Regional Course on 2008 SNA (Special Topics): Improving Exhaustiveness of GDP coverage

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Price and Volume Measures-Rebasing & Linking

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Are national account aggregates at current price estimates enough?

- Do not reveal real growth of the economy
- The growth may largely reflect increase in prices of the produced commodities
- Current price estimates have two dimensions?
  - Price
  - Quantity
- What is needed?

  Decomposition of value in terms of prices and quantities for various commodities

Why do we need price and volume measures?

* **To properly interpret the changes in nominal figures when relative prices and/or the general price level are changing**

* **For goods and services this means that when the nominal value of goods and services transacted changes**

  > how much is due to changes in quantity?

  > how much is due to changes in the prices of the goods or services?

* **For nominal income this means that when such income increases or decreases**

  > how much more or less of goods can be bought as a result of the change?

The scope of price and volume measures in the system

Price and volume measures are required

> to factor the changes in the values of goods and services into components reflecting changes in their volumes and prices

> measure the cash flows in real terms by deflating their values by price indices

The scope of the price and volume measures also includes:

* Taxes and subsidies
* Trade margins
* Balancing items (value added, GDP)
* Compensation of employees
* Consumption of fixed capital
* Stocks of produced assets (inventories, fixed assets)

Price and Volume measures in the System of National Accounts main issues

* What is meant by price and volume measurement for these items and their components?
* What is the relationship between the current price value and the price and the volume measures for these items?
* How to aggregate them?
* How to obtain price and volume measures in practice?

Main SNA recommendation for price and volume measures

Ideal method:

* Annually chained Fischer price and volume indices for GDP and its components

Second best

* Annually chained Laspeyres volume indices and Paasche price indices OR
* Annually chained Paasche volume indices and Laspeyres Price indices

Note: When chain indices are compiled for output, intermediate consumption and value added, they are not additively consistent

Volume Measures - Main Principles

* (1) Level of aggregation
  * Detailed level of aggregation
    * GDP by activity - at least 2 digits by ISIC, NACE
      * For output as well as intermediate consumption
    * GDP by expenditure
      * HH consumption – as detailed as possible
      * GG consumption – from production side GDP
      * Inventories – by activity and by type
      * GFCF – by activity and by type
      * Imports and exports – detailed HS level, separate for goods and services

Volume Measures - Main Principles

* (2) Choice of index formula
  * Fisher volume (and Fisher price indices)
  * Alternatively, Laspeyres volume (and Paasche price indices)
  * Price indices should be Paasche type indices
    * However, at a very detailed level one can assume that Paasche is closer to Laspeyres

Volume Measures - Main Principles

* (3) Choice of base year
  * What is base year?
    * The year of price and quantity ratios or the pricing year of the NA
  * What is weight year?
    * The year from which weights are taken
  * What is reference year?
    * The year used for presentation of time series of constant price data, the year equal to 100
  * Rebasing or re-referencing?

Volume Measures - Main Principles

* (3) Choice of base year
  * SNA recommends moving from fixed base year to previous year prices and chain-linking
    * Use Fisher volume and price indices
    * Alternatively, use Laspeyres volume and Paasche price indices
  * Time series – chain-linking
    * Non-additivity

Volume Measures - Main Principles

* (4) Methods – deflation, extrapolation, quantity revaluation
  * Deflation of current year value with a price index or extrapolation base year value with a volume index – not equivalent entirely in practice
    * A sample of price observations is normally more representative than a sample of quantity observations
    * It is more difficult to control quality changes in volume indicators than in price indicators
  * Assessing price and volume indicators - 4 criteria
    * Coverage of products, valuation basis, quality changes, conceptual consistency

Current-price vs Volume Measures of GDP

* Volume measures of GDP can be obtained through various methods
  * Deflation
    * Divide current-price value of the transaction (output, intermediate consumption, final consumption, etc) by an appropriate price index
  * Quantity revaluation
    * Multiply base period prices by actual quantity data
  * Volume extrapolation
    * Extrapolate base period value by appropriate quantity indicator

Current-price vs Volume Measures of GDP

* Deflation is preferred because
  * Prices usually show less variation than quantities
  * Sampling errors associated with price indexes tend to be smaller
  * Price indexes can capture quality changes better than quantity revaluation and volume extrapolation methods

Volume Measures - Methods

* By transaction category
  * Market and non-market output
  * Intermediate consumption
  * Value added
  * Final consumption expenditure
  * Gross fixed capital formation
  * Changes in inventories
  * Exports and imports of goods and services
  * Taxes and subsidies
* By industry – agriculture, mining, manufacturing, etc.

Volume Measures - Methods

* Classification of methods
  * Best methods – most appropriate methods
  * Second best methods
  * Methods to be avoided

Volume Measures - Methods

* Market output and output for own final use
  * Price deflation
    * PPIs – if Laspeyres, the most detailed level of aggregation; however if huge fluctuations PPI should be recalculated as Paasche
    * Model and specification prices – rapid product change, construction
    * Hourly rates (price charged per hour) – productivity and quality changes?
    * CPIs – personal services (no distribution margin, no change in tax or subsidy rates, and households consume most of the output)
    * Unit value indices – heterogeneity, quality issues
    * Input prices – should be avoided

Volume Measures - Methods

* Market output and output for own final use (cont)
  * Volume extrapolation
    * Output volume indicators
      * Collected at a detailed level, homogeneous products
      * Representative for all output
    * Input volume indicators – should be avoided
  * Quantity revaluation – usually agricultural output

Volume Measures - Methods

* Market output and output for own final use (cont)
  * Best methods - deflation with PPIs or extrapolation with volume index which is fully representative
  * Second best methods – less appropriate PPIs (no quality adjustment), CPIs, less representative output volume index
  * Methods to be avoided – input methods, secondary indicators, overall CPI

Volume Measures - Methods

- Non-market output
  - Best methods
    - Sum of total observed input of production factors at constant prices as the volume indicator (that is, compensation of employees at constant prices, intermediate consumption at constant prices, and consumption of fixed capital at constant prices)
      - Second best - input indicators could be used if the volume of each input is estimated separately (possibly taking quality changes of the inputs into account)
      - To be avoided - outcome indicators, input indicators

Volume Measures - Methods

- Intermediate consumption
  - Best method
    - Deflation product by product
    - Separate deflation of domestically produced and imported products
  - Second best – might not distinguish between domestically produced and imported products
  - To be avoided – deflation of intermediate consumption at aggregated level, with no product detail

Volume Measures - Methods

- Value added
  - Double indicator methods – best methods
    - Separate volume measure estimates for output and intermediate consumption
  - Single indicators method
    - Extrapolation with volume indicators – second best method
    - Direct deflation – should be avoided

Volume Measures - Methods

- **Household final consumption expenditure**
  - Best method – deflation using appropriate CPIs
    - Follows same concepts as the national accounts
    - Takes into account quality changes
  - Second best – if CPIs do not meet criteria above
  - Methods to be avoided – using an index that does not correspond to all products, deflation with overall CPI

Volume Measures - Methods

- **Gross fixed capital formation**
  - From supply side usually for construction works; valuation is an important issue – purchaser prices
  - Structure of GFCF is important; domestic and imported goods; detailed level by product as possible
  - Best methods – deflation with investment price indices or PPIs adjusted to purchasers prices and imports price indices
  - Second best – if no imports price indices, use partner country price indices (adjusted for exchange rates)
  - UVIs for imports should be avoided

Volume Measures - Methods

- **Exports and imports of goods**
  - Price indices – actual exports and imports prices, UVIs, price indices of a partner country
  - Best method – deflation using actual (transaction prices) imports and exports price indices
  - Second best – UVIs for homogeneous group of goods, price indices of partner countries adjusted for exchange rates (for non-homogeneous groups)
  - All others, including UVIs for non-homogeneous groups, should be avoided

Volume Measures - Methods

- **Taxes and subsidies on products – never deflate!**
  - Levied on quantities of products – volume measures are equal to the volume index of the product
  - Levied on values of products – use extrapolation of base year current price values with volume index of products subject to taxes/subsidies or apply tax margin from base year
  - New taxes are recorded as price changes, collection rate increase is also a price change

Volume Measures – Methods by Industry

- Financial services
  - Not well covered by price indices
  - Charges from fees and commissions separate from FISIM
  - For FISIM – no direct price or quantity
    - Use of volume indicators (FISIM broken down by activity) – number of bank accounts, number of checks processed, volume index of loans
    - Base period interest margin on loans and deposits to the stocks of loans and deposits re-valued to base period prices
  - Insurance
    - Volume indicators by type of insurance and by products

Volume Measures – Methods by Industry

- Other services – business, public administration, education, healthcare, community, social, personal services
  - Market output
  - Non-market output
  - Depending on the price and volume indicators available
    - Double indicator methods preferred
    - If not, single extrapolation

How is rebasing done?

- Rebasing (update of base year) can be carried out as follows:
  - Periodic rebasing
  - Annual rebasing (annual chain-linking)
- Rebasing is often carried out in conjunction with the incorporation of data for a new benchmark year
- Current-price data between benchmark years will need to be revised before rebasing is carried out

How is rebasing done? Periodic rebasing

* Update base year every 5 years
* Need to select appropriate new base year which should be normal year without dramatic economic changes
* Price structure for new base year should be applied from new base year onwards
* Price structure for previous base years should be applied before new base year

How is rebasing done? Periodic rebasing

* For volume measures of transactions which are obtained by deflation
  * Change reference year of deflator at most detailed level possible to new base year (i.e., divide value of deflators in old base year by value of deflator for new base year)
  * Deflate current-price value using the new deflators
  * Alternatively, extrapolate most detailed current-price value of transaction at new base year using real growth rates of previous base year

How is rebasing done? Periodic rebasing

* For volume measures of transactions which are obtained by quantity revaluation
  * Replace prices for revaluation with those for new base year
* For volume measures of transactions which are obtained by volume extrapolation
  * Change the year from which level is being extrapolated to new base year

How is rebasing done? Periodic rebasing

* Aggregate volume measures of transactions to calculate volume measures of GDP from new base year onwards using price structure of new base year
* Volume measures of GDP before new base year are calculated using price structure of previous base years
* Join volume measures of GDP at new and previous base years so that they are expressed in terms of the prices of a specific year (i.e., reference year)
* This process is known as **linking**

How is rebasing done? Periodic rebasing

* Reference year is usually the same as new base year in practice so that the GDP volume measures for recent years are close to corresponding current-price measures
* Reference year is assigned index value of 100
* At the reference year, current-price and volume measures of GDP and its components are the same
* Linking is done by extrapolating backward separately the volume measures of GDP and its components at the most detailed level possible at the reference year using the real growth rates of GDP and its components which are calculated using the previous base years
* Apply same process to index values at reference year to obtain Laspeyres volume indexes

How is rebasing done? Periodic rebasing – Main effects

* Products with relatively higher volume growth and relatively weaker price increases will tend to have lower weight in new base year
* Real GDP growth rates will be revised from new base year onwards (tend to be lower)
* Real GDP growth rates of previous base years will not be revised
* Real GDP growth rates are calculated using weights which are more representative of each base year
* Consistent time series of volume measures of GDP expressed at prices of a specific (reference) year
* Volume measures of GDP are chained at the reference year

How is rebasing done?
Periodic rebasing – Main effects

* But, volume measures of GDP before reference year will not be additive due to linking of GDP and its components separately
* Statistical agency will need to explain clearly in its methodology notes and metadata why volume measures of GDP are not additive

How is rebasing done?
Annual rebasing (Annual chain-linking)

* Update base year (weights) every year (2008 SNA recommendation)
* For volume measures of transactions which are obtained by deflation
  * Change reference year of deflators annually
  * Alternatively, extrapolate most detailed current-price value of transaction using corresponding deflated value
* For volume measures of transactions which are obtained by quantity revaluation
  * Change prices for revaluation annually
* For volume measures of transactions which are obtained by volume extrapolation
  * Change the year from which level is being extrapolated annually

How is rebasing done?
Annual rebasing (Annual chain-linking)

* Use unchained volume indexes to derive chained volume measures of GDP and its components at the prices of a specific reference year
* Linking is done by extrapolating forward and backward separately the volume measures of GDP and its components at the reference year using the real growth rates of GDP and its components which are calculated using the unchained volume indexes
* Apply same process to index values at reference year to obtain chained volume indexes

How is rebasing done?
Annual rebasing (Annual chain-linking) – Main effects

* Products with relatively higher volume growth and relatively weaker price increases will have lower weight
* Price structure to calculate volume measures of GDP is updated annually
* Real GDP growth rates are calculated using weights of previous year (Laspeyres), current and previous years (Fisher)
* Real GDP growth rates are calculated using weights which are more representative than those under periodic rebasing (tend to be lower)
* Volume measures of GDP are chained at the reference year
* Consistent time series of volume measures of GDP expressed at prices of a specific (reference) year

How is rebasing done?
Annual rebasing (Annual chain-linking) – Main effects

* But, volume measures of GDP are mostly not additive
* Statistical agency will need to explain clearly in its methodology notes and metadata why volume measures of GDP are not additive
* More calculations needed, especially for Fisher
* More demanding data requirements

How to solve non-additivity problem?

* Statistical agency will need to explain clearly in its methodology notes and metadata why volume measures of GDP are not additive
* Calculate contributions to real GDP growth which are additive
* Contributions to real GDP growth measure how much each component contributes to the percentage change in real GDP

Conclusion

* 2008 SNA recommends calculation of annually-chained volume estimates of GDP
* But, this is a resource-intensive and computationally-demanding exercise with many steps
* Countries which are not in a position now to compile annually-chained GDP may consider periodic rebasing in the interim
* Base year should be updated every 5 years
* At the earliest convenience, countries should switch to computing annually-chained volume measures of GDP

Conclusion

* Periodically-rebased and annually-chained volume measures of GDP are mostly non-additive when expressed at the prices of a particular reference year
* Countries should explain clearly to users why the linked volume measures of GDP are not additive
* Countries can also consider calculating contributions to growth which are additive