

2. Index Number

ECON304 (Economic Statistics)

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This course is a part of Bachelor of Economics at Chiang Mai University, Thailand

What we will learn in this topic

- 1 Introduction to index number
- 2 Simple Index Number
 - Price Relative
 - Interpretation of Index
- 3 Composite Index Number
 - Simple Aggregate Index
 - Averages of relative prices
- 4 Weighted index number
 - Laspeyres index
 - Paasche index
 - Comparison of the Laspeyres and Paasche indexes
 - Fishers ideal index
- 5 CPI

Introduction to index number

what is index number?

- An index number is a statistical value that measures the change in a variable with respect to time
- Two variables that are often considered in this analysis are *price* and *quantity*
- With the aid of index numbers, the average price of several articles in one year may be compared with the average price of the same quantity of the same articles in a number of different years
- There are several sources of official statistics that contain index numbers for quantities such as food prices, clothing prices, housing, wages and so on

Simple Index Number

- We will examine index numbers that are constructed from a single item only
- Such indexes are called simple index numbers
- Current period = the period for which you wish to find the index number
- Base period = the period with which you wish to compare prices in the current period

Simple Index Number

The choice of the base period should be considered very carefully The choice itself often depends on economic factors

- ① It should be a normal period with respect to the relevant index
- ② It should not be chosen too far in the past

Price Relative

- The price relative of an item is the ratio of the price of the item in the current period to the price of the same item in the base period
- The formal definition is:

Formula

$$\text{Price Relative} = \frac{p_n}{p_0}$$

The notation we shall use is:

- p_n = the price of an item in the *current* period
- p_0 = the price of an item in the *base* period

Simple Price Index

- 1 The price relative provides a ratio that indicates the change in price of an item from one period to another
- 2 A more common method of expressing this change is to use a simple price index
- 3 The formal definition is:

Formula of Simple Price Index

$$\begin{aligned}\text{Simple Price Index} &= \text{Price Relative} \times 100 \\ &= \frac{p_n}{p_0} \times 100\end{aligned}$$

Simple index numbers

The simple price index finds the percentage change in the price of an item from one period to another

- If the simple price index is more than 100, subtract 100 from the simple price index. The result is the percentage increase in price from the base period to the current period
- If the simple price index is less than 100, subtract the simple price index from 100. The result is the percentage by which the item cost less in the base period than it does in the current period

Composite Index Number

- A composite index number is constructed from changes in a number of different items
- Simple aggregate index
 - ▶ the simple aggregate index has appeal because its nature is simplistic and it is easy to find
 - ▶ The formal definition is:

Formula: Simple Aggregate Index

Simple Aggregate Index = $\frac{\sum p_n}{\sum p_0} \times 100$ Where

- 1 $\sum p_n$ = the sum of the prices in the current period
- 2 $\sum p_0$ = the sum of the prices in the base period

Simple Aggregate Index

Even though the simple aggregate index is easy to calculate, it has serious disadvantages:

- 1 An item with a relatively large price can dominate the index
- 2 If prices are quoted for different quantities, the simple aggregate index will yield a different answer
- 3 It does not take into account the quantity of each item sold

Disadvantage 2 is perhaps the worst feature of this index, since it makes it possible, to a certain extent, to manipulate the value of the index

Averages of relative prices

- This index also does not take into account the quantity of each item sold, but it is still a vast improvement on the simple aggregate index
- The formal definition is:

Formula: Average of Relative prices

Average of Relative prices = $\frac{\frac{\sum p_n}{\sum p_0} \times 100}{k}$ Where

- 1 k = the number of items
- 2 $\sum p_n$ = the sum of the prices in the current period
- 3 $\sum p_0$ = the sum of the prices in the base period

Weighted index number

- The use of a weighted index number or weighted index allows greater importance to be attached to some items.
- Information other than simply the change in price over time can then be used, and can include such factors as quantity sold or quantity consumed for each item.

Laspeyres index

- The Laspeyres index is also known as the average of weighted relative prices
- In this case, the weights used are the quantities of each item bought in the base period

Formula: Laspeyres index

$$\text{Laspeyres index} = \frac{\sum p_n q_0}{\sum p_0 q_0} \times 100$$

Where

- 1 $\sum q_0$ = the quantity bought (or sold) in the **base** period
- 2 $\sum p_n$ = the sum of the prices in the current period
- 3 $\sum p_0$ = the sum of the prices in the base period

Paasche index

- The Paasche index uses the consumption in the current period.
- It measures the change in the cost of purchasing items, in terms of quantities relating to the current period.
- The formal definition of the Paasche index is:

Formula: Paasche index

$$\text{Paasche index} = \frac{p_n q_n}{p_0 q_n} \times 100$$

Where

- 1 Σq_n = the quantity bought (or sold) in the **current** period
- 2 Σp_n = the sum of the prices in the current period
- 3 Σp_0 = the sum of the prices in the base period

Comparison of the Laspeyres and Paasche indexes

- The **Laspeyres** index measures the ratio of expenditures on base year quantities in the current year to expenditures on those quantities in the base year.
- The **Paasche** index measures the ratio of expenditures on current year quantities in the current year to expenditures on those quantities in the base year.
- Since the **Laspeyres** index uses base period weights, it may overestimate the rise in the cost of living (because people may have reduced their consumption of items that have become proportionately dearer than others)

Comparison of the Laspeyres and Paasche indexes (cont.)

- Since the Paasche index uses current period weights, it may underestimate the rise in the cost of living
- The Laspeyres index is usually larger than the Paasche index
- With the Paasche index it is difficult to make year-to-year comparisons, since every year a new set of weights is used
- The Paasche index requires that a new set of weights be obtained each year, and this information can be expensive to obtain
- Because of the last 2 points above, the Laspeyres index is the one most commonly used

Fishers ideal index

- Fishers ideal index is the geometric mean of the Laspeyres and Paasche indexes
- Although it has little use in practice, it does demonstrate the many different types of index that can be used
- The formal definition is:

Formula: Fishers ideal index

$$\text{Fishers ideal index} = \sqrt{(\text{Laspeyres index})(\text{Paasche index})}$$

$$= \sqrt{\frac{p_n q_0}{p_0 q_0} \frac{p_n q_n}{p_0 q_n}} \times 100$$

Consumer Price Index: CPI

- Bank of Thailand (BoT) uses Inflation Targeting as KPI for their monetary policy
- Ministry of Commerce is responsible for CPI calculation
- [Link to CPI in Thailand](#)

The screenshot shows a web browser window with the URL www.price.moc.go.th/price/cpi/index_new_e.asp. The page title is "Consumer Price Index (CPI)". On the left, there is a vertical sidebar for the "BUREAU OF TRADE AND ECONOMIC INDICES". The main content area is titled "Consumer Price Index (CPI)" and includes a "Report" dropdown menu set to "Report For Monthly". Below this is a table with columns for Region, Index, MM, YN, and A.A. The table lists Bangkok Metropolis, Central, Northern, North Eastern, and Southern regions, all with checkmarks in the Index, MM, YN, and A.A. columns. A "Schedule of release 2010" link is also present. On the right side of the page, there is a "Year" dropdown menu set to "2015" and a "Report For Consumer Price Index Country" section with a grid of month selection buttons (Jan. through Dec.).

Region	Index	MM	YN	A.A.
Country	✓	✓	✓	✓
Bangkok Metropolis	✓	✓	✓	✓
Central	✓	✓	✓	✓
Northern	✓	✓	✓	✓
North Eastern	✓	✓	✓	✓
Southern	✓	✓	✓	✓

Q&A