Aggregate Measures and Related Price Indices

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Abstract
The authors of this article deal with the issues raised by aggregate measures and their related price indices within an integrated system of the economic statistics. Apart from the aggregate measures’ content used for the main price indices, this article also presents the methods for their assessment and registration, considered useful for practitioners in determining the prices and weights used in establishing the indices.

Key words: accounts, resource, aggregate level, service, goods

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General Data
The aggregate value for a field of goods and services is defined as the sum of the prices and quantities product for those goods and services that are part of the relevant field.

The price index can be characterized as a factor that measures the relative change of this aggregate value as a result of the price change. Consequently, all the important price indices measurement formulas may be expressed as the weighted mean of the relative prices of which weight is represented by each product’s (item’s) contribution to the overall value. Out of the most familiar price indices measurement formulas expressed as the weighted mean of the relative prices, we mention the Laspeyres index, the Paasche index and the Walsh and, respectively, the Torngvist indices. Expressed as the geometrical mean of the Laspeyres and Paasche indices, the Fischer index may as well be considered a function of the expenditures’ weights directly derived from the overall value.

In order to develop a price index, certain features of the overall value must be known from the beginning. The aggregate value defines the following aspects of the price index:

- what merchandise or item must be included in the index
- how is the price per item or merchandise determined
- type of transactions that involve these items included in the index
- how are the weights determined and what should be the source of such weights

There are four important types of price indices known and closely monitored in the economic statistics system, i.e.: the Consumer Price Index (CPI), the Producer Price Index (PPI) and the export and import price indices (EPI and IPI). These indices do not include or should not include a collection of irrelevant indicators, in exchange, they should provide a consistent and integrated view upon the evolution of prices in terms of production, consumption and international goods and services transactions. That is why, the meaning of these indices results in great part from the meaning of the aggregate value to which each of them refers, separately. The existing relations between the most important four price indices are defined by associating them to the centralized aggregates established by the System of National Accounts (SNA). The system of national accounts is subjected from time to time to revision, the last version being the one in 2008.
In what follows, we will explain the concepts used for defining the institutional sectors and the types of transactions mentioned by SNA in order to observe better the association between the four types of indices and the measured aggregate values, using these concepts.

The system of national accounts is described in the 2008 version, as follows:

„The System of National Accounts is a standard set of recommendations, agreed at international level, on the method of measuring the economic activity, in consistency with the strict conventions of accounting based on economic principles. The recommendations are expressed within the terms of a set of concepts, definitions, classifications and accounting rules/norms that include the standards on the measurement of elements such as the gross domestic product (GDP), one of the most cited indicators of economic performance. The SNA accounting framework allows the calculation and the presentation of the economic data in a format conceived with the purpose of substantiating the economic analyses, the decision-making and the issuance of economic policies. The accounts display, in a condensed form, a great mass of detailed information, organized according to the principles and perceptions upon economy’s means of operation.

They provide a detailed and comprehensive registration of the economic activities that take place on a state's territory and of the connections between different economic operators or group of operators that occur on a market or in any economic environment.

The system's architecture makes available accounts that meet the following requirements:

- they are complete, meaning that all the activities are covered and, by means of consequence, so are the operators existing in the economy;
- they are consistent, because for determining the consequences of a single action upon all the parties involved identical values are used, using the same accounting rules
- they are integrated, meaning that all the consequences of an operator’s single action are necessarily reflected in the accounting results, including the compraisal in the balance sheets of the impact upon the measurement of the wealth.”

SNA 2008 contains a complete framework, the resources-uses chart that establishes and shows the connections between all main goods and services flows that take place in an economy. The flows included in this chart and their contents are defined, classified and measured consistently from a conceptual viewpoint. This chart presents simplified and directly the existing connection between the production, consumption, distribution, import and export of goods and services. Thus, it may be considered that this chart represents an adequate framework for the establishment and formation of a statistic price system consistent at domestic level, which refers to a set of goods and services flows that are economically interdependent.

**Resource and Use of Goods and Services**

At the most aggregate level, the resource and the use of goods and services in the national accounts are represented by the basic macroeconomic identity, i.e.:

\[ P + \text{Im}p + T = IC + C + H + I + Exp \]

(1)

where \( P + \text{Im}p + T \) represents the total value of resources and \( IC + C + H + I + Exp \) the total value of uses.
By subtracting the intermediate consumption and the import from both equation parts (1) we discover the alternative calculation expressions for the gross domestic product (GDP), known as the production method and the expenditure method:

\[ P - IC + T = GVA + T \]

\[ \equiv C + H + I + Exp - Im p \]

\[ = GDP \] \hspace{1cm} (2)

The gross domestic product (GDP) is internationally known as the central macroeconomic aggregate for the measurement of the economic performance at national level. More precisely, it measures the added value of the production activities performed by all the resident units registered in an economy.

Because Import (Imp) is not included in the GDP, the GDP price index (deflator) measures the inflation generated at domestic level. The calculation of the indices that allow the monitoring of the relative changes of the GDP and of its components and the attribution of such changes separately per prices and volume represents one of the main objectives of the price statistics development based on a modern statistic system.

As I will explain hereinafter, the resources-uses chart (RUC) within the system of national accounts (SNA) 2008 is a complete economy matrix which includes the identities highlighted through equation (1) and (2) at the detailed disaggregation levels. Each matrix line indicates the total use of a product or group of products and each column presents the total resource obtained from the domestic production activity and from import. RUC provides an accounting framework which imposes discipline both with respect to concepts as well as to the numerical consistency of the data regarding the goods and services operations obtained from different sources. The operations must be defined, classified and assessed in a similar way and any error must be reconciled. RUC represents a solid basis for the calculation of an interdependent set of price and volume indices.

**Resources-Uses Flows System**

In order to separate the price and the volume components of resources and of uses, we need to build the aggregates mentioned in equation (1) based on the economic operators’ institutional sectors accounts. The basic accounts of SNA 2008 where all such aggregates are recorded at the institutional units’ level are the following: the production account, the revenue use account, the capital account and the goods and services operations external account. According to these accounts, the products and services operations of the institutional units are organized as follows:

- Production account: production P is recorded under resources, and the intermediate consumption IC under uses. This account’s balance is the gross value added (GVA)
- Revenue use account: the expenditure for the final consumption C is recorded under uses
- Capital account: the gross capital formation is recorded under uses
- Goods and services operations external account: the import Imp is recorded under resources, and the export Exp under uses.

**Recording the Goods and Services Operations**

The aggregates mentioned in equation (1) represent the goods and services flows classified by operations categories. There are two defining aspects for the recording of such operations: the moment and the assessment.

**The moment the operation is recorded**

The general principle of the national accounts is that the operations in the institutional units must be recorded at the moment the receivables and debentures are
created, transformed, disappear or when such are cancelled. This principle bears the name of principle of recording based on the ascertained right.

In other words, in order to associate each operation to a moment, the national accounts consider each operation as consumed when the event occurred and a payment obligation exists. In the case of goods and services flows, this happens when the property right upon the good is transferred or when the service is provided. It is said that an operation is ascertained when the property exchange occurred or when the service was provided. It is not automatically implied that such moment is similar to the moment when the payment was made.

This principle may seem simple, but its enforcement into practice is complicated due to the fact that the institutional units involved do not always use the same accounting rules and even when such rules are similar, differences may appear at the level of recording owed to delays in communication. Such differences must be removed through specific adjustments.

The System of National Accounts uses three price concepts, according to the way in which taxes and subventions per product are recorded, as follows:

- **Base price** – represents the price paid to the producer by the purchaser, comprising the subventions per product and excluding any type of tax per product. Likewise, the price does not include the transport and delivery costs, invoiced separately by the producer.
- **Production price** - represents the price paid to the producer by the purchaser, which excludes the deductible value added tax (VAT) and any transport and delivery expense separately invoiced by the producer.
- **Purchase price** - represents the price paid to the producer by the purchaser, which excludes the deductible value added tax (VAT) and includes the transport and delivery expenses separately invoiced by the producer.

According to these concepts, two assessment principles may be distinguished, one applied to the producer (supplier) and the other one to the purchaser (user).

In equations (1) and (2), production \( P \) and import \( \text{Imp} \) are assessed at the base price to which the taxes per products are added and the subventions per products are subtracted in order to assess the total resource at purchase price. In the case of imports and exports the assessment is made at the FOB price (free on board), which means the value declared at customs, at the exporter’s border.

Below, we elaborate on the main aspect of the four types of accounts and on the products and services operations pertaining to each account.

**Production Account and Production**

The production account records the operations related to the production process. It is calculated for the institutional sectors and for the activity branches. It includes production \( P \) under resources and intermediate consumption \( \text{IC} \) under uses.

The production account allows the obtainment of one of the main accounting balances of the system, namely the value added, which is the value created by an unit hired in an activity that highlights a production process and an essential aggregate: the gross domestic product. The value added has an economic meaning both for the institutional sectors, as well as for the activity branches.

The value added (the account balance) may be calculated – as well as all accounts balances – prior or after the deduction of the fixed capital consumption. Therefore, we may speak about gross value added and net value added. Due to the fact that production is
assessed at the base price and the intermediate consumption is assessed at the purchase price, the value added does not include taxes, but it comprises the subventions per products.

At the overall economy level (national economy), in the production account resources, to the production of goods and services taxes are added, save for the subventions per products. This allows the obtainment of the gross domestic product (at the market price).

The production account is related to the definition of production. Production is an activity performed under the control and responsibility of an institutional unit that combines resources (labour force, capital, goods and services) in order to produce goods or to provide services. The purely natural processes that do not involve the human intervention or control are not part of the production.

SNA 2008 differentiates between the production performed at the level of an institutional unit, using a classification according to the types of unfolded activities. The most aggregate level is the enterprise which is seen as an institutional unit hired in production or, in other words, each institutional unit may be assimilated to the notion of enterprise. The term of enterprise may refer to a company, non-profit institution or to an enterprise without legal personality.

The greatest part of the production is performed by a relatively low number of large companies that are involved in several types of production, and, practically, there is no threshold for the expansion of the production diversity at the level of a large enterprise. If all enterprises are grouped based on their main activities, at least some of the resulted categories are susceptible to be very heterogeneous in relation to the type of performed production processes and, likewise, to the produced goods and services.

Thus, in order to analyse the production in which the production technology plays an important role it is necessary to work with groups of producers that are mainly hired in the same type of production.

The production includes all the products manufactured throughout an accounting period. The particular cases below are included in the production, as well:

- the goods and services of a unit with local economic activity provided to another unit with local economic activity belonging to the same institutional unit;
- the goods that are produced by units with local economic activity at local level and that remain in stock by the end of the period over which they were produced, irrespective of their subsequent intended use.

Nevertheless, the goods and services produced and consumed over the same accounting period by the same local institution are not subjected to different recording. Thus, neither are they recorded under production, nor under the intermediate consumption of such unit.

The production of an institutional unit comprising several local institutions is equal to the sum of the relevant units’ productions, also comprising parts of the production which the units exchange between them. SNA distinguishes between: the market production, the own final consumption production and other non-market production. The same distinction is also applied to local institutions and to institutional units.

This distribution is fundamental, due to the fact that it determines the selection of the applied assessment principles, namely: the market production or the total production of other non-market goods or services producers.

In a price index formation process, we must focus on those operations of the organizational units that occur at significant prices from an economic viewpoint – subsequently, we will be interested in the market production. According to SNA, the
significant price from the economic viewpoint is the price that has a significant effect both upon the quantity a producer is willing to offer as well as upon the quantity a buyer is willing to buy.

The prices collected for the market production elements may, nevertheless, be used in assessing the production for the own final consumption. Thus, the price indices range may be extended in order to also cover this component of the non-market production.

**Revenue Use Account and Household Final Consumption**

For the institutional sectors that have a final consumption, the revenue use account indicates the way in which the available revenue is distributed between the final consumption expenditure and the savings.

In the SNA, only public administrations, the institutions without lucrative purpose in the service of households and the population households have final consumption. The flows for these goods and services may be decomposed in price and volume components and this is why they are interesting for the statisticians in the prices field.

The final consumption expenditure comprises the individual consumption expenditures and the collective consumption expenditures.

The final consumption expenditure financed by the different sectors taken into consideration: population households, public administrations and institutions without lucrative purpose in the service of population households, is included in the available revenue use account.

SNA also uses a notion for the final consumption, i.e. the effective final consumption. This notion corresponds to the value of goods and services effectively available to the population households for their final consumption, even though their procurement is financed by the public administration or by the institutions without lucrative purpose in the service of households. Consequently, the effective final consumption of the public administrations corresponds only to the final collective consumption. As the final consumption expenditure of the institutions without lucrative purpose in the service of households is considered as full individualized, their effective final consumption is null.

Household consumption may have three distinct meanings. Firstly, it may mean the total set of individual goods and services acquired by the households, including the ones received as social transfers in kind. Secondly, it may mean the effective payments made by the population in order to procure a subset of products and services for own use. In order to differentiate between these two meanings, SNA 2008 describes the first as being the effective consumption of households and the second is found under the notion of population households consumption expenditure. The third possible interpretation of household consumption is the effective physical process of goods and services consumption, i.e., that process in which the utility notion appears and which determines the households’ standard of living. The goods and services consumption or use process may occur after their acquisition, as many consumption goods may be stored.

The existence of social transfers in kind is not recognized by the consumer price indices, even though it is desirable to consider them, especially when we approach the evolution of the cost of living. Moreover, the governments may start to ask for the payment of services which were previously provided for free, a practice that became more often met in many countries. The goods and services provided for free as social transfers could, virtually, be seen as part of the household consumption expenditures – but at zero price. The passage from the zero price to a positive price is, by means of consequence, a price raise that may be recorded by a consumer price index.

Not all household expenditures are monetary. A monetary expenditure is one in which the equivalent of the procured good or service is the creation of a certain type of
financial obligation. This obligation may be extinguished immediately through a monetary payment, though many monetary expenditures are made using credits. The household consumption expenditures also comprise certain expenditures for goods or services which the households produce for their own use. These are treated as expenditures because the households incur the costs for their production.

The referred household expenditures accepted by SNA include all the expenditures for goods which the households produce for their own consumption, but exclude all the household services produced for their own service, except for the rental services produced by the occupants-landlords. The referred prices to which the included goods and services are assessed are their estimate market prices. In the case of rental services, the prices are the rents practiced on the market. Other prices, such as the prices of vegetables, fruit, dairy or meat products produced for their own use could be included if they account for a sufficiently high component from the household’s consumption expenditures.

It is useful to note that all the household consumption expenditures are individual expenditures by definition. We may distinguish within SNA the aggregate indicators for the household consumption, relevant for the CPI indices.

**Capital Account and Gross Capital Formation**

The capital account records the acquisitions minus the non-financial assets assignations to the resident units and measured the variations in the net value owed to the economy and capital transfers.

The capital account allows us to determine to which extent the acquisitions minus the non-financial assets assignations have been financed through economy and capital transfers. It causes to appear either a financing capacity, which is the amount available to a unit or to a sector in order to finance, directly or indirectly, other units or sectors, or a financing need that corresponds to the amount a unit or sector is obliged to lend to other units or to other sectors.

As mentioned before, the element that draws the attention from the viewpoint of the decomposition into the volume and price components is in our case the gross capital formation.

It would be easy to conclude from all the above about units and institutional organizations that the smallest economic unit to which the capital account may refer is the institutional unit. It is known that only institutional units draft balance sheets and can monitor the stock variations. Nevertheless, the physical capital goods of which evolution is monitored in the capital account can be and should be recorded if possible, under local institutions. Such data is useful especially in order to analyze productivity, even though complete capital accounts cannot be drafted at local institution level.

**Goods and Services Operations External Account**

The goods and services imports are recorded in the account’s resources and the goods and services exports are recorded under uses. The difference between resources and uses represent the account balance, known as "the goods and services external exchanges balance". If the balance is positive, it represents a surplus for the rest of the world and a deficit for the overall economy, and vice-versa if the balance is negative.

In order to be consistent with the base price of the resident units’ production the imports of goods are recorded at a level equivalent to the base price, i.e. by excluding the taxes per imports, but including the subventions per imports.

Imports and exports of goods recorded in the goods and services operations external account are measured in the FOB value, i.e. at the border of the exporting country.
On the other hand, when the transport and insurance services included in the FOB value of the imports of goods (meaning between the enterprise and the exporter’s border) are produced by resident units, we mention that they must be entered in the services export value of the economy importing the goods. Symmetrically, when the transport and insurance services included in the FOB value of the exports of goods are produced by non-resident units, they must be entered in the services import value of the economy exporting the goods.

**Resources-Uses Chart**

The resources-uses charts are matrixes by branches of activity (industry) and by products that describe in detail the internal production activities and the operations per product of the national economy. The chart shows: the production costs structure and the revenue generated by the production activities; the goods and services flows produced in the national economy and the goods and services flows with the rest of the world. The resources chart includes the goods and services resources by product and by source, making the difference between the domestic production and the imports.

Two fundamental identities connect the resources chart to the uses chart:
- Identity by branch: Production by branch = Entries by branch;
- Identity by product: Total resources by product = Total uses by product: 
  Production + Imports + Taxes minus subventions per product and import = Intermediate Consumption + Exports + Final Consumption Expenditure + Gross Capital Formation.

These identities by activity branch and by product serve for the verification and improvement of the estimates’ coherence and comprehensiveness.

The resources and uses charts serve for statistic and analytical objectives. The main statistical needs that can be covered are the following:
- a) identifying the gaps and inconsistencies that affect the basic data;
- b) weighting and calculating the indices that measure price and volume;
- c) obtaining the estimates in a residual manner (in order to obtain a variable, start from the estimate of all the other variables, the unknown variable resulting as a difference), especially for the production and final consumption of specific products;
- d) verifying and improving coherence, reliability and comprehensiveness of the data included in the resources and uses charts and of the deriving numbers (e.g. the production accounts numbers). Finally, the accounts balancing process should not be limited only to the resources and uses charts in current prices.

**References**