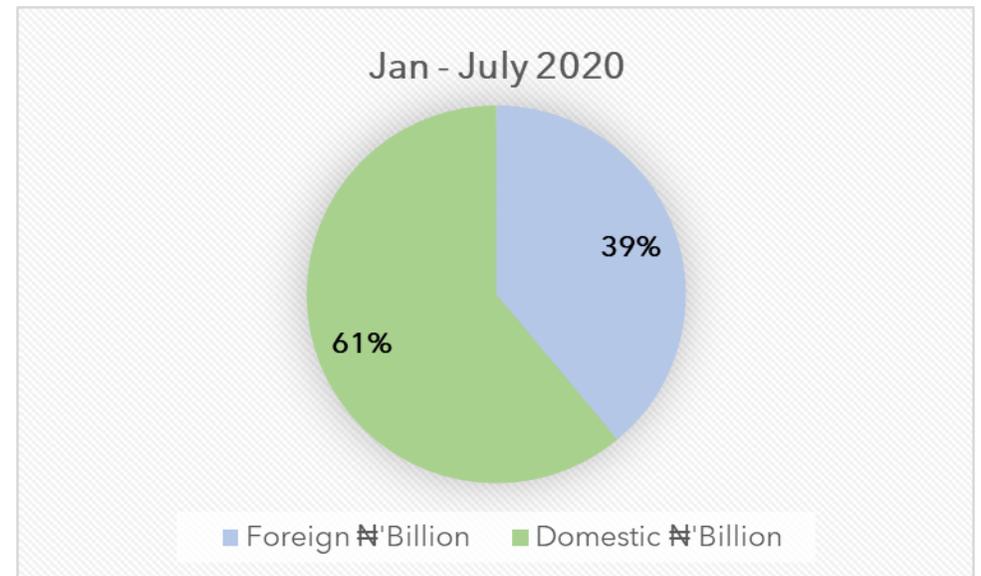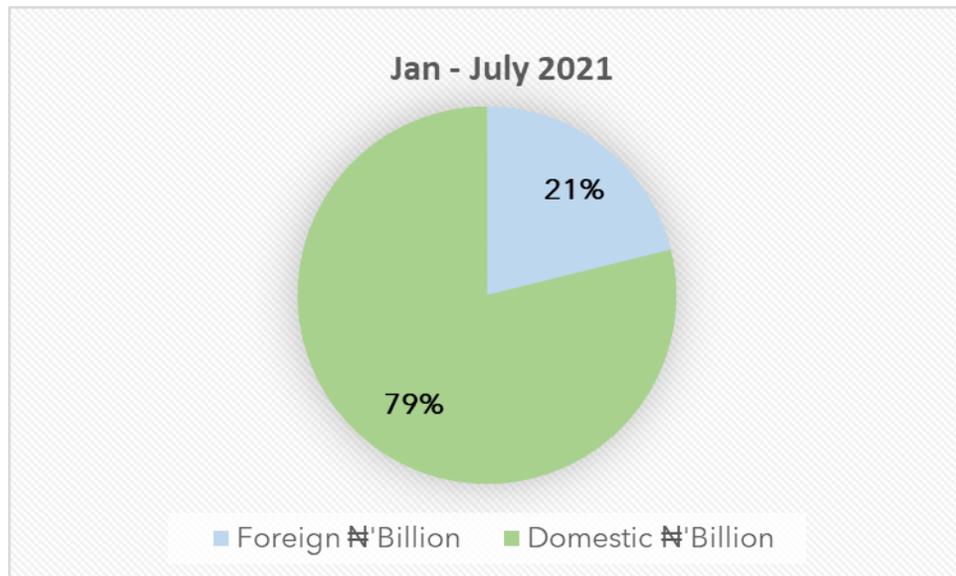
# Foreign Investor Participation on NGX

- And over a longer period…..



Fig 7: Foreign/Domestic Trend 2007 - 2021

# The NGX Market Equity Index Futures Suite

# Exchange Traded v OTC Derivatives

| ETD | OTC |
|---|---|
| • Traded "on-exchange" through a central order book | • Traded "off-exchange" (but now also listed on SEFs, MTFs and OTFs) |
| • Long history of (central) clearing | • Very recent history of clearing |
| • All contracts cleared | • Only more vanilla and liquid instruments cleared |
| • Predominantly futures and options | • Includes IRS and other swaps |
| • Simple payment flows | • More complex payment flows |
| • Standardized contract specifications | • Contract terms negotiable (but subject to CCP eligibility criteria, where applicable) |
| • Liquid trading market | • Tend to be less liquid, with less price transparency |
| • Contract size smaller | • Larger size |
| • VM mostly settled to market | • VM collateralized to market |

# Equity Index Futures

- *What is a futures contract?*
  - An agreement, originally between two parties, a buyer (the "long") and a seller (the "short"), to exchange a particular good – in this case, a broad equity index – at a date in the future
  - In essence, it is "a bet" – go long, if you expect the market to rise; go short, if you expect it to fall

- *What do they add?*
  - No cash payment today
  - Ability to sell first, buy back later
  - Tighter bid – offer spreads

# Why Trade Equity Index Futures?

- Track a recognised benchmark index, with minimal tracking error
  - NGX 30 and NGX Pension


- High degree of correlation with the underlying index
  - No problem with adjusting cash portfolio when individual stocks drop out of the index and replaced by other stocks

# Reasons to be Optimistic: The US Experience

## CME Equity Index Futures & Options Long-Term Growth



Equity Index quarterly ADV and open interest
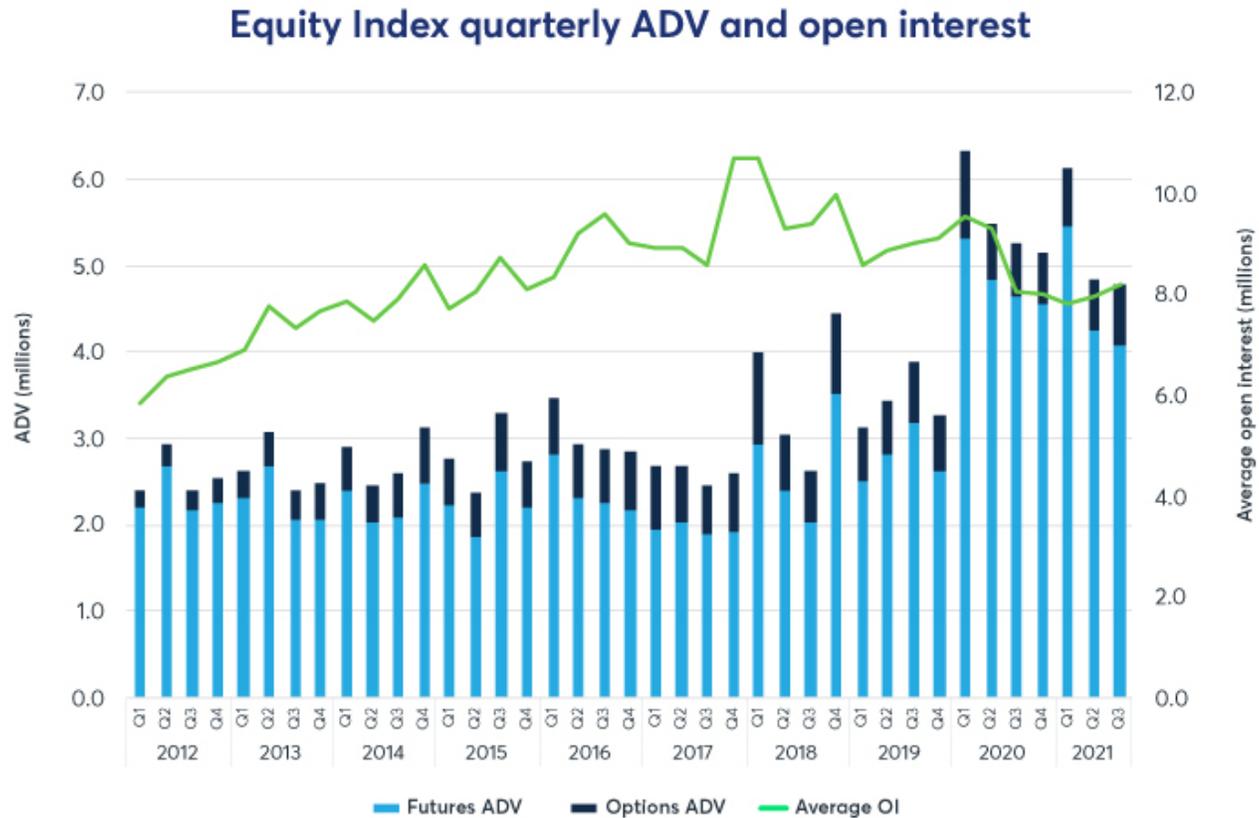
# What Contract Terms are Key

1. What is the underlying?

2. What is the contract size?

3. When does it end (in technical terms, the "delivery day")

4. How does it settle?

# The Index Contract Specs

| | NGX 30 | NGX Pension |
|---|---|---|
| Contract multiplier | ₦1,000 x NGX 30 Index | ₦1,000 x NGX Pension Index |
| Tick size and value | 0.25 index points; ₦250 | |
| Contract months | Two months in the Mar quarterly cycle | |
| Trading hours | 09:30 – 14:30 | |
| Last trading day | Third Friday of the delivery month | |
| Expiration settlement price | Closing Price of the appropriate NGX index as calculated by NGX on the last trading day rounded to the nearest tick | |
| Position limits | NG Clearing shall specify client level open position limits as the maximum limit of an open position that can be maintained at the client level across all futures contracts on a particular underlying security or Index | |

# Contract Months & Timings

# Contract Months & Timings



Monday, 14-Mar-22        Monday, 13-Jun-22        Listing Day

Time

DEC (Z)        MAR (H)        JUN (M)

Delivery Day:        Friday, 18-Mar-22        Friday, 17-Jun-22

# Calculating the Profit/Loss on Futures

*Futures P & L = # of contracts x changes in ticks x tick value*

You open 10 long NGX 30 Mar futures at 1636.75 index points in the morning session
The DSP that day is 1643.25
Index point value and tick value: ₦1000/ ₦250

*Futures P & L = 10 x 6.5 x ₦1000 = ₦65,000*

Index points

*Futures P & L = 10 x 26 x ₦250 = ₦65,000*

Ticks

# Application of Index Futures

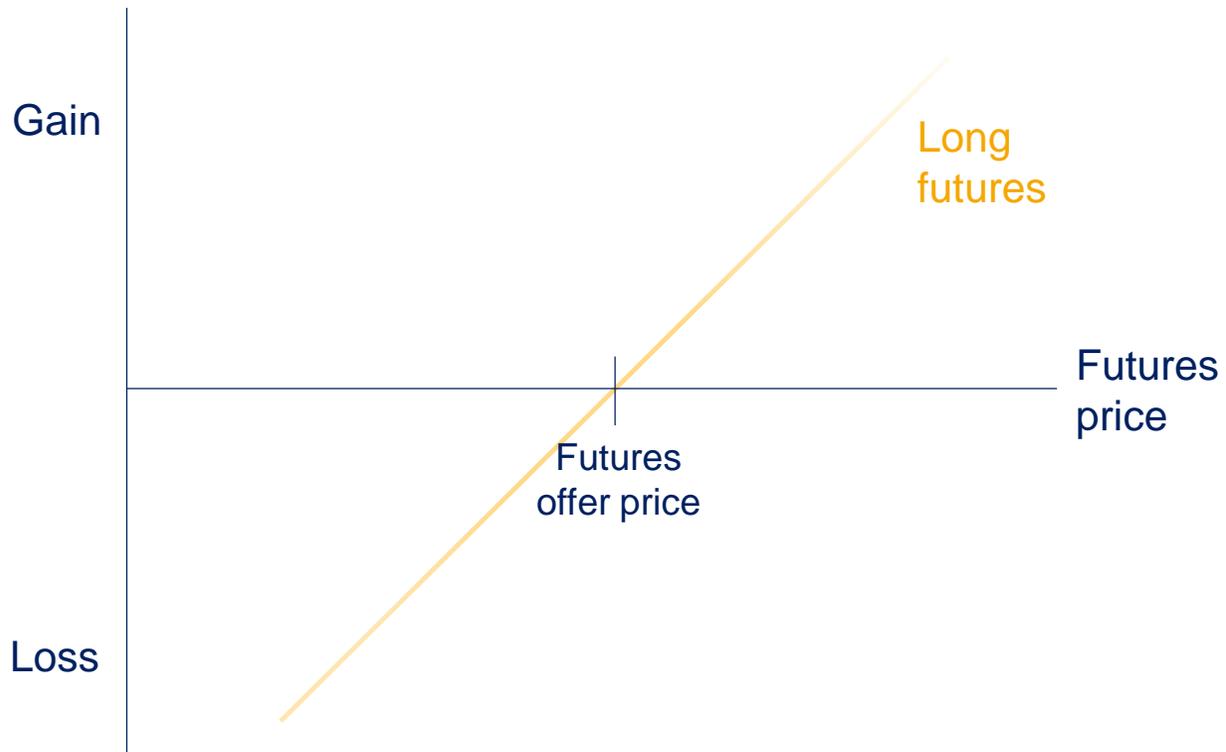# Users of Futures

- Traders
    - These are the liquidity providers
    - Short-term, directional trades
    - Relative value trading strategies

- Portfolio managers
    - Reducing exposures – hedging; asset allocation; decreasing beta exposure
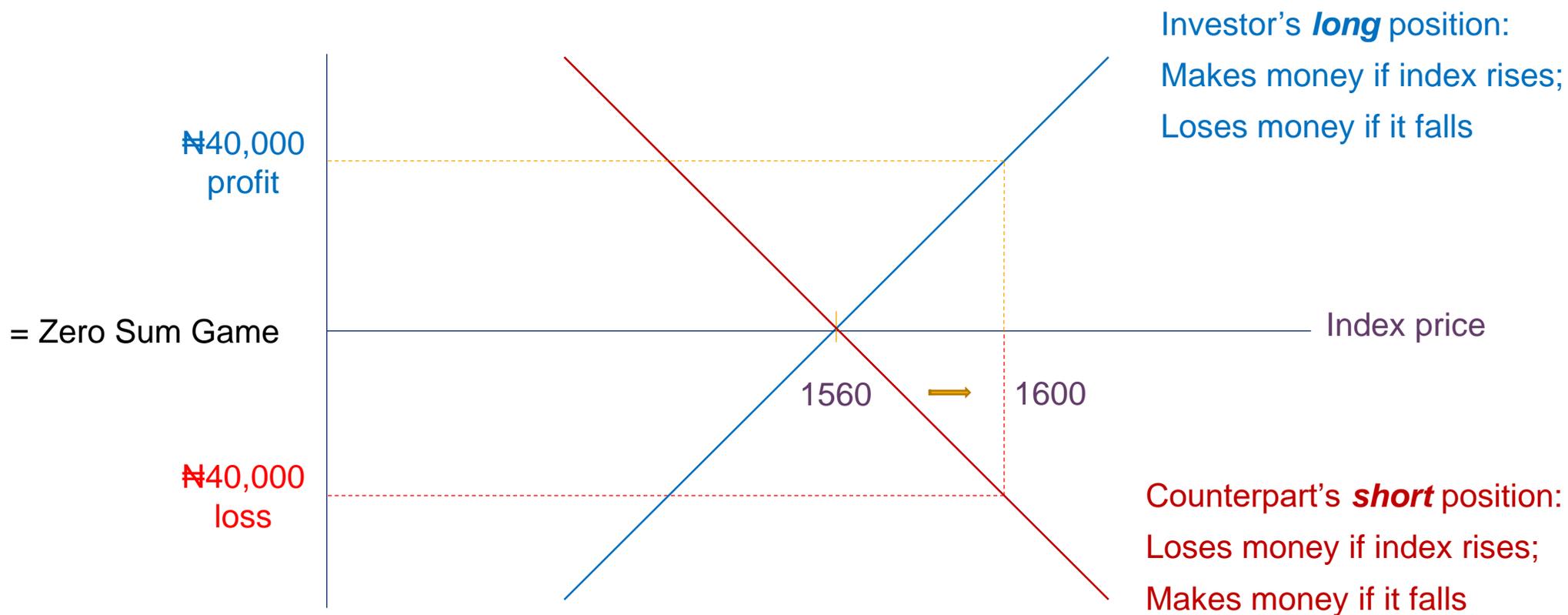    - Gaining exposure – synthetic funds; asset allocation; increasing beta exposure; equitisation

# Trading Applications

# Directional Trading
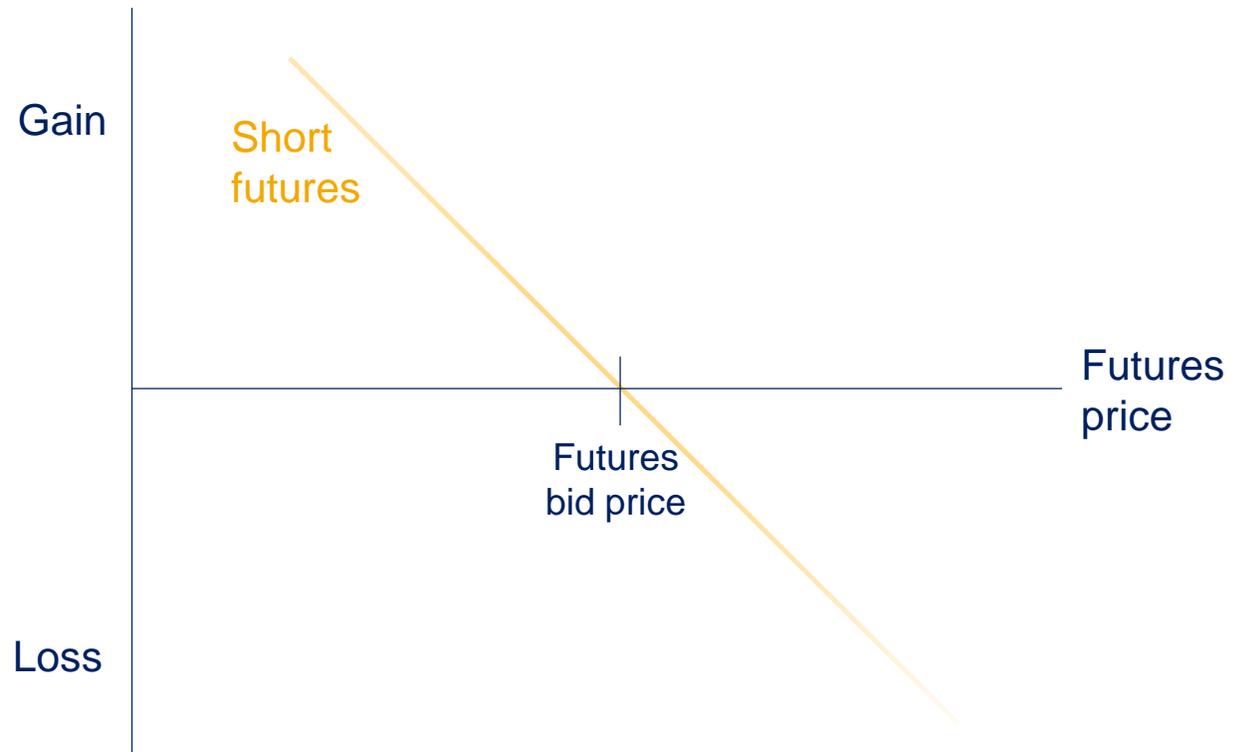
# The P/L Profile as at Delivery

A trader enters into an index futures contract with a bank to *go long* (i.e. buy) the index at **1560 index points** for delivery on 17-Dec

Investor's ***long*** position:
Makes money if index rises;
Loses money if it falls

₦40,000 profit

= Zero Sum Game

Index price

1560 ⟶ 1600

₦40,000 loss

Counterpart's ***short*** position:
Loses money if index rises;
Makes money if it falls

# The Basis & Basis Trading

- The "Basis" is the term used to describe the *relationship* between the cash price and the futures price and is the difference between the cash and forward (or futures) prices:

$$Gross\ Basis = Cash\ price\ -\ futures\ price$$

- Over time, due to convergence, the basis will converge towards zero, as the futures price settles at the spot price at delivery

- *Basis trading* seeks to take advantage of changes in the basis over time, either a weakening or strengthening of the basis

# What Drives the Basis: Determining a "Fair" Price

- Futures price and the underlying cash price relationship
  - Cost of carry:
    - Finance costs (interest)
    - Storage costs
    - Insurance
  - Carry return:
    - Dividends
- Convergence:
  - As the point of delivery approaches, the costs of carry diminish and the differential must narrow

$$\text{"Fair" } Futures\ Price = Spot + cost\ of\ carry - carry\ return$$

# Fair Forward Price: Worked Example

- Gold is trading at $1,642.10 per ounce

- One-month (31-days) USD rate: 1.25%

- Storage costs: 0.75% pa

Rate quoted as a MM rate with simple interest

What is the fair one-month forward price?

| | |
|---|---|
| Spot | $1,642.10 |
| Plus, cost of carry | |
|     Interest:      $1,642.10 x 1.25% x 31/360 | 1.77 |
|     Storage:      $1,642.10 x 0.75% x 31/360 | 1.06 |
| Forward | $1,644.93 |

What have we actually calculated?

# Executing an Arbitrage Trade (1)

- Suppose in the previous example gold is quoted at $1,646.00 for delivery one-month forward
    - *What does this imply?*
    - *What trade can be executed in order to secure a risk-free return?*
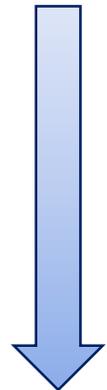
| The trade: | Buy gold spot, pay | - $1,642.10 |
| | Borrow the spot amount paid | +$1,642.10 |
| | Sell gold one-month forward | $\underline{\quad 0.00}$ |
| Cash out today | | $\underline{\quad 0.00}$ |

| One-month: | Deliver gold, receive | $1,646.00 |
| | Repay borrowing, with interest | |
| | $1,642.10 x (1 + 0.0125 x 31/360) | - $1,643.87 |
| | Pay storage costs | |
| | $1,642.10 x 0.0075 x 31/360 | $\underline{- \$ \quad 1.07}$ |
| Net cash in after one-month | | $\underline{+\$ \quad 1.06}$ |

This is a ***cash and carry*** arbitrage trade

# Executing an Arbitrage Trade (2)

- Suppose in the previous example gold is now quoted at $1,642.00 for delivery one-month forward

  - *What trade can be executed in order to secure a risk-free return?*
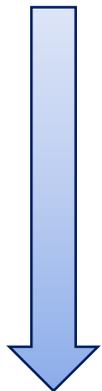
| | | |
|---|---|---:|
| The trade: | Sell gold spot, receive | + $1,642.10 |
| | Invest the spot proceeds | - $1,642.10 |
| | Buy gold one-month forward | $____0.00 |
| **Cash out today** | | **$____0.00** |

| | | |
|---|---|---:|
| One-month: | Receive gold, pay | - $1,642.00 |
| | Receive deposit back, with interest | |
| | $1,642.10 x (1 + 0.0125 x 31/360) | + $1,643.87 |
| **Net cash in after one-month** | | **+ $____1.87** |

**This is a reverse *cash and carry* arbitrage trade**

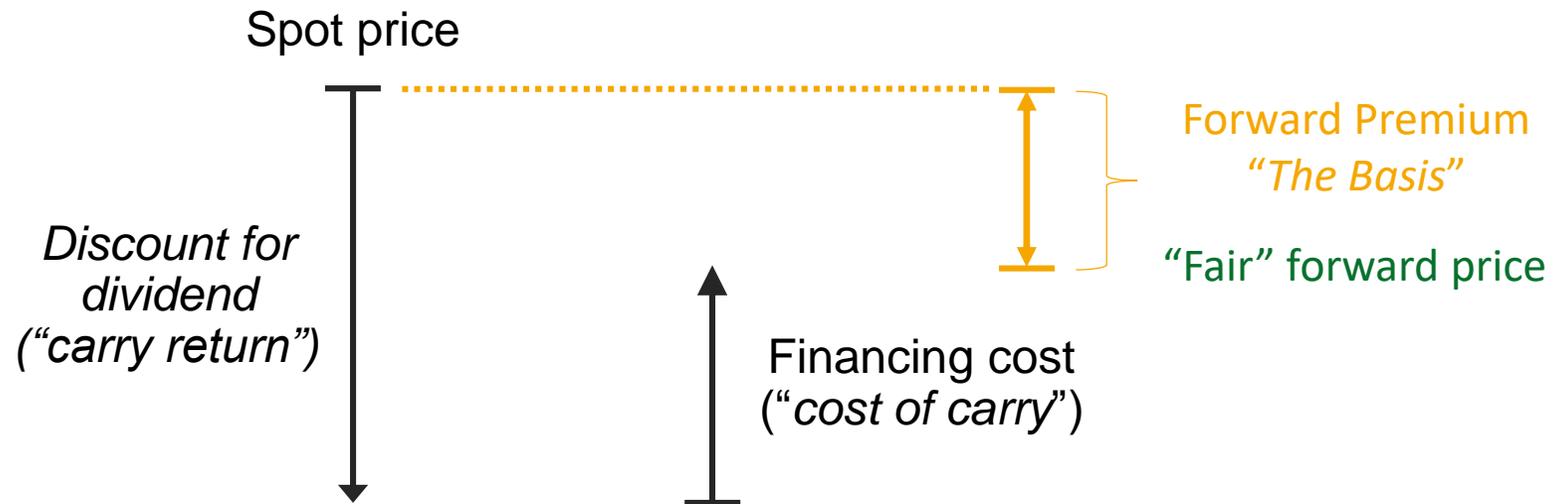# Applying the Concept to Index Futures

- NGX 30 is trading at 1650 index points

- Three-month (92-days) Nigerian interest rate: 8.75%

- Dividend yield: 3.75% pa

- What is the fair three-month futures price?

| | |
|---|---:|
| Spot | 1650.00 |
| Plus, cost of carry | |
|     Interest: 1650 x 8.75% x 92/365 | 36.39 |
| Less, carry return | |
|     Dividend: 1650 x 3.75% x 92/365 | (15.59) |
| Forward | 1670.80 |

$$Or, Forward = Spot \ x \ \left[1 + (cost \ of \ carry - carry \ return)x \ ^{Days}/_{Day \ basis}\right]$$

$$Forward = 1650 \ x \ \left[1 + (8.75 - 3.75)\% \ x \ ^{92}/_{365}\right] = \mathbf{1670.80}$$

# Schematic Representation

Spot price

Forward Premium
*"The Basis"*

*Discount for dividend ("carry return")*

Financing cost ("*cost of carry*")

"Fair" forward price

1. Where might we expect a broad index (e.g. NGX 30) forward price to trade *relative* to the cash price?

# Schematic Representation

Spot price

Forward Premium
"The Basis"

"Fair" forward price

*Discount for dividend ("carry return")*

*Financing cost ("cost of carry")*
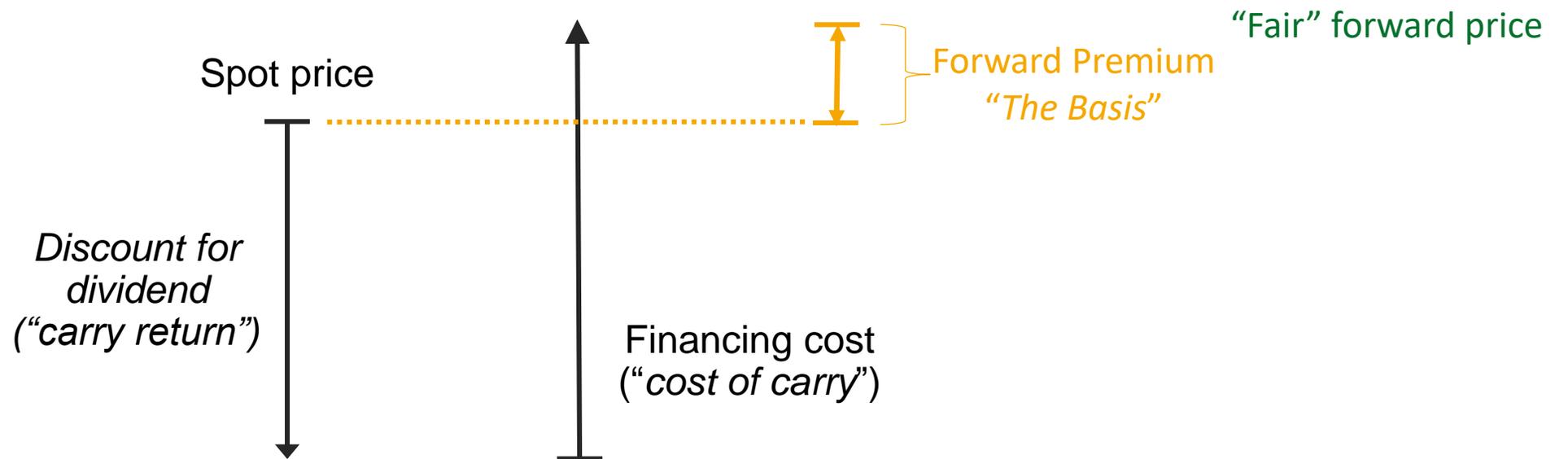
2. How is the NGX Pension Index different?

3. What happens to the basis over time

# Calculating the "Fair" Futures Price

- The NGX 30 equity index is trading at 1653.00 index points

- Calculate the "fair" three-month (92-days) futures price, given that the three-month interest rate is trading at 7.90% and the dividend yield on the index is 3.60% pa

$$1653 \; x \; \left[1 + (7.90 - 3.60)\% \; x \; \frac{92}{365}\right] = 1671.00 \qquad (\textit{rounded to nearest } 0.25)$$

# Choosing the Right Trade

- The NGX 30 futures contract for delivery in 80-days is trading at 1669.50 index points

- The cash index is trading at 1649.25 index points

- The 80-day interest rate is 8.05% and the dividend yield is 3.50% pa.
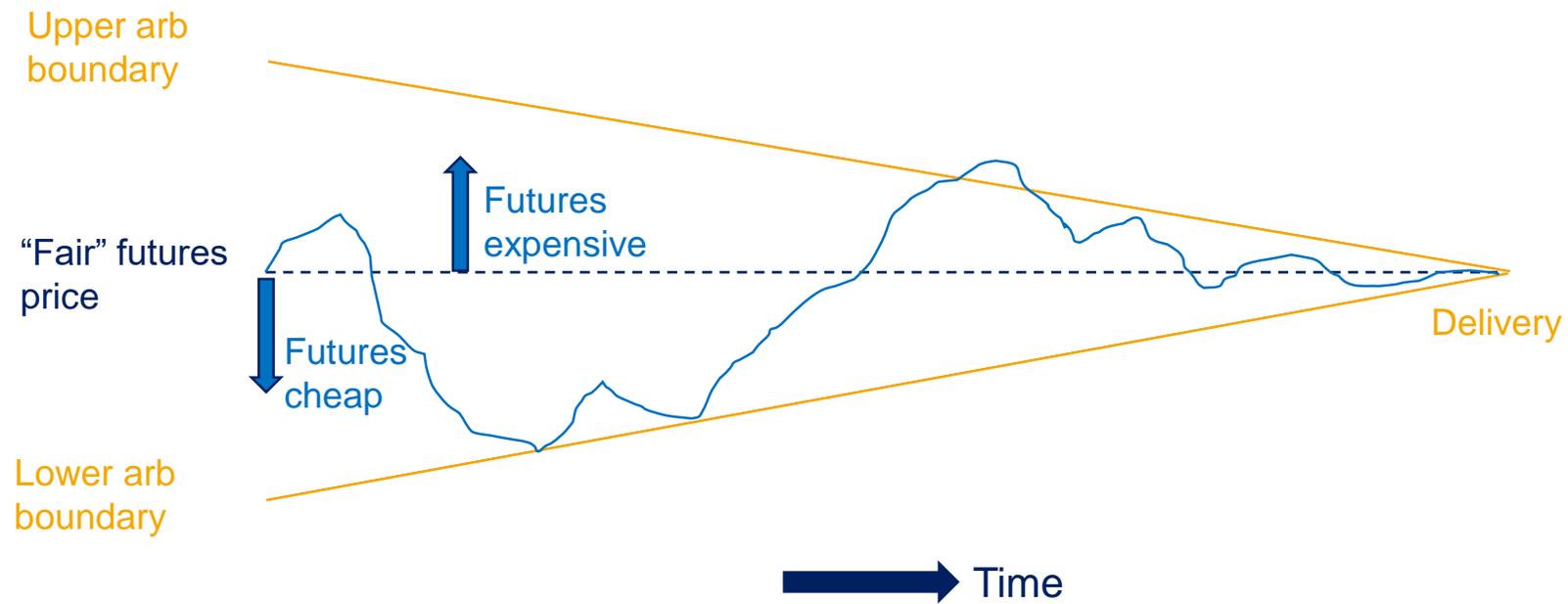
What trade(s) would you execute?

We first calculate a "fair" price:

$$1649.25 \; x \; \left[1 + (8.05 - 3.50)\% \; x \; {}^{80}\!/_{365}\right] = \mathbf{1665.75} \qquad (rounded \; to \; nearest \; 0.25)$$
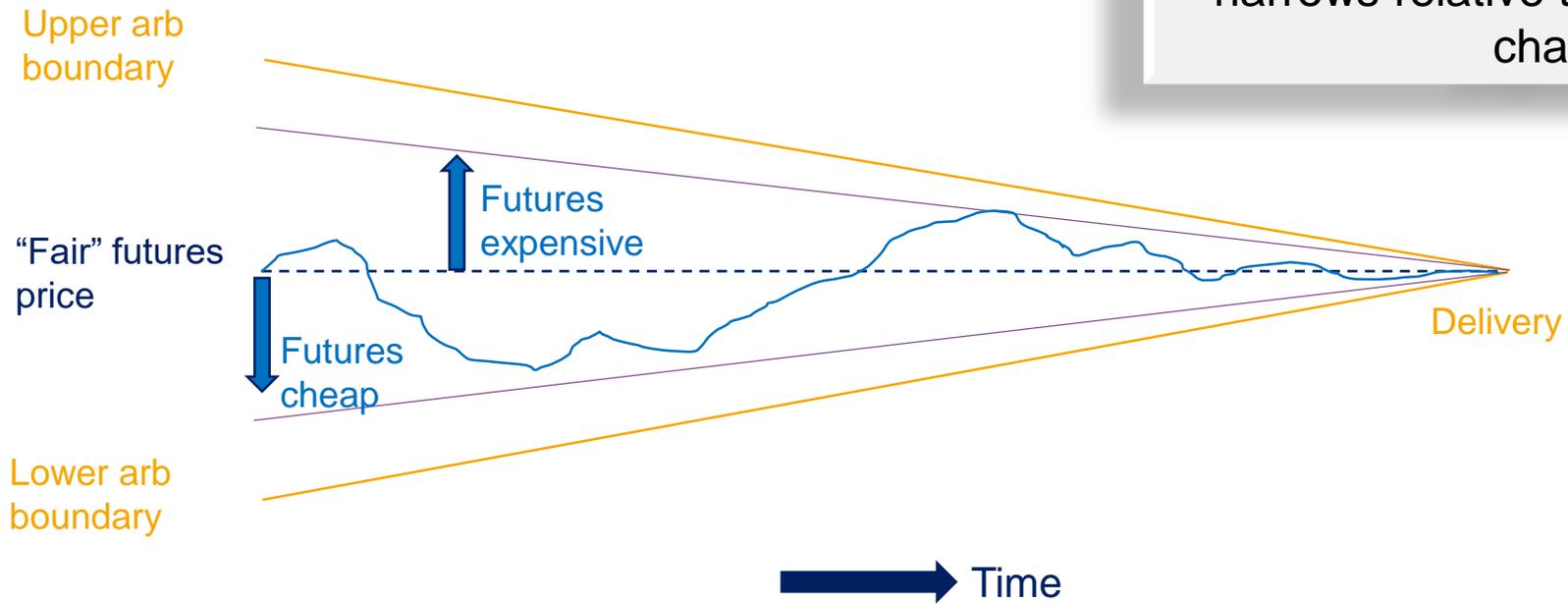
The actual futures is trading at 1669.50, which looks **expensive** to fair value

Hence, you should sell (the expensive) futures and buy the cash index;
i.e. the **cash and carry arbitrage**
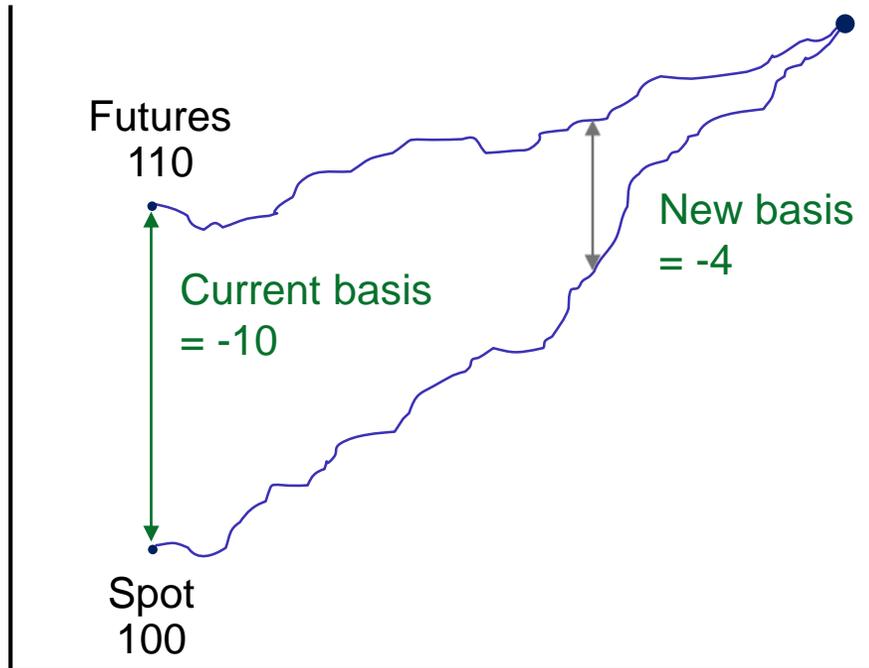
# The "Fair" Price & the Arbitrage Channel

# The Impact of Arbitrage Trading on the Actual Futures Price

Note that the actual arbitrage channel narrows relative to the "theoretical" channel
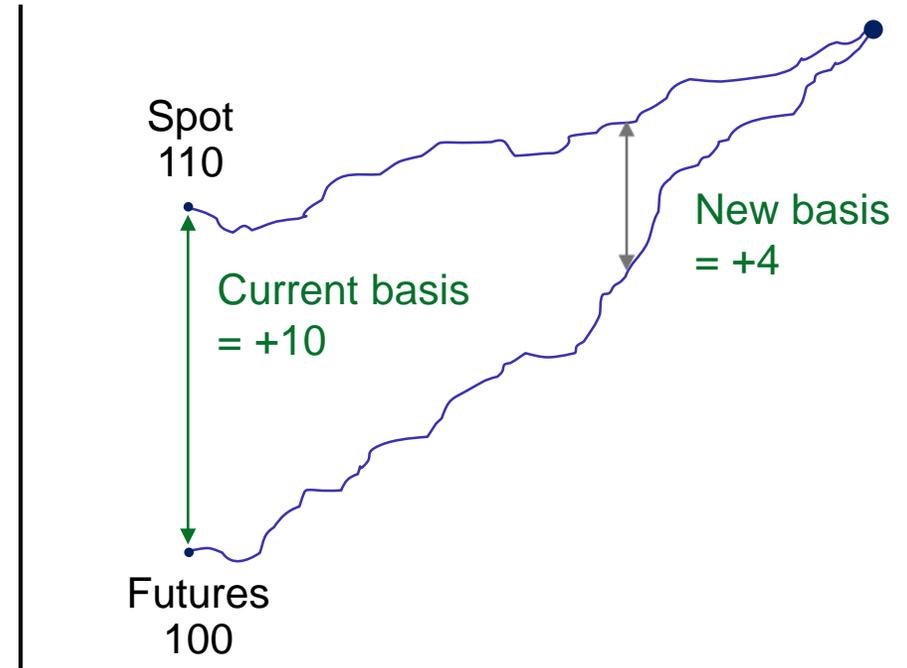
Upper arb boundary

Futures expensive

"Fair" futures price

Futures cheap

Lower arb boundary

Delivery

Time

# The Basis over Time

## Contango

Futures
110

Current basis
= -10

Spot
100

New basis
= -4

New basis *less negative*

Basis has *strengthened*

"Buy the basis"

## Backwardation

Spot
110

Current basis
= +10

Futures
100

New basis
= +4

New basis *less positive*

Basis has *weakened*

"Sell the basis"

# The Basis Trades

Contango
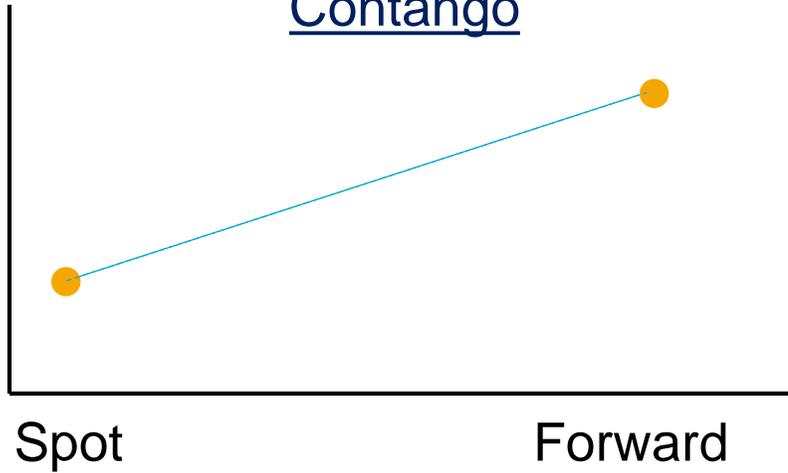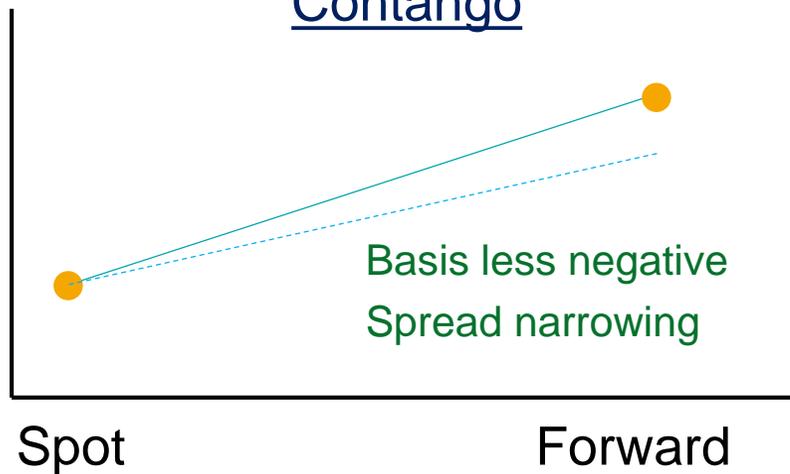
Spot          Forward

Backwardation

Spot                    Forward

# The Basis Trades

## Contango



Basis less negative
Spread narrowing

Spot                    Forward

BASIS

Strengthening

"Buy the basis"

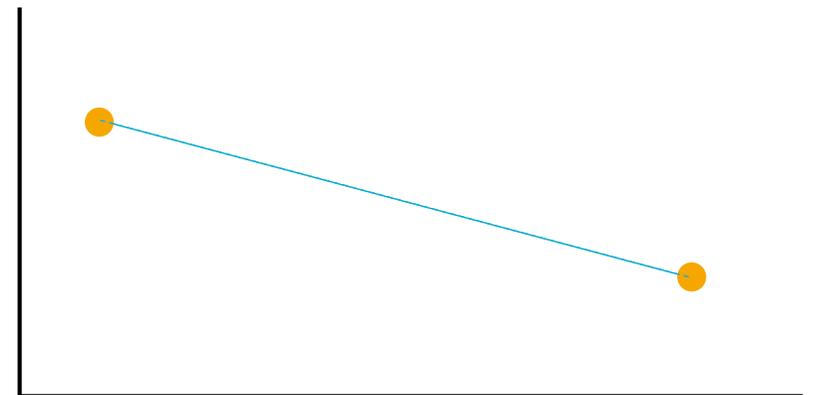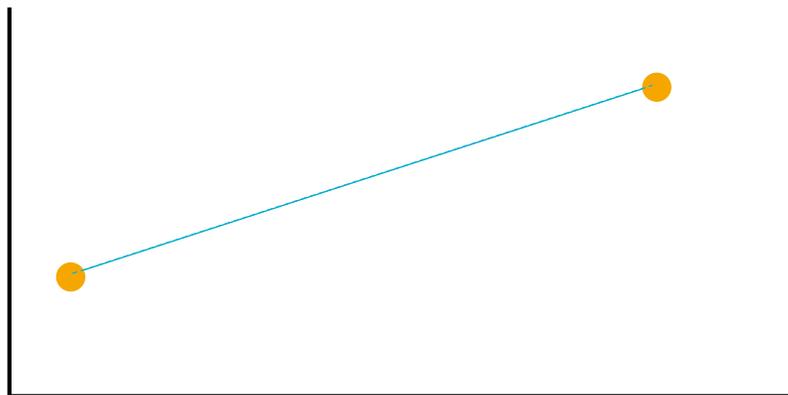## Backwardation



Basis more positive
Spread widening

Spot                    Forward

# The Basis Trades

## Contango



Basis less negative
Spread narrowing

Spot          Forward
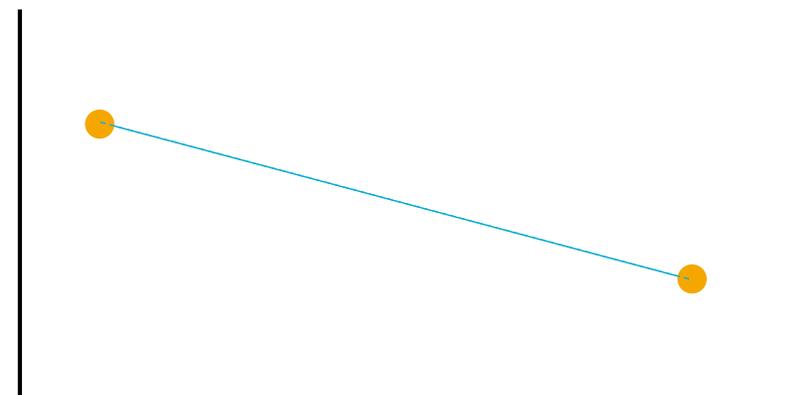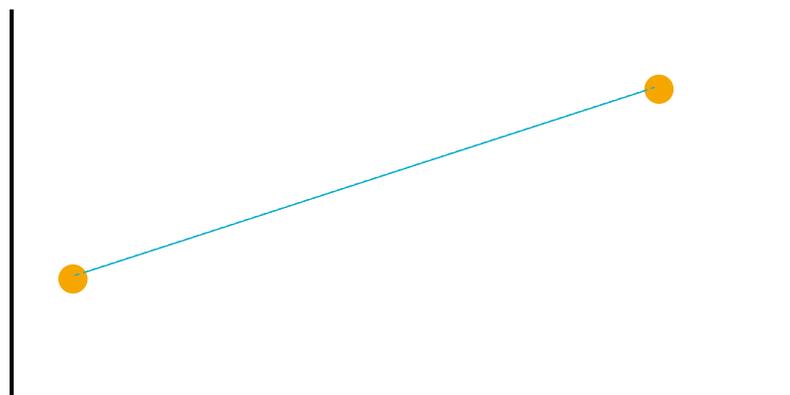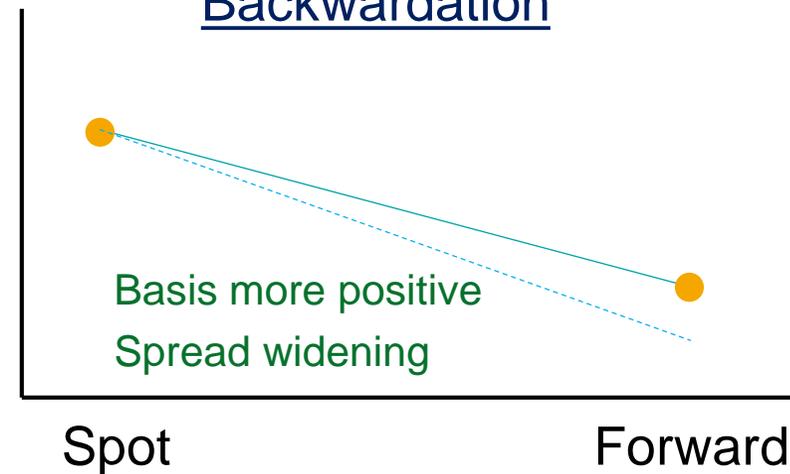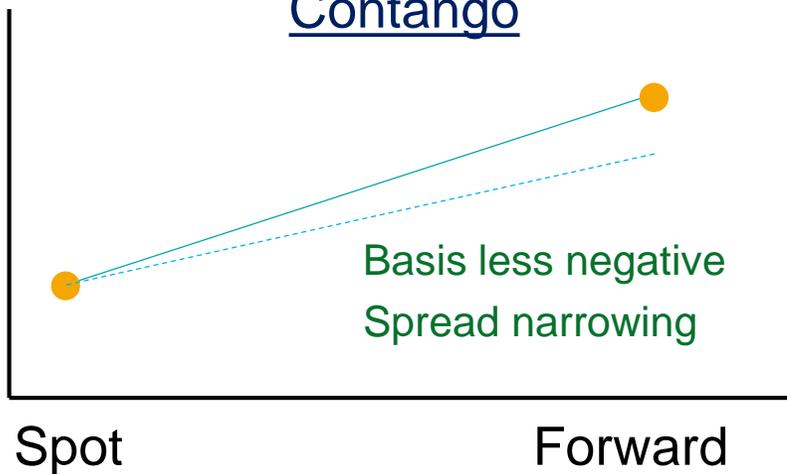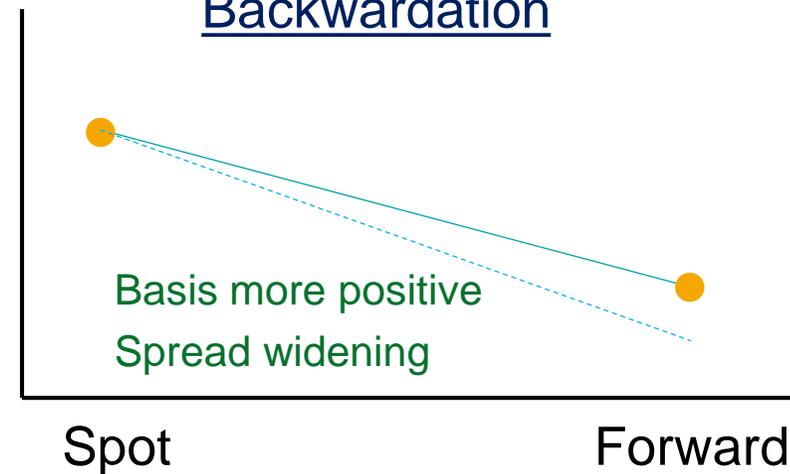
Basis more negative
Spread widening



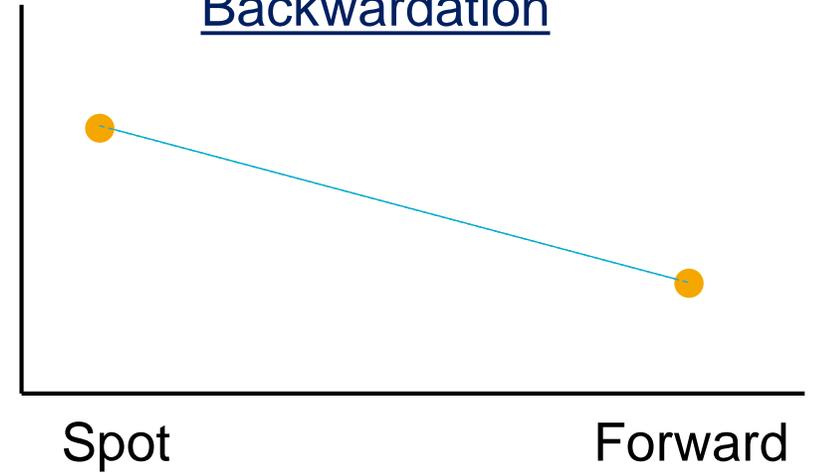## BASIS

### Strengthening

"Buy the basis"

### Weakening

"Sell the basis"

## Backwardation



Basis more positive
Spread widening

Spot          Forward

Basis less positive
Spread narrowing

# Summary

$$Gross\ Basis = Cash\ price - futures\ price$$

- The Basis measures the difference between the cash and forward (or futures) prices:

| Market | Gap | Basis | Action |
|---|---|---|---|
| Contango | Narrowing | Strengthening | Buy the spread |
| Contango | Widening | Weakening | Sell the spread |
| Backwardation | Narrowing | Weakening | Sell the spread |
| Backwardation | Widening | Strengthening | Buy the spread |

# A Basis Trade

- The NGX Pension futures are currently trading at the following prices:

  Sep      1520.25                    Dec      1539.25

- You expect the Sep – Dec NGX Pension basis to **_widen_** temporarily

- What trades should you make in the two contracts?

  A. **_Sell_** the basis, i.e. sell the front month, buy the back month

- The prices the following day are:

  Sep      1495.75                    Dec      1520.75

If you trade in 50 lots, what profit/loss have you made?

Basis is currently -19 IP s (1520.25 – 1539.25)

| | |
|---|---|
| Sell Sep at 1520.25, buy at 1495.75 | 50 x   24.50 x ₦1,000 = ₦1,225,000 |
| Buy Dec at 1539.25, sell at 1520.75 | 50 x -18.50 x ₦1,000 = -₦   925,000 |

₦300,000

New basis is -25 IPs (1495.75 – 1520.25), an increase of 6 IPs, resulting in a profit of ₦300k

> What might cause this to happen?
>
> What impact might this have on the Index?

# Portfolio Management Applications

# Equity Fund Management

- Institutional investment is predicated on two alternative:
    - Passive: i.e. tracking an index
    - Active management

- Most active strategies seek to capture "alpha" by either:
    - Reducing or increasing market exposure (market timing strategies)
    - Adjusting sectoral/stocks weights against the benchmark index (sector/stock selection)

# Equitisation

# Cash Equitization with Index Futures

- Institutional funds often hold cash, primarily for operational reasons, such as meeting both expected and unexpected redemptions

- But, one problem with holding cash is that it is a drag on performance *relative* to the fund's benchmark

  - This is a particular problem for index funds (i.e. those following a passive strategy), where there performance is measured on the minimization of tracking error, but can also apply to the more actively traded funds

# Performance Impact of the Cash Drag

- For example, take a $100 million fund invested in equities but withholding 1.0% in uninvested cash

- Assume the index has an annualized rate of return of 10% over a forty-year period

- In this example, over a 40-year investment horizon this equates to a variance of roughly $161 million, or approximately 10 basis points annual cash drag!

**Difference in Total Returns, Fully Invested vs. 1.0% Cash w/h**
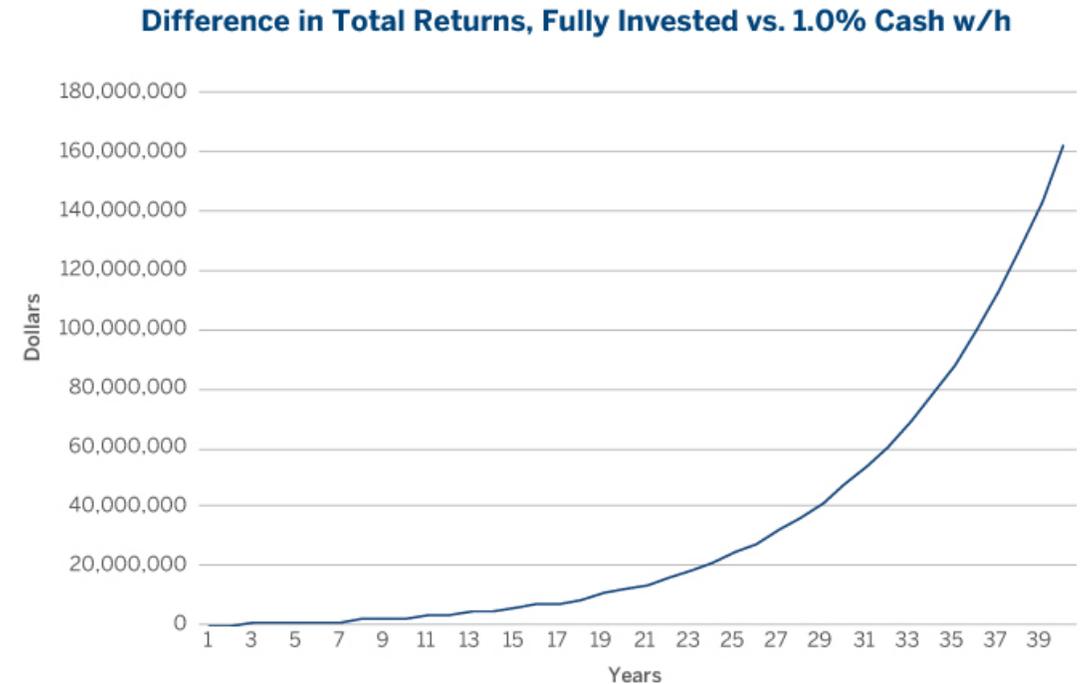
# Managing the Cash Drag: Setting up the Trade

- How could this "cash drag" be managed?

- Suppose that a ₦1,200m fund is benchmarked to the NGX Pension Index and ₦56m is currently held in cash (aggregated over time from dividends, plus contributions less withdrawals)

- The Dec NGX Pension futures is trading at 1565 index points

How many futures should the fund manager buy/sell to be fully invested?

One futures contract controls ₦1,565,000 [1565 x ₦1,000]

The fund manager should **buy 36** Dec NGX Pension futures [₦56m/ ₦1,565,000

# Principal Portfolio Strategies

**Beta Replication Strategies**

Beta Targeting

Equitisation
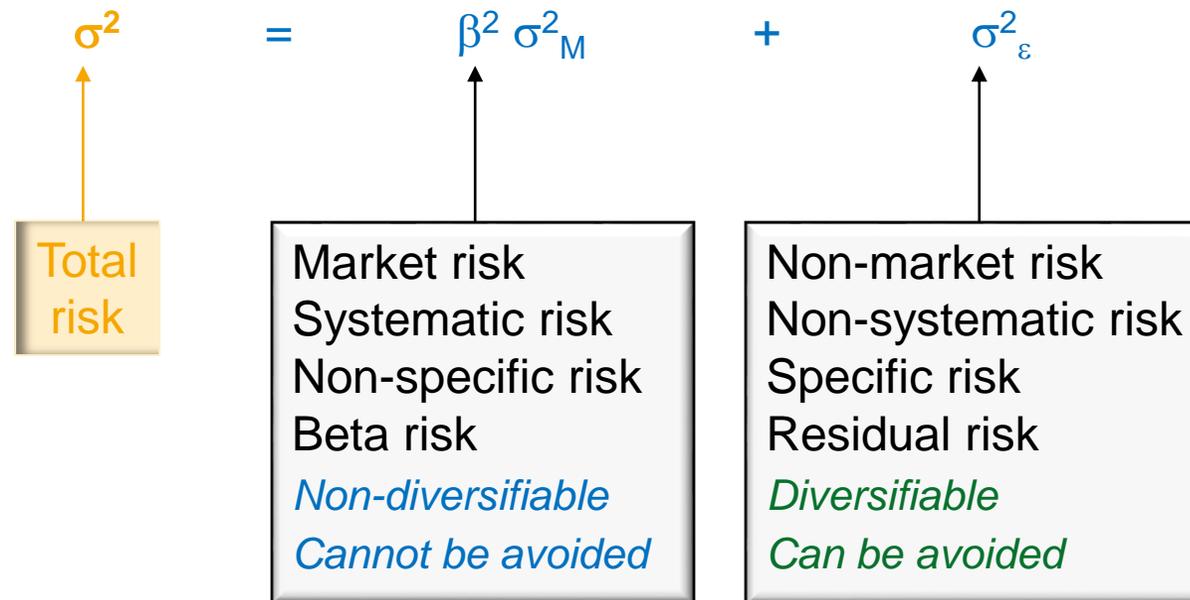
Asset Rebalancing

Portable Alpha Strategies

Sector Rotation

# Equity Index Futures: A Recap

- How do index futures help?

  1. Gain exposure to (hopefully, the benchmark) index in one trade quickly and efficiently

  2. Close correlation to the underlying index

  3. Can go long or short, enabling risk to be assumed or transferred

  4. If liquid, cost of trade will be low and result in low or zero price slippage even in large size (unlike trades in the less liquid stocks that make up the index)
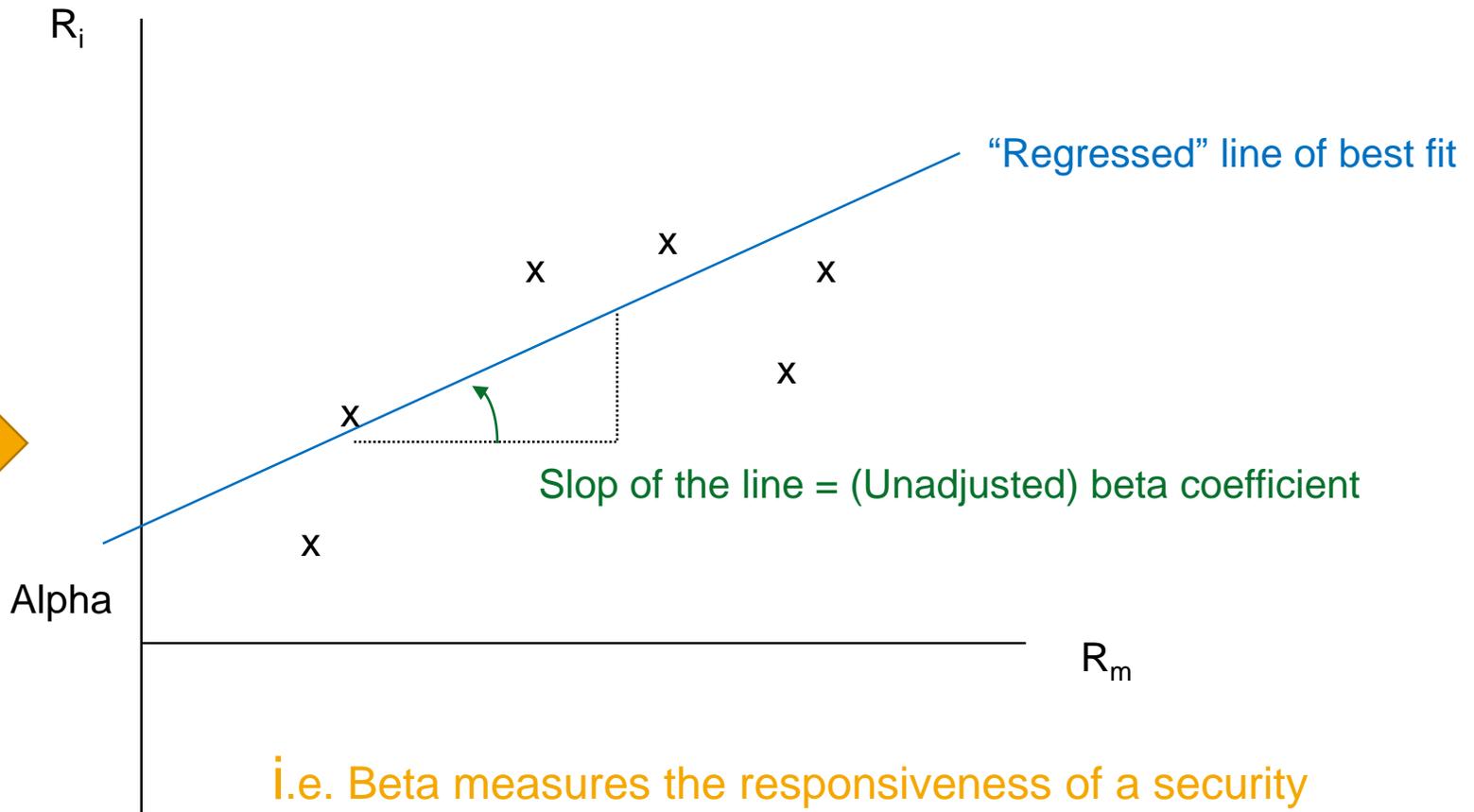
# CAPM, Beta & Portfolio Risk

- The risk of an equity portfolio can be split into two components:

$$\sigma^2 \quad = \quad \beta^2\, \sigma^2_M \quad + \quad \sigma^2_\varepsilon$$

| Total risk | Market risk<br>Systematic risk<br>Non-specific risk<br>Beta risk<br>*Non-diversifiable*<br>*Cannot be avoided* | Non-market risk<br>Non-systematic risk<br>Specific risk<br>Residual risk<br>*Diversifiable*<br>*Can be avoided* |
|---|---|---|

- Institutional funds are typically benchmarked to an index

# What is "Beta" & How is it Measured

$$(Unadjusted)\beta = \frac{Covar_{M,S}}{Var_M} = \frac{\sigma_S}{\sigma_M} \, x \, \rho_{M,S}$$

$R_i$

"Regressed" line of best fit

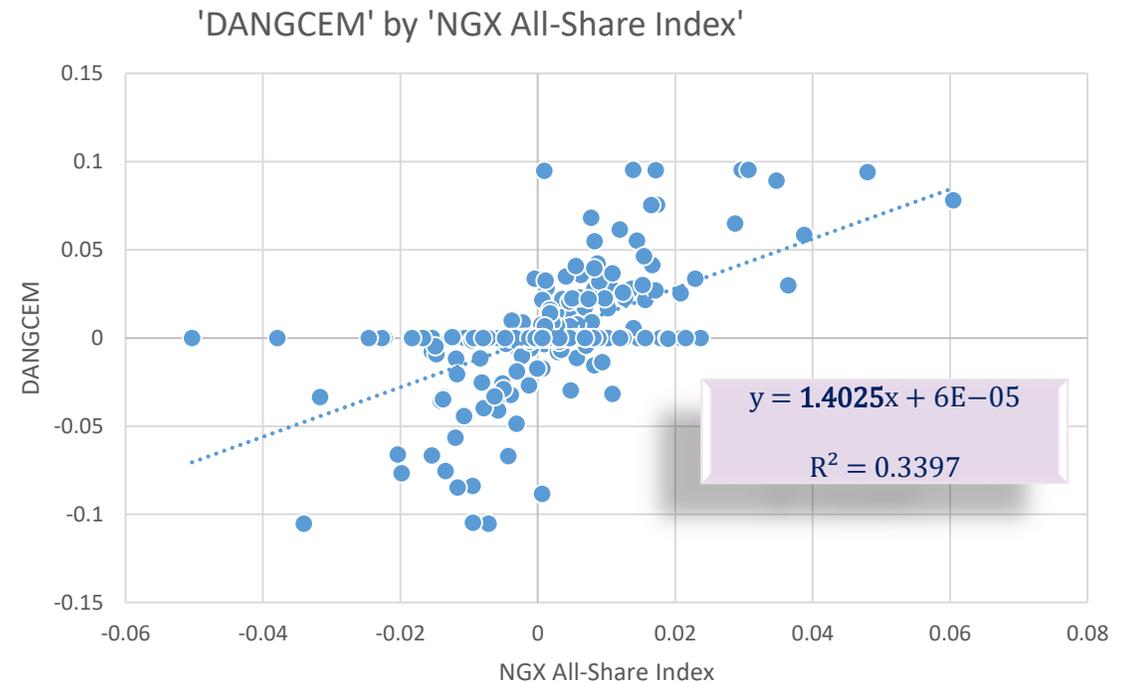Alpha

$R_m$

Slop of the line = (Unadjusted) beta coefficient

i.e. Beta measures the responsiveness of a security against a given market index

# Dangote Cement Plc (DANGCEM)

$$(Unadjusted)\beta = \frac{0.0001431}{0.000102049} = \frac{2.4307\%}{1.0102\%} \; x \; 0.5828605 = \mathbf{1.4025}$$

*[Based on daily closing prices from 02-Jan-21 to 26-Aug-21]*



'DANGCEM' by 'NGX All-Share Index'

$y = \mathbf{1.4025}x + 6E{-}05$

$R^2 = 0.3397$

# Determining & Interpreting Portfolio Beta

- Beta measures *market risk*

- The beta value of a *portfolio of shares* is the weighted sum of the betas of the underlying shares included in the portfolio:

$$\beta_p = \sum_{i=1}^{n} \beta_i x_i \qquad where, \sum_{i=1}^{n} x_i = 1$$

β = 1          Matches the performance of the index

β > 1          Implies an *aggressive* strategy, where the fund manager is *bullish*

β < 1          Implies a *defensive* strategy, where the fund manager is *bearish*

# Beta Targeting & Hedging

- Beta targeting is a very commonly utilised strategy by active fund managers, as a form of market timing

- The objective is "tilt" the fund in such a way such that the portfolio will outperform in bullish or bearish market conditions

Profit

Index
$\beta = 1$

Index

Loss
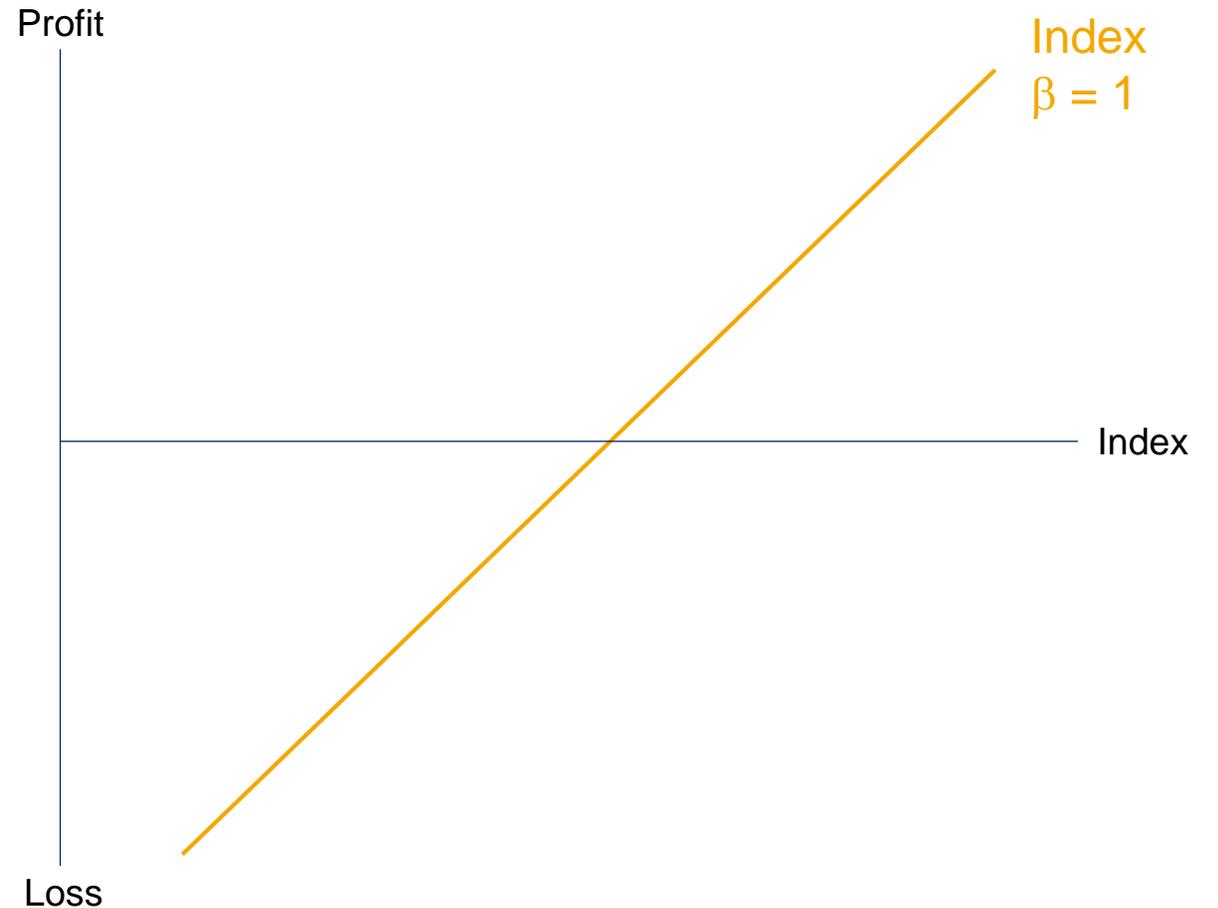
# Timing the Economic Cycle



Bull Prediction

Bear Prediction
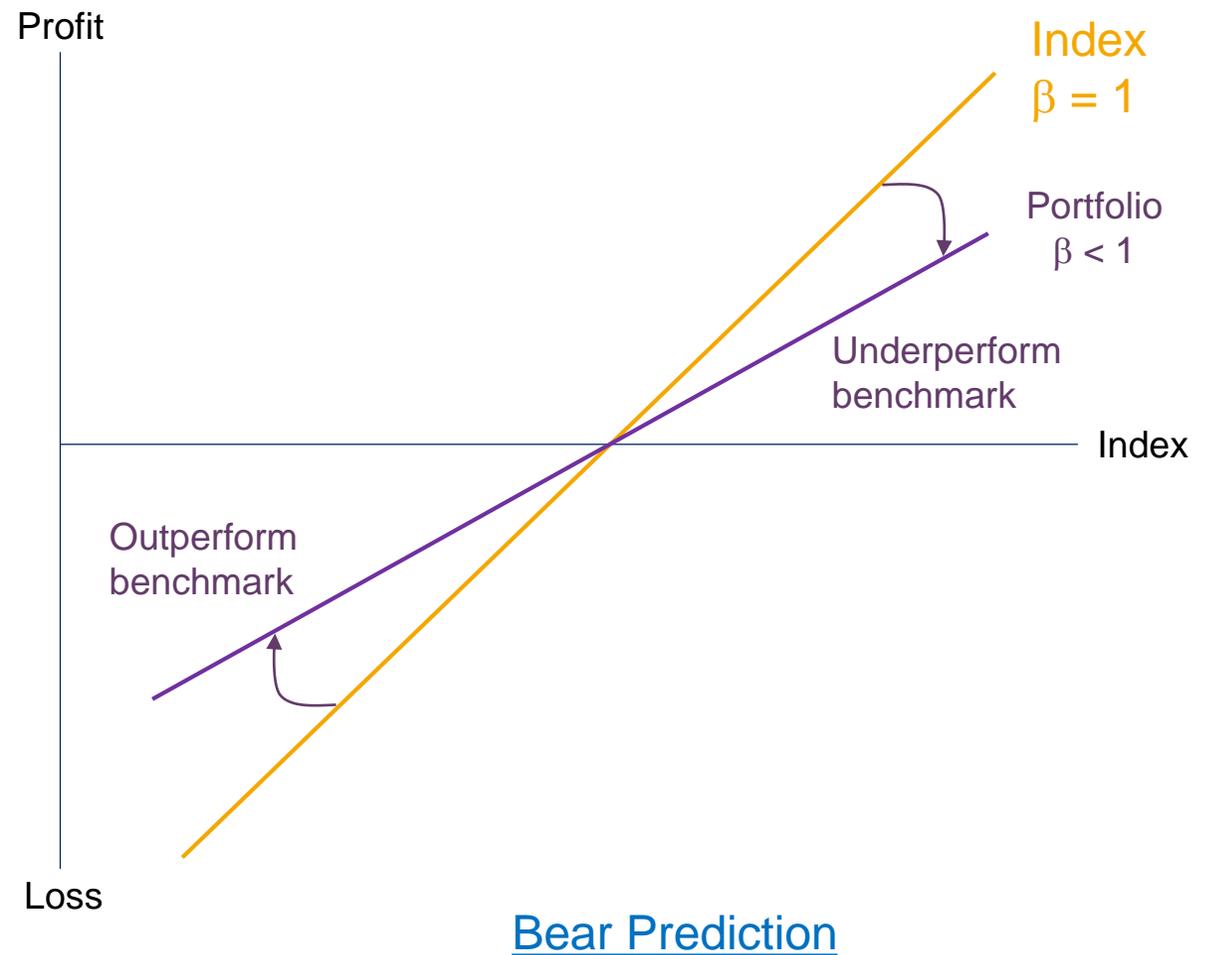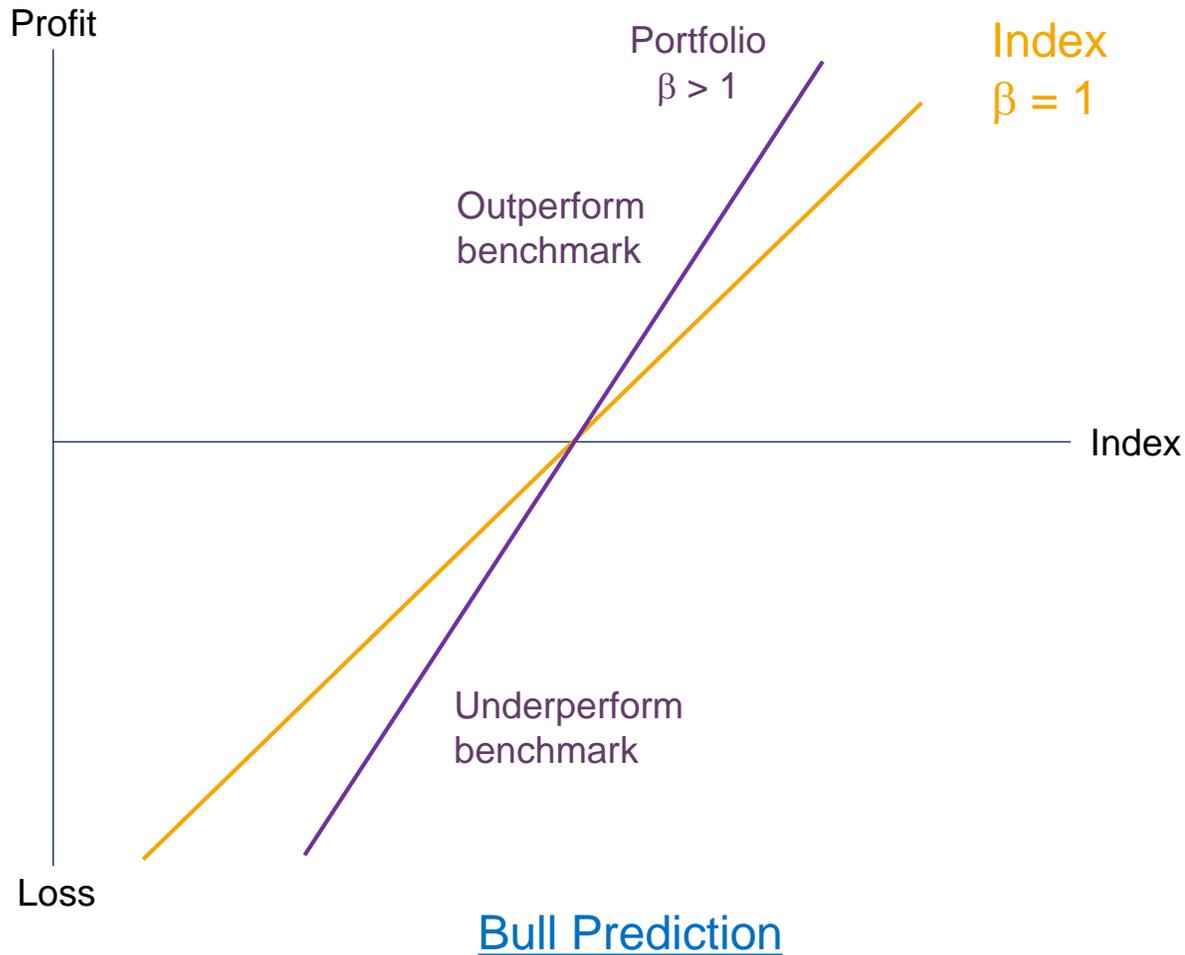
# Special Case: Full Hedge

- In the case of the "full hedge", the fund manager sells an appropriate number of futures to reduce an equity exposure to cash exposure

- As such, the beta is zero

Profit

Index
$\beta = 1$

Index

Loss

Fully hedged position: equity exposure converted to a cash exposure
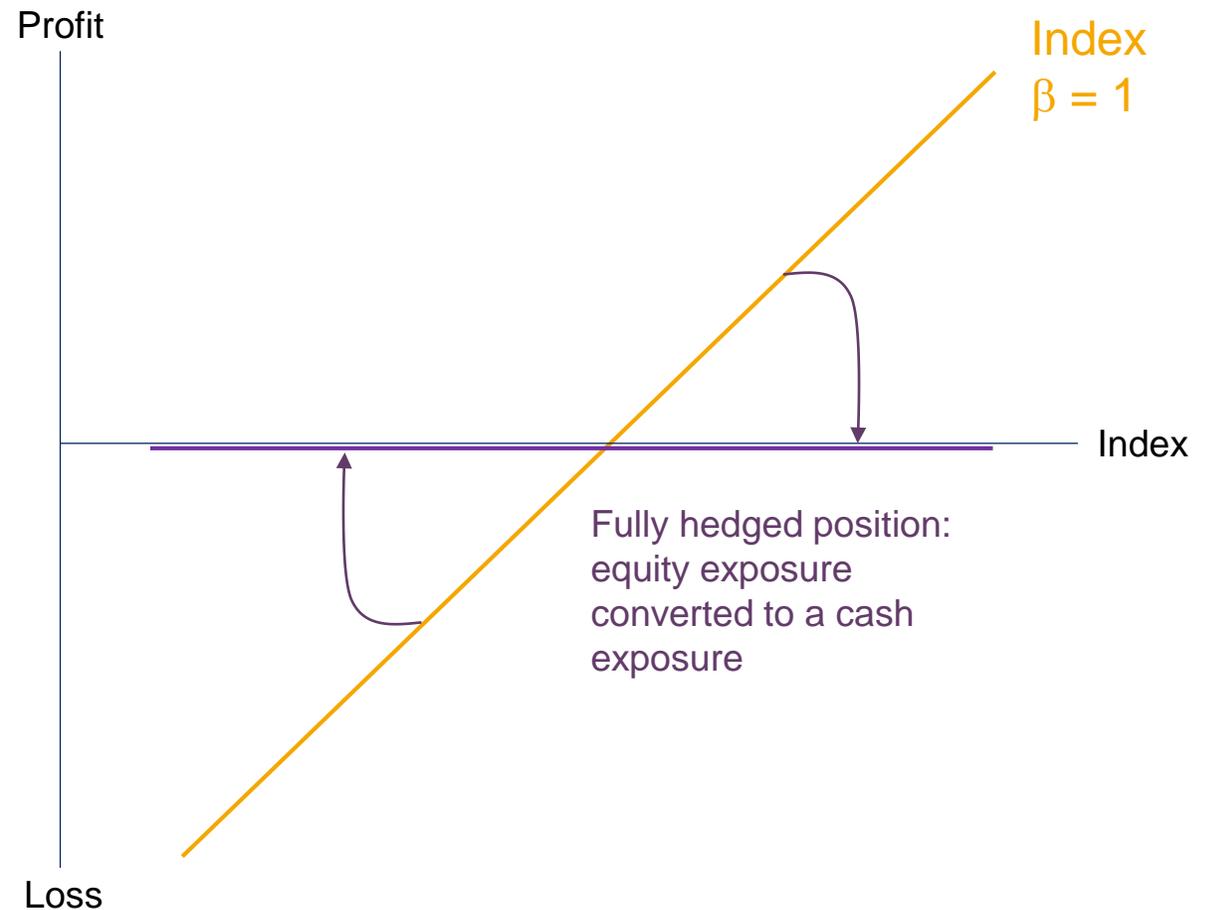
# Hedging an Equity Index

- The ratio used for a hedge through to *delivery day* is as follows:

$$Number\ of\ contracts\ \# = \frac{Portfolio\ Market\ Value}{Cash\ index\ level\ x\ Index\ point\ value}\ x\ \beta$$

- Where β measures the *relative volatility* of the portfolio to the underlying index futures

# Determining the Hedge Ratio

- A fund manager overseas a diversified fund of large cap stocks quoted on NGX with a market value of ₦150,000,000 and a beta with respect to the NGX 30 index of 0.95

- The NGX 30 is trading at 1650, and the nearby Mar futures at 1674.25

How many contracts should the fund manager buy/sell to hedge overnight?

$$Number\ of\ contracts\ \# = \frac{₦150,000,000}{1674.25\ x\ ₦1,000}\ x\ 0.95 = 85.11$$

The fund manager should *sell* 85 NGX 30 Mar futures

Note, if the manager was hedging to the delivery day, you would substitute the *cash index price* for the futures price

# Hedging an Equity Portfolio: Example

- The current date is August 15; the NGX 30 index is trading at 1650.00 index points, and the Sep futures (delivery date September 17) is trading at 1675.00

- You own the following portfolio of three stocks and are looking to implement a full hedge to delivery day

| Stock | Holding | Share Price (Naira) | Market Value (Naira) | Beta | Specific Risk | Total Risk |
|---|---|---|---|---|---|---|
| ACCESS | 4,000,000 | 9.1 | 36,400,000 | 1.30 | 41.91% | 46.96% |
| DANGCEM | 125,000 | 249.6 | 31,200,000 | 1.40 | 31.86% | 39.19% |
| MTNN | 175,000 | 172.0 | 30,100,000 | 1.01 | 25.33% | 30.21% |
| | | | 97,700,000 | 1.24 | | |

- The annual market risk or volatility is estimated at 16.3% per annum, and the index point value of the futures contracts is ₦1,000

# Determining the Hedge Ratio

- STEP 1: Determine the portfolio β

$$\beta_p = \frac{36{,}400{,}000}{97{,}700{,}000}(1.30) + \frac{31{,}200{,}000}{97{,}700{,}000}(1.40) + \frac{30{,}100{,}000}{97{,}700{,}000}(1.01) = 1.24$$

- STEP 2: Calculate the hedge ratio

$$Number\ of\ contracts\ \# = \frac{Portfolio\ Value}{Cash\ Index\ Level\ x\ ₦1{,}000} \ x\ \beta_{Port}$$

$$\frac{₦97{,}700{,}000}{1650\ x\ ₦1{,}000}\ x\ 1.24 = 73.42 \qquad or,\ \textbf{sell 73}\ Sep\ NDX\ 30\ futures$$

# Portfolio Locked-In Value at Delivery

- The locked in value of the portfolio is given by the following:

$$Portfolio\ MV + [\#contracts\ x\ (futures\ price - cash\ index\ level)]\ x\ IP\ multiplier$$

I.e.
$$₦97,700,000 + [(73)\ (1675 - 1650)\ (₦1,000)] = ₦\ 99,525,000$$

- If the futures is *fairly priced*, the futures premium represents the interest foregone, less the dividends received

- Accordingly, we should be indifferent between a long stock, short futures position and a long cash position

  We can create a *synthetic equity index exposure* (more on this later)

# And the Proof….

Assume the market falls by 5% to 1567.50 index points as at delivery day:

(*Expected*)   portfolio fall: 5% x 1.24        or, 6.20%

| | | |
|---|---|---|
| Portfolio value | = | ₦97,700,000 x (1 – 0.062) |
| | = | ₦91,642,600 |

| | | |
|---|---|---|
| Futures profit | = | [1675 – 1567.50] x ₦1,000 x 73 |
| | = | ₦7,847,500 |

| | | |
|---|---|---|
| Total net value | = | ₦91,642,600 + ₦7,847,500 = **₦99,490,100**\* |

\*The small discrepancy is due to rounding the number of futures  traded

# Why the Hedge May Not Perform as Expected

1. Portfolio not fully diversified and thereby carrying some specific risk

2. Beta risk, i.e. a diversified portfolio with no or limited specific risk, does not perform in line with the portfolio beta estimate

3. Cash/futures basis risk if hedge not held until delivery

# Identifying the Specific Risk

| Stock | Holding | Share Price (Naira) | Market Value (Naira) | Beta | Specific Risk | Total Risk |
|---|---|---|---|---|---|---|
| ACCESS | 4,000,000 | 9.1 | 36,400,000 | 1.30 | 41.91% | 46.96% |
| DANGCEM | 125,000 | 249.6 | 31,200,000 | 1.40 | 31.86% | 39.19% |
| MTNN | 175,000 | 172.0 | 30,100,000 | 1.01 | 25.33% | 30.21% |
| | | | 97,700,000 | 1.24 | | |

$\sigma_M = 16.3\%$

$Portfolio\ market\ risk: 1.24\ x\ 16.3\%$

$\sigma_M = 20.21\%$

$$Portfolio\ specific\ risk: \sqrt{\left[\left(41.91\ x\ {}^{36.40}/_{97.70}\right)^2 + \left(31.86\ x\ {}^{31.20}/_{97.70}\right)^2 + \left(25.33\ x\ {}^{30.10}/_{97.70}\right)^2\right]}$$

$\sigma_S^2 = 408.23$

$\sigma_S = 20.20\%$

$Total\ portfolio\ risk^2:\quad Market\ risk^2 + Specific\ risk^2$

$\sigma_P^2 = 20.21^2 + 20.20^2$

$\sigma_P = 28.58\%$

# Hedging to a Non-Delivery Day: Quantifying Basis Risk

- A fund manager has a portfolio of large cap Nigerian equities with a β of 1 relative to the NGX 30 Index, currently valued at ₦125,000,000

- She hedges the portfolio by selling 78 NGX 30 index futures at 1610.00, when the cash index is trading at 1650.00

- A day later, the NGX 30 falls by 15 index points and the futures by 12 points to 1598.00

Calculate the loss due to the change in basis

$$Portfolio\ loss\ in\ value = \frac{-15}{1650} \ x \ ₦125,000,000 = -₦1,136,364$$

$$Futures\ profit = 78 \ x \ (1610 - 1598) \ x \ ₦1,000 = ₦936,000$$

$$\Rightarrow Loss\ due\ to\ basis\ change = ₦1,136,364 \ - ₦936,000 = ₦200,364$$

# Targeting Beta: "Market Timing"

There are three ways in which a fund manager can attempt to control the beta of the portfolio:

1. Trade shares:

   Buy high beta securities, sell low beta securities to *extend* portfolio beta

   Sell high beta securities, buy low beta securities to *reduce* portfolio beta

2. Borrow or lend and invest in the benchmark index

3. Buy or sell index futures

# Problems with the "Trading Shares" Approach

- May result in a poorly diversified portfolio, with (substantial) firm specific risk

- Beta values for individual securities tend to be unstable in the short run, and are not always reliable

- Beta values generally are in the range 0.5 to 1.7- accordingly, its difficult to attain lower or higher beta portfolios without incurring unsystematic risk

- High transaction costs

# Using Index Futures to Control Portfolio Beta

- A *total hedge* reduces the portfolio β to zero (effectively, converting an equity exposure to a cash exposure); as such, it is a special case

- Active fund managers may want, however, to simply *change* the portfolio β – either to extend it (buy futures), or to reduce it (sell futures) – based on their view of where we are in the equity cycle (bull or bearish phase)

- The number of index futures required to change the beta value of a portfolio is given by:
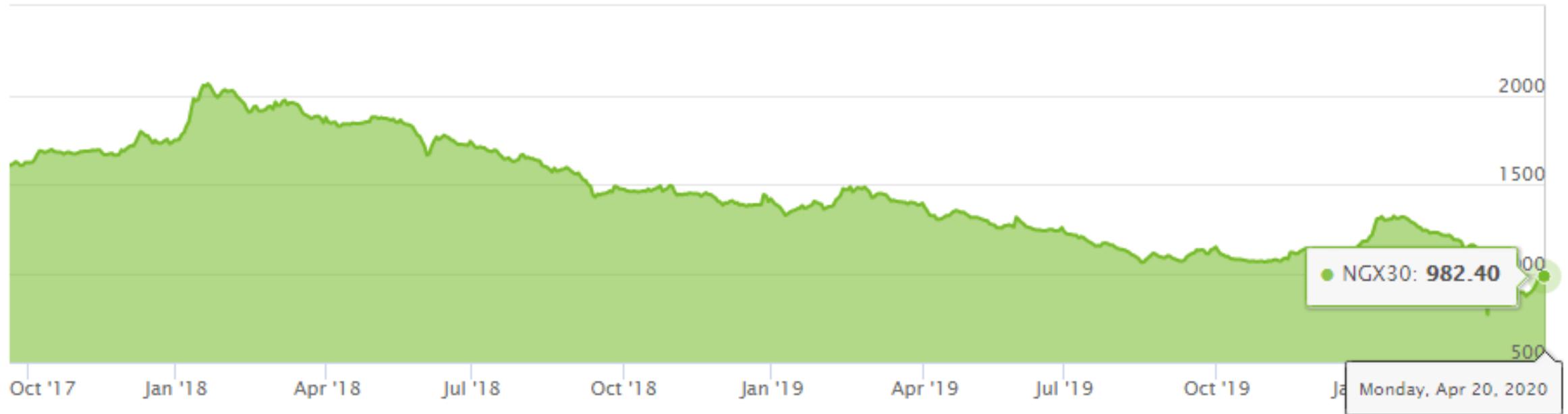
$$\#_{FUTS} = \frac{Portfolio\ MV}{Index\ point\ multiplier\ x\ index}\ x\left[\beta_{target} - \beta_{old}\right]$$

# Targeting Beta

- Following a sustained period of weakness since the high recorded in January 2018, a fund manager has successfully reduced the fund's market risk exposure by *tilting* the portfolio to more defensive stocks such that the portfolio beta is currently standing at 0.86



Zoom 1m 3m 6m YTD 1y All          Sep 19, 2017 → Apr 20, 2020

NGX30: **982.40**

Monday, Apr 20, 2020

Oct '17   Jan '18   Apr '18   Jul '18   Oct '18   Jan '19   Apr '19   Jul '19   Oct '19   Ja

At the regular Monday morning briefing, the consensus is that the market has reached its low, and should now recover

# Action Taken

- Date:                                    20-Apr-2020

- Portfolio value:                    ₦650,000,000

- Cash index:                         975.30 index points

- Jun NDX 30 index futures:    980.25 index points

- Current and target portfolio beta    0.86/1.25

$$\# \ of \ Jun \ futures = \frac{₦650{,}000{,}000}{975.30 \ x \ ₦1{,}000} \ x \ (1.25 - 0.86) = 259.92$$

i.e. The fund buys 260 Jun NDX 30 index futures

# Follow-up Action

- The fund manager now has a number of options:
  - She could re-position the cash portfolio by selling down the low beta, defensive stocks and replace with higher beta, cyclical stocks whilst at the same time reducing the futures positions in order to maintain the portfolio beta at 1.25
  - Alternatively, she could maintain the cash portfolio position (thereby not incurring transaction costs) and adjust or close-out the futures if her view becomes more bearish; note that in this case, she may have to roll into the subsequent delivery months – more on this later

# Close Out

- The manager holds the position to delivery (Friday, 18 June) and lets the position roll off at the EDSP of 1078.50

- As such, at that time the beta reverts to the original cash portfolio beta

Zoom  1m  3m  6m  YTD  1y  All

Mar 13, 2020 → Jun 23, 2020

259 long position opened at 980.25

NGX30: **1 078.56**

1100

1000

900

800

16. Mar   23. Mar   30. Mar   13. Apr   20. Apr   27. Apr   4. May   11. May   18. May   1. Jun   8. Jun

Friday, Jun 19, 2020

EDSP 1078.50

# Trade Performance

- Percentage change in index:

$$\frac{1078.56 - 975.30}{975.30} = 10.59\%$$

- *Expected* new cash portfolio value:

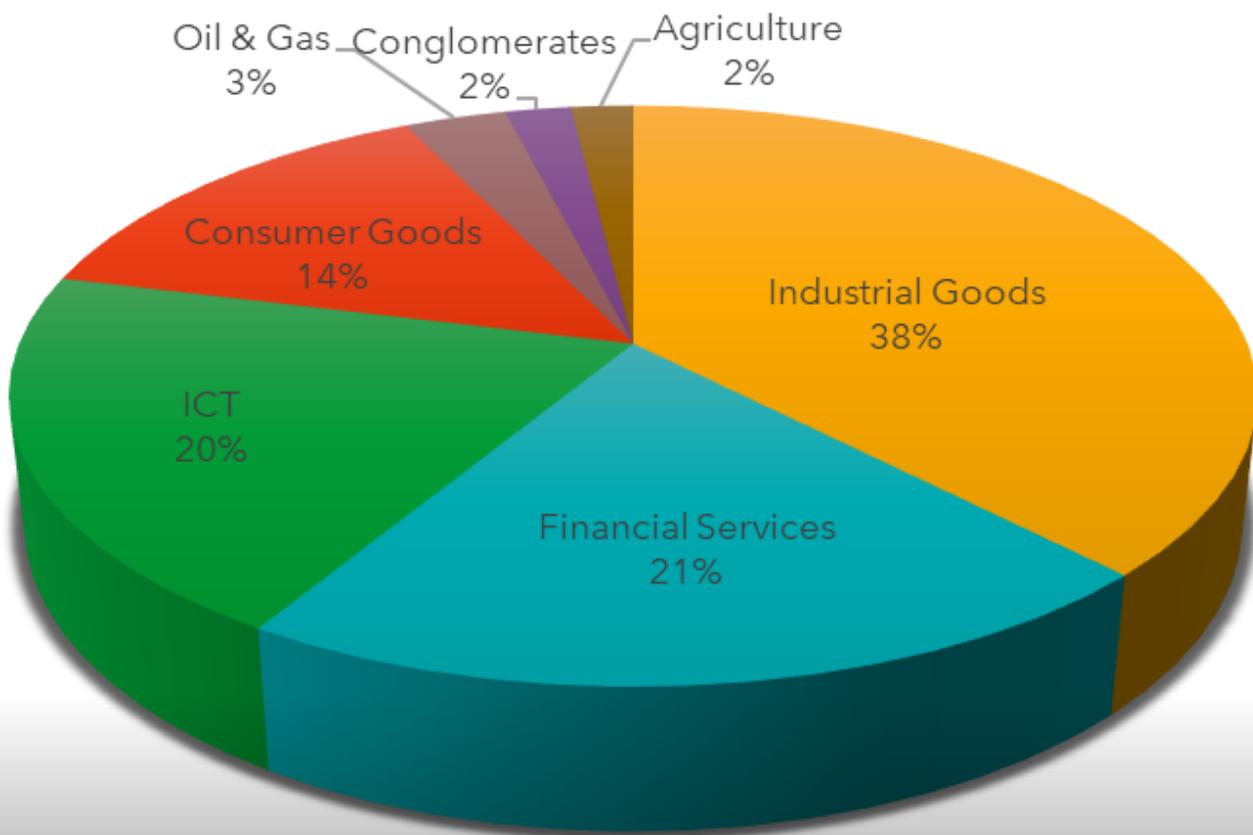$$₦650,000,000 \ x \ (1 + 10.59\% \ x \ 0.86) = ₦709,198,100$$

- Futures gain:

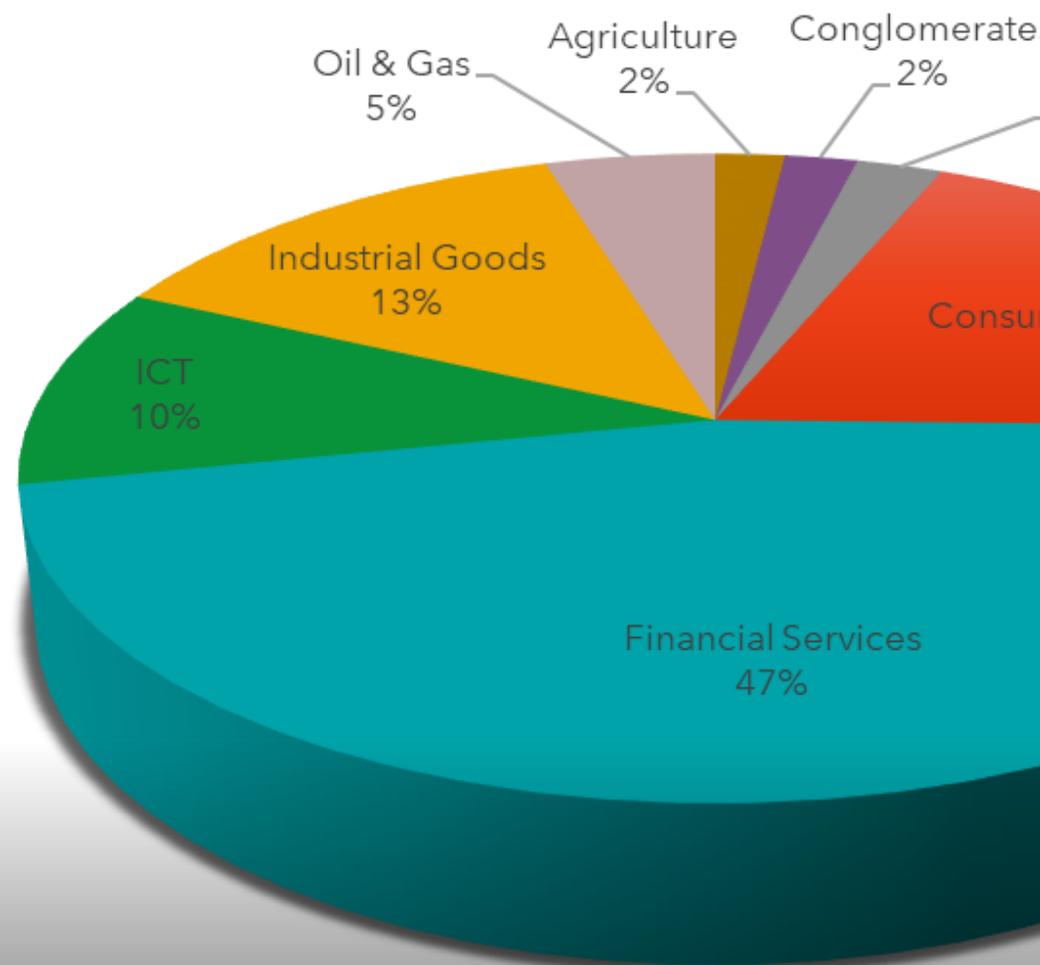$$260 \ x \ (1078.50 - 980.25) \ x \ ₦1000 = ₦ \ 25,545,000$$

- To give a total portfolio value of:          $$\mathbf{₦734,743,100} \ + dividends$$

|  | Expected Portfolio Value (₦) |
|---|---|
| Original cash portfolio | 709,198,100 |
| Index fund | 718,835,000 |
| β targeted fund | 734,743,000 |

Trading the Index Sectoral Mix

# NGX 30 v NGX Pension



Chart: NGX 30/NGX Pension ratio from 02/01/2020 to 02/08/2021, with Average, -1 St. dev, and +1 St dev reference lines.

Annotations: "NGX 30 expensive?" (upper), "NGX 30 cheap?" (lower)

Legend: NGX 30/NGX Pension — Average — -1 St. dev — +1 St dev
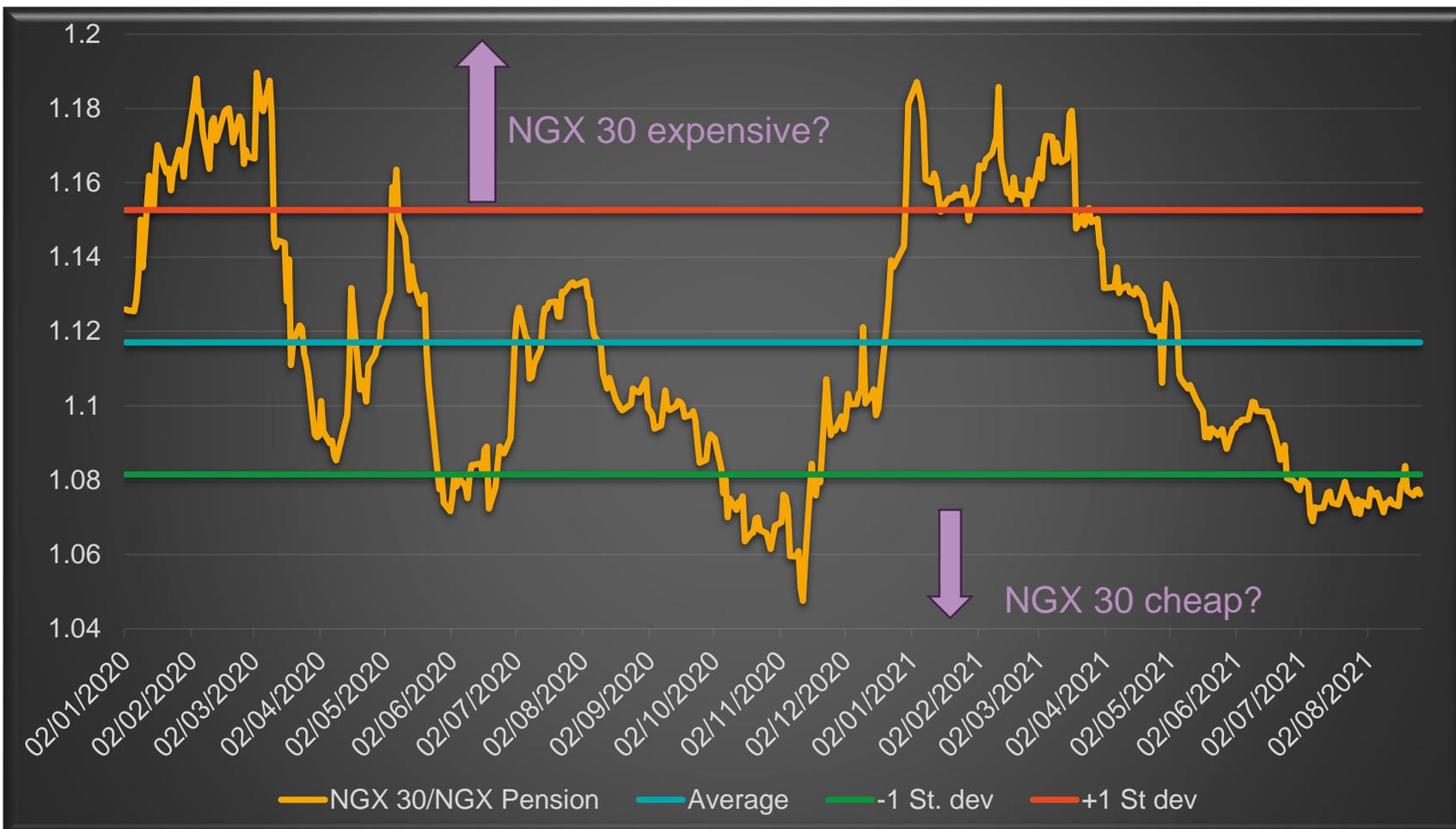
Possible trade??:
Which index do we think might outperform?

Buy NDX 30 futures
Sell NDX Pension futures

What trade have we effectively done?

# Passive Investing & Synthetic Funds

# Using Index Futures to Create a Synthetic Fund

Date - 18th Mar:

NGX 30 Index     1650.00
Jun NGX 30 Future   1658.25

Passively Managed Cash Fund
Buy index at 1650.00 (market value ₦495,000,000)
Receive dividends at 4% p.a.

Synthetic Futures Fund
Buy 300 futures at 1675.00 and place ₦495,000,000 on deposit
Receive interest at 6% p.a.

# Synthetic Index Fund: Outcome

Date - 18th June:

NGX 30 Index   1700.00
Jun  NGX 30 Future 1700.00

Passively Managed Cash Fund
Capital Gain = ₦495,000,000 x (1700 - 1650)/1650          =    ₦15,000,000
Dividends    = ₦495,000,000 x 4% x 1/4                    =    ₦  4,950,000
                                                               ₦ 19,950,000

Synthetic Futures Fund
Capital Gain = (1700.00 - 1658.25) x ₦1,000 x 300          =    ₦ 12,525,000
Interest        = ₦495,000,000  x 6%  x 1/4               =    ₦  7,425,000
                                                               ₦ 19,950,000
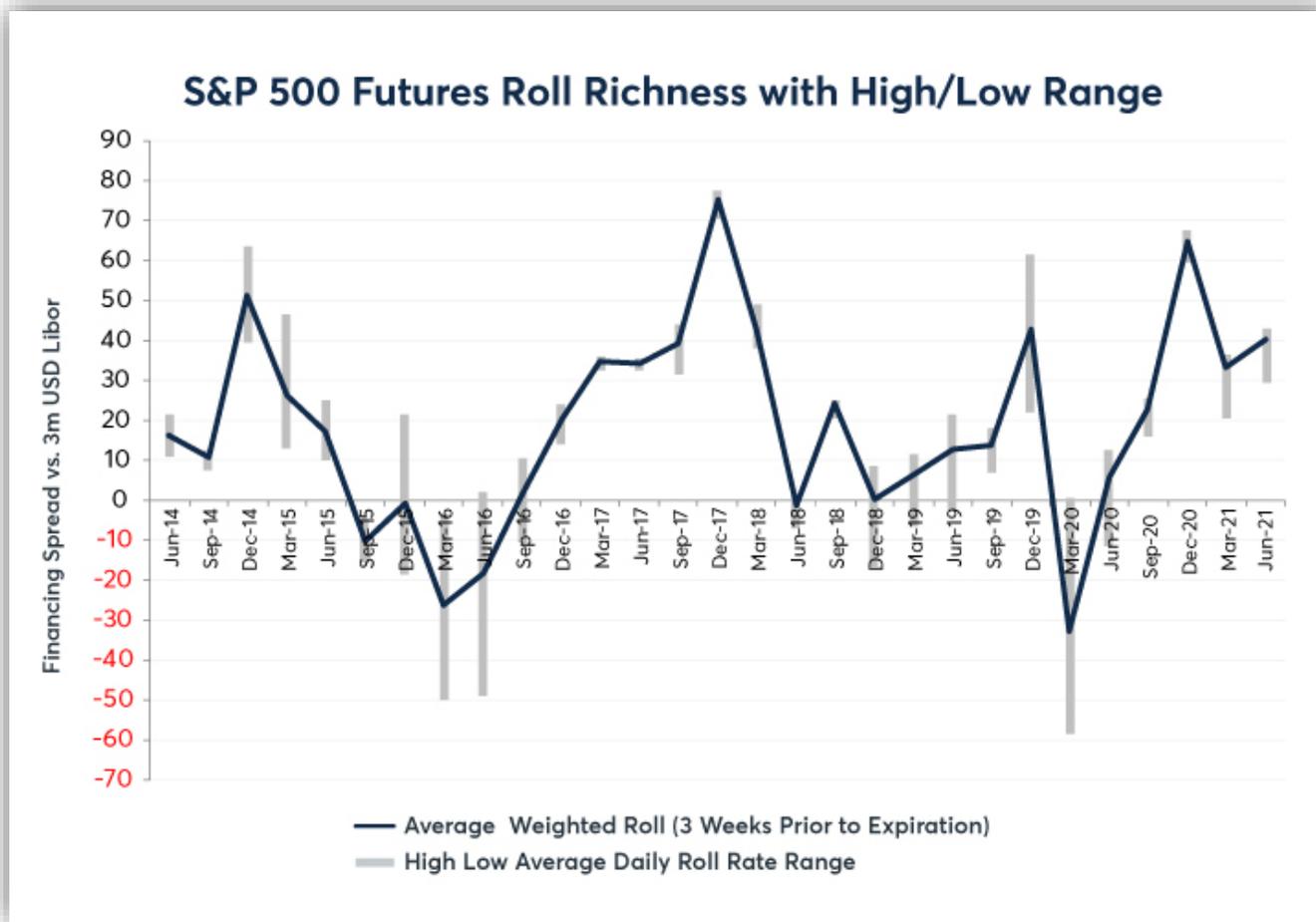
# Potential Problems when using Futures

1. Futures not trading at "*fair value*" at trade initiation

2. Tax
   - Potential problems unless tax-exempt fund

3. Re-establishing the exposure and *roll-over risk*
   - In order to remain invested, at each quarterly delivery, the fund will need to roll into the next quarterly contract
   - Risk that towards delivery of the near contract, the near contract trades cheap-to-fair value and the back contract trades expensive!

# Timing the Roll



*https://www.cmegroup.com/trading/equity-index/paceofroll/main.html*
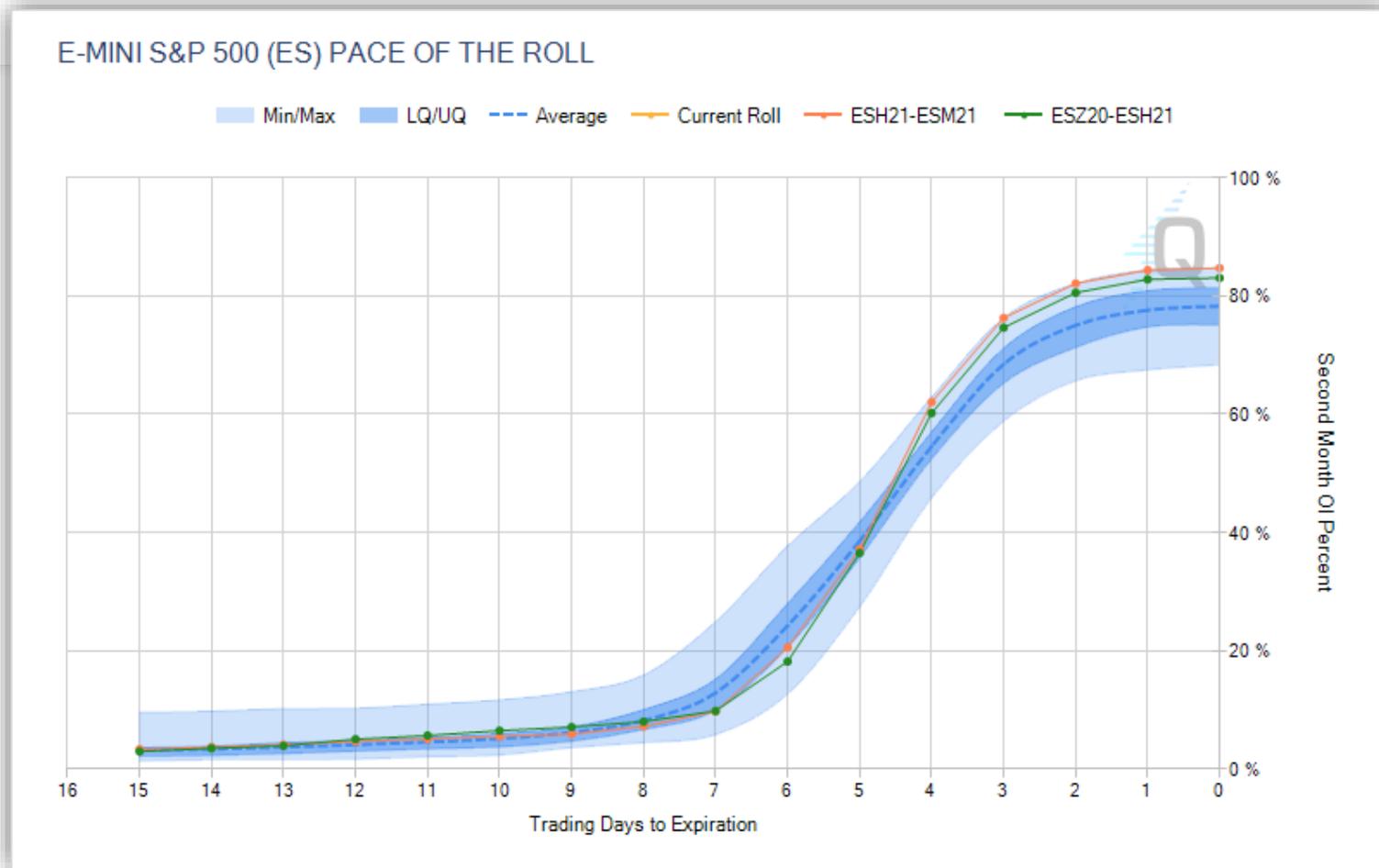
# The Variable Nature of the Roll over Time



S&P 500 Futures Roll Richness with High/Low Range

# Synthetic Exposure for Overseas Investors

- Index futures enables overseas investors to gain access to Nigerian equities more efficiently than by buying individual stocks

- Furthermore, they can gain exposure and limit their exposure to the Naira to the capital gain/loss on the index by holding cash in their domestic currency

# Portable Alpha

# Portable Alpha Strategies

- The *expected* return on a portfolio is given by:

Excess return

$$\widehat{R_P} = R_F + \beta_P(R_M - R_F) + \alpha$$

Long-term historic excess return of the "market" over the risk-free return

Investment objective: Outperform benchmark by "*adding*" $\alpha$

# Portable Alpha Strategies

Use available cash to create a positive α by:

Under/over weighting specific sectors that make up the index

Under/over weighting individual stocks included in the index

Investing in a different asset class (e.g. fixed income securities) to outperform the cost of carry implied in the index futures

Utilise money market trading strategies to outperform the cost of carry implied in the index futures

Use index futures to get *exposure* to market index: Cheap; minimal tracking error, easy access

$$\widehat{R_P} = R_F + \beta_P(R_M - R_F) + \alpha$$