Security Market Indexes

Abstract

Keywords
Keyword1 — Keyword2 — Keyword3

Contents

12a	Calculate and interpret price, income and cross-price elasticities of demand and describe factors that affect each measure
12b	Compare substitution and income effects
12c	Distinguish between normal goods and inferior goods
12d	Describe the phenomenon of diminishing marginal returns
12e	Determine and interpret breakeven and shutdown points of production
12f	Describe how economies of scale and diseconomies of scale affect costs

1. Index Definition

A **security market index** represents a given security market, market segment or asset class. The individual securities included in indexes are *constituent securities*. There are two broad categories: **price return indexes**, which only reflect the prices of constituent securities and **total return indexes** which also include the value from reinvestment of all income (dividends et all). *Price return* measures only the appreciation in price levels and *total return* measures the price appreciation plus interest, dividends or other distributions.

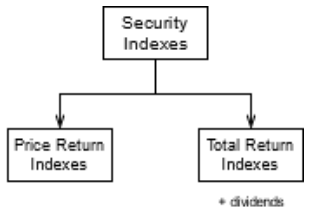

Figure 1

2. Calculation of Index Values and Returns

The value can be calculated in two ways: (i) as a percentage change in value of the price return index or (ii) as the weighted average of price returns of the constituent securities.

2.1 Calculation over Single Periods

2.1.1 Calculation of Price Return Values

$$PR_1 = \frac{V_{PRI1} - V_{PRI0}}{V_{PRI0}} \quad (1)$$

The percentage change in value of the price return index (PR_1) equals to the difference between the value of the price return index in subsequent periods ($V_{PRI1} - V_{PRI0}$), normalized by the value of the price return index in the beginning of the period (V_{PRI0}).
Similarly, the price returns index can be computed as the sum of each individual price return multiplied by the corresponding weight in the index.

$$PR_1 = \sum w_i PR_i \quad (2)$$

$$\mathrm{PR}_I = \sum_{i=1}^{N} \mathrm{w}_i \mathrm{PR}_i = \sum_{i=1}^{N} \mathrm{w}_i \left(\frac{P_{i1} - P_{i0}}{P_{i0}} \right) \quad (4)$$

where:

PR_I = the price return of index portfolio (as a decimal number)
PR_i = the price return of constituent security i (as a decimal number)
N = the number of individual securities in the index
w_i = the weight of security i (the fraction of the index portfolio allocated to security i)
P_{i1} = the price of constituent security i at the end of the period
P_{i0} = the price of constituent security i at the beginning of the period

Equation 4 can be rewritten simply as:

$$\mathrm{PR}_I = \mathrm{w}_1\mathrm{PR}_1 + \mathrm{w}_2\mathrm{PR}_2 + \ldots + \mathrm{w}_N\mathrm{PR}_N \quad (5)$$

Figure 2

2.1.2 Calculation of Total Return Values

The difference between price return and total return values is the addition of dividends and other forms of income in the latter.

$$\mathrm{TR}_I = \frac{V_{PRI1} - V_{PRI0} + Inc_I}{V_{PRI0}} \quad (6)$$

where

TR_I = the total return of the index portfolio (as a decimal number)
V_{PRI1} = the value of the price return index at the end of the period
V_{PRI0} = the value of the price return index at the beginning of the period
Inc_I = the total income (dividends and/or interest) from all securities in the index held over the period

The total return of an index can also be calculated as the weighted average of total returns of the constituent securities. The total return of each constituent security in the index is calculated as:

$$\mathrm{TR}_i = \frac{P_{1i} - P_{0i} + Inc_i}{P_{0i}} \quad (7)$$

where

TR_i = the total return of constituent security i (as a decimal number)
P_{1i} = the price of constituent security i at the end of the period
P_{0i} = the price of constituent security i at the beginning of the period
Inc_i = the total income (dividends and/or interest) from security i over the period

Figure 3

2.2 Calculation over Multiple Time Periods

The calculation over multiple periods involves the compounding effect of return rates.

$$\mathrm{V}_{PRIT} = \mathrm{V}_{PRI0}(1 + \mathrm{PR}_{I1})(1 + \mathrm{PR}_{I2})\ldots(1 + \mathrm{PR}_{IT}) \quad (10)$$

where

V_{PRI0} = the value of the price return index at inception
V_{PRIT} = the value of the price return index at time t
PR_{IT} = the price return (as a decimal number) on the index over period t, t = 1, 2, …, T

Figure 4

Period	Return (%)	Calculation	Ending Value
0		1,000(1.00)	1,000.00
1	5.00	1,000(1.05)	1,050.00
2	3.00	1,000(1.05)(1.03)	1,081.50

Figure 5

The difference between price return and total return is the additional percentage return from dividends or other income in the latter.

3. Index Construction and Management

- Which target market should the index represent?
- Which securities should be selected from the target market?
- How much weight should be allocated to each security in the index?
- When should it be rebalanced? (change % weights)
- When should it be reconstituted? (change listed securities)

3.1 Target Market and Security Selection

The first decision should answer on what does the index ought to represent? Usually indexes are based on specific assets and specific geographic regions, although they can also represent other characteristics such as economic sector, company size, investment style, duration and credit quality for debt securities.
The **target market** represents the universe and the securities available for inclusion in the index. Once the investment universe is identified, the number of securities and criteria of inclusion must be determined. Hence, the second question is how are securities selected from the target market?
Some indexes, such as S&P 500 Index and FTSE 100 fix the number of securities included (*fixed size index*). The Tokyo Stock Price Index (TOPIX) includes all the largest stocks, known as the First Section, listed on the Tokyo Stock Exchange. To be included in the First Section and thus TOPIX, stocks must meet certain criteria such as number of shares outstanding, market capitalization, etc.

3.2 Security Weighting

$$w_i^M = \frac{Q_i P_i}{\sum_{j=1}^{N} Q_j P_j} \qquad (14)$$

where

w_i = fraction of the portfolio that is allocated to security i or weight of security i
Q_i = number of shares outstanding of security i
P_i = share price of security i
N = number of securities in the index

Figure 6

The index weighting of constituent securities varies between (i) *price weighting*, (ii) *equal weighting*, (iii) *market capitalization weighting* and (iv) *fundamental weighting*.

3.2.1 Price Weighting

The price weighting attributes the weights by dividing its price by the sum of all prices of the constituent securities:

$$w_i = \frac{P_i}{\sum P_i} \qquad (3)$$

As result, securities with higher prices also have higher weighting and therefore a bigger impact than other securities. This methods main advantage is its *simplicity* but because it uses arbitrary weights for each securities, they can be misrepresented, limiting the utility of such indexes. Stock splits are an issue.
An example of price indexes is the Dow Jones (30).

3.2.2 Equal Weighting

Each security is attributed the same weight w.

$$w_i = \frac{1}{N} \qquad (4)$$

This method is also good for *simplicity* but it misrepresents the securities: those with higher market share are underrepresented while those with higher market share are overrepresented. With the addition of new securities, frequent weight adjustments are required (*rebalancing*).

3.2.3 Market-Capitalization Weighting

Market-capitalization weighting (or value weighting) involves determining the weight on each constituent securitiy by dividing its market capitalization by the total market capitalization of the index (sum of market capitalizations).

$$w_i^M = \frac{Q_i P_i}{\sum_{j=1}^{N} Q_j P_j} \qquad (14)$$

where

w_i = fraction of the portfolio that is allocated to security i or weight of security i
Q_i = number of shares outstanding of security i
P_i = share price of security i
N = number of securities in the index

Figure 7

3.2.4 Float-Adjusted Market-Capitalization Weighting

In **float-adjusted market-capitalization** (or free-float-adjusted market capitalization weighted indexes), the weight on each constituent is determined by adjusting the market capitalization for its **market float**. The market float is the market value of the number of shares that are available for investing to the public. Shares owned by small controlling investors such as owners, other corporations or governments are not considered.

$$w_i^M = \frac{f_i Q_i P_i}{\sum_{j=1}^{N} f_j Q_j P_j} \qquad (15)$$

where

f_i = fraction of shares outstanding in the market float
w_i = fraction of the portfolio that is allocated to security i or weight of security i
Q_i = number of shares outstanding of security i
P_i = share price of security i
N = number of securities in the index

Figure 8

The main advantage of this method is that constituent securities are held in proportion to their value in target market. However, this method also leaves indexes prone to overweighting stocks that have risen and may be overvalued or underweighting stocks which may be undervalued.

3.2.5 Fundamental Weighting

Fundamental weighting methods attempt to measure weights with measures of a company's size that are independent of its price, namely revenue, earnings, cash-flow, dividend, number of employees, book value, etc.

3.3 Index Management

3.3.1 Rebalancing

The **rebalancing** refers to adjusting the weights of the constituent securities in the index. Indexes have regular schedules - usually quarterly - for rebalancing purposes (*rebalancing dates*).
Rebalancing is the act of reapplying the initial weighting criteria and updating the relative weights of securities.

3.3.2 Reconstitution

The reconstitution is the process of changing the constituent securities in an index. It is the act of reapplying including criteria to securities, excluding constituents which do not match them anymore and including other securities that do match them.
The reconstitution reflects changes in the target market such as bankrupcies, de-listings, mergers, acquisitions, etc

4. Uses of Market Indexes

- *gauges of market sentiment*
- *proxies for risk and return*
- *proxies for asset classes* in asset allocation models
- *benchmark* for actively managed portfolios
- *model portfolios*, such as index funds and exchange-traded funds

4.0.1 Gauges of Market Sentiment

The original purpose of stock market indexes was to provide gauge of investor confidence and market sentiment. Indexes reflect investor attitudes and behavior.

4.0.2 Proxies for Systematic Risk-Adjusted Performance

In the CAPM model, the *beta* is defined as the systematic risk of a security. To represent the performance of the market portfolio, investors use a broad index like TOPIX and S&P 500. Another example of global stocks is the MSCI World Index.

4.0.3 Proxies for Asset Classes

These indexes exhibit the risk and return profiles of selected groups of securities, such as equity indexes, fixed-income indexes, commodity indexes, etc.

4.0.4 Benchmark for Actively Managed Portfolios

Investors use indexes as benchmarks to evaluate the performance of active portfolio managers. The selected index must reflect the investment strategy and composition used by the manager. For example, an active portfolio manager investing in small cap stocks should be evaluated using a benchmark index, such as the FTSE Global Small Cap Index.

4.0.5 Model Portfolios

Indexes also serve as the basis for new investment products, such as the index funds. Some investors invest directly in broad market funds that aim to reproduce the performance of equity indexes.
The first ETF's, for example, were based on existing indexes.

5. Equity Indexes

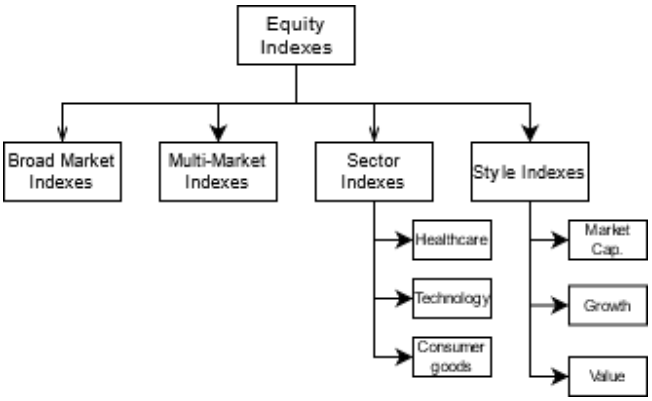

Figure 9

5.1 Broad Market Indexes

A **broad market index** represents an entire equity market and typically includes at least 90% or more of the selected market. The Russel 3000 consists of the largest 3000 stocks by market capitalization and represents about 98% of US equity market.

5.2 Multi-Market Indexes

Multi-market indexes comprise indexes from different countries and regions and are designed to represent multiple security markets. World indexes are important for investors who take a global approach and do not want a special bias towards any particular country or region.

The MSCI offers multi-market indexes and has two major classifications: level of economic development and region. It distinguishes between developed markets, emerging markets and frontier markets.

Developed Markets

Americas	Europe and Middle East	Pacific
Canada, United States	Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Israel, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom	Australia, Hong Kong SAR, Japan, New Zealand, Singapore

Emerging Markets

Americas	Europe, Middle East, Africa	Asia
Brazil, Chile, Colombia, Mexico, Peru	Czech Republic, Egypt, Greece, Hungary, Poland, Qatar, Russia, South Africa, Turkey, United Arab Emirates	Chinese mainland, India, Indonesia, South Korea, Malaysia, Pakistan, Philippines, Taiwan region, Thailand

Frontier Markets

Americas	Europe & CIS	Africa	Middle East	Asia
Argentina	Croatia, Estonia, Lithuania, Kazakhstan, Romania, Serbia, Slovenia	Kenya, Mauritius, Morocco, Nigeria, Tunisia, WAEMU[1]	Bahrain, Jordan, Kuwait, Lebanon, Oman	Bangladesh, Sri Lanka, Vietnam

MSCI Standalone Market Indexes[2]

Europe, Middle East, and Africa	Americas	Europe and CIS	Africa	Middle East
Saudi Arabia	Jamaica, Panama,[3] Trinidad & Tobago	Bosnia Herzegovina, Bulgaria, Ukraine	Botswana, Ghana, Zimbabwe	Palestine

Figure 10

Fundamental weighting in Multi-Market Indexes are usually proportional to the GDP.

5.3 Sector Indexes

Sector indexes represent and track different economic sectors such as consumer goods, energy, finance, health care, technology, etc.

5.4 Style Indexes

Style indexes are directed towards investors with different investing styles such as growth investor, value investor, small cap investor.

5.4.1 Market Capitalization

5.4.2 Value/Growth Classification

6. Fixed-Income Indexes

The fixed-income universe include securities issued by governments, government agencies, corporations, etc. Each of these entities may issue several forms of fixed-income securities with different characteristics and as result, the fixed-income universe is many times larger than the equity market (in number of securities).
Another challenge in fixed-income indexes is the fact that these instruments are predominantly dealers markets. This means that dealers are assign to specific securities and contractualized to provide liquid markets for those securities.
Other issue is the illiquity of some securities that do not trade often. As result, index providers must sometimes estimate the value of constituent securities using securities with similar characteristics as price proxies.

6.1 Types of Fixed-Income Indexes

There is a wide variety of fixed-income securities, ranging from zero-coupon bonds to bonds with embedded options (callable or putable bonds), resulting in very dissimilar types of fixed-income indexes. Fixed-income securities can be categorized according to the issuer's economic sector, geographic location, econimic development, etc.

- Type of issuer (government, corporation)
- Type of financing (general obligation, collaterized)
- currency of payments
- maturity
- credit quality (investment grade, high yield)
- Absence or presence of inflation protection

Indexes can also be categorized into:

- broad market indexes
- market sector indexes
- style indexes
- economic sector indexes

Market	Global			
	Regional			
	Country or currency zone			
Type	Corporate	Collateralized *Securitized* *Mortgage-backed*	Government agency	Government
Maturity	For example, 1–3, 3–5, 5–7, 7–10, 10+ years; short-term, medium-term, or long-term			
Credit quality	For example, AAA, AA, A, BBB, etc.; Aaa, Aa, A, Baa, etc.; investment grade, high yield			

Figure 11. Different fixed-income indexes

7. Indexes for Alternative Investments

The three of the most widely followed alternative investment classes are (i) *commodities*, (ii) *real estate* and (iii) *hedge funds*.

7.1 Commodity Indexes

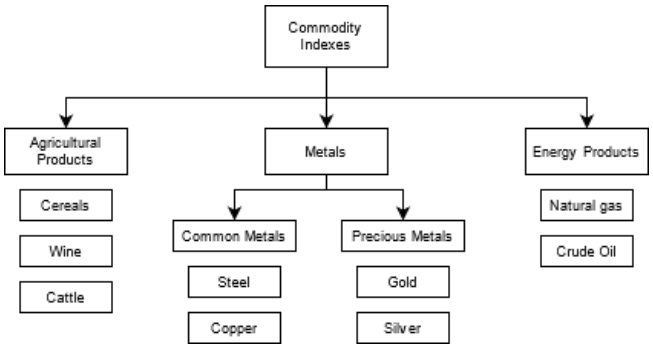

Figure 12

Commodity indexes consist of futures contracts on commodities such as agricultural products, livestock, precious and common metals and energy products (crude oil and natural gas). The weighting schemes can be more complicated as there isn't an obvious weighting mechanism, so the most common methods are either equal weighting or fundamental weighting based on liquidity measures and world production values. As result, some indexes are biased toward energy products and they value them more, other to metals or agricultural products.

7.2 Real Estate Investment Trust Indexes

Real estate indexes can be categorized as *appraisal indexes*, *repeat sales indexes* and *real estate investment trust (REIT) indexes*.
REIT's are private or public corporations organized to specifically invest in real estate, either through direct investment in ownership and property management or through mortgages.
The main indexes are FTSE EPRA/NAREIT global family, which include the *European Public Real Estate Association* (EPRA) and the *National Association of Real Estate Investment Trusts* (NAREIT).

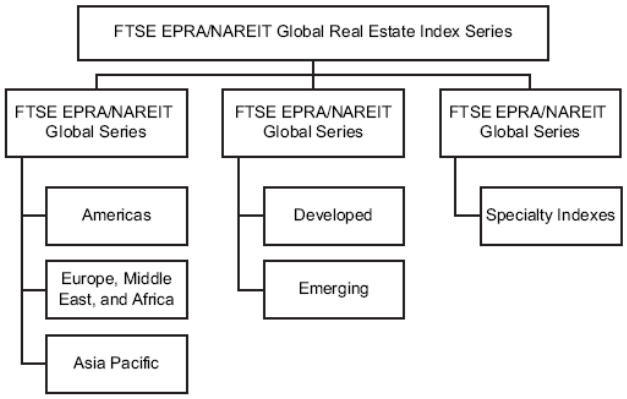

Figure 13

7.3 Hedge Funds Indexes

A number of private research organizations maintain databases of hedge fund returns and summarize them in indexes. These indexes are design to represent the performance of hedge funds on a global (broad) level.

However, unlike other indexes, these companies rely on the voluntary cooperation of hedge funds to provide them with performance data. As result, instead of the index providers determine the constituents, the constituents determine the index.

This creates a few issues, namely the survivorship bias where hedge funds with bad performances have fewer incentives to report their performance and so their returns are excluded from the index. Another situation is hedge funds that go out of business.

References

[cfa, 2019] 2019. *CFA program curriculum*. CFA Institute.