INDEX NUMBER

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Introduction

- 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

Methods of Constructing Index Numbers

The index number for this purpose is divided into two heads :

(1) Unweighted Indices; and

(2) Weighted Indices.

Each one of these types is further sub-divided under two categories :

(i) Simple aggregative ; and

(ii) Average of price relatives.

Simple index numbers

- 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
- 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

Simple index numbers (cont…)

The notation we shall use is:

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

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:

$$\text{Price relative} = \frac{p_n}{p_o}$$

Simple index numbers (cont…)

Simple price index

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

$$\text{Simple price index} = \text{price relative} \times 100$$

$$= \frac{p_n}{p_o} \times 100$$

Simple index numbers (cont…)

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 numbers

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:

$$\text{Simple aggregate index} = \frac{\sum p_n}{\sum p_o} \times 100$$

Where

Σp_n = the sum of the prices in the current period

Σp_o = the sum of the prices in the *base* period

Composite index numbers (cont…)

Simple aggregate index (cont…)

- 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

Composite index numbers (cont…)

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:

$$\text{Average of relative prices} = \frac{\sum\left(\frac{p_n}{p_o} \times 100\right)}{k}$$

where

k = the number of items

p_n = the price of an item in the *current* period

p_o = the price of an item in the *base* period

Weighted index numbers

- 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

Weighted index numbers (cont…)

The formula is:

$$\text{Laspeyres index} = \frac{\sum p_n q_o}{\sum p_o q_o} \times 100$$

Where:

q_o = the quantity bought (or sold) in the *base* period

p_n = price in current period

p_o = price in base period

Thus, the Laspeyres index measures the *relative* change in the cost of purchasing these items in the quantities specified in the base period

Weighted index numbers (cont…)

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:

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

Where:

p_n = the price in the *current* period

p_o = the price in the *base* period

q_n = the quantity bought (or sold) in the *current* period

Weighted index numbers (cont…)

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)

Weighted index numbers (cont…)

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

Weighted index numbers (cont…)

Fisher's ideal index

- *Fisher's 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:

$$\text{Fisher's index} = \sqrt{(\text{Laspeyres index})(\text{Paasche index})}$$

$$= \sqrt{\frac{\sum p_n q_o \sum p_n q_n}{\sum p_o q_o \sum p_o q_n}} \times 100$$

The Consumer Price Index (CPI)

The measure most commonly used as a general indicator of the rate of price change for consumer goods and services is the *consumer price index*

The CPI assumes the purchase of a constant 'basket' of goods and services and measures price changes in that basket alone

The description of the CPI commonly adopted by users is in terms of its perceived uses; hence there are frequent references to the CPI as

- a measure of inflation
- a measure of changes in purchasing power, or
- a measure of changes in the cost of living

The Consumer Price Index (CPI) (cont…)

The conceptual basis for measuring price changes

- The CPI is a quarterly measure of the change in average retail price levels
- In measuring price changes, the CPI aims to measure only pure price changes
- The CPI is a measure of changes in transaction prices, the prices actually paid by consumers for the goods and services they buy
- It is not concerned with nominal, recommended or list prices
- The CPI measures price change over time and does not provide comparisons between relative price levels at a particular date

The Consumer Price Index (CPI) (cont…)

The index population

- Because the spending patterns of various groups in the population differ somewhat, the pattern of one large group, fairly homogeneous in its spending habits, is chosen for the purpose of calculating the CPI

- The CPI population group is, in concept, metropolitan employee households

- For this purpose, employee households are defined as those households that obtain the major part of their household income from wages and salaries

The Consumer Price Index (CPI) (cont…)

Periodic revision of the CPI

- The CPI is periodically revised in order to ensure it continues to reflect current conditions
- CPI revisions have usually been carried out at approximately 5-yearly intervals

Changes in quality

- it is necessary to ensure that identical or equivalent items are priced in successive time periods
- This involves evaluating changes in the quality of goods and services

The Consumer Price Index (CPI) (cont…)

Long-term linked series

- A single series of index numbers has been constructed by linking together selected retail price index series
- The index numbers are expressed on a reference base 1945 = 100

International CPIs

- A comparison of the CPIs for a number of countries, including Australia, as measured in September quarters
- The base year is 2000
- During the 8-year period up to 2008–09, of the countries listed, Japan had the smallest increase in CPI (0.4%), while Indonesia had the largest (111.0%)

Using the CPI

- There are a number of situations where the CPI is used to make adjustments to prices charged and payments made
- Examples include changes in rent, pension payments and child support payments
- Such adjustments are often made by the relevant government agency, but if members of the community wish to use the CPI for such purposes, it is their responsibility to ensure that this index is suitable

Index numbers as a measure of deflation

- One of the uses for price indexes is to measure the changes in the purchasing power of the dollar
- This is known as *deflation*
- In order to eliminate the effect of inflation and obtain a clear picture of the ‘real’ change, the values must be deflated
- For example, to *deflate* an actual salary and express it in terms of ‘real’ salary (of the base year), use:

$$\text{'Real' salary} = \text{actual salary in current year} \times \frac{\text{CPI in base year}}{\text{CPI in current year}}$$

Thank you