Considerations of National Accounts Deflators

Senior Lecturer Aurelian DIACONU PhD
aurelian.diaconu@gmail.com
„Artifex” University of Bucharest

Abstract
One problem highlighted by the specialized literature is to identify the most appropriate ways of deflating the national accounts aggregates. Starting from this, the authors present the issue of the price indices used in the construction of National Accounts, highlighting the peculiarities of calculating the national accounts in terms of inflation and the need to estimate macroeconomic aggregates in constant prices.

Key words: account, product, process, information, price

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National accounts aggregates such as gross domestic product (GDP) are developed both in current prices and constant prices. The constant price value of an aggregate is obtained by a process called "deflation", in which the current price value is divided by a price index called "deflator". The constant price values are called "volumes" and express the value of an aggregate, if the subsidiary quantities must be multiplied by base year prices.

Price indices used in the process of deflation may be CPIs, PPIs, indices of export and import prices, etc. In national accounts, information provided by these sources are compared and integrated in order to achieve a single measurement. GDP deflator is often used as a general measurement of the inflation as it covers all price changes in the economy, which are supported by households, enterprises and governments. The deflator of final consumption expenses of households is an alternative measurement of the inflation experienced by consumers. It may differ from CPI due to the differences in the scope of goods and services, due to the methodological differences between the CPI and national accounts, and due to the national accounts deflators which incorporate information from other price statistics.

Calculation of the synthetic price index
The System of National Accounts (SNA) provides a general framework for the measurement and the integrated analysis of the price and volume of the main macroeconomic aggregates. From this point of view, The System of National Accounts simply covers the transactions in goods and services and some items such as taxes and subsidies on products, trading margins, consumption of fixed capital, wage compensation, inventory objects stocks and the fix assets produced. Using the prices, the national accountancy enables the statistic measurement of the volume of the added value (representing the balance account of production), which doesn’t express a noticeable flow of goods and services that can be directly divided into price and volume components.

Consequently, it can be stated that the macroeconomic data that characterize the different aspects of economic activity become much more important in temporal comparisons. Time series calculated for synthetic indicators is an important basis for macroeconomic analysis, and thus can underlie economic and political decisions.

When the elements of the time series are compared it must be taken into account that the macroeconomic aggregates are evaluated in "nominal terms" of the current price
and the level and changes of these aggregates are expressed in terms of price and volume. Therefore, there appears the problem of the division of the nominal change in at least two components: one that expresses changes in prices and another expressing the actual changes of the physical volume. This involves the elimination of the changes of aggregate prices from the nominal change by using deflation, thus achieving the real modifications (volume).

The aggregates of the economic performances (GDP, for example) contain various goods and services. Therefore, there appears the need to include price variations for goods and services in a numeric expression (the GDP price index, for example), which can be regarded as a synthesis of the general price levels for the corresponding aggregates. From a practical standpoint, the problem is hard to solve because of the difficulties in dividing nominal aggregates in the two components.

Choosing the formula to get the best index that summarizes the evolution of prices was an intensely debated issue in the specialized literature. For practical reasons, the decomposition of the nominal aggregates into two components - price and volume - is based on independent judgments regarding the interpretation of the results and the cost of collecting the required information for calculating the index. For these reasons, it can be concluded that there is no such thing as a "true", "real" price index; the sense of the private economic development, always correlated with an "exact" value of the evolution of price. Such conception would lose sight of why a relationship for calculating a certain price index is chosen and applied, depending on the problems which await an answer.

On the other hand, deflating aggregate time series can be regarded as a way to dispose price changes compared to a fixed structure of goods (quantities) and prices. Deflating, in a narrow sense, means to relate the nominal indicator to an appropriate price index (deflator). Statistical practices highlight a small number of formulas that can be applied to obtain price indices. Consequently, price indices as Laspeyres and Paasche are very important since they summarize the relative changes in the prices of goods and services. Taking into account the differences between formulas, each of them has its advantages and limitations. The problem that can always occur, is to choose between the two, balancing the possibilities to obtain data, to easily explain the results and to ensure comparability over time of the computed indices.

The System of National Accounts 1993 recommended the usage of annual chained Fisher-type indices for measuring the prices and volumes of GDP and its components. As an alternative, it is recommended to an annual chained Laspeyres index for volume and Paasche-type index for prices. Fisher-type index has the advantage of achieving for the same indicator, both the Laspeyres index and Paasche index, and thus determining the influence of the weighting systems.

The Calculation of National Accounts in the context of inflation

The compilation of national accounts for a country facing phenomenon specific to inflation raises various difficulties. The negative impact of inflation strongly manifests both in the calculation of constant prices and current prices, because it induces a distortion of prices.

Inflation not only involves major changes in prices, but also a decrease in the purchasing power of the currency. National accountancy should consider this phenomenon to assess the real economic situation. In these circumstances there is a need to know the way of measuring inflation.

Measuring the inflation depends on the position of the decision makers. Inflation is not an independent phenomenon, each chosen product exhibiting a specific price variation. On the other hand, the purchasing power of a currency depends on the products to be
purchased. If the same basket of reference is not taken into consideration, the constant deviation will not be the same. Consequently, there are enough indicators that show the presence of inflation.

In the measurement of inflation, the most commonly used is the consumer price index. Its advantage is that it is easily calculated each month, and that it is based on a limited basket of goods from final consumption of households.

Also a significant index to measure inflation in the economy is the price index of GDP. But for its development, it is necessary to calculate national accounts, which means more than two years.

National accountancy considers the inflation process in certain phases of developing summary tables, as follows:

- to analyze changes in property values (for example, nominal holding gains or losses) arising from changes in their prices;
- to measure the evolution of the purchasing power of macroeconomic aggregates income and calculate the evolution in "real" terms (not to be confused with measurement at constant prices), it is sufficient to deflate them with inflation;
- The National Accounts System presents interest flows for countries affected by the inflation. The method allows expressing interest flow, which should be regarded as a repayment of principle, to the extent that inflation leads to a loss of the purchasing power.
- The comparison of economic activities throughout the year is disturbed by inflation, making it necessary to measure GDP in real terms. This procedure is not relevant because all variables should be included in the price comparison. Therefore, it requires a more complex analysis, such as analysis in constant prices.

Need to estimate macroeconomic aggregates in constant prices

Establishing the prices and volumes used to estimate GDP is achieved by successive evaluations of its components at the most detailed level possible. If GDP is obtained by using the production method, it is necessary to measure the prices and volumes for production, the intermediate consumption and gross value added for each activity, as well as for the taxes and subventions on products. Similarly, the expenditure method is based on the evaluation of the final consumption of households, governments, and non-profit institutions serving households, the gross capital formation (including inventories), exports and imports of goods and services. Once these estimates obtained, GDP and its components can be calculated in both current and constant prices.

When using various price and volume indicators for the determination of macroeconomic aggregates, we should consider some important aspects of evaluations (in current and constant prices). There are three methods used to obtain expression in constant prices of the macroeconomic aggregates, namely: reevaluation, deflating and extrapolation. Reassessment consists in expressing the volume of each period in the prices of the basic T year. Deflating is achieved by dividing the values of the components expressed in current prices \( V_t \) of each period by the suitable price index, convenient \( (P_0, t) \).

Extrapolation of the physical volume represents the updating the values of the base period, using a suitable volume index.

Except from the hyperinflation situation, the estimates in constant prices, by deflating, are generally more accurate than the values obtained by extrapolating volume indices. This statement is based on the fact that in a stable economy individual price indices are less variable than the ones of individual volume. In cases in which direct and
independent calculations of prices and volumes can be made, a technique which is easier
than determining of the value, it is necessary to check the consistency between the value,
price and volume within the national accounts.

In principle, all deflators must be Paasche-type indices (requiring current weight)
and the volume indices used to extrapolate volumes should be a Laspeyres type (base
period for the shares should be the same as the period used as "base year" in national
accounts). In most countries, these requirements are difficult to achieve. To solve this
practical problem, it is necessary to make deflation / extrapolation to the highest level of
detail possible and, conversely, to obtain synthetic key indicators of national accounts
starting from the most basic level.

Economics literature often makes use of two interrelated concepts: real GDP and
real national income. Real GDP is estimated as a sum of its components, measured in
constant prices by deflating using the necessary price indices. For a national economy this
indicator suggests the extent of the economical ‘growth’. Real national income involves
measuring the changes in purchasing power, and is given by the sum of the real GDP and
effects of changes in external prices (gains or losses).

From this point of view, the problem highlighted in the specialized literature is to
identify the most appropriate ways of deflating the national accounts aggregates. After the
50s, most macroeconomic accounting experts agreed to the idea of deflating with a price
index for each stream. GDP price index was calculated as a residual, indirect element,
resulting in a default" price index ", using the so-called Geary method, which involves:

- estimating the GDP price index by dividing the GDP in current prices, to
  the total sum of its deflated components;
- GDP volume index calculation by dividing the total amount of current
deflated GDP components to the total sum of the same components of the
  base year, at the base year prices.

Geary method is compatible with double deflation method, which consists in
separate deflation of output and intermediate consumption, from which will result the
deflated gross value added. Statisticians unanimously decided that this method be used to
calculate national accounts, but the concept of purchasing power was not completely
abandoned. Also, in the 50s an agreement was made that there should be two categories of
macroeconomic aggregates in constant prices: the GDP and the real national income (which
includes the concept of purchasing power). Many economists have focused their studies on
measuring the effects of external price relationships changes (Nicholson, Stone, Burge,
Stuvel, Godley and Cripps, Courbis / Kurabayashi)

The price indices used in the construction of the National Accounts

The fluxes registered by the National accounts represent economic transactions
measured in terms of monetary units. The value of a transaction can be directly
decomposed into two components: the number of quantitative units and the price at which
each of these elementary quantitative units are sold.

For a basic product, this can be expressed by the following equation: "value =
quantity x price", which corresponds to the relation "value index = volume index x
price index".

Each post of the national accounts generally covers transactions involving more
basic products. Measuring the changes in volume and price related to the need of the
aggregation of individual indices corresponding to basic products. Aggregate volume index
is a Laspeyres one, which corresponds to the aggregation of the individual indices by
weighting base period values. Aggregate price index is the Paasche type and is calculated
by aggregating individual price indices, using as weights the values of the current period.
European System of Accounts uses three concepts of price, depending on the recording mode of taxes and subsidies on products as follows: base price, purchase price and cost of production.

- The basic price (PB) - is the price paid by the buyer to the manufacturer; this includes subsidies on products and excludes any tax on the product; also this price does not include transportation and delivery charges invoiced separately by the producer.

- Production cost - is the price paid by the purchaser to the manufacturer, excluding the deductible value added tax and any other costs related to shipping and delivery, which are made and invoiced separately by the producer. The formula for calculating this kind of price is: \( PB + \text{taxes} - \text{VAT} \).

- The purchase price - is the price paid by the purchaser, excluding the value added tax; the price covers the cost of transport and delivery, which are billed separately by the manufacturer. The formula for calculating this kind of price is: \( PB + \text{taxes} - \text{VAT} + \text{Shipping costs} \).

The evaluation in constant prices of the main aggregates in Romanian national accounts is achieved using the previous year’s prices. For each year, the final version of the main aggregates in the national accounts can be found in the "Input-Output table", in current prices as well as in prices of the last year. For Romanian national accounts it should be mentioned that a base year is not established.

Getting the Input-Output table in constant prices requires separate assessment, in constant prices of each component for both the uses and resources in the first stage, by balancing their components at the level of each product and in a later stage, by constructing the matrix of intermediate consumption, in constant prices.

To deflate the aggregates of the national accounts some price indices calculated by different directions in the field of the INS and the General Directorate of National Accounts and Macroeconomic Synthesis of the same institute are necessary. The evaluation of the aggregates of the national accounts in constant prices is done within the framework of input-output table.

Several main sets of indicators are used. The most important is the consumer price index (CPI) for products and services used by the population in a given period of time (current), compared to a prior period (base or reference period); to construct this index the base year weights derived from the Household Survey data processing is used. CPI is calculated for the goods and services consumed directly by households. Using the CPI to deflate the production should be based on knowledge of the weight of the total final consumption from the total production and the differences in price and structure variation and between the intermediate and final realization of that production. CPI measures the changes in the purchase price of a product, but not the basic price, and - as a result – its use is not recommended in deflating the output.

Industrial production price index (IPPI) on activities measures prices in a given period (named ‘current’) from the previous period (the basic reference), using weights based on gross value added structure. Deflation by IPPI is a method preferred by professionals because they directly measure the production price and quality changes are taken into account. IPPI requires special investigations involving high costs and difficulties in organizing them, especially in the case of services. In general, the IPPI is a Laspeyres index with monthly or quarterly periodicity.

Other series of indices used are: price indices in peasant markets by product, price indices of vegetal and animal agricultural production, price indices for construction, unit
value indices of imports and exports of goods; average wage indices, on industries. All these indicators are rough indicators because they are not adjusted in terms of quality.

Some aspects of assessing GDP in constant prices

The Romanian National Accounts System was based on the framework of the European System of Accounts 1979 (ESA79) until 1998, when the shift to the new system ESA 1995 was realized. This is the reason why the national accounts calculated for the year of 1998 were made using both systems. For any country, the existence of National Accounts is an important contribution to achieving an overall picture of its financial position. The principle of the National Accounts in constant prices is based on the separation of current value changes in price and volume changes.

A change in the volume of GDP is considered an indicator of the changes that have occurred in the national economic activities, measured in the prices of the last year. By comparing the change in volume with the change in value of the GDP one can calculate the GDP implicit price change which is an aggregation of all the price changes used in the formation of Input-Output table. Therefore, the implicit price index of GDP can be considered an indicator of the general evolution of prices in the economy.

GDP in current prices can be calculated by using three methods: of production, of expenditures and of incomes. GDP in constant prices can be calculated through the methods of production and costs, including specific operations of the account of goods and services (calculations for the production, intermediate consumption, gross value added, imports, exports, final consumption, gross fixed capital formation, stock variation). In principle, these methods should lead to the same results, both for current prices and constant prices. Basically, this only happens when an integrated balance calculation based on supply and use, provided by the national accounts, is used.

Using price indices in the method of production for GDP at constant prices

This method consists of adding up the gross value added of the branches, at constant prices, and the net taxes on products at constant prices.

A) Gross value added (GVA) at constant prices

GVA is an unnoticeable concept which represents the balance of the account of production, and is calculated as the difference between the output in a given period of time and the corresponding intermediate consumption. Therefore, it is difficult to split GVA in the two elements: price and volume. GVA at constant prices represents the contribution of an individual element of production or of a group of units to the final output of goods and services at constant prices, which are available for the various uses in the economy (consumption, gross capital formation and net exports).

The measurement of the value added at constant prices can be obtained using different methods of deflating (single and double) or of extrapolation of physical volume. From a conceptual point of view, the double deflation is the only correct method, but in practice it is possible that the necessary information used for reasonable and independent assessments of the output and the intermediate consumption at constant prices, are not available or do not meet the required quality. For example, an alternative method is to use price indices (like the deflators for output and intermediate consumption or wage index) to extrapolate the added value directly. The procedure represents the single deflation method, and is based on the hypothesis of a constant relationship between the production deflators, the intermediate consumption and the value added. The value added must be determined at the level of services and goods in the production industries. If we sum up all the values added of the economic branches, we obtain their contribution to the formation of the GDP.

B) Production at constant prices
Production at constant prices is the result of economic activities of the resident units in a given period of time, in the prices of the base year (precedent). This indicator consists of the market and non-market production of goods and services.

The market production is evaluated using basic prices, which corresponds to the sum of the values of the cost of the goods and services which were consumed, the remuneration of the factors of production and the subsidies on products. In Romania, the price indices which are used to assess the market production of goods and services at constant prices are:

- aggregate price indices of industrial production, on industry;
- consumer price indices, on groups of products and services;
- wholesale price indices on Romanian markets;
- price indices of agricultural production.

At the same time, an assessment of the production at constant prices is obtained by using production volume indices, when available. The results which are estimated by the two methods are then compared. Special difficulties arise in calculating the production at constant prices for services of financial intermediation, which are indirectly measured. At this point, it is estimated by deflating the intermediate consumption (based on the price indices specific to its components) and the gross value added (using the average wage rate of the workers in the sector), separately.

"Non-market services" are classified into individual and collective services. For individual services another quantitative measurement can be made (education, health), aside from the qualitative one and thus a production of these branches is obtained. For the collective services (like for example the public administration) the calculation of the production starts with the assessment of production at constant prices of intermediate consumption, remuneration of employees (using the average wage index of the employees from that sector), taxes on production and the consumption of fixed capital. Thus the resulting output was based on the single deflation of the value added of these types of services. Therefore the output market of non-market producers is extracted from this part of production. The Romanian national accounts system does not use this types of estimation indicators such as capital per worker or work per hour.

C) intermediate consumption (IC) at constant prices

In the balance of supply and use, the intermediate consumption is treated as a destination of the production of each branch towards the productive consumption of other branches.

CI estimation is done using purchase prices of the composing goods and services. To calculate CI at constant prices we use price indices which are specific to the origin of the resources involved, which correspond to the purchasing price indices of goods and services that are included in each intermediate consumption of certain activity branches, on products. Another method of evaluating the intermediate consumption matrix is by applying technical coefficients, even if this method should be applied with caution. The two arrays of intermediate consumption at constant prices obtained are then compared and analyzed.

The assessment at constant prices of the final consumption is made by using various price indices, knowing that there are many distinct parts, such as:

- Purchases of market goods and services - are estimated in Constant prices using aggregate indices of consumer prices on products;
- Purchases of goods from the agricultural market or from the household industry - are estimated in constant prices using selling price indices on the agricultural markets;
Independent final consumption of agricultural producers - the price indices used are the same as those employed to estimate agricultural production, the ground rule is to evaluate the production for final independent consumption at basic prices, the same as those used for the products on the market or the costs of production;

Benefits in kind or the transfers of production – estimating constant prices depends on the way of purchasing goods and services. CPI is used for goods and services which are purchased on the market, and PPI is used for the goods and services produced by the enterprise itself.

Housing services for owners - average rent index on the market is used to deflate this special part of the final consumption.

B) Final consumption expenditure of the public administration and the non-profit institutions serving households. In accordance with the ESA 95, these types of expenditures are equal to the non-market production of these producers (non-market) minus what was cashed in from the sale of goods and market services at economically significant prices, plus the goods and services purchased to be supplied to households without any other alteration. The value of the final consumption and the public administration and NPISHs is estimated by the "inputs" method and the deflation is done by the suitable using price index, especially the appropriate IPPI.

C) Gross fixed capital formation at constant prices

Price changes for different types of fixed capital can be significant. It is important that the estimates in constant prices should be realized at least for the following groups of fixed capital: buildings and other construction works, machinery and equipment, vehicles. In the Romanian national accounts, the evaluation of gross fixed capital formation (GFCF) is based on different price indices, as it follows:

If the product in question is mainly used for gross capital formation, the indices that are used are the average price index the same way as they are calculated for the total resources in the Input-Output table (production + imports + VAT + customs duty).

If the product in question is included in fixed capital formation by exception, normally being intended for the final consumption, then the average price indices are calculated for these two elements together.

D) Changes in inventories at constant prices

Changes in inventories represent the difference between stock entries and stock exits in a given period. In national accounts, there are three types of stocks: stocks at producers, at users and commercial stocks; this is the reason why the assessment is made separately for each of these categories.

A method used by the Romanian national accounts system to assess changes in stocks at producers consists of calculating them by the difference between existing stocks at the end of the period and the existing stocks at the beginning of the period, at the prices which correspond to each moment. In this way one can consider "stock appreciation" which can be induced by the inflationary process. Changes in inventories without "stock appreciation" can then be evaluated at constant prices using most of the price indices of the resources corresponding to each branch, noting that agricultural products hold some particular cases. These three elements (initial stock, final stock and stock appreciation) are deflated separately to obtain the main indicator from the national accounts.

The stocks at the user are calculated at current prices on the basis of the inputs and outputs in the stock, evaluated at the acquisition price for each moment of the movement.
For the assessment at constant price indices used for the intermediate consumption are employed. Commercial stocks are deflated using Paasche-type price index.

E) Exports and imports of goods and services at constant prices

To assess exports and imports at constant prices, the implicit price index Paasche-type should be adjusted to the specific nature of foreign relations. In the concrete frame of the conditions within the Romanian national accounts the determination of the values of imports and exports in constant prices is accomplished by using their values at current prices and the price indices (corrected with exchange rate index) for imports and separately for exports. Since the unit value index is a better measure for international economic relations in forming the GDP and that this index is available in the Romanian statistics since 1997, the national accounts use it for calculations at constant prices. This index is obtained separately and adjustments occur in the process of comparison with the results from the usage of volume indices.

References