

# **Using high frequency turnover indexes to improve quality of Quarterly GDP estimates**

**Training Workshop on Turnover Indices**

**22-24 May 2017**

**Muscat-Oman**

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# Overview

What we'll learn in this session

- How turnover indexes can be used to improve QGDP
- Preferred methods of estimating volume changes
- Special uses for Retail Sales Indexes

# **But first... a question for you...**

- How would you define 'quality' in relation to your quarterly (or annual) estimates of GDP?

# ...another question for you...

- *How would you define 'quality' in relation to your quarterly (or annual) estimates of GDP?*
- What do users want from QGDP?

# ...last question for you (for now!)...

- *How would you define 'quality' in relation to your quarterly (or annual) estimates of GDP?*
- *What do users want from QGDP?*
- Why might we want to use a turnover index to improve estimates of QGDP?

# Using turnover to estimate changes in Value Added

- Turnover indexes are generally based on sample surveys or administrative sources (e.g. the VAT system)
- These provide data on the sales ('turnover', TO) of businesses in a particular period
- How can we use this to measure changes in volume Gross Value Added?
- *[Just to add that the current price estimates of QGDP are much less interesting to key users – although the aggregate prices, 'IPDs' are generally of interest]*

# Using turnover to estimate changes in Value Added: some assumptions.

- First, recall that GVA is defined as follows:

$$\text{GVA} = \text{Gross Output less Intermediate Consumption}$$

*and*

$$\text{Gross Output} = \text{Sales less changes in inventories}$$

- So, if we wish to use TO as a 'proxy' for changes in GVA, we need to assume that, in the short term:
  1. (for goods only) changes in inventories are relatively small over the period compared to total sales, and average close to zero in the longer term (say, 12 months)
  2. the ratio of Intermediate Consumption to Sales (or Output) is stable
  3. we have suitable price indicators to deflate the current price TO into constant prices (i.e. volume terms)

# Using turnover to estimate changes in Value Added: some assumptions..

- Regarding changes in inventories
  - for most goods the average will be close to zero in the long run
    - can you think of any exceptions?
  - inventories tend to be small relative to sales, because businesses don't want to tie up cash in stocks ('just in time' stock control etc.)
  - There can be issues with the 'stock cycle' though:
    - Businesses may sell off stock and reduce production at the start of a downturn...
    - ...and build up stock and increase production as the economy recovers



# Using turnover to estimate changes in Value Added: some assumptions...

- Regarding Intermediate Consumption
  - In volume (i.e. quantity) terms, the ratio of IC to Sales is generally stable in the short term because the technical characteristics of the production process are fixed
  - In value terms the ratio is likely to vary more as firms absorb/benefit from price changes/cost pressures in their compensation of employees/operating surpluses
- Where does this leave us in terms of using TO as a proxy for changes in GVA?
- [we'll come back to the question of suitable deflators shortly...]

# Using turnover to estimate changes in Value Added

- With the above assumptions, empirically, TO has been found to be a good proxy for changes in GVA
- But, since we're interested in volume changes why not just use direct volume measures to estimate changes in GVA?

e.g.

- Number of cars manufactured
- Tonnes of steel produced
- Number of legal contracts processed
- Number of teachers employed
- etc.

# Why not just use direct volume measures to estimate changes in GVA?

- Before we answer this, another question for you (which contains a clue to the above question)...
- **Where are changes in the quality of goods and services recorded in estimates of GDP?**
  - A. In the Volume measure?
  - B. In the Value measure?
  - C. In both the Volume and Value measures?
  - D. In the Prices?

# Estimating changes in volume GDP: the preferred measure

- Answer: Quality changes are included in both the volume and value measures of GDP
- But they are not included in the Price of GDP
- Using direct volume measures as a proxy for changes in GVA, e.g. the number of TVs produced, would not take account of any changes in the quality of the TVs
- But using TO (deflated using appropriate price indicators) can capture the quality changes in the volume estimates
- This is the 'preferred measure'
- But how is it achieved?

## Capturing quality changes in deflated TO estimates

- Let's consider an example of the production of Televisions
- In this example, there is no change in price between 2014-15, but more 'higher quality' TVs are produced

### Pure Volume change, with quality mix

Sales of TVs

	Price	Volume (units sold)	Sales (local currency)	Sales in constant 2014 Prices	Implicit Price deflator
<b>2014</b>					
Flat screen	100	50	5,000	5,000	
Old valve models	70	150	10,500	10,500	
		200	15,500	15,500	100.0
<b>2015</b>					
Flat screen	100	150	15,000	15,000	
Old valve models	70	50	3,500	3,500	
		200	18,500	18,500	100.0
			Current Prices	Volume	Price
<b>Index (2014=100)</b>			<b>119.4</b>	<b>119.4</b>	<b>100.0</b>

## Capturing quality changes in deflated TO estimates

- In this example, the price of 'higher quality' TVs increases and the 'old style' TVs decreases

### Price and volume change, decomposition

	Price	Volume (units sold)	Sales (local currency)	Sales in constant 2014 Prices	Implicit Price deflator
<b>2014</b>					
Flat screen	100	50	5,000	5,000	
Old valve models	70	150	10,500	10,500	
		200	15,500	15,500	100.0
<b>2015</b>					
Flat screen	120	150	18,000	15,000	
Old valve models	60	50	3,000	3,500	
		200	21,000	18,500	113.5
			Current Prices	Volume	Price
<b>Index (2014=100)</b>			<b>135.5</b>	<b>119.4</b>	<b>113.5</b>

# Estimating changes in volume GDP: the preferred measure

- The key point here is that, with suitable differentiation (i.e. stratification) of types of production between higher and lower quality goods/services, **price acts as a proxy for quality**
- Assumes consumers are prepared to pay more for higher quality goods/services
- Is this always the case?
- Can you think of examples where it does not apply?

# Estimating changes in volume GDP: the preferred measure

- We haven't time today to consider the case of technology products, notably computers and mobile phones, where adjustments are needed to the actual prices to remove the increased quality element
  - e.g. the actual price of mobile phones has fallen, but the quality has increased!
- Quality adjusted or 'hedonic' price indexes are used in such cases
- In some limited cases it is also considered a 'preferred method' for measuring changes in volume GVA to use direct volume measures.
- But 'preferred' by whom?



# Eurostat's Price and Volume Handbook

<http://ec.europa.eu/eurostat/documents/3859598/7152852/KS-GQ-14-005-EN-N.pdf/839297d1-3456-487b-8788-24e47b7d98b2>

## *"A, B and C methods"*

- The A method for manufactured goods is to use suitable PPIs to deflate the value of output, in particular PPIs that are representative of the product group, are valued at basic prices, and take proper account of quality.
- Clearly the PPIs should be sufficiently disaggregated to undertake deflation at the lowest possible product level.
- For certain manufactured products, where there are precise quality standards set for a homogenous product, an A method could also be to use data on the quantities of product at the necessary level of disaggregation, as long as these quantity data are fully representative.
  - Examples of products that could be suitable for this treatment include bulk chemicals, wood pulp and petroleum.
- One B method is to use detailed CPI data adjusted to basic prices for deflating the value of output.
- Use of less appropriate PPIs, for example where there is incomplete product coverage, would also be a B method.
- Any methods based on input costs (except for unique products like large equipment goods), or which use an unrepresentative price index, are considered C methods.

# Aside: Laspeyres-Paache 'Duality'

Volume ('quantity') indexes are most often expressed using the Laspeyres formula  $Q_{Laspeyres}^t = \sum_i \frac{I_i^t}{I_i^B} \frac{V_i^B}{\sum_i V_i^B}$

And changes in current prices are given by  $V^t = \frac{\sum_i V_i^t}{\sum_i V_i^B}$

In which case, 'implied deflators' are of the Paasche form, i.e.

$$P_{Paasche}^t = \frac{1}{\sum_i \left( \frac{I_i^t}{I_i^B} \right) \frac{V_i^t}{\sum_i V_i^t}}$$

This is because of 'Laspeyres-Paasche duality', i.e. that, arithmetically,  $Q_{Laspeyres}^t P_{Paasche}^t = V^t$

[It is also the case that  $P_{Laspeyres}^t Q_{Paasche}^t = V^t$  : this is the 'duality']

**So: Implicit Price Deflators are naturally of the Paasche-type, if volume indexes are of the Laspeyres-type**

[where

$B$  is the base period

$I_i^t$  is the price index for item  $i$  at time  $t$

and

$V_i^t$  is the sales value for item  $i$  at time  $t$ ]

# Using TO to estimate changes in volume of QGDP: summary

- We now have a working basis for using TO to estimate changes in volume GDP

In short we need:

- Good quality TO data at a sufficient level of detail to estimate changes in current price GVA
- Suitable, and similarly detailed, PPIs and SPPIs to deflate these estimates into volume terms

# Where can't we use T0 to estimate changes in volume of QGDP?

- Some activities need a different approach
- Which ones?

# What about a Retail Sales Index?

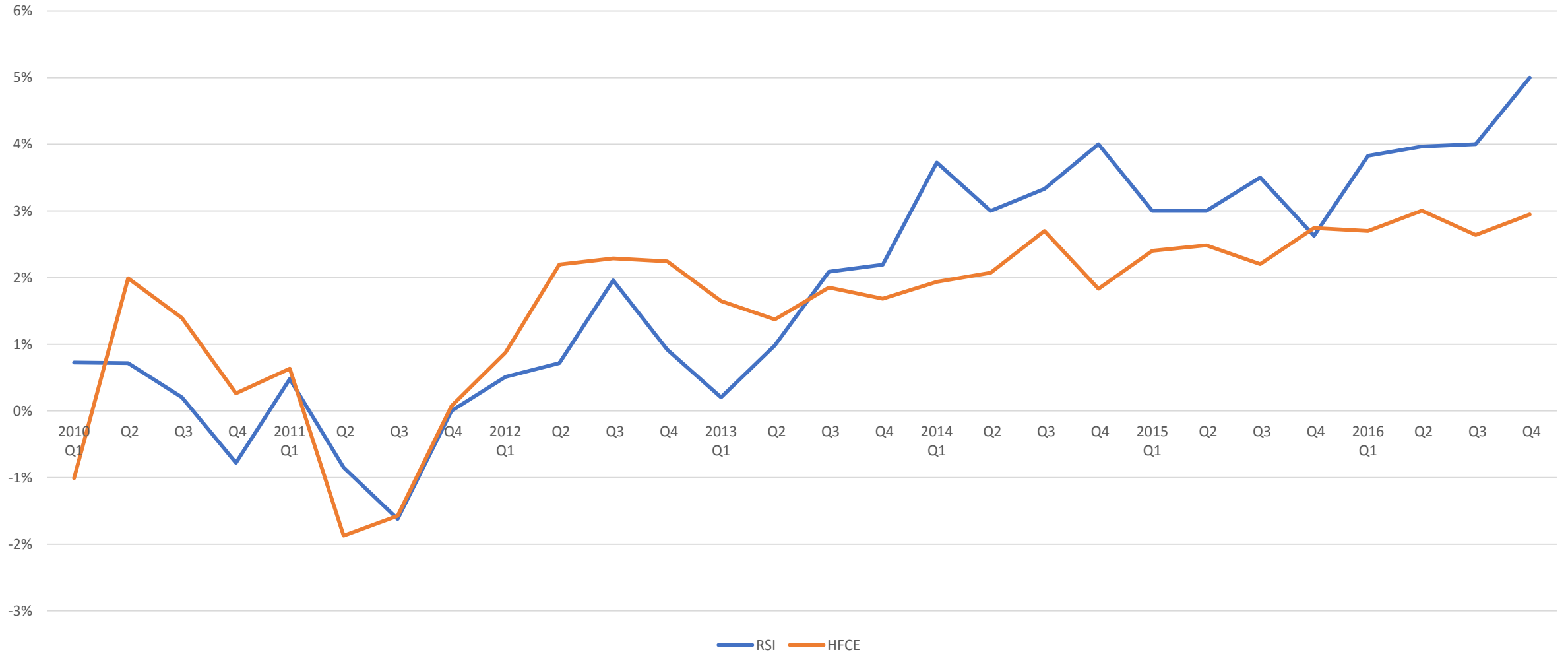
- Can a RSI be used in the same way as other turnover estimates?
- Remember:
  - Output of the Retail trade activity = Margin
  - Margin = Sales *less* purchases of goods for resale
- What if margins change?
- So, ideally, we'd need to know purchases as well as sales
  - ...and it may not be realistic to collect the purchases each month
- And we'd also need separate prices for the purchase and the sales
- And there are other difficulties:
  - 'Retailers' may include some 'non-retail' sales in their turnover
  - And (predominately) 'non-Retailers' may also have some retail sales
- Given all these difficulties, is an RSI helpful in estimating QGDP?

# What about a Retail Sales Index?

- In practice, these issues are usually not critical, and RSIs are used alongside other TO type surveys to estimate short-term changes in volume GDP
- In addition, given users' preference for GDP expressed in expenditure components, a RSI can be a useful early indicator of household consumption (which may typically be 80% or more of total GDP)
- Let's look at the RSI in the UK...

# UK Retail Sales Index and HFCE

UK RSI v HFCE (volumes, seasonally adjusted) - annual % change



# Some other issues to consider...

- What weights should be used to aggregate TO indexes for different activities?
- What about informal activity?
- Need to co-ordinate timing of the release of monthly and quarterly series, e.g. IIP, ISP, and QGDP
- Benchmarking: need to ensure that TO indexes are aligned with annual GDP
  - Revisions issues
  - Biases in TO indexes v annual/SUT?



# “Take home” messages

- Using TO indexes in conjunction with suitable PPIs/SPPIs is the internationally recommended ‘preferred’ method for measuring volume changes in GDP for most activities
  - Price differences act as proxy for quality differences
  - Need quality adjusted prices in some cases
- Some exceptions where direct volume is preferred
- Some cases where different methods needed (Non-market, Banking /Insurance, Agriculture)
- RSI can be used as a further indication of GDP from the expenditure side

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# Capturing quality change in a volume index: An exercise

- To illustrate how quality changes are captured through changes in composition (stratification), consider...
- A box of chocolates includes a mix of 30 milk and plain chocolates
- In the base year, the box contains 20 milk chocolates and 10 plain chocolates and costs 7.5 'dollars'
- Over time, the mix of chocolates changes, there being more plain chocolates than milk chocolates and this pushes up the price of the box (people will pay more for plain chocolates!).
- The following table shows the composition of the box and the prices of milk/plain chocolates in each of 6 periods (T0-T5)

	T0	T1	T2	T3	T4	T5
<b>Quantities</b>						
No. of milk chocolates	20	18	16	10	6	4
No. of plain chocolates	10	12	14	20	24	26
<b>Prices</b>						
Price of milk chocolate	0.125	0.13	0.14	0.14	0.15	0.17
Price of plain choc	0.5	0.55	0.6	0.75	0.75	0.7

*Notice that the total number of chocolates remains the same at 30, so a simple quantity index for boxes of chocolates containing 30 chocolates would be constant. However, the quality of the contents changes over time, so we need to reflect this quality change in the volume index.*

*Calculate:*

1. A value index for the box
2. A volume index for the box
3. The IPD Price index

*Advanced:*

4. Verify that the IPD is a weighted combination of the price indexes for Milk and Plain chocolates using the 'Paasche' formula (see next slide)

# The Paache Price Index

$$P^t = \frac{1}{\sum_i \frac{1}{\left(\frac{I_i^t}{I_i^{t-1}}\right)} \frac{V_i^t}{\sum V_i^t}}$$

*where*

$I_i^t$  is the price index for item  $i$  at time  $t$

*and*

$V_i^t$  is the sales value for item  $i$  at time  $t$