

Quarterly GDP Estimation in China

Dong Lihua

Department of National Accounts,

National Bureau of Statistics of China

China's quarterly GDP estimation was formally established in 1992. Afterwards, following the development of SNA of China, quarterly GDP is successively standardized and improved in estimation methodology, accounting classification, accounting procedure, release time and data quality control. Accumulated quarterly GDP estimation is formed. Not only quarterly GDP estimation by industries is established but also quarterly GDP estimation at expenditure approach is being studied.

Based on the industrial classification for national economic activities of China, there are 14 industries in quarterly GDP estimation, which are farming, forestry, animal husbandry and fishery; industry; construction; transport, storage and post; wholesale and retail trade; hotels and catering services; financial intermediation; real estate; information transfer, computer services and software; leasing and business services; services to households and other services; culture, sports and entertainment; public management and social organization and other services, and value added of each industry is separately calculated.

Depending on resources of basic data, different methods are used in different industries. Some industries use the sum of survey data from bottom to top to obtain the value added and most industries use extrapolation method to calculate the value added. For the constant price value estimation, a few industries use volume extrapolation method, and most industries use deflation method.

Based on the accounting procedure and release time, quarterly data should be benchmarked to annual data each year. That is, benchmarking quarterly GDP according to the annual GDP of final verification. Pro-rata method is used for the benchmarking.

The regional statistical bureaus also develop quarterly GDP estimation at the same time according to the system and approach made by NBS. But there are differences between the regional and national quarterly GDP data due to differences of basic data.

For the problems in quarterly GDP estimation, such work should be done to improve the estimation. Firstly, reinforce the study and gradually change from accumulated quarterly GDP estimation to sequential quarterly GDP estimation. Secondly, improve

and perfect the statistics of service industry to enrich basic accounting data, therefore to improve the methodology of quarterly GDP estimation. Thirdly, improve the methodology of quarterly GDP estimation at expenditure approach and formally establish the system of quarterly GDP estimation at expenditure approach.

I. Establishment and development

China has started quarterly GDP estimation by industries since 1992. “*The Tentative Scheme of Quarterly GDP Estimation*” was compiled then and used as the guide of quarterly GDP estimation. At the beginning of this work, the accounting basis was still weak though the national economic accounting system of China has basically changed from MPS to SNA. Based on the basic data of that time, quarterly GDP is calculated by industries, and there are 8 industries then. The value added of each industry is calculated using direct calculating method, value added pro-rata method and extrapolation method synthetically, that is, the part of which the financial data can be obtained is directly calculated by income method; the part of which only the data of operating income or gross put can be obtained is calculated by value added pro-rata method; the part of which only the relative indicators can be obtained is calculated using the weight or growth rate of relative indicators. Quarterly GDP estimation of China is accumulated quarterly accounting, that is, calculate the data only for the first quarter, half year, first to third quarter and the whole year. Separate quarterly data is not available now and is obtained from the difference of two consecutive quarter’s accumulated result.

In practice, following the development of SNA of China, quarterly GDP is successively standardized and improved in estimation methodology, accounting procedure, release time and data quality control. In the aspect of estimation methodology, “*The Method of Quarterly GDP Estimation of China*” was compiled and published in 1997, which provides a detail explanation of quarterly GDP estimation principle and methodology. “*The Manual of Quarterly GDP Estimation*” was compiled in 2000, which focuses on improving the method and increases its maneuverability. “*The Supplementary Regulation for Regional Quarterly GDP*” was compiled in 2004, which makes the regional quarterly GDP standardized and increases the harmoniousness of quarterly GDP between national level and regional level. Based on the first national economic census, “*The Manual of Quarterly GDP Estimation (tentative)*” was compiled in 2006, which delineates the industry classification into detail, establishes corresponding accounting approach and revises the accounting approach of previous industry.

In the aspect of accounting procedure and release time, a series of standardized systems are established. After approved from the State Council in 2003, the three steps of accounting procedure in sequence are settled up, which are preliminary accounting, preliminary verification and final verification. The three steps results are

released in 20 days after accounting quarter, 45 days after accounting quarter (planning to change to 110 days) and the end of December next year when the annual final data confirmed, respectively. In addition, in order to realize the harmoniousness of quarterly GDP between nation and region, quarterly data has been benchmarked base on annual final verification data since the fourth quarter of 2003.

In the aspect of data quality control, establish the data quality evaluation system, and set up the “National Accounts Experts Committee” and the “GDP Estimation Coordination Committee” in 2004. Experts from the relative departments of government, universities and economic research institutions are invited to be members of those two groups. Those experts form the two groups should evaluate the quarterly GDP before it is released. Regional GDP co-evaluation system has also been established since the third quarter of 2004. The national accountants from every provincial statistical bureau should work together with NBS to evaluate and harmonize regional quarterly GDP before it is released to public.

Quarterly GDP at expenditure approach in China has been studied since 2000 and is still being on trail.

II. Methodology of Quarterly GDP Estimation

There are 14 industries in quarterly GDP estimation, which are Farming, Forestry, Animal Husbandry and Fishery; Industry; Construction; Transport, Storage and Post; Wholesale and Retail Trade; Hotels and Catering Services; Financial Intermediation; Real Estate; Information Transfer, Computer Services and Software; Leasing and Business Services; Services to Households and Other Services; Culture, Sports and Entertainment; Public Management and Social Organization and Other Services.

Depending on resources of basic data, different methods are used in different industries. For the calculation of value added at current price, the main methods are as follows: (1) Value added ratio method, that is, $VA_{ct} = GO_{ct} \cdot VAR$. where the VA_{ct} 为 denote value added at current prices in period t, GO_{ct} denote gross output at current prices in period t, VAR refers to ratio of value added to gross output of last year. (2)

Extrapolation method, that is, $VA_{ct} = VA_{ct-1} \cdot EI_{ct}$. where VA_{ct-1} refers to value added at current prices in period t-1 that is the same period last year to period t, EI_{ct} refers

to the extrapolator at current prices in period t. (3) Constant value added reverse method, that is, $VA_{ct} = VA_{kt} \cdot PI_t$. Where VA_{kt} refers to value added at constant

prices in period t , PI_t refers to relevant price index in period t . For the calculation of value added at constant prices, the main methods are as follows: (1) Single deflation method, that is, $VA_{kt} = VA_{ct} / DI_t$, where DI_t refers to deflator in period t . (2) Extrapolation method, that is, $VA_{kt} = VA_{kt-1} \cdot EI_{kt}$, where VA_{kt-1} refers to value added at constant prices in period $t-1$ that is the same period last year to period t , EI_{kt} refers to extrapolative volume indicator in period t .

The methods of value added estimation by industries are showed as follows.

1. Farming, Forestry, Animal Husbandry and Fishery

Calculate the value added at current price first, and then the value added at constant price.

i. Value added at current price

Value added of farming, forestry, animal husbandry, fishery and agriculture service is separately calculated. Of which, farming, forestry, animal husbandry, and fishery use value added ratio approach and agriculture service uses extrapolation method, which uses the growth rate of compensation of employees as the extrapolative indicator.

ii. Value added at constant price

Value added at constant price is calculated by single deflation method, that is, value added at constant price = value added at current price \div deflator. The deflators for Farming, Forestry, Animal Husbandry, and Fishery are the indices of producer's price for their respective agriculture products; the deflator for agriculture service is the price indices of services in CPI.

2. Industry

Calculate the value added at constant price first, and then the value added at current price.

i. Value added at constant price

Industry is divided into two parts that industrial enterprises above designated size (all enterprises that annual sale are above 5 million RMB) and industrial enterprises under designated size.

a) Industrial enterprises above designated size

Value added at constant price of industrial enterprises above designated size is calculated using the growth rate of industrial production, that is, value added of current period at constant price = value added of same period last year at constant

price \times growth rate of industrial production of current period.

In the above formula, the growth rate of industrial production is the growth rate of value added at the price of last year. Value added at current price is calculated using the gross output of industrial enterprises above designated size by groups (2-digit) and the fixed value added ratio (using the value added ratio of last year in principle). Value added and growth rate at last year's price is calculated by single deflation method. Ex-factory price index of industrial products is used as the deflator.

b) Industrial enterprises under designated size

Value added at constant price of industrial enterprises under designated size is also calculated using the growth rate of value added at last year's price that is, value added of current period at constant price = value added of same period last year at constant price at constant price \times growth rate of value added at last year's price of current period.

In the above formula, value added at current price is calculated using the gross output of industrial enterprises under designated size and individual units in sample survey and the determined value added ratio (using the value added ratio of last year in principle). Value added and growth rate at last year's price is calculated by single deflation method. Ex-factory price index of industrial products is used as the deflator.

ii. Value added at current price

Value added at current price is calculated using the above value added of all industries at constant price (the sum of value added of the industrial enterprises above cutoff and under cutoff) and the ex-factory price index of industrial products, that is,

value added at current price = value added of current period at constant price \times ex-factory price index of industrial products of current period which makes the base year as 100.

3. Construction

Calculate the value added at current price first, and then the value added at constant price.

i. Value added at current price

Construction is divided into two parts, which are construction enterprises upon qualification criteria and construction enterprises under qualification criteria. Of which, value added of construction enterprises upon qualification criteria is calculated by value added method based on gross output value of construction of qualified general contractors and professional contractors. Total value added of construction is calculated by using percentage of construction enterprises upon qualification criteria value added in total construction value added at current price and in the year of

economic census. That is

Construction value added = Value added of construction enterprises upon qualification criteria \div percentage of value added of construction enterprises upon qualification criteria in total construction value added in the year of economic census

ii. Value added at constant price

Value added at constant price is calculated by single deflation method. The deflator is price indices of investment in Construction and Installation.

4. Transport, Storage and Post Services

Calculate the value added at constant price first, and then the value added at current price.

i. Value added at constant price

Value added at constant price was calculated by the extrapolation method. The whole industry can be divided into four parts as transport、storage、loading、unloading、portage and other transport services and post service; separately using freight and passenger traffic growth rate, constant price growth rate of storage operating revenue、constant price growth rate of loading, unloading, portage and operating revenue of other transport services, growth rate of gross volume of post service, weighted average growth rate was calculated first, where the weight is value added ratio corresponding to the four parts last year, then extrapolator is derived from coefficient which is the ratio of growth rate of the industry's value added at constant price at last year compared to weighted average growth rate at last year. That is

Extrapolator = the weighted average growth rate at current period \times (the growth rate of constant price value added at last year \div the annual weighted average growth rate at last year).

ii. Value added at current price

According to the constant price value added calculated above, calculate value added at current price by using price indices of transport in CPI as inflator.

5. Information transmission, Computer Services and Software

Calculate the value added at constant price first, and then the value added at current price.

i. Value added at constant price

Value added at constant price was calculated by the extrapolation method. Separately using gross volume of telecommunication, growth rate of computer services operating revenue at constant price, and growth rate of software operating revenue at constant price, weighted average growth rate is calculated first, where the weight is value added ratio responding to telecommunication and other information transmission

services ,computer services and software. Then extrapolator is derived from the weighted average growth rate and adjusted coefficient which is the ratio of growth rate of the industry's value added at constant price last year compared to weighted average growth rate last year. That is

Extrapolator=the weighted average growth rate of the three parts at current period \times (the growth rate of constant price value added of the industry last year \div the weighted average growth rate last year).

ii. Value added at current price

Value added at current price is calculated by using weighted average index of telecommunication price index and service items price index in CPI as inflator.

6. Wholesale and retail trades

Calculate the value added at current price first, and then the value added at constant price.

i. Value added at current price

Value added at current price was calculated by the extrapolation method. The extrapolator is derived from the growth rate of total retail sale of consumer goods at current price, and adjusted coefficient which is the ratio of growth rate of value added compared to growth rate of total retail sale of consumer goods at last year. That is
Extrapolator = the growth rate of total retail sale of consumer goods at current period \times (the growth rate of value added at current price last year \div growth rate of total retail sale of consumer goods last year).

ii. Value added at constant price

Value added at constant price is calculated by single deflation method. The deflator is retail price index.

7. Hotels and Catering services

Calculate the value added at current price first, and then the value added at constant price.

i. Value added at current price

Value added at current price was calculated by the extrapolation method. The extrapolator of hotels is derived from the growth rate of star-ranking hotels operating revenue, and adjusted coefficient which is the ratio of growth rate of hotels value added at current price last year compared to growth rate of star-ranking hotels operating revenue last year. The extrapolator of catering services is derived from the growth rate of operating revenue of catering services above designated size, and adjusted coefficient which is the ratio of growth rate of catering services value added

at current price at last year compared to growth rate of business revenue of catering services above designated size last year. That is

Extrapolator = growth rate of star-ranking Hotels (or Catering services above designated size) operating revenue at current period \times [growth rate of hotels (or catering services) value added at current price last year \div growth rate of star-ranking Hotels (or Catering services above designated size) operating revenue at last year]

ii. Value added at constant price

Value added at constant price is calculated by single deflation method. The deflator of hotels is the average of price indices for hotel and price indices for other accommodation in CPI. The deflator of catering services is outward dinner food price index in CPI.

8. Financial Intermediation

Calculate the value added at current price first, and then the value added at constant price.

i. Value added at current price

Value added of bank and other financial activities, securities and insurance at current price is calculated separately by the extrapolation method. Of which, the extrapolator of bank and other financial activities is derived from growth rate of the deposits and loans, and adjusted coefficient which is the ratio of growth rate of value added at current price at last year compared to growth rate of the deposits and loans at last year. The extrapolator of securities is derived from growth rate of securities transaction, and adjusted coefficient which is the ratio of growth rate of value added at current price last year compared to growth rate of total Securities turnover. The extrapolator of Insurance is derived from growth rate of Premium income, and adjusted coefficient which is the ratio of growth rate of value added at current price last year compared to growth rate of premium income. That is

Extrapolator = growth rate of related indicators (deposits and loans, securities transaction, Premium income) \times (growth rate of value added at current price of related industries last year \div growth rate of related indicators last year)

ii. Value added at constant price

Value added at constant price is calculated by single deflation method. The deflator is the weighted average price index that weighting price index of investment in fixed assets and CPI.

9. Real Estate

Calculate the value added at constant price first, and then the value added at current

price.

i. Value added at constant price

Value added at constant price was calculated by the extrapolation method. Separately using growth rate of floor space of selling house, constant price growth rate of private housing service, and constant price growth rate of earnings of employed persons, the weighted average growth rate at current period is calculated first, where the weight is value added ratio at last year responding to real estate development, private housing service and other real estate activities. Of which, growth rate of private housing service is growth rate of private dwellings virtual depreciation at constant price. Then extrapolator is derived from the weighted average growth rate, and adjusted coefficient which is the ratio of growth rate of real estate value added at constant price at last year compared to the weighted average growth rate at last year. That is

Extrapolator = weighted average growth rate of the three parts at current period \times (growth rate of real estate value added at constant price at last year \div weighted average growth rate at last year)

ii. Value added at current price

Value added at current price was calculated by using the inflator which is the average of selling price indices of houses, transactions price indices of land, renting price indices of houses and property management price indices.

10. Leasing and Business Services, Services to Households and Other Services

Calculate the value added at current price first, and then the value added at constant price.

i. Value added at current price

Value added at current price was calculated by the extrapolation method. The extrapolator is derived from growth rate of the industry's operating revenue or sales tax and adjusted coefficient which is the ratio of growth rate of the industry's value added at current price at last year compared to growth rate of operating revenue (or sales tax) at last year. That is

Extrapolator = growth rate of operating revenue or sales tax at current period \times (growth rate of value added at current price at last year \div growth rate of operating revenue or sales tax at last year)

ii. Value added at constant price

Value added at constant price is calculated by single deflation method. The deflator is price indices of service in CPI.

11. Culture, Sports and Entertainment

Calculate the value added at current price first, and then the value added at constant price.

i. Value added at current price

Value added at current price was calculated by the extrapolation method. Separately using growth rate of sales tax of culture and sports, and growth rate of entertainment operating revenue; weighted average growth rate is calculated first, where the weight is value added ratio responding to culture, sports and entertainment. Then extrapolator is derived from the weighted average growth rate, and adjusted coefficient which is the ratio of growth rate of value added at current price last year compared to weighted average growth rate last year. That is

Extrapolator = weighted average growth rate at current period \times (growth rate of value added at current price last year \div weighted average growth rate last year)

ii. Value added at constant price

Value added at constant price is calculated by single deflation method. The deflator is price indices of service in CPI.

12. Public Management and Social Organizations

Calculate the value added at current price first, and then the value added at constant price.

i. Value added at current price

Value added at current price was calculated by the extrapolation method. The extrapolator is derived from growth rate of expenditure for general public service, diplomacy, national defense and public security in government expenditure, and adjusted coefficient which is the ratio of growth rate of the industry's value added at current price at last year compared to growth rate of expenditure for general public service, diplomacy, national defense and public security at last year. That is

Extrapolator = growth rate of expenditure for general public service, diplomacy, national defense and public security at current period \times (growth rate of value added at current price last year \div growth rate of expenditure for general public service, diplomacy, national defense and public security at last year)

ii. Value added at constant price

Value added at constant price is calculated by single deflation method. The deflator is price indices of services in CPI.

13. Other Services

Other Services refers to all industries except industries mentioned above, including scientific research ,technical services, and geological prospecting、 management of water conservancy, environment and public facilities、 education、 health, social securities and social welfare. Calculate value added at current price first, and then value added at constant price.

i. Value added at current price

Value added at current price was calculated by the extrapolation method. The extrapolator is derived from growth rate of labor remuneration in Other Services at current period, growth rate of value added at current price last year and growth rate of labor remuneration at last year. That is

$$\text{Extrapolator} = \text{growth rate of labor remuneration in other services at current period} \times (\text{growth rate of value added at current price last year} \div \text{growth rate of labor remuneration at last year})$$

ii. Value added at constant price

Calculate with deflation method. The deflator is price indices for services in CPI

Detail List for China GDP Quarterly Estimation				
Industries	At Current Price		At Constant Price	
	Estimation Approach	Basic Information	Estimation Approach	Basic Information
Agriculture, Forestry, Animal Husbandry, and Fishing	1. Agriculture, Forestry, Animal Husbandry, and Fishing: Value added pro-rata method; Service industry to Agriculture, Forestry, Animal Husbandry, and Fishing: Extrapolation method	NBS: Survey for Agriculture, Forestry, Animal Husbandry, and Fishing	Deflation Method	NBS: Indices of producer’s price for farm products
Industry	Reverse method with data at constant price	NBS: Ex-factory price indices of industrial products	: Extrapolation method;	NBS: 1. Survey for Industrial enterprises above designated size: Gross output, Value added ratio of last year, Growth rate of value added of industrial enterprises above designated size at last year’s prices. 2. Sample

				Survey for Industrial enterprises below designated size: Gross output, Value added ratio of last year, Growth rate of value added of industrial enterprises below designated size at last year's prices. 3.Ex-factory price indices of industrial products
Construction	1.Enterprises upon qualification criteria: Value added pro-rata method; 2. Enterprises under qualification criteria: pro-rata method	NBS: Survey for constructional enterprises	Deflation method	NBS: price indices of construction and installation
Transport, Storage, and Post	Constant value added reverse method	NBS: Price indices of transport and mail in CPI	Extrapolation method	1. Ministry of Communications: Transport: Ministry of Communications; 2. NBS: storage、loading, unloading, portage and other transport services: growth rate of operating revenue, indices of services in PCI; 3. Administration of post: Growth rate of gross volume of post
Information transmission, Computer Services and Software	Reverse method with data at constant price	NBS: Price indices of telecommunication and price indices of services in CPI	Extrapolation method	1. Ministry of Information Industry: telecommunication: Growth rate of gross volume; 2、NBS: Computer Services and Software: Growth rate of operating revenue, price indices of services in CPI

Wholesale and retail trades	Extrapolation method	NBS: Growth rate of retail sale of consumer goods;	Deflation method	NBS: Retail price indices
Hotel and Catering service	Extrapolation method	NBS: 1. Hotel Service: Growth rate of turnover of star-ranking hotels; 2. Catering Service: Growth rate of turnover of enterprises above designated size	Deflation method	NBS: Price indices of hotel, other accommodations, outward dinner in CPI;
Financial Intermediation	Extrapolation method	1. People's Bank of China: 2. China Securities Regulatory Commission: Growth rate of turnover of securities transaction; 3. China Insurance Regulatory Commission: Growth rate of premium income	Deflation method	NBS: Price indices of investment in fixed asset and CPI
Real Estate	Reverse method with data at constant price	NBS: Selling price indices of houses, transactions price indices of land, and renting price indices of houses;	Extrapolation method	NBS: 1. Development and management of Real estate: Growth rate of houses selling 2. Property management: Growth rate of labor remuneration; 3. Private housing service: Growth rate of virtual depreciation; 4. Price indices of construction and installation and CPI;
Leasing and Business Services, Services to	Extrapolation method	1、NBS: Growth rate of operating revenue; 2. State	Deflation method	NBS: Price indices of services in CPI

Households and Other Services		Administration of Taxation: Growth rate of sales tax;		
Service to Household and Other Services	Extrapolation method	1、NBS: Growth rate of operating revenue; 2. State Administration of Taxation: Growth rate of sales tax;	Deflation method	NBS: Price indices of services in CPI I
Culture, Sports and Entertainment	Extrapolation method	1. State Administration of Taxation: Growth rate of operating revenue of culture, and sports; 2. NBS: Growth rate of operating revenue of entertainment	Deflation method	NBS: Price indices of services in CPI
Public Management and Social Organizations	Extrapolation method	Ministry of Finance: Growth rate of expenditure of public service, diplomacy, national defense, and public security;	Deflation method	NBS: Price indices of services in CPI
Other Services	Extrapolation method	NBS: Growth rate of labor remuneration;	Deflation method	NBS: Price indices of services in CPI

III. Approaches of Benchmarking QGDP to AGDP

For process of preliminary accounting, preliminary verification and final verification, the advanced estimation means to revise the data of preliminary accounting, and the final verification means to benchmark the data of quarterly GDP to make the quarterly data comparable.

After quarterly GDP accounting was established, NBS did not do benchmark work until 2003. In 2003 NBS benchmark QGDP history data to AGDP from 1992 to 2003, and establish the benchmark scheme from 2004.

The benchmark method is pro-rata method, that is, revise every quarterly data by the same ratio that calculated by the difference between final verification data of annual GDP and the sum of quarterly GDP from Q1 to Q4 (quarterly GDP is preliminary verification data).

(1) Calculate the the difference between final verification data of annual GDP and the sum of quarterly GDP from Q1 to Q4 (quarterly GDP is preliminary verification data).

$\Delta VA = VA_a - \sum_{i=1}^4 VA_{qi}$. Where ΔVA refers to the difference between annual GDP and

the sum of four quarterly GDP, VA_a refers to final verification data of annual GDP,

VA_{qi} refers to value added of preliminary verification data in quarter i.

(2) Calculate the ratio of difference. $r = \frac{\Delta VA}{\sum_{i=1}^4 VA_{qi}}$.

(3) Benchmark the quarterly data by the ratio of difference. $RVA_{qi} = VA_{qi} \cdot (1 + r)$,

where RVA_{qi} denote the revised data of quarter i.

In process, quarterly value added of each industry should be benchmarked first of all, and then get the benchmarked GDP; current data should be benchmarked first of all, and then get the constant data with the original price indices.

IV. Quarterly Regional GDP Estimation

Quarterly regional GDP estimation (provincial level) is established at the same time of establishment of national level GDP estimation, and implemented by 31 provincial statistics departments. As the GDP estimation at national level, the quarterly regional GDP estimation approach includes estimation at current price and estimation at constant price. But industrial classification for quarterly regional GDP estimation is little rougher than that for annual estimation, only 9 industries, and varies with different situation of different provinces.

As regional GDP estimation is implemented by provincial statistics departments independently, undistinguishable trans-provincial units and difference of basic information bring the gap into regional GDP estimation result and national GDP estimation result.

V. Some Aspects to be improved

To improve quarterly GDP estimation following aspects need to be improved:

1. Improving estimation method of service industries. After the first economic census, NBS enhanced routine statistics for service industry. According to new basic information and integrating existing estimation method, NBS improved estimation for service industry.
2. Establishing sequential quarterly estimation. Basing on accumulated quarterly GDP estimation and existing basic information, establish sequential quarterly

estimation to ensure the result of sequential quarterly estimation comparable.

3. Establishing quarterly expenditure method for GDP estimation. The result of tentative quarterly GDP estimation has not been satisfied since the tentative scheme established because of insufficiency of basic information. There is obvious gap between estimation result by expenditure approach and by production approach. Directing to existing problem, NBS will further investigate basic information to select proper basic information for estimation, and further improve existing tentative estimation scheme, enhance accuracy of estimation result, and establish formal estimation scheme.
4. Investigate basic information, estimation method and estimation result of production method and expenditure method to improve the relationship between two estimation methods.