Real GDP, Price Indices and Accounting Improvement in China

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Abstract. The real GDP (or constant-price GDP) eliminates price fluctuation, which makes it easier to compare the changes of production, business activities, and economic scale and growth between different periods. China's real GDP accounting adopts the index deflation method, but the representativeness, accuracy, international and vertical comparability of the price indices need to be further improved. This paper suggests that China's real GDP accounting system should be in line with the international standard as soon as possible and adopt the chain price index recommended by NSA2008, so as to standardize the statistical work, reduce potential deviations and omissions, and improve the quality of statistics.

1. Introduction

GDP reflects the overall size and growth potential of the economy that supplies goods and services to the society. The accounting process includes a series of surveys, records and statistical activities that are both theoretical and technical [1]. Due to the wide range of goods and services, it is difficult to use the volume index for the calculation of the total GDP directly, but to use the value index. However, the GDP in terms of value depends on two factors: one is the number of goods and services; the other is the price of goods and services. Depending on the prices of the products and services, GDP accounting includes two basic methods: current-price accounting and constant-price accounting. Current price GDP, or Nominal GDP, is accounted at current price. In general, the GDP at current price includes both volume and price changes, which is inconvenient for direct comparison between different periods. As a result, it can’t directly reflect the change of production level. Therefore, it is necessary to eliminate the price fluctuation and calculate the real GDP. The so-called GDP annual growth rate is calculated based on the real GDP data of the adjacent years.

The method of real GDP accounting mainly include the base-year fixed price method, the extrapolation of volume index method and the price index deflation method, among which the price index deflation method uses the relevant price index to deflate the price changes contained in the current GDP [1]. For example, using the Consumer Price Index (CPI) to deflate the prices of residential and social consumption components, using Price Indices of Investment in Fixed Assets (PII) to deflate the fixed capital formation and inventory changes in the current GDP composition, and using Export Price Index (EPI) to deflate the current export value of goods and services are common practice of real GDP accounting [3]. Therefore, the real GDP accounting is inseparable from the use of various price indices. It is an important prerequisite to improve the accuracy of real GDP accounting by exploring deeply the price indices and finding out the potential problems and then solve them.

2. Constant Price Indices

In general, the typical price indices include four types: year-based price index, annual change of price index, relative price index and chain price index [4]. With reference to the definition of the international standard of the above-mentioned price indices in the United Nations System of National Accounts 2008 (NSA2008), the formula of the constant price index is given as follows so that the intrinsic linkages can be explored, analyzed and compared.
Fixed base price index and its annual change. Based on the construction of weights, the fixed base price index is divided into the Laspeyres index and the Paasche index. The weights of the Laspeyres index is set based on data of the base period, while the weights of the Paasche index is set based on data of the reporting period. Here we take the Laspeyres index as an exampl. The Laspeyres index can be expressed as Eq. 1:

\[
L^F_i = \frac{\sum_{i=1}^{n} P_{i,0} Q_{i,t}}{\sum_{i=1}^{n} P_{i,0} Q_{i,0}} = \frac{\sum_{i=1}^{n} \left( \frac{Q_{i,t}}{Q_{i,0}} \right) P_{i,0} Q_{i,0}}{\sum_{i=1}^{n} P_{i,0} Q_{i,0}} = \sum_{i=1}^{n} \left( \frac{Q_{i,t}}{Q_{i,0}} \right) P_{i,0} = \sum_{i=1}^{n} w_{i,0} \frac{Q_{i,t}}{Q_{i,0}}
\]

where \(Q_{i,t}\) and \(Q_{i,0}\) are the sales value of product \(i\) during the reporting period and the base period; \(P_{i,0}\) is the price of product \(i\) in the base period; \(w_{i,0}\) is the weight, constructed as the proportion of sale value of product \(i\) to total sales value of all products in the base period. Noting that Eq. (1) uses prices in base period and sales value in the reporting period, another form of Laspeyres index (Eq. 2) can be obtained by using sales value in base period and price in reporting period:

\[
L^F_i = \frac{\sum_{i=1}^{n} P_{i,t} Q_{i,0}}{\sum_{i=1}^{n} P_{i,t} Q_{i,0}} = \frac{\sum_{i=1}^{n} \left( \frac{P_{i,t}}{P_{i,0}} \right) Q_{i,0}}{\sum_{i=1}^{n} P_{i,t} Q_{i,0}} = \sum_{i=1}^{n} \left( \frac{P_{i,t}}{P_{i,0}} \right) Q_{i,0} = \sum_{i=1}^{n} w_{i,t} \frac{P_{i,t}}{P_{i,0}}
\]

If the Laspeyres index is divided by its value one lag behind, one can get the annual changes of the price index (Eq. 3):

\[
L^F_{t,t-1} = \frac{L^F_t}{L^F_{t-1}}
\]

The Laspeyres index can then be expressed as:

\[
L^F_t = L^F_{t,t-1} \times L^F_{t-1,t-2} \times \cdots \times L^F_2 = \prod_{i=1}^{t} L^F_{i,i-1}
\]

Therefore, the Laspeyres index is in essence equal to the product of a series of annual changes in the fixed base price index from the base period to the end of the reporting period. However, both the annual changes in the fixed base price index and the fixed base price index have the problem of slow renewal of weights (generally renewed every five years or ten years). The longer the weights are from the base period, the worse the representation of the price indices are.

Relative price index and Chain Price Index. The United Nations System of National Accounts 1993 (NSA 1993) recommends the use of the relative price index and chain price index. Compared with the fixed base price index, the relative price index adopts the price structure of the previous period to measure the changes of the price levels in the two adjacent periods. Relative price index can be expressed as Eq. 5:

\[
L^{CP}_t = \frac{\sum_{i=1}^{n} P_{i,t} Q_{i,t-1}}{\sum_{i=1}^{n} P_{i,t} Q_{i,t-1}} = \frac{\sum_{i=1}^{n} \left( \frac{P_{i,t}}{P_{i,t-1}} \right) Q_{i,t-1} P_{i,t-1}}{\sum_{i=1}^{n} P_{i,t} Q_{i,t-1}} = \sum_{i=1}^{n} \left( \frac{Q_{i,t-1}}{Q_{i,t-1}} \right) P_{i,t-1} = \sum_{i=1}^{n} w_{i,t-1} \frac{P_{i,t}}{P_{i,t-1}}
\]

where \(P_{i,t}\) and \(P_{i,t-1}\) is the price of product \(i\) during period \(t\) and \(t-1\) respectively; \(Q_{i,t-1}\) is the sales value of product \(i\) in period \(t-1\); \(w_{i,t-1}\) is the sales value of product \(i\) over total product sales value during period \(t-1\).

On the basis of relative price index, the chain price index, \(L^C_t\), can be defined as the product of a series of relative price indices:
3. Comparison of Fixed Price Index and Chain Price Index

From Eq. (4) and (6), the fixed base price index and the chain price index are very similar in formation and can both be expressed as the product of a series of short-term price indices, that is, they can both reflect the long-term changes through short-term price changes. However, the structural differences between the fixed base price index and the chain price index are obvious. The fixed base price index is expressed as the product of a series of annual changes in price indices while the chain price index is expressed as the product of a series of sequential price indices. Fixed base price index has both the reporting period and the base period, by contrast, the chain price index only has reporting period, but has no base period.

Considering the formation and features of these two indices, we can conclude that although both price indices can calculate real GDP, the chain price index is obviously better than the fixed price index in two aspects:

First, as the goods and services evolve over time, the product mix will change, price structure of fixed base period cannot sufficiently reflect these changes timely and is prone to substitution bias, especially when new product and service categories emerge far away from the base period. Chain price index, by contrast, can better reflect the product and price structure by constantly updating weights (equivalent to updating the base period annually).

Second, different goods and services vary in prices. For example, the price of IT products may fall due to the decrease of production cost and the improvement of technology and large-scale production, while the price of energy-based products will be lifted due to the scarcity and non-renewable nature. Compared to the fixed base price index, the chain price index can better reflect the price changes of such products and their contribution to the real GDP.

4. Discussions

China’s real GDP accounting began in 1985, and has developed into two ways: by production and by expenditure. GDP by production method is deflated using price index, while GDP by expenditure method is extrapolated using volume index. The fixed base price index and the chain price index is published at the same time. China’s real GDP accounting and price indices compilation still need further improvement.

First, The method used to construct the price indices in China are different from the international standard indices, so the indices in China was called “Chinese style” price index [4]. The annual relative price index is calculated as the simple arithmetic average of 12 monthly relative price indices; annual fixed base price index is calculated as the product of annually relative price indices from the base year to the reporting year, significantly different from the international standard. Therefore, China is ought to promptly revise the formulation of the indices and integrate them according to international standard so as to enhance the representativeness, accuracy, international and vertical comparability of the price index.

Then, by comparing the fixed base price index and the chain price index, we can find that the fixed base price index has some problems, such as outdated product and price structure, low updating frequency of weights, and it cannot reflect the substitution effect, by contrast, the chain price index is obviously better than the fixed price. At present, many countries, including the United States, Japan, Canada, the United Kingdom, Australia and some EU countries, have adopted the chain price index. China should also formulate the relative price index and the chain price index according to the international standard timely.
Third, in addition to the problems stemming from the indices themselves, there are still some other problems in the process of compiling the price indices such as the statistical caliber, the rough classification of the goods and services, or even some omissions and errors. Prices of some products are absent and can only be extrapolated arbitrarily. In addition, China is still lacking of producer price index on services and export and import trade price indices on services at country level, which can only be replaced by relevant price indices, affecting the accuracy of the value added of service industry and service trade. These problems will undoubtedly affect the quality of statistics and should be improved or supplemented in future statistical work.

Last, during the period of economic and institutional transition, the market decision mechanism of prices of some goods in China still needs to be deepened. The statistical system of constant price indices needs to be further improved. In addition, the number of staff working at basic units is small and the work intensity is high. There may be strong subjectivity in such fields as statistical sampling, investigation and reporting, leading to deviation of statistical results and even statistical intervention, affecting the accuracy of GDP accounting and credibility. As a result, some researchers and scholars both at home and abroad have strongly questioned the data quality and even some improper economic decisions are made by the government relying on the inaccurate data itself. The problems can be solved by strengthening the importance and seriousness of statistical work, and improving performance the System of National Accounts.

5. Summary

This paper focuses on discussing China’s constant price of GDP accounting. By comparing the fixed base price index and the chain price index, this paper considers that the later is better than the former. At present, the representativeness, accuracy, international and vertical comparability of China's price indices and real GDP accounting need to be improved. Therefore, China should adopt the chain price index recommended by NSA2008 to standardize statistical work, reduce potential deviations and omissions, and improve the quality of statistics.

Acknowledgements

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References