

Introduction to Property Market Indexes

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What is a market index?

- It is an indicator that answers the question: What happened in the market today?
- Indexes are widely used to measure historical rates of return across different securities.
- Video: [What is the Dow Jones Industrial Average](#) (Credit: Ameritrade)



Uses of Market Indexes

- For calculating benchmark returns to judge portfolio performance
- To compute a security's systematic risk by examining how its return responds to changes in the market index
- For the development of an index portfolio
- Measure the general performance of an economy
- For examining factors that influence aggregate security price movements
- For technical analysis, to predict future price movements

Types of Market Indexes

- **The Sample**
 - Random/Non-random sampling
 - Industry/Specific sector
- **Computational Procedure**
 - Simple average (Arithmetic mean)
 - Geometric mean
 - Base index
- **Market indexes can be classified according to the weighting scheme index in constructing them:**
 - Price Weighted Index Series
 - Value Weighted Index Series
 - Equally Weighted Index Series
 - Fundamental Weighted Index Series.

Price Weighted Index

- A price weighted series is an arithmetic average of current prices, which means that index movements are influenced by the differential prices of the components.
- Dow Jones Industrial Average (DJIA)
 - Best-known, oldest, most popular index
 - First computed in 1896
 - Price-weighted average of thirty large well-known industrial stocks, leaders in their industry, and listed on the New York Stock Exchange.
- The Nikkei 225 Index is another example of a price-weighted index.

Price Weighted Index

$$\text{Index Value}(I_t) = \sum_{i=1}^n \frac{P_{i,t}}{D_{adj}}$$

Where:

I_t = Value of index on day t

n = the number of assets in the index

$P_{i,t}$ = Price of stock i in period t

D_{adj} = *Adjusted Divisor*

Example 1

- An index is made up of two constituent securities – Stock A and Stock B.

	Stock A	Stock B
Initial Price/Unit (R)	10	100
New Price/Unit (R)	11	120

- Calculate the Price Return Index.
- Rebase the index to 100.

Example 1a

	Stock A	Stock B	Sum	Divisor	Price Index (PI)	Change in PI (%)
Initial Price/Unit	10	100	110	2	55.00	
New Price/Unit	11	120	131	2	65.50	19.09%

Example 1b

Instead of using the number of stocks as divisor, you can choose a divisor that would produce a particular starting index value, e.g. 100

$$\frac{110}{d} = 100 \Rightarrow d = \frac{110}{100} = 1.10$$

	Stock A	Stock B	Sum	Divisor	Price Index (PI)	Change in PI (%)
Initial Price/Unit	10	100	110	1.10	110/1.1 = 100	
New Price/Unit	11	120	131	1.10	131/1.1 = 119.09	19.09%

Example 2

- Construct a price weighted index using the information below. Set the beginning index to 1,000:

Stock	ABC	XYZ
Initial Price (R)	250	1000
New Price (R)	300	900

- b) Demonstrate the impact of differently priced shares on the index.

Example 2 (Answer)

			Price Changes	
	ABC	XYZ	ABC	XYZ
Initial Price/Unit	250	1000		
New Price/Unit	300	900	20%	-10%

Example 2 (Answer - Option 1)

	ABC	XYZ	Sum	Divisor	Price Index (PI)	Change in PI (%)
Initial Price/Unit	250	1,000	1,250	2	625.00	
New Price/Unit	300	900	1,200	2	600.00	-4.00%

Example 2 (Answer - Option 2)

Instead of using the number of stocks as divisor, you can choose a divisor that would produce a particular starting index value, e.g. 100

$$\frac{1250}{d} = 100 \Rightarrow d = \frac{1250}{100} = 12.50$$

	ABC	XYZ	Sum	Divisor	Price Index (PI)	Change in PI (%)
Initial Price/Unit	250	1,000	1,250	12.50	1250/12.5 = 100	
New Price/Unit	300	900	1,200	12.50	1200/12.5 = 96	-4.00%

Example 2b (Answer)

- **Although ABC increased by 20% and XYZ fell by 10%, the index dropped in value**
 - This is because the 20% increase in ABC represented a small price gain (R50) than the 10% decrease in XYZ (R100)
 - The portfolio has four times as much invested in XYZ (R1,000) as in ABC (R250)

Example 3

- Construct a price Index using the information below:

Stock	Stock Price (Period T)	Stock Price (Period T+1)	
		Scenario A	Scenario B
A	100	110	100
B	50	50	50
C	30	30	33

Example 3 (Scenario 1 - Answer)

				Price Changes		
Period	A	B	C	A	B	C
T	100	50	30			
T+1	110	50	30	10%	0%	0%

Example 3 (Scenario 1 - Answer)

Period	A	B	C	Sum	Divisor	Price Index (PI)	Change in PI (%)
T	100	50	30	180	3	60.00	
T+1	110	50	30	190	3	63.33	5.56%

Example 3 (Scenario 2 - Answer)

Period	A	B	C	Sum	Divisor	Price Index (PI)	Change in PI (%)
T	100	50	30	180	3	60.00	
T+1	100	50	33	183	3	61.00	1.67

Example 4 (Try)

- Calculate the stock price index for years 1 to 5 using the information below:

	Stock Prices				
Year	1	2	3	4	5
Stock 1	150.00	165.00	181.50	181.50	181.50
Stock 2	100.00	110.00	110.00	121.00	121.00
Stock 3	50.00	55.00	55.00	55.00	60.50

Example 5 - Selected SA REITs

- You intend to create a specialised price index to track the performance of the SA REITs with the following constituent list: Accelerate; Attacq, Growthpoint, Hyprop and Vukile. The monthly, quarterly and annual price data for these REITs is available here:

[DATA - QUESTION 5](#)

- a) Use this data to create the monthly, quarterly and annual price indexes. Set the divisor to the number of assets.
- b) Calculate the price returns for the various frequencies.
- c) Show how an investment of R100m would grow if invested in each REIT as well as the index portfolio.
- d) Graph the price indexes against the prices of the individual REITs for the respective frequencies.
- e) What do you notice?

Stock Splits

- A stock split is essentially the multiplication (or division) of a company's number of shares outstanding by a certain factor (split ratio) in such a way that the company's market value or market capitalization remains unchanged.
- The two main types of stock splits are:
 - Forward stock splits
 - Reverse stock splits

Forward Stock Splits

- Forward Stock Split increases the number of shares outstanding by a certain factor (split ratio) while reducing the value of each share by the same factor. The net effect is that the value of the investor's stock holding remains unchanged.
- Forward stock splits are the most common type of stock splits. The goal of this type of split is to make the shares of a company more affordable to a wider investing public.

Forward Stock Splits

- For example, a 3 for 1 forward stock split means that an investor who previously had 100 shares would end up with 300 shares. If the price per share were R30 per share before the split, the price falls to R10 per share. This way, the value of the investor's portfolio remains the same.
- **Before Split**
 - Value of Portfolio = Number of Shares × Price Per Share
 - Value of Portfolio = $100 \times 30 = \text{R}3,000$
- **After Split:**
 - Value of Portfolio = $300 \times 10 = \text{R}3,000$

Reverse Stock Splits

- Reverse stock splits result in a company's number of shares outstanding being reduced by a certain factor (split ratio) while increasing the price per share by the same factor.
- A reason for companies to do a reverse stock split is to avoid having their shares delisted. Some Stock Exchanges have rules that allow them to delist stocks that trade below a certain price over an extended time period.

Reverse Stock Splits

- For example, a 1 for 3 reverse stock split would result in an investor who previously had 300 shares to now have just 100 shares. If the share price were R10 before the split, the price increases to R30 so that the value of portfolio remains the same.
- Before Split
 - Value of Portfolio=Number of Shares ×Price Per Share
 - Value of Portfolio=300×10=R3,000
- After Split:
 - Value of Portfolio=100×30=R3,000

Price Weighted Index Series – Handling Stock Splits

- When there is a stock split, we would not want the average to fall, as that would incorrectly indicate a fall in the general level of market prices.
- Following a split, the divisor must be reduced to a value that leaves the index value unaffected.
- In other words, the divisor is adjusted so the index value will be the same before and after the split.

Example 1

- Construct a REIT price index using the information below:

REIT	A	B*	C
Initial Share Price	10	15	20
Ending Share Price	12	10	20
* Note that Stock B forward split two-for-one during the year			

Example 1 (Answer)

Share	Initial Share Price	Price Just After split	Ending Share Price
A	10	10	12
B*	15	7.5	10
C	20	20	20
Sum	45	37.5	42
Divisor	3	2.5	2.5
Index Value	15	15	16.8
Change in index			12%

Example 1 (Answer)

- If divisor is set to the number of stocks:

Share	A	B*	C	Sum	Divisor	Index Value	Change in Index
Initial Share Price	10	15	20	45	3	15	
Price Just After split	10	7.5	20	37.5	2.5	15	
Ending Share Price	12	10	20	42	2.5	16.8	12%

Example 1 (Answer)

- If divisor is set to the number of stocks:

Share	A	B*	C	Sum	Divisor	Index Value	Change in Index
Initial Share Price	10	15	20	45	0.45	100	
Price Just After split	10	7.5	20	37.5	0.375	100	
Ending Share Price	12	10	20	42	0.375	112	12%

Example 2 - Stock Split

Stock	Initial Price	Price just after Split
ABC	25	25
XYZ	100	50

- Suppose XYZ were to split *two for one* so that its price fell to R50, what would the new divisor be?

Example 2 - Stock Split (Answer)

Stock	Price before stock split	Price just after stock split
ABC	25	25
XYZ	100	50
Sum	125	75
Divisor	2	1.20
Average/Index	62.50	62.50

Example 3

- Calculate the price index using information on the three stocks below.

Stock	Initial Price
A	30
B	20
C	10

- Adjust the index divisor after a three-for-one forward split by stock A.

Example 3 (Answer)

Stock	Before Split	After 3-for-1 Split by Stock A
	Prices	Prices
A	30	10
B	20	20
C	10	10
Sum	60	40
Divisor	3	2
Index	20	20

Example 4

- The following table contains market information about a number of REITs which CEM25 Limited has selected for inclusion in a special REIT Index. Use this information to construct a REIT Price Index.

REIT Name	Share Price on 31/12/2020	Share Price on 31/12/2021
Lecce Real Estate (LC)	15	18
Rethimno REIT (RT)	12	12
Xanthi REIT* (XR)	30	20
Thiva REIT (TR)	25	26
Pilos REIT (PR)	32	32
Lyttelton Property Investment (LPI)	15	13
Turin Real Estate (TRe)	60	60

* Note that Xanthi REIT had a two-for-one forward split during the year.

Criticisms of Price Weighted Series

- The idea is similar to assuming an investment of one share per stock
- Places more weight on higher-priced stocks rather than those with higher market values
- Introduces a downward bias by reducing weight of growing companies whose stock splits
- Divisor changes frequently to account for stock splits and firms being replaced (divisor in 2025 has reduced to 0.1475 for the DJIA from the initial divisor of 30)

QUESTIONS

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