THE MAIN THEORETICAL ASPECTS REGARDING THE DEFLATION OF THE MACROECONOMIC INDICATORS

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Abstract

Macroeconomic results indicators are calculated using known methods and are used for both static analysis and comparative analysis over a period of time. In order to bring the result indicators to the concrete possibility of comparability, we must start from the fact that for each period for which the macroeconomic indicators of the results are calculated they are expressed in the current prices of the respective period. Of course, over time, primarily because of inflation, the prices used are no longer comparable. Consequently, if volumes in natural and conventional units can be used for comparability, if the issue and quality are concerned, things get complicated and become insignificant. For this, prices must be brought to a common denominator by using the deflation process. Deflation or deflation involves the transformation of an aggregate from a nominal monetary expression into a real one. To simplify this, this is done by reporting the aggregate expressed in nominal or current prices to the price index corresponding to the period in which we want to achieve this comparability. Practically, in the national accounts system, each year, after calculating the macroeconomic outcome indicators, then deflating so many data using chain-linked indices is used to ensure that data is included in bases that can be used in comparibility. There are several problems in deflagration, namely, deflation of a fixed structure nominal aggregate for which we use appropriate statistical-mathematical relations. The second is deflating a nominal aggregate that does not have a physical structure and in this context the deflation relationships are different. Depreciation is and should be considered a method of eliminating price changes from a nominal aggregate. That is, in the same aggregate, it is questionable, by reference to

the price index, to reach comparative sizes that we can use in international comparisons. In this context, for example, we use a Paasche type index and obtain an aggregate that deflates all nominal aggregates. In the study we can also talk about double deflation, which is a special deflation procedure applied in macroeconomic calculations when the aggregate is actually the difference between two aggregates with a physical structure. For example, we can interpret the deflation of gross value added and gross domestic product. In other words, by double deflation it is eliminated from the level of an aggregate in a value expression that can not be directly decomposed into a physical and price component to identify the price variation. The relationship of calculation in this context is a particular one that we will continue to refer to. Last but not least, we can talk about deflation in macroeconomic calculations as only deflation can ensure knowledge of the volume of aggregates with a physical structure made by double deflation. This type of deflation is recommended for gross national income and net national income, but not for GDP or PIN, for which double deflation will be used and not deflation through economic calculations.

JEL Classification: E01, E31, E64

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Introduction

In this study, the authors sought to finalize and present the main elements suggesting the possibility of bringing macroeconomic indicators to a value level that could be subject to comparability over time. First, defining the economic category of deflation, the content of this method of statistical method, then an incurs in presenting the particularities of deflating a nominal aggregate with a physical structure, deflating an aggregate that does not have a precise physical structure, deflation which involves the elimination of the influence of prices from a nominal aggregate, the double deflation and the modalities of use. The authors focus, after defining the content of these statistical categories, on the presentation of the main statistical and mathematical relations that underlie this macroeconomic deflationary process. The authors also focus on presenting the main aspects or principles that need to be considered when deflating is used. There is also emphasis on deflation in macroeconomic calculations in the sense that this genre is currently practiced in order to know the volume of aggregates with a precise physical structure. Aggregates that are not accessible to these processes are analyzed by carefully considering the use of gross or net values, which means bringing gross or net indicators to comparability levels. On the other hand, the authors study and

accurately present the price index used in GDP, which measures the average price variation of the final products and services produced by the domestic economic subjects. It is also possible to make use of the determination of the national net product given that only economic subjects with the possibility to achieve results are concerned here. In this context, it is stated that for each component that is included in the gross domestic product calculation, a Paasche type price index used to deflate that component is calculated. In this study, the authors sought to synthesize the elements in successive chronological order in order to arrive at the idea that the GDP resulting from the deflagration should be a sum of the actual components, thus deflated, so that the deflation is applied to the structural elements of macroeconomic indicators of results, so that in this way we can achieve comparability not only global but also structural of the macroeconomic indicators that we are considering.

Literature review

The issue of international comparability is an important aspect that can not be achieved without deflating the indicators analyzed. This aspect is given attention, a number of specialists giving him an appropriate space. Thus, Abraham (1969), in the work of national income and economic accounts, also dealt with deflation. Anghelache, Popovici, Solomon and Stanciu (2017) paid attention to aggregates expressed in comparable price indices using deflation. Anghelache, Mitruţ and Voineagu (2013) analyzed the system of national accounts and brought indicators to a comparable level by deflation, and Anghelache (2008) and Anghelache, Isaic-Maniu, Mitruţ. and Voineagu (2006), studies on economic statistics and macroeconomic ratios / correlations also referred to deflation. Anghelache and Capanu (2004) also addressed this issue, and Anghelache (1996) paid attention to deflation in the treatment of the measurement and comparison of economic development. The deflation problem was extensively dealt with by Barro (1987) and Biji, Biji, Lilea and Anghelache (2002). Boskin, Dulberger, Gordon, Griliches and Jorgenson (1998) conducted a study of consumer prices, the consumer price index and the cost of living, pointing out that it would be impossible to analyze without deflation. Capanu and Anghelache (2000) referred to the role of deflation, and Dornbusch, Fischer and Startz (2007) dealt extensively with this aspect. Ferri (2000) referred to the deflation process, and Gilbert and Kravis (1954) made extenso explanations on the international comparison of the National Product. Smith (1970), Usher (1980) and Turnovsky (2000) have extensively referred to the role of deflation in international studies.

Research methodology, data, results and discussions

The method of deflating macroeconomic indicators is the basis for comparability in time and space. The comparability of the results macroeconomic indicators is a complex but necessary activity and should lead to pertinent conclusions.

In each country, which uses or does not use the National Accounts System, these macroeconomic indicators are calculated in the prices of the year considered, ie current prices. These prices are influenced by a number of factors that exert your influence differently from time to time. Therefore, comparing the indicators in current prices is not enlightening for the intended purpose. At the same time, it is also not relevant for the comparison over time from year to year. Only by deflation, eliminating the influence of inflation factor (price index), can be reached comparable data, which makes sense in comparability in time and space. Therefore, in the following, we will present the statistical model used in deflating data, in fact the macroeconomic indicators globally or on its structural elements.

Deflation or deflation means the transformation of an aggregate into nominal currency, in a real currency. The transformation is done by dividing the nominal aggregate at a calculated price index. The price index used should be based on the prices of goods specific to the typology of the national economy and measure their change. When constructing the price index, a distinction must be made between monetary aggregates that have or not a physical volume (volume). From this point of view, there are three situations, namely: aggregates that measure the streams or stocks corresponding to a set of goods, in which case the aggregate has a volume component and a price component; aggregates that express monetary amounts, thus without an effective physical component and aggregates that can be interpreted in both aspects.

The deflation methodology refers to the construction of a price index to ensure the transformation of a nominal aggregate into a real one corresponding to the objective of knowledge sought by deflation. Corresponding to the objectives of knowledge, it opts for a particular deflation method. Among the most important methods underlying the development of deflation models are the following:

- **Deflation of a nominal aggregate with physical structure**

The transformation of the nominal aggregate $A_{i(1)} = \sum p_{i1}q_{i1}$ into a real one $A_{i(0)} = \sum p_{i0}q_{i0}$ (i=$\overline{1,m}$ groups) explicitly made on the basis of the expression $p_{i0} \cdot q_{i1}$, but by dividing the $A_{i(1)}$ nominal aggregate at a price index that measures the average change in the prices of the goods that make up the aggregate. The appropriate price index is a weighted harmonic average of price indices $\left[p_{i1} / p_{i0}\right]$, the weight being $\left(p_{i1}q_{i1}\right)$, so a Paasche price index (IPP). The calculation relation is the following:

$$A_{i(1)} : \text{IPP} = \sum_{i=1}^{m} p_{i1} qi1 : \frac{\sum_{i=1}^{m} p_{i1} qi1}{\sum_{i=1}^{m} \frac{p_{i0}}{p_{i1}} \cdot p_{i1} qi1} = \sum_{i=1}^{m} p_{i0} q_{i1} = A_{i(0)} \quad (1)$$

The ratio $A_{i(1)}:A_{i(0)}$ is a Laspeyres volume index that isolates the change of the volume component for a time series. In practice, the physical structure of the available price index is not always identical, with the physical structure of the aggregate $A_{i(1)}$. We believe that it is sufficient that the available price index represents an approximation of the „exact" index of aggregate prices Aj(i).

No Paasche „pure" indices are available for the current (monthly, quarterly, semester, yearly) calculation of macroeconomic aggregates. However, the statistical information required for calculating the Laspeyres indices is available. It admits a good solution. If the aggregate is broken down as analytically as possible over groups of goods and deflated by partial aggregates ($A_{il(i)}$) with corresponding Laspeyres price indices, the sum of deflated partial aggregates represents a good approximation for the deflated aggregate by a pure „Paasche"). The following relationship is used, the notations in this calculation formula being as outlined in the text:

$$\sum_{i=1}^{k} \frac{A_{il(1)}}{IPL} = A^{*}_{I(0)} \approx A_{I(0)} = \frac{A_{I(1)}}{IPP} . \quad (2)$$

Volume-orientated deflation also leads to interpretable results if the price structure has not changed significantly, so when price changes stem from a general change in price levels. If the price structure has changed, there is no real economic justification for assessing quantities q_{i1} at p_{i0} prices.

• Deflating a nominal aggregate without a physical structure

When measuring the change in the purchasing power parity of an income (salary, pension, dividends, etc.) based on the price evolution of a group of goods to be bought or usually purchased with that amount of money, then the deflator is the price index of that group of goods - the deflation starts from the use, not the creation of the aggregate. If the group of goods to be purchased includes qi quantities, it means that their value is $\sum p_{i0} q_i$ in the base period and $\sum p_{i1} q_i$ in the current period. The price index is Paasche type and as such, the real aggregate is given by the relationship:

$$\mathrm{Ai}(0) = \mathrm{Ai1}(1) : \frac{\sum p_{i1} q_i}{\sum p_{i0} q_i} \quad (3)$$

The quantities to be bought (q_i) may be those actually purchased during the base period, in which case a Laspeyres price index results. This option is used to deflate salary, pension, income, etc.

- **Clearing method to eliminate price changes from a nominal aggregate**

The elimination of the inflationary component is achieved by dividing the nominal aggregate into a price index considered an appropriate measure of inflation. Building such an index will be based on the idea that the inflation factor is estimated for all prices or a generalized basket of goods and services is used. We can argue in favor of using the price index for the end use of goods (final consumption + gross investment).

By using the Paasche type index, a real aggregate ($A_{1(1)}$: IPP) is obtained. According to this method, all nominal units are deflated by this price index.

- **Double deflation** is a special deflation procedure applied in macroeconomic calculations, when $A_{i(1)}$ is the difference (balance) between two aggregates with physical structure. Such aggregates are Gross Value Added and Gross Domestic Product. This procedure attempts to deflate a hump aggregate according to the rules applied to the physical structure aggregates. This test fails because the hub-aggregate does not have a physical structure, so it can not be highlighted as $\sum p_{i1} q_{i1}$. However, an output ($A^*_{1(0)}$) that is compatible with the volume of the aggregate can be obtained indirectly using the relationship:

$$\frac{A_{1(1)\cdot 1}}{IPP_1} - \frac{A_{1(1)\cdot 2}}{IPP_2} = A_{1(1)\cdot 1} - A_{1(1)\cdot 2} = A^*_{1(0)} . \quad (4)$$

The notations used are those in the presentation.

The difference between the volume of the two aggregates is the actual aggregate. This model is plausible and simple in statistical terms. But the economic interpretation of the outcome is problematic. The real gross value added calculated by this method does not mean either the value of an actual or potential set of goods that is the result of production, no actual input of inputs or gross value added „cleaned" by inflation. The default deflator $A_{1(1)} / A_{1(0)}$ is not an average of IPP_1 and IPP_2. The double deflation mixes, from the point

of view of content, pure price changes and changes in price structure. At the level of the economy, double deflation leads to the fact that GDP in constant prices maintains the price relationships between export and import at the base period. As a result, the rate of change in GDP in constant prices is not an adequate measure of the change in the output of distributable output, ie of the real distributable income.

Thus, double deflation is a method by which it is removed from the nominal level of an aggregate in value expression, but it can not be decomposed directly into a volume (physical) and a price component (price variation). Applies to macroeconomic calculations for indicators measured in current prices, which result as a balance between two flows of goods. This may include gross value added, gross domestic product and net exports. The constant price evaluation for such indicators is done by independently deflating the two indicators from which the balance value results.

The price index for the balance is based on the current and constant price balance. The resulting implicit price change may take unpredictable values if the prices of the two sizes involved in the difference change very differently. The double deflation method corresponds to the revised National Accounts System recommendations.

• Deflation in macroeconomic calculations

In macroeconomic calculations, nowadays, only the deflation designed to know the volume of the aggregates with a physical structure and double deflation is practiced. Aggregates that are not accessible to these processes are presented as nominal aggregates only. The revised SCN introduces a deflation oriented towards knowing the real values.

Macroeconomic deflation is recommended for Gross National Income (GNI) and National Net Income (GNI), but not for GDP and PIN, for which double deflation will continue to be used. The difference between the proposed deflation methods is explained by the fact that in the revised system the domestic product essentially measures output, while the national income (gross or net) represents a distributed revenue amount.

• GDP price index

IPPIB measures the average price variation of end products and services produced by domestic economic subjects. This index is also referred to as the GDP deflator, being a Paasche-type price index ($I_P^{PIB(p)}$), because it is not determined on the basis of the quantities and prices claimed by the calculation of this index but as a ratio between the nominal GDP index ($I^{PIB}_{nominal}$) and and the physical volume index of Laspeyres GDP ($I_L^{PIB(q)}$), after the relationship:

$$IPPIB = \frac{\sum_i q_{i1} p_{i1}}{\sum_i q_{i0} p_{i0}} : \frac{\sum_i q_{i1} p_{i0}}{\sum_i q_{i0} p_{i0}} = \frac{\sum_i q_{i1} p_{i1}}{\sum_i q_{i1} p_{i0}}. \quad (5)$$

The notations in this relationship are explained in the content of the article.

In order to determine the Paasche GDP index, the relationship between the nominal GDP index and the Laspeyres real GDP index is based on the cost of obtaining the information necessary to calculate the Paasche price index, ie the price and volume elements (q_{i1} şi p_{i1}). For the calculation of Laspeyres physical volume index, it is known from the previous records p_{i0} and q_{i0}.

Determining real GDP ($\sum q_{i1} p_{i0}$) involves deflating GDP by homogeneous components (C_j; j = $\overline{1,k}$ components) and expressing them in constant (comparable) prices. Such components are, in the case of end-use products and services, private consumption, state consumption, gross investment in fixed capital, stock change, net export.

For each component (C_j), a default Paasche (I^p_{Cj}) price index is calculated which serves to deflate the considered nominal component. The Paasche price index results from the ratio between the nominal component index ($I_{Ci\ nominală}$) and Laspeyres physical volume index of the respective component ($I^q_{Cj,\ l}$), using the relation:

$$I^p_{Cj} = \frac{I_{Cj\ nominală}}{I^q_{Cj,L}}. \quad (6)$$

where:
I^p_{Cj} = Paasche type price index;
$I_{cj\ nominală}$ = the homogeneous component index;
$I^q_{Cj,L}$ = volume index of the Laspeyres type.

In turn, each real component is determined as a ratio between the nominal component and the corresponding price index, using the relation:

$$C_{j\ reală} = \frac{C_{j\ nominală}}{I^p_{Cj}} \quad (7)$$

where:
$C_{j\ reală}$ = the component expressed in real terms;
$C_{j\ nominală}$ = component expressed in nominal (current) prices;
I^p_{Cj} = Paasche type price index.

Finally, real GDP results as a sum of actual components (ie deflated).

In the context of this study, we highlighted the content of the calculation elements for the shift of GDP from current prices into comparable (constant) prices. Usable in domestic or international comparisons. In other words, deflation is a statistical process through which a correct analysis of the macroeconomic indicators is made in time and space. The model under consideration clearly expresses the succession of the steps required to be followed in the deflation process.

Conclusion

From the author's study it follows that deflation is a necessary and necessary statistical method to ensure the possibility of comparability in the data string over time. Also, deflation as a statistical method applies not only to the macroeconomic indicators of results but also to the components that are included in the structure of these indicators, which in fact ensure by subsequent summing the determination of the macroeconomic indicators considered in comparable prices, so it brings it in real terms. Another conclusion is that the method of deflation is a method which, for application, must take into account the physical structure of goods and services, price knowledge on each structure that is more realistic than the application of a global index. For example, in the calculation of either the consumer price index, which we often sum up at the inflation index, we talk about food, non-food and services. Each of the structural components has a certain price index that should not ultimately be applied to all aggregates. One final conclusion is that this comparability in time, in real and accurate way, can only be achieved by the use of deflated data.

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