

Using High Frequency turnover indicators to improve the quality of quarterly estimates of GDP

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Overview

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Why might we want to use a turnover index to improve estimates of QGDP?

- Improved timeliness
- Improved frequency - monthly
- Readily availability of data (if VAT is used)
- Ease of methodology
- Conceptual relevance

Statistical pre-requisites for STTIs

Short Term Turnover Indicators (STTIs) need to be:

- Available sufficiently quickly (say within 3 months of the reference month)
 - Price indexes must also be available
- At sufficient levels of detail – at least as detailed as estimates of QGDP
- Classified on the same basis as QGDP, e.g. ISIC Revision 4
- Of good quality
 - What do we mean by quality?

QGDP in the context of AGDP

- The SNA can be applied to any length of time
 - the general framework set out in the SNA can be equally applied to quarterly as to annual estimates
- The QNA is an important specialty within national accounting
- Is increasingly recognized as an essential tool for the management and analysis of the economy.
- The QNA consist of a system of integrated quarterly time series which adopt the same principles, definitions, and structure as the Annual National Accounts (ANA).
- The QNA can be positioned between the ANA and short-term indicators like the IIP and the TII.

QGDP in the context of AGDP – ‘do’s and ‘don’t’s

Some high-level ‘dos’ and ‘don’ts’, related to best practice

- QGDP should use timely and accurate quarterly data that directly covers most activities
- QGDP should not use econometric methods as a substitute for actual data.
- QGDP should be made consistent with their annual equivalents.
- QGDP should be presented as consistent time series.

QGDP in the context of AGDP – compilation in practice

- Each country's QGDP methodology will differ according to circumstances
 - user preferences
 - availability of source data
 - economic conditions

What does QGDP measure?

- GDP combines in a single figure, with no double counting...
- all the output (or production) carried out by all
 - firms
 - non-profit institutions
 - government bodies and
 - households
- during a given period
- within the country's 'economic territory'.
 - consists of all institutional units operating within a national territory whose predominant economic interest lies within that territory.

What does QGDP measure? A word on the meaning of 'Gross'

- 'Gross' refers to the fact that GDP includes 'consumption of fixed capital' (CFC).
- CFC is the amount that the stock of capital is estimated to have been reduced during the accounting period in the process of generating the observed output.
- Broadly equivalent to the business accounting concept of 'depreciation'
 - differs because of the specific method of valuation
- 'Net Domestic Product' (NDP) removes the cost of capital consumption, thereby recognising that this capital was needed to produce the output.
- In theory, NDP provides a more accurate measure of the value of economic activity than does GDP.
- However, estimating CFC is difficult in practice, and attempts to ensure consistency between different countries' estimates of CFC have proven difficult.
- For this reason, GDP remains the most popular basis for estimating economic activity.

What does QGDP measure? What is 'Product'?

- Production (or 'Output') is the value of the amount of goods and services produced
- For a single institutional unit we add up the amount of goods and services produced in the period of interest.
 - For example, for a manufacturer of pasta, it is just the value of the production of pasta produced for sale in the period.
- Differs from 'sales' because some sales may be produced in an earlier period. And some production within the period may be sold in a future period.
- There may also be some production started but not finished (for example pasta which has been prepared by which has not yet been packaged).
- This also counts as production during the period, but is classified as 'work in progress' rather than 'finished goods'.

What does QGDP measure? What is 'Product'? (2)

- Thus, output differs from sales because of these changes in stocks, or inventories, of finished goods and work in progress during the period. i.e.
- **Output = Sales**
 - plus* inventory of finished goods and work in progress at the start of the period
 - less* inventory of finished goods and work in progress at the end of the period.

What does QGDP measure? The concept of 'value added' (1)

- If there was only one institution in the economy it would be necessary only to measure its output to estimate GDP.
- However, an economy consists of very many different institutions, each interacting with the others.
 - The pasta manufacturer buys flour and other raw materials from other businesses which it uses as inputs to produce its output.
- If we added the output of the flour manufacturer to the output of the pasta manufacture, we would be doubled counting the value of the total production by including the value of the flour twice:
 - first as the output of the flour manufacture, and
 - then again as part of the total value of the pasta produced by the pasta manufacture.

What does QGDP measure? The concept of 'value added' (2)

- To avoid this double counting, we need to remove from the value of output the value of the *inputs* used by each institution to produce their output.
- These inputs are referred to as the '*intermediate consumption*' of the institutions.
- The difference between the output and the intermediate consumption is known as the 'gross value added' (GVA), i.e.,

Gross Value Added = Output *less* Intermediate Consumption

What does QGDP measure? Exercise: measuring market sector 'value added'

Given the following data for a manufacturer of cars:

- Sales of cars: 1 353 500.
- Purchases: raw materials: 540 000;
- Purchases: Machine tools: 264 000.
- Purchases: Temporary employment services: 350 500;
- Wages and Salaries: 100 300;
- Inventories of finished products at the start of the period: 245 000; at the end of the period: 346 700.
- Inventories of raw materials at the beginning of the period: 73 200; at the end of the period: 43 000.
- Depreciation over the period: 65 143.

Calculate output, intermediate consumption and value added (assuming no change in prices during the period).

Other issues: Value v Volume

- When estimating GDP we can measure:
 - The value of output less the value of intermediate consumption
- Or*
- The quantity of output less the quantity of intermediate consumption
- The 'quantity method' is more difficult in practice
- Why?

Other issues: Value v Volume (2)

- In practice, to calculate the total quantity of GDP, referred to as the ‘**volume**’ of GDP, we usually:
 1. Measure the value of GVA for detailed components (‘activities’)
 2. Divide these by a price indexes to create detailed volume series
 3. Aggregate these detailed volume series using an index formula
- The most common form of the index is the Laspeyres Formula

$$Q_{Laspeyres}^t = \sum_i \frac{I_i^t}{I_i^B} \frac{V_i^B}{\sum V_i^B}$$

where

B is the base period

I_i^t is the volume index for item i at time t

and

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

Other issues: Level v Changes

- GDP is usually presented in the form of time series
 - in either current or constant price monetary units.
- This presents level of production in each period, i.e. *as a flow* and not in as a stock
- In current prices this level represents the best estimate of the actual value of production in each period
- In constant prices the time series is also presented in monetary units, but it is more difficult to interpret it as a *flow of the quantity production*.

Other issues: Level v Changes (2)

- In fact, while the constant price series is presented as though it has some monetary value, in fact, the units used do not represent actual money at all.
 - the use of monetary units for the volume series is just a convenient basis for presenting the series, which really should be interpreted in terms of how the series changes over time.
- The constant price series is in fact *an index of change*, and not a level in some monetary unit.
- In short, quarterly GDP is useful primarily as a measure of how economic activity has changed compared to an earlier period, rather than what its absolute level is.

Other issues: Quantity v Quality

- How are changes in quantity and changes in quality are reflected in estimates of GDP?
- If the quality of a product improves over time, how is this to be accounted for in the value and the volume measures of GDP?
- The answer to this lies in the fact that volume measures in the national accounts include not just *increases in the number* of products, but also the *utility derived* from them by the consumers.

Other issues: Quantity v Quality: an example

Consider a manufacturer which produces two kinds of cheese: a standard variety (s) and a luxury variety (l).

Consider the sales of these cheeses in 2015 and 2016:

Sales of cheese

Year	Quantity (000s kg), (Q)	Price (P)	Value in Current Prices (Q x P)
2015			
Standard	40	50	2000
Luxury	30	70	2100
Total			4100
2016			
Standard	30	50	1500
Luxury	40	70	2800
Total			4300

Notice that prices are assumed to be the same in 2015 and 2016 and, although the total quantity of cheese sold (in 000s of KGs) is also the same in each year (i.e. $40 + 30 = 70$), the value of sales has increased by 4.9%, i.e. $4300/4100 - 1$.

This is because the demand for luxury cheese has increased, and the demand for standard cheese has decreased.

More consumers are prepared to pay the extra to buy luxury cheese.

Using 2015 as the constant price base, the table shows the sales expressed in constant 2015 prices, i.e. by applying the prices in 2015 to the sales quantities in each year:

Again, we see than the change in consumer preference for more luxury cheese is reflected in the percentage change in constant prices, which again shows a 4.9% increase between 2015 and 2016 ($= 4300/4100 - 1$).

In this case the change in value (4.9%) is *fully reflected as a change in volume* of 4.9%, because the prices of both varieties of cheese did not change between 2015 and 2016.

Sales of cheese				
2015	Quantity (Q)	Price (P)	Value in Current Prices (Q x P)	Value in 2015 Prices (Q x P in 2015)
Standard	40	50	2000	2000
Luxury	30	70	2100	2100
Total			4100	4100
2016				
Standard	30	50	1500	1500
Luxury	40	70	2800	2800
Total			4300	4300

What if the prices had changed as well as the quantities?

Now we see that the total change in value was 22.0% ($5000/4100-1$),

Whereas the volume change, expressed in constant 2015 prices, was still 4.9% ($4300/4100-1$).

In the national accounts we consider this as a 'quality change', because consumers *derive more utility* from the higher volume of their consumption of luxury cheeses in 2016.

Sales of cheese, with price increases				
2015	Quantity (Q)	Price (P)	Value in Current Prices (Q x P)	Value in 2015 Prices (Q x P in 2015)
Standard	40	50	2000	2000
Luxury	30	70	2100	2100
Total			4100	4100
2016				
Standard	30	60	1800	1500
Luxury	40	80	3200	2800
Total			5000	4300
			% Change 2016/2015	
			Value in Current Prices	Value in 2015 Prices
		Total	22%	4.9%

Other issues: Quantity v Quality

- More generally, whenever we observe changes in both the quantity of goods produced and change in their relative prices, we can separate out the price effects from the volume effects in this way.
- The changes in consumer preference – buying a greater quantity of luxury cheese at a higher price, allows us to reflect this quality change within the volume measure of GDP.
- This depends on the fact that the luxury cheese has a higher price. In effect, price is used as a proxy for quality: consumers are prepared to pay more for a higher quality product.

Source of GVA weights

- As we saw, the Laspeyres formula requires us to have some measure of the relative 'size' of each activity within total GDP.
- Specifically, we need to have an estimate of the gross value added of each activity in the economy.
- The proportion of gross value added of an activity compared with total gross value added for all activities is sometimes referred to as the 'weight' of the activity.
- What source should be used for these weights?
- When considering only the production measure of GDP, it may be possible to use an Establishment Survey to estimate weights for a particular year, which can be referred to as the 'base year'.
- If resources allow, it may even be that such a survey can be undertaken each year, so that the weights can be updated every year.
- However, more usually, such surveys are undertaken less frequently, perhaps every three to five years.

Source of GVA weights (2)

- While the use of Establishment Surveys to estimate value added shares is legitimate, the SNA recognises that a more robust basis for estimating the GVA weights needed to aggregate the output of different economic activities is to develop a Supply and Use Table (SUT).
- In brief, a SUT consists of two or three sub-tables, which show the supply of goods and services by product (including domestic production and imports), the demand (or 'uses') of these products, split between intermediate uses and final uses of households, government and non-profit institutions serving households, and exports.
- There can also be a table which shows, for each economic activity, the income components of value added, which include compensation of employees, gross operating surplus and mixed income, consumption of fixed capital and other taxes on production.

Source of GVA weights (3)

- An SUT allows data from multiple sources to be compared and for each product and activity in the table to be ‘balanced’
 - i.e. ensuring that the total supply of each product is equal to the total demand and the total output of each activity is equal to the total input.
- In this way, it is possible to use data on international trade, government expenditure, household consumption, and much else, in addition to the data from Establishment Surveys on domestic production.
- This is particularly relevant for economies which have a significant informal sector, where Establishment Surveys are often inadequate.

What about Informal activity?

- In many countries the economic production of unincorporated businesses, essentially households operating in what is referred to as the 'informal sector', can be significant.
- Developing countries may have between 30% - 50% of their total economic production undertaken within this sector.
- Measuring the amount of informal activity is generally more difficult than measuring the production of the formal sector (usually defined as those businesses which are registered with the national tax authorities).
- As such, sample surveys or tax records, of formal businesses, will not represent the activity of informal businesses.

What about Informal activity?

- The usual assumption is that extent of *informal activity changes in line with that of the formal sector*.
- In the short term this might be reasonable: both formal and informal activity is likely to respond to changes in demand or prices in similar ways.
- However, the ‘short-term’, might at best be a few quarters, rather than years.
- In terms of using STTIs for estimating QGDP, it is important that the annual estimates of GVA within each economic activity include the production of informal businesses.
- These annual estimates can then be used to ‘benchmark’ the STTIs, which will include such production.
- In this way, any bias in the STTIs in terms of their underrepresentation of informal activity, can be removed.

Which STTIs can be used to estimate QGDP?

- For the industry sector of QGDP, if a IIP has been compiled in both current prices and in volume terms, this is preferable to using the TII as an indicator.
- This is simply because the IIP is a measure of industrial *output*, which is a closer concept to *GVA* than *turnover*, as measured by the TII.
- If the IIP is only produced in volume terms (i.e. in constant prices), it will still be possible to use relevant price indicators, for example the PPIs, to 'reflate' the volume IIP into current prices (i.e. multiply the IIP by a relevant price index).
- In fact it is more usual that the current prices estimates of output are produced first, and then deflated (i.e. dividing the current price IIP by a relevant price index).
- Where volume data are used to estimate the IIP, e.g. gigawatt hours of electricity produced, it is possible to convert this into a current price index by multiplying by the price for the relevant unit, in this case the price per kilowatt hour.
- Only if the IIP is not produced should the use of the TII be considered as a possible basis for estimating QGDP.

Which STTIs can be used to estimate QGDP? (2)

- With regard to retail sales, i.e. ISIC 47, the current price TIRT can be expressed in constant prices using the CPI as a suitable indicator.
- If the constant price equivalent of the TIRT is aggregated using weights which represent sales, rather than the retail margins, this may introduce some short-term bias in the estimation, but the TIRT and its constant price equivalent will still be useful indicators.

Biases in STTIs

- Finally, we consider the implications of using the IIP, TII and TIRT for estimating QGDP, in terms of potential biases this may introduce.
- But first, remember: whatever the causes and extent of bias in the STTIs compared with the annual SBS estimates, these will only affect the quality of the short-term estimation if the rates of change between the short-term and annual estimates are different.
- The levels of the estimates can be quite different, and this will have *no effect* on the benchmarked short-term estimates.
- With that in mind, we consider sources of potential bias in each of the STTIs

Biases in STTIs: The TII

- The TII may be based on a specific monthly survey or surveys, or administrative sources.
- If there is an annual structural business survey (SBS), which has greater coverage and/or more detail about the type of sales, it is likely that there will be differences between the annual estimate of total turnover in the short term data in any given economic activity and the equivalent estimate from the SBS.
- The reasons why these differences might have come about should be investigated.
- It may be, for example, that the TII survey sample is not representative of the population in ways that the SBS addresses.
- If VAT sales from the revenue system are used as the basis of the TII, and equivalent data from the annual income tax system are used as the basis of annual estimates, it may be that the monthly VAT system misses some important businesses which only report for Income Tax purposes, perhaps smaller businesses.
- The absence of the informal sector from the TII data sources is also a potential source of bias.

Biases in STTIs: The IIP

- The IIP may be estimated using monthly data on output, or it may just use the same data on sales turnover as used for the TII.
- If based on output data, the key issue may be the value of intermediate consumption, which may be estimated in the annual GDP figures but not in the IIP itself, at least not at the elementary level of aggregation (remember, these elementary IIP series are weighted using GVA weights).
- Essentially, unless actual data are available each month for the IC, an underlying assumption with the IIP is that the ratio of IC to output is stable in the short term.
- If this assumption is violated, say during a recession when firms may reduce the extent of their 'discretionary' expenditures on training, new computers etc., it may be that the ratio of IC to Output reduces.
- This will mean that the growth in GVA as estimated by the IIP index will overstate growth in GVA.
- In practice, without introducing new monthly data collections related to IC, there is little the compiler can do about such short-term biases.
- This is why it is important to have regular annual estimates of the level of GVA to which the IIP can be benchmarked.

Biases in STTIs: The IIP (2)

- If sales turnover, rather than output, is used as the basis of the IIP, this creates a further source of potential bias
- This is because changes in inventories are being ignored.
- Usually, changes in inventories are relatively small compared with the total output (although this may not be the case for large equipment goods like the production of ships, oil rigs, aeroplanes and special purpose machinery, where the work-in-progress component of inventories is significant). But during an economic cycle inventories tend to vary.
- Typically inventories build-up as the economy expands (to meet rising demand), and are reduced as economic activity slows down (to avoid holding excessive inventories for which demand is expected to fall).
- This 'stock cycle' can mean that, if inventories are not adequately measured in the monthly survey on which the IIP is based, but are well-measured in the annual surveys on which annual GDP is based, then there is a further source of bias.
- In practice, in response to such cycles, IIPs based purely on turnover will tend to underestimate growth as the economy expands and understate the decline in growth as the economy contracts.

Biases in STTIs: The IIP (3)

- As with the TII, informal activity, which is not well-represented in the sources for the IIP, is another source of potential bias.
- Differences in the growth of formal and informal activity can arise, for example, in response to short-term problems with supply, perhaps because of changes in the international trade regime, where informal activity may be quicker to respond to such changes than formal activity.
- In such situations it will be important to capture these changes in the annual estimates if possible, which can then be reflected in the IIP through the benchmarking process.

Biases in STTIs: The TIRT

- The Turnover Index for Retail Trade is based on data on the sales of retailers each month.
- In addition to the bias issues discussed above for the TII and IIP, there is a further potential source of bias in the context using a TIRT for estimating the growth in *value added* for the retail activity.
- The implicit assumption when using the TIRT as a proxy for changes in GVA is that changes in the total retail margin, i.e. the sales value less the cost of purchases, is the same as for the sales value itself.
- This is equivalent to assuming that the ratio of the margin to the cost of sales remains fixed, at least in the short term.
- Any deviation from this assumption will lead to bias in the estimation of the growth of GVA for retailers if the TIRT is used.
- For example, if retailers increase their average margin from, say, 30% to 31%, then estimates of the changes in retail GVA will be understated, since the TIRT only records the change in total sales and not the change in the margin.

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