

# Information and indices

## 1. Introduction

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### 1.1. Chapter overview

News reports often talk about a bad day for the FTSE 100 or a surge in the Dow Jones. What these news reports are referring to are movements to stock market indices. This chapter explains precisely what an index is.

An index is just an average. It can be an average of prices of goods and services (it would then be a useful measure for inflation) or it can be a measure of stock market prices. The index measures how these average prices change over time.

An important idea is that the index number itself is arbitrary. What matters is how the index number changes, so if it moves up by 10% it means the constituents of the index have moved by 10%.

There are many ways of constructing indices. The first question is how to calculate the average itself, either on an **arithmetic** or **geometric** basis. You will see that most indices are arithmetic.

Having decided upon the type of average to be used you then need to decide whether or not to **weight** your index. This would give some constituents of the index greater importance than others. Common weighting techniques include **market weighted** where the shares in companies with the biggest total value are most important, or by **price** (unweighted) where the shares with the highest price are the most important.

Understanding indices is essential to understanding the financial markets as they are used for so many purposes; journalists may use them for sound bites, but financial professionals also use them as benchmarks for comparisons of performance.

### 1.2. Learning outcomes

#### Indices: uses

- 7.4.1 Explain the purpose of an index values
- 7.4.3 Explain the role of financial market indices in fund management
- 17.3.1 Explain the purpose of benchmarking
- 17.3.2 Identify the characteristics of an appropriate benchmark
- 17.3.3 Identify the key types of benchmark used in the investment management industry
- 17.3.4 Explain how to construct a benchmark portfolio comprising global equities

#### Construction of indices

- 7.4.5 Calculate and interpret a simple arithmetic index
- 7.4.2 Calculate an index level for the current year, given the base year data and the current year data
- 7.4.6 Calculate an index level having re-based the index series
- 7.4.7 Interpret a geometric index

- 7.4.8 Calculate and interpret a market value-weighted index

### **Global market indices**

- 7.4.9 Describe the composition and construction of key global bond and equity market indices
- 7.4.10 Explain the relevance of free-floating indices

## 2. Indices: uses

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### 2.1. Background

An index is a number that gives the value of something (e.g. shares in a stock market) relative to its value at some other point in time.

When an index starts, it is assigned a value of, say, 1,000 (the base value).

Any movement in the index measures the change in value of the constituents of the index.

If, in our example, the index rises to 1,100, then we know that the constituents of the index have risen in value by 10%.

All major stock exchanges calculate indices based on the shares traded on that exchange.

### 2.2. Uses of indices in fund management

A tracker fund is a fund set up to match the movements of a chosen benchmark index.

Many unit trusts and other collective investment vehicles managing portfolios of securities are established as tracker funds by matching the constituents of a specific index.

This style of management is called **passive**, and its aim is to do at least as well as the market as a whole.

An appropriate **active** style would attempt to beat a particular index using market timing and stock selection.

#### Derivative products

Some of the largest traded futures and option products around the world are based on stock market indices, such as Liffe's FTSE100 index future.

These allow investors to **speculate** on the movement of the market in general rather than on the price of an individual security.

### 2.3. Treatment of constituent companies

Most indices are weighted towards the **market capitalisation** of their constituent companies. Market capitalisation takes the share price for the company and multiplies it by the number of shares in issue.

In these indices, not all constituent companies are treated equally by the index.

For example, consider the FTSE 100 index; Royal Dutch Shell is one of the largest companies by market capitalisation currently listed on the LSE. The FTSE 100 index is weighted to market capitalisation. Therefore, a 1% movement in the share price of Royal Dutch Shell will have a greater impact on the FTSE 100 index than a 1% movement in the share price of another FTSE 100 constituent, e.g. Marks and Spencer Group.

Not all indices are calculated in this way; for example, the Dow Jones Industrial Average, used by the New York Stock Exchange, is weighted towards the **price** of a share in a company rather than the full market capitalisation.

## 2.4. Benchmark indices

### Introduction

Indices are frequently used as a method of assessing the performance of a fund manager. An index used for this purpose is called a benchmark index. To effectively evaluate performance, a valid benchmark should be specified in advance and should be known to both the investment manager and the investor. These benchmarks should be appropriate to the portfolio that it is compared against.

### Appropriate benchmarks

The benchmark should be appropriate. That is:

- The benchmark should be consistent with the manager's investment **approach and style**
- The benchmark should be **measurable**
- The benchmark should be **unambiguous**
- The securities and their respective weights should be **clearly defined**
- The benchmark should be reflective of the manager's current **investment opinions**
- The manager should know about the securities of the benchmark
- The benchmark should be **investable** (see next section)

### Free-float indices

One of the requirements of a valid benchmark is that it is investable. Most indices are calculated on a 'free-float' basis to meet this requirement. Free-float shares are the shares that are theoretically available to be purchased by the general public. For instance, shares held by directors would not be considered free-float shares as directors are unlikely to sell their shares in the short-term. Companies with a low level of free-float shares will have a more volatile share price that may distort an index.

The index weighting will reflect the amount of free-float shares available. For instance if a company has 40% free-float shares, its index weighting will be 40% rather than 100%. This will ensure that those companies with a low free-float level of shares do not distort the index.

### Stock indices vs. bond indices

Stock or share indices normally measure the **increase in share prices** in certain markets such as the London Stock Exchange. The indices do not normally include dividends, instead focusing on the increase in the capital value of the shares.

Bond indices, however, are normally calculated as **total return indices** including both movements in bond prices and the coupon income received. The index chosen as a benchmark will normally reflect the characteristics of the portfolio being managed i.e. by sector, duration etc.

## 3. Construction of indices

### 3.1. Index numbers: background

Index numbers in themselves tell us little about the markets that they reflect. Instead, it is the **change** in those numbers that tell us the percentage change in something (normally a price) from a particular (base) point in time.

### 3.2. Creating an index

To create an index number, a base year and a base value must be chosen.

The base year is the point in time you wish to monitor the constituents of the index from. The base value is the numerical starting point of the index (usually something simple like 100).

It is possible to create an index on any variable – such as the price of eggs:

**Table 6. Creating an index example**

Year	Price of eggs (per ½ doz.)	Index calculation	Index value
1995 (Base year)	58p	$58 \times 100 / 58$	100 (Base value)
1996	55p	$55 \times 100 / 58$	94.8
1997	62p	$62 \times 100 / 58$	106.9

Eggs are now 62/58ths of their 1995 price; the index must be worth more than its base value.

Changes to an index are referred to in percentage points. In the example above the difference between 1996 and 1997 is 12.1 percentage points (i.e.  $106.9 - 94.8$ ).

### 3.3. Re-basing indices

Sometimes, if the index moves too far away from its base value, re-basing is necessary.

This is achieved by simply 're-setting' the index to the base value. Let's do this for 1997.

**Table 7. Re-basing an index example**

Year	Price of eggs (per ½ doz.)	'Old' index value	Re-basing calculation	Re-based index value
1995	58p	100		
1996	55p	94.8		?
1997	62p	106.9	$106.9 \times 100 / 106.9$	100

The problem with re-basing an index is that it makes comparisons with previous years difficult. For this reason we will need to adjust the previous values of the index using the same re-basing factor we used to rebase the index (in our example, this is  $100 / 106.9$ )

The 'new' value of the 1996 index is calculated by multiplying the old index value by the re-basing factor:  $94.8 \times 100 / 106.9 = 88.7$

### 3.4. Indices for financial markets

The financial markets use a range of different indices to track the performance of the stocks traded within them. Different markets use different types of indices; the major features and characteristics of these indices are now described.

#### Simple arithmetic indices

A simple arithmetic index is calculated by adding up all the current prices of the constituents of the index and dividing the total by the sum of their value at the base date; the result is then multiplied by a base number representing the value of the index in the base year.

Below is a worked example of a price weighted, simple arithmetic index:

$$\text{Simple arithmetic index} = B \times \frac{\sum P_{\text{new}}}{\sum P_{\text{old}}}$$

Where B is the base value,  $\sum P_{\text{new}}$  is the sum of the new prices of the index's constituents and  $\sum P_{\text{old}}$  is the sum of the constituents' prices in the base year.

A simple arithmetic (simple aggregate) index therefore reflects the value of an **equally** weighted portfolio of stocks.

The Dow Jones (USA) and Nikkei 225 (Tokyo) are examples of such an index.

Below is an example of a price weighted index calculation:

A simple arithmetic index of two shares; A and B over five years. The base value is 100:

Time period	Share A	Share B	Index value
Base year	10	10	100
1	12	9	105
2	12	7	95
3	10	9	95
4	11	10	105
5	13	9	110

$$105 = 100 \times \frac{(12 + 9)}{(10 + 10)}$$

#### Geometric indices

A geometric index measures the **rate of change** in the prices of the constituents making up the index.

A geometric index multiplies all the price relatives of an index together and then takes the nth root of the answer, where n is the number of index constituents.

Note: the price relative of a share is how many times higher (or lower) it is now compared to its base value.

The price relative of a share worth £1.52 on the base date, but now worth £1.87 is:

$$\frac{£1.87}{£1.52} = 1.23 \text{ (1.23 times, or 123\% of its base price)}$$

To calculate the geometric index of a basket of, say, six stocks:

**Example:**

$$\begin{aligned} \text{Geometric index} &= \sqrt[6]{1.23 \times 1.28 \times 1.62 \times 1.17 \times 1.39 \times 0.08} \\ &= \sqrt[6]{0.3318} \\ &= 0.8320 \end{aligned}$$

The features of geometric indices (GI) are:

- When there is a change in capital, the divisor of each component of an arithmetic index must be altered, with a geometric index only the base price is changed
- GIs are less sensitive to large changes in the price of any one constituent than a simple arithmetic index
- If the price of any one constituent falls to zero, the value of the entire index falls to zero
- GIs will always be less than or equal to a simple arithmetic index of the constituent stocks – geometric indices therefore tend to underestimate the performance of its constituents
- The FT-30 Ordinary Share index is an example of a geometric index calculation

### Market value-weighted indices

These seek to give more influence to the shares of larger companies in the index.

Unlike an equally weighted index, a 1% change in the price of a large company will have a greater effect on a weighted index than a 1% change in the price of a smaller company.

A large company is one with a higher market capitalisation – which is calculated by:

Market capitalisation = no. of shares in issue x share price

The formula used to calculate a market weighted index is shown below:

$$\text{Market weighted index} = B \times \frac{\sum N_{\text{new}} \times P_{\text{new}}}{\sum N_{\text{old}} \times P_{\text{old}}}$$

Where:

B is the base value of the index

$N_{\text{old}}$  is the number of shares in a constituent company on the base date of the index

$N_{\text{new}}$  is the number of shares in a constituent company now (or at the time of calculation)

$P_{\text{old}}$  is the share price of a constituent company on the base date of the index

$P_{\text{new}}$  is the share price of a constituent company on now (or at the time of calculation)

The FTSE 100 and FTSE 250 are examples of market-weighted indices. These indices are based only on the shares that form the free float shares so that they are representative of the investable stock of a company.

An example of how to calculate a market weighted index is shown below:

### Example

A market weighted arithmetic index of two shares; A and B over four years. The base value is 100:

Time period	Share A	No. of shares in A	Share B	No. of shares in B	Index value
Base year	10	100	10	1000	100
1	12	100	9	1000	92.72
2	12	100	7	1000	74.54
3	10	100	9	1000	90.91
4	11	100	10	1000	101

$$90.91 = 100 \times \frac{(10 \times 100) + (9 \times 1000)}{(10 \times 100) + (10 \times 1000)}$$



## 4. Global market indices

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### 4.1. Indices: UK

#### Background

The Financial Times, together with the London Stock Exchange, are responsible for calculating the 'FTSE' series of indices. Some of the more important ones are described below:

#### FT 30

**Equally weighted geometric** mean of the prices of 30 leading UK stocks.

#### FTSE 100

Commonly referred to as the **footsie**, this is calculated as an arithmetic average of the top 100 UK companies based on market capitalisation. This is about 70% of the value of UK listed shares.

#### FTSE 250

This index provides a benchmark for the next 250 (after the FTSE 100) largest UK companies based on market capitalisation arithmetic average.

#### FTSE Actuaries 350

A combination of the FTSE 100 and the FTSE 250.

The FTSE 350 is broken down into industry sectors and calculated on a real-time basis.

#### FTSE All-Share

A market capitalisation weighted arithmetic index covering around 900 companies on the LSE.

The FTSE All-Share is the main benchmark for UK fund managers.

### 4.2. Indices: US

#### Background

The New York Stock Exchange (NYSE) calculates a series of indices called the Dow Jones Stock Averages.

#### Dow Jones Industrial Average (DJIA)

The DJIA is a simple unweighted arithmetic index. It was originally based on the 30 largest industrial stocks on the NYSE but now also includes non industrial stocks.

#### Standard and Poor's 500 Index (S&P 500)

A market capitalisation weighted arithmetic index comprising 500 US stocks selected from industrial, transportation, financial and utility sectors.

The index provides a broader base of US stocks than the Dow Jones Industrial Average.

## 4.3. Indices: Europe

### Germany

#### DAX 30 - Deutscher Aktienindex

The main German index comprising the 30 leading German stocks (based on market capitalisation). The DAX is a weighted arithmetic index.

### France

#### CAC 40

This index represents the 40 leading stocks (weighted by market capitalisation) traded on the Paris Stock Exchange. The CAC is a weighted arithmetic index.

#### SBF 250

Comprises 250 French blue chips to provide a wider overview of the French economy compared to the CAC - 40.

### FTSE European index series

#### Eurofirst

The FTSE Eurofirst indices take their prices from local exchanges. They are designed to provide a derivative friendly index by tracking liquid assets. The aim is to aid fund managers who may use the indices to track or hedge against the use of derivative products.

The FTSE Eurofirst is calculated in Euro's rather than home currency.

The Eurofirst indices are market capitalisation weighted arithmetic indices.

#### Eurotop 100

Traded on Euronext-Amsterdam and NYSE.LIFFE, the FTSE Eurotop 100 tracks Europe's largest 100 companies by market capitalisation based on an arithmetic mean.

### STOXX

STOXX Ltd provides and services the Dow Jones STOXX index series of European regional equity indices. These are a family of indices covering a variety of countries and over 50 industries. The STOXX indices are market capitalisation weighted arithmetic.

## 4.4. Indices: Asian

### Japan

#### Nikkei Stock Average

Comprises 225 of the biggest companies traded in the Tokyo Stock Exchange (TSE).

The Nikkei is an **unweighted arithmetic index**.

## India

### S&P CNX Nifty

Called the Nifty 50 it comprises of 50 of the largest liquid stocks on India's National Stock Exchange. The S&P CNX Nifty **market capitalisation weighted arithmetic index**.

## 4.5. Indices: Global

### FTSE All-World

An arithmetic weighted market value indices constructed for various national stock markets in both local currency and US dollars.

## 4.6. Bond indices

Unlike equity indices, bond indices reflect **total returns** i.e. coupon and price changes.

Examples are:

### FTSE Actuaries UK gilts indices

The FTSE produce a UK gilt index that is based on a range of 12 other indices: seven conventional gilt indices and five index-linked gilt indices. The price indices reflect the actual price performance of an equally weighted portfolio of all government bond issues.

The component indices are divided into less than five years, 5-10 years to redemption, 5-15 years to redemption, 10-15 years to redemption, greater than 15 years to redemption and all stocks. The conventional gilt indices also include irredeemable (undated) gilts. Their real yields are given for assumed inflation rates of 0% and 5%.

### Other indices

There are a variety of indices that cover different countries and sectors, such as the Citigroup World Government Bond Index. Major categories include: government/corporate, US government, mortgage-backed securities, corporate, asset-backed securities, Emerging Americas, Global, Eurobond and Municipal.

## 5. Information and indices: summary

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### 5.1. Key concepts

#### Indices: uses

- 7.4.1 Explain the purpose of an index value
- 7.4.3 Explain the role of financial market indices in fund management
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- 7.4.9 Describe the composition and construction of key global bond and equity market indices
- 7.4.10 Explain the relevance of free-floating indices

**Now you have finished this chapter you should attempt the chapter questions.**