



Compiling Quarterly GDP by Economic Activity in Volume Measures during COVID-19 Pandemic

Alex LI Sze-chun, Howard WONG Ho-fai
Census and Statistics Department, Hong Kong, China

Abstract

Volume measures of Gross Domestic Product (GDP) by economic activity show the total value of production of individual economic activities in real terms and therefore provide a useful perspective on the economic performance of different sectors. However, in the presence of sudden yet prolonged material shocks like the Coronavirus Disease 2019 (COVID-19) pandemic, the single indicator method, which official statistical agencies widely use for compiling quarterly GDP by economic activity, may result in biased results as the underlying assumption of a stable relationship between gross output and intermediate consumption may no longer be valid.

The double indicators method, which estimates and deflates gross output and different intermediate consumption components separately using appropriate output/input/price indicators, could address the issue of divergence between gross output and intermediate consumption. However, this method is data-demanding and is usually not practical for compiling quarterly volume measures of GDP in a timely manner.

This paper discusses the methodological challenges encountered stemming from COVID-19 pandemic. The way that Hong Kong addresses the issue will also be highlighted.

Keywords: Gross Domestic Product, volume measures, single indicator method, double indicators method, COVID-19

1. Introduction

Volume measures of GDP by economic activity show the total value of production of individual economic activities in real terms and therefore provide a useful perspective on the economic performance of different sectors. The value of production is measured by value added, which is calculated by deducting intermediate consumption (i.e. input consumed in the process of production of goods or services, such as rentals, fuel, and raw materials) from gross output (say, business receipts from goods or services rendered, less cost of goods sold if applicable).

By separately estimating and deflating gross output and individual intermediate consumption components using appropriate output/input/price indicators, and then deducting the sum of deflated intermediate consumption components from the deflated gross output, one can derive the volume estimates of value added through double indicators method. Although double indicators method is theoretically sound, the *System of National Accounts 2008* and *Quarterly National Accounts Manual (2017 Edition)* point out that this method requires large amount of data which may not be available in a timely manner and are sensitive to measurement errors. In view of the data limitations and timeliness requirement of GDP statistics, single indicator method

is commonly used by official statistical agencies to compile real-term industry-level value added on a monthly or quarterly basis (i.e. volume change in either gross output or input is adopted as an indicator to extrapolate value added), implicitly assuming that the real changes of gross output, intermediate consumption and value added are the same.

This underlying assumption is generally reliable under normal situations. However, such an assumption should be assessed more carefully when the economic cycle experiences sudden yet prolonged material shocks, such as COVID-19 pandemic. In the ensuing paragraphs, current practices of official statistical agencies on compiling volume measures of quarterly GDP by economic activity will be revisited, followed by a discussion on the methodological challenges encountered stemming from COVID-19 pandemic. The way that Hong Kong addresses the issue will also be highlighted.

2. Practices of Official Statistical Agencies on Compiling Real-term Quarterly Value Added by Economic Activity

While revenue data on quarterly basis are usually available through quarterly or monthly business surveys, quarterly data on detailed intermediate input are generally not available because accounting records of the business entities surveyed are either not yet ready, or such data may only be available with a long time lag due to huge respondent burden in collating relevant records, which hinders the timeliness of GDP statistics by economic activity. Consequently, three types of single indicator are commonly adopted by official statistical agencies to extrapolate the value added of individual economic activities, namely:

- (i) *Deflated gross output indicators* (e.g. business receipts deflated by producer price indices). This is the most frequently applied method for compiling Hong Kong's quarterly GDP, which is applicable to a wide range of industries including accommodation services; transportation, storage and courier services; and selected business services including accounting, legal and travel agency activities;
- (ii) *Volume / quantity indicators*, which are applicable when service prices of economic activities are very difficult to be measured (thus price indices, which are required by the deflated gross output indicators method, are not available), or quantity indicators concerned are highly correlated with the volume of output; and
- (iii) *Input indicators* (e.g. deflated wages or hours worked of employees).

3. Methodological Challenges Stemming from COVID-19 Pandemic

With no exception, the threat of COVID-19 has severely disrupted local consumption activities (such as retail trade, food and beverage services, personal and recreational services) worldwide. Sectors like accommodation services, passenger transportation (particularly air transport), and travel agencies are also hit hard as extensive travel restrictions have been imposed globally and locally to curb the pandemic.

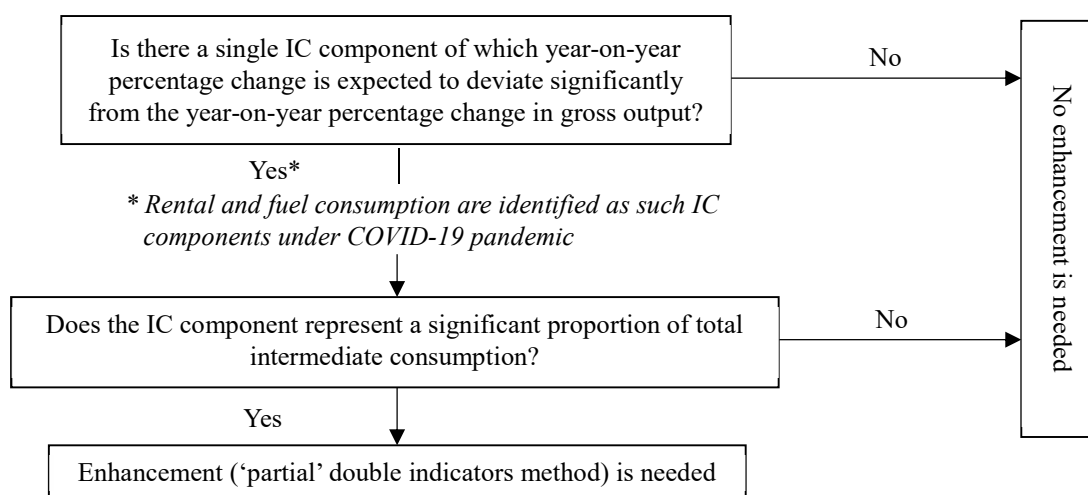
The pandemic has resulted in a sudden yet prolonged and significant decrease in gross output for many consumption- and tourism-related sectors. However, downward

adjustments in some intermediate input in real terms (in particular rentals of office premises or fuel consumption) may be more rigid relative to the sudden decline in gross output. Consequently, the divergence in year-on-year changes between gross output and intermediate consumption may likely be enlarged during the pandemic. This calls for a more rigorous assessment on the validity of using single indicator method to compile value added for those hard-hit sectors, which assumes that volume measures of intermediate input consumed in the production process is directly proportional to that of output. If the decrease in intermediate consumption is much less than that in gross output, the real-term decrease in value added based on single indicator method will be biased upwards.

4. How Hong Kong Addresses the Methodological Challenges

The Census and Statistics Department (C&SD), the official statistical agency in Hong Kong, has conducted an additional assessment on the validity of single indicator method since the first quarter of 2020. For sectors in which the assumption of single indicator method may not be appropriate, a ‘partial’ double indicators method is introduced by separately extrapolating certain intermediate consumption components (viz. rentals for office premises and fuel consumption) which are (i) more important yet (ii) more rigid in response to COVID-19 pandemic shock, making use of readily available proxy information (e.g. changes in number of establishments, quantity of net imports of oil products). This ‘partial’ double indicators method is less data-demanding because only one or two selected intermediate consumption components need to be separately estimated. Hence, this method is more practical from the implementation perspective, while benefits of the ‘full’ double indicators method in addressing divergence between gross output and intermediate consumption can still be reaped. The workflow of the assessment is outlined in Figure 1.

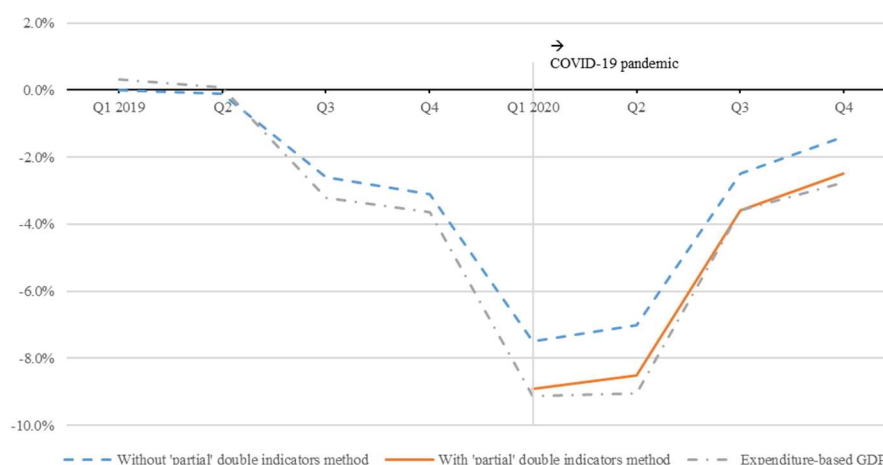
Figure 1: Workflow in Checking the Validity of Single Indicator Method



C&SD has introduced the ‘partial’ double indicators method to the following sectors since the first quarter of 2020: (i) retail trade; (ii) accommodation services; (iii) private social and personal services; (iv) land transport; and (v) air transport, in view of the more important contribution yet more rigid downward adjustment of rentals observed in sectors (i) – (iii), and similar rigid adjustment in fuel consumption in sectors (iv) – (v). A comparison in the real change in GDP of all economic activities with and without the

‘partial’ double indicators method is shown in Figure 2 to illustrate the possible magnitude of upward bias if the enhancement has not been introduced. It can also be seen from Figure 2 that the year-on-year change in volume measures of the GDP by economic activity aligned much better with the year-on-year change in the expenditure-based GDP after adopting the ‘partial’ double indicators method.

Figure 2: Year-on-year Change in Volume Measures of GDP (in Chained (2019) dollars) - All Sectors (With and Without the ‘Partial’ Double Indicators Method)



5. Conclusion

Since different economies have different economic structures, the experience of Hong Kong in adjusting the compilation method of short-term volume measures for compiling GDP by economic activity during COVID-19 pandemic may not apply to other economies. More deliberations among the international statistical communities regarding possible adjustments to address the measurement/compilation issues in GDP arising from COVID-19 pandemic should be facilitated.

The ‘partial’ double indicators method implemented in Hong Kong is a quick fix to adjust for the possible bias under COVID-19 pandemic, based on the data available at the time of compilation. C&SD will continue to assess the quality of quarterly GDP statistics by economic activity and fine-tune the current methodology if deemed necessary to ensure the value of production in real terms of different sectors can be accurately measured under the pandemic. We will also further review the quality of the ‘partial’ double indicators method when detailed data on operating expenses in 2020 are available from annual business surveys by end 2021.

References

- Census and Statistics Department (2021). *Gross Domestic Product (Yearly) (2020 Edition)*.
- International Monetary Fund (2018). *Quarterly National Accounts Manual (2017 Edition)*.
- United Nations, European Commission, International Monetary Fund, Organisation for Economic Co-operation and Development, and World Bank (2009). *System of National Accounts 2008*.