

Price & volume measures:

3.1 - Introduction

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Objectives

After this session, participants will be aware of:

- Our main focus: GDP
- Laspeyres price & volume indices:
 - Three methods of calculation, giving the same result
- GDP deflator – a Paasche price index
- Basic level price relatives
 - Unweighted aggregation methods
- Areas of weakness in constant price estimates

GDP at current & constant prices

Our main focus is GDP at constant prices

- It is all about goods and services (products),
But GDP is a balancing item, in terms of products:

- Expenditure: $C + I + X - M$
- Production: $TO - IC$

The Income measure of GDP is not defined in terms of products. It can only be deflated using the GDP deflator based on expenditure or production

Price and volume decomposition

- In principle, there is a quantity and a price for every product (sometimes hard to determine)
- Standard notation (current prices):

$$v_{i,t} = p_{i,t} * q_{i,t} \quad (\text{and } V_t = \sum_i v_{i,t})$$

- Estimates at constant prices (3 ways):

$$\begin{aligned} v'_{i,t} &= p_{i,0} * q_{i,t} \quad (\text{and } V'_{i,t} = \sum_i v'_{i,t}) \\ &= v_{i,0} * q_{i,t} / q_{i,0} = v_{i,t} / (p_{i,t} / p_{i,0}) \end{aligned}$$

What national accountants should know about index numbers

Simple indices (relatives)

Data on any two of the three elements are needed

- I find it useful, for extrapolation, to work with simple indices like these:

- $VI(t) = 100 * v_t / v_0$

- $QI(t) = 100 * q_t / q_0$

- $PI(t) = 100 * p_t / p_0$

Value indices are always simple.

But quantity and price indices are more complex for non-homogeneous products

Laspeyres Price/Volume Indices Method 0

- Volume indices

$$QI_L(t) = \frac{\sum_i p_{i,0} * q_{i,t}}{\sum_i p_{i,0} * q_{i,0}}$$

- Price indices

$$PI_L(t) = \frac{\sum_i p_{i,t} * q_{i,0}}{\sum_i p_{i,0} * q_{i,0}}$$

Laspeyres Price/Volume Indices Method 1

- Volume and price indices have the same form

$$Q \text{ or } PI_L(t) = \sum_i w_{i,0} * r_{i,(t,0)}$$

where $w_{i,0} = v_{i,0}/v_0$ ($v_0 = \sum_i v_{i,0}$)

and $r_{i,(t,0)} = q_{i,t}/q_{i,0}$ (volume relatives)

or $r_{i,(t,0)} = p_{i,t}/p_{i,0}$ (price relatives)

Laspeyres Price/Volume Indices Method 2

- “Modified” Laspeyres

$$I_L(t) = I_L(t - 1) * R_{t,t-1}$$

where $R_{t,t-1} = \sum_i w_{i,t-1} * r_{i,(t,t-1)}$

$$w_{i,t} = u_{i,t} / U_t \quad (U_t = \sum_i u_{i,t})$$

and $u_{i,t} = w_{i,t-1} * r_{i,(t,t-1)}$ (updated)

NB: $R_{t,t-1} = U_t$

Advantages of modified Laspeyres

- $w_{i,t}$ are “price/volume updated” weights
- Easier to substitute new items
- Possible to insert new weights at any time
- If this is done, the index becomes “chained”

GDP deflator

- The (implied) GDP deflator is of course the ratio of GDP at current prices to the GDP at constant prices
- It is a Paasche price index number

$$= \frac{\sum_i p_{i,t} * q_{i,t}}{\sum_i p_{i,0} * q_{i,t}} \quad \text{or} \quad \frac{V_t}{\sum_i v_{i,t} / (p_{i,t} / p_{i,0})}$$

Deflation

To measure GDP at constant prices:

- We do not construct the GDP deflator so as to deflate the current price GDP
- We deflate individual component values by an appropriate price relative and then we aggregate

It does not make much sense to create a Paasche index to deflate product values

- To do so implies you have the data you need to calculate the constant price figures in detail and sum up.

Basic level price relatives

- Composite price indices such as the CPI or PPI are not very interesting for national accountants. The basic level relatives (used to compile such indices) are much more useful.
 - If more than one price relative is applicable to a basic heading, below which there is no information on weights, how would you combine them?

Three possible methods

Basic level unweighted aggregation

- **Carli price Index**
 - A simple, or unweighted, arithmetic average of the price relatives. (This varies with the choice of base period.)
- **Dutot price index**
 - The ratio of the unweighted arithmetic averages of the prices in the two periods compared. (This varies with the relative levels of the prices.)
- **Jevons price index (recommended)**
 - The unweighted geometric average of the relatives = the ratio of the geometric average of the prices. (Invariant.)

Discussion

In which areas are your constant price estimates the weakest?