

Analysis of Revisions to Gross Domestic Product Estimates

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Introduction

The compilation of statistics generally involves a trade-off between timeliness and accuracy. This is observed in the compilation of Singapore's Gross Domestic Product (GDP) estimates.

Assessing real-time economic conditions is challenging due to the limited availability of timely economic data which may be subsequently revised as more information becomes available. Timely estimates are used to paint a short-term picture of the current economic situation for macroeconomic policymakers and analysts, even before all information is available.

Hence, it is normal and inevitable for GDP estimates to be regularly revised and refined by incorporating previously unavailable data. Revisions can also arise from improvements in compilation methodology. This article explains and analyses these revisions to the quarterly and annual GDP growth estimates.

Why are GDP Estimates Revised?

The recent-period quarterly GDP estimates¹ are compiled using an extensive number of timely short-term indicators of economic activities in each industry. This is prior to the availability of comprehensive annual survey benchmarks. Sources of these indicators include high frequency administrative data and short-term survey data obtained from a relatively small number of companies or establishments.

Revisions to Incorporate Newer Data in Recent-period Estimates

Singapore's advance GDP estimates are released no later than two weeks after the end of each reference quarter. The advance GDP estimates are largely computed from data for the first two months of the

reference quarter and are intended as an early indicator of GDP growth for that quarter. More comprehensive data on the full quarter's performance become available after this advance release and are incorporated in the subsequent updates. For example, the preliminary GDP estimates of the quarter are released no later than eight weeks after the end of the reference quarter and are published in the Economic Survey of Singapore (ESS).

Did You Know?

United States and United Kingdom were the first few economies to release advance GDP estimates, in addition to the preliminary GDP estimates. Within Southeast Asia, Singapore was the first to release advance GDP estimates. In recent years, an increasing number of economies such as India and Malaysia have started releasing advance GDP estimates.

Revisions to Incorporate Annual Survey Benchmarks and Updated Annual Supply and Use Tables

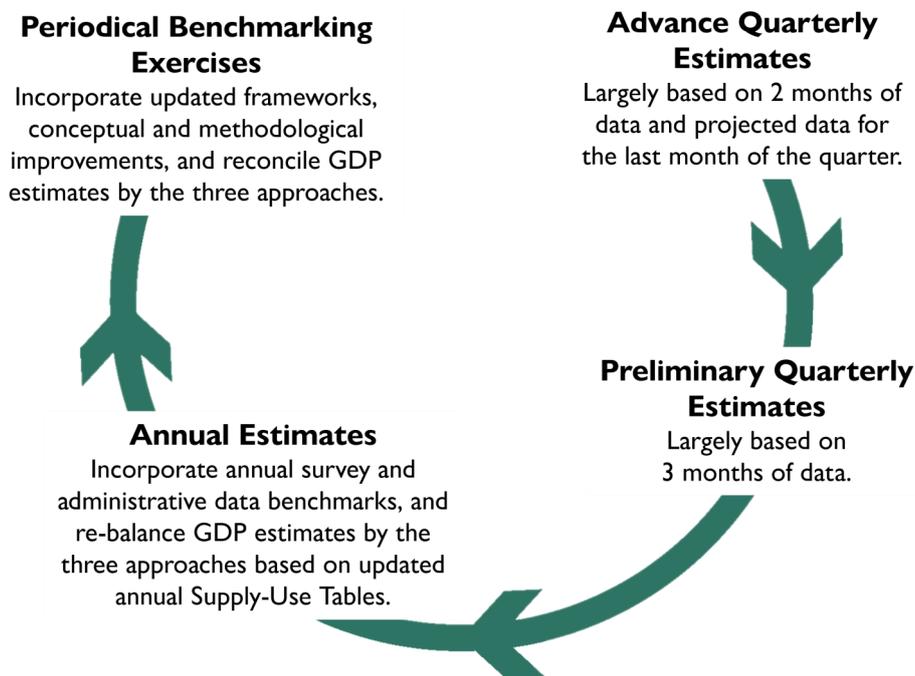
A comprehensive review of the GDP estimates occurs annually during which annual survey benchmarks and up-to-date administrative data are incorporated into the estimates. Survey benchmarks are a comprehensive set of data compiled from aggregated survey returns from establishments.

Survey returns are usually only available 9 to 15 months after the reference period as detailed survey results follow after companies have compiled full financial details from their operations and filed statement of accounts. GDP estimates compiled by the three approaches (i.e., production, expenditure and income approaches) are also re-balanced on the basis of updated annual supply and use tables².

1 More details are available in the information paper '[Quarterly Estimates of Output-Based GDP](#)' dated Jul 2023

2 Learn more about Supply and Use tables from the [video](#) and [infographic](#).

FIGURE 1 REVISION CYCLE OF GDP ESTIMATES



Revisions to Incorporate Conceptual and Methodological Improvements During Periodical Benchmarking Exercises

Besides revising the GDP estimates to incorporate updated annual survey benchmarks, the estimates are also revised during periodical benchmarking exercises. The periodical benchmarking exercises reconcile the three GDP estimates from the production, expenditure and income approaches and allow for the inclusion of conceptual and methodological improvements, as well as updated international frameworks.

The revisions from periodical benchmarking exercises³ are applied to past data where applicable, to ensure comparability of the estimates over time. The incorporation of latest and more complete data is in line with international best practices. Figure 1 illustrates how GDP estimates are revised over time.

Revisions to Real GDP Growth Estimates

The following sections discuss the revisions to real GDP estimates with reference to both shorter-term revisions (advance to preliminary GDP estimates revisions) and longer-term revisions (preliminary GDP estimates revisions).

Advance to Preliminary GDP Revisions

First released in 4Q 2002, advance GDP estimates act as early estimates of economic activities to facilitate timely policy and business decision making.

The mean absolute revision⁴ is 0.5 percentage points over the periods between 4Q 2002 to 4Q 2023. Most revisions to the year-on-year GDP growth estimates

Did You Know?

In the latest periodical benchmarking exercise, annually reweighted chain volume measures of GDP were adopted, replacing the previous five-yearly reweighted volume measures. Other conceptual and methodological improvements included the refined estimation of insurance service charges and revised conceptual treatment of goods for processing.

3 Read more about the benchmarking exercise from the information paper '[Benchmarking of Singapore's National Accounts to Reference Year 2015](#)' dated May 2019.

4 The mean absolute revision (MAR) statistic is a widely used measure of the size of the revisions and is defined as the simple average of the absolute value of revisions.

were small, at less than 1.0 percentage point absolute revision (Chart 1). Larger revisions were generally observed near the start of economic booms and downturns, as business cycle turning points⁵ may not be apparent in real time.

For example, 4Q 2008 and 1Q 2020 saw revisions of -1.6 percentage points and 1.5 percentage points respectively. The large revision of 2.4 percentage points observed in 1Q 2010 was due to the benchmarking of GDP from reference year 2000 to 2005.

Revisions to Preliminary GDP Estimates

Year-on-year (y-o-y) preliminary GDP growth estimates are revised due to the incorporation of data updates,

annual survey benchmarks and periodical benchmarking exercises.

The following evaluation is based on the differences between the first-available quarterly or annual preliminary GDP growth estimates and the growth estimates as at the Annual Economic Survey of Singapore (AES) one or two years later.

Figure 2 illustrates the timeline on the availability of the first-available quarterly and annual GDP estimates as at the AES one and two years later.

The mean absolute revision to the overall annual GDP growth for the reference period of 2002 to 2023 as at the AES one year later is relatively small, at around

CHART 1 ADVANCE TO PRELIMINARY QUARTERLY GDP GROWTH RATES AND REVISIONS

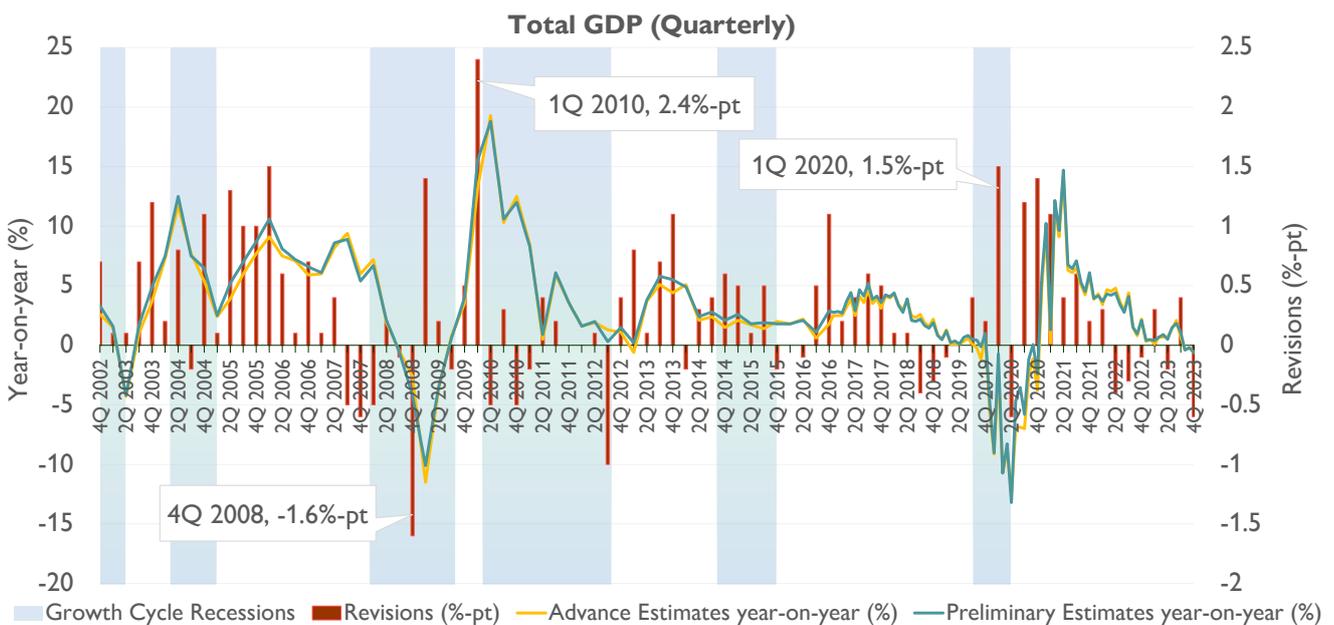
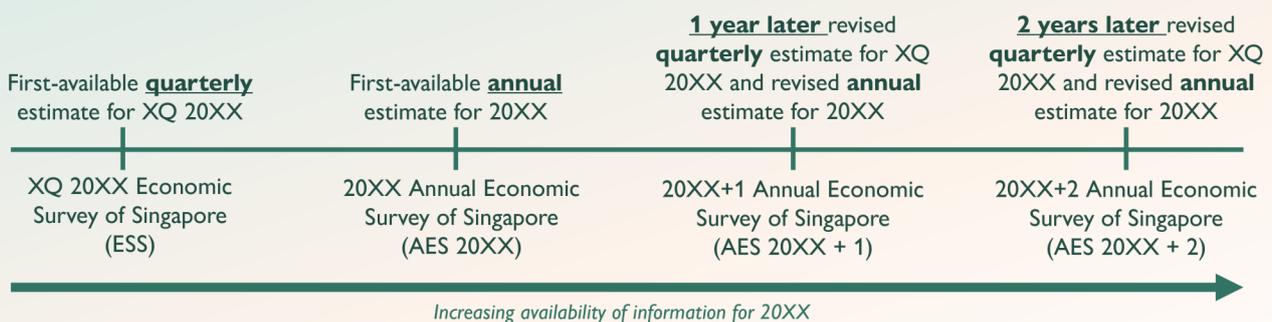


FIGURE 2 TIMELINE ON FIRST-AVAILABLE, 1 YEAR LATER AND 2 YEARS LATER ESTIMATES



5 More information on business cycle turning points are available from the article [‘Singapore’s Growth Cycle Chronology, Coincident and Leading Indicators’](#).

TABLE 1

MEAN ABSOLUTE REVISIONS TO GDP GROWTH ESTIMATES (Y-O-Y)

Real GDP Growth (year-on-year)	Mean Absolute Revisions (%)			
	Annual Series		Quarterly Series	
	Year 1	Year 2	Year 1	Year 2
Reference Period				
2002 to 2019*	0.31	0.79	0.44	0.79
2002 to 2023#	0.41	0.84	0.44	0.88

* Quarterly periods from 1Q 2002 to 4Q 2019

Quarterly periods from 1Q 2002 to 4Q 2023

0.41 percentage points (Table 1). At the AES two years later, the mean absolute revision is larger at 0.84 percentage points, mainly due to the incorporation of more complete and updated annual survey benchmarks.

Growth magnitudes of the quarterly GDP series are generally more pronounced than the annual series, leading to larger revisions in the quarterly series compared to the annual series. The mean absolute revision to quarterly overall GDP growth for the reference period of 2002 to 2023 after a year is 0.44 percentage points (higher than the 0.41 percentage points for the annual series) and around 0.88 percentage points after two years (higher than the 0.84 percentage points for the annual series).

Larger Revisions in Recent Years Due to Greater Uncertainties

Revisions to quarterly GDP growths for COVID-impacted periods are comparatively more significant than periods without. For instance, the mean absolute revision to annual overall GDP growth for the reference period of 2002 to 2019 as at the AES one year later stands at 0.31 percentage points, compared to the 0.41 percentage points for the reference period 2002-2023 (Table 1).

The onset of COVID-19 had significantly disrupted business operations and impacted firms' responses to some short-term surveys and administrative filing, as many were adjusting to new modes of operations. This resulted in greater revisions when more up-to-date data were provided in the annual survey returns and administrative records.

The growth revisions as at the AES two years later showed that GDP growths were revised up to 2.6 percentage points for reference quarters in 2020 and 2021 (COVID-impacted periods), as compared to the largest growth revision of around 1.3 percentage points for reference quarters from 2017 to 2019. The relatively larger revision of 2.6 percentage points registered for reference quarters 1Q 2021 and 2Q 2021 can be attributed to the Construction, Wholesale Trade and Transportation & Storage industries (Chart 2).

CHART 2 PRELIMINARY GDP GROWTH RATES AND REVISIONS 2 YEARS LATER

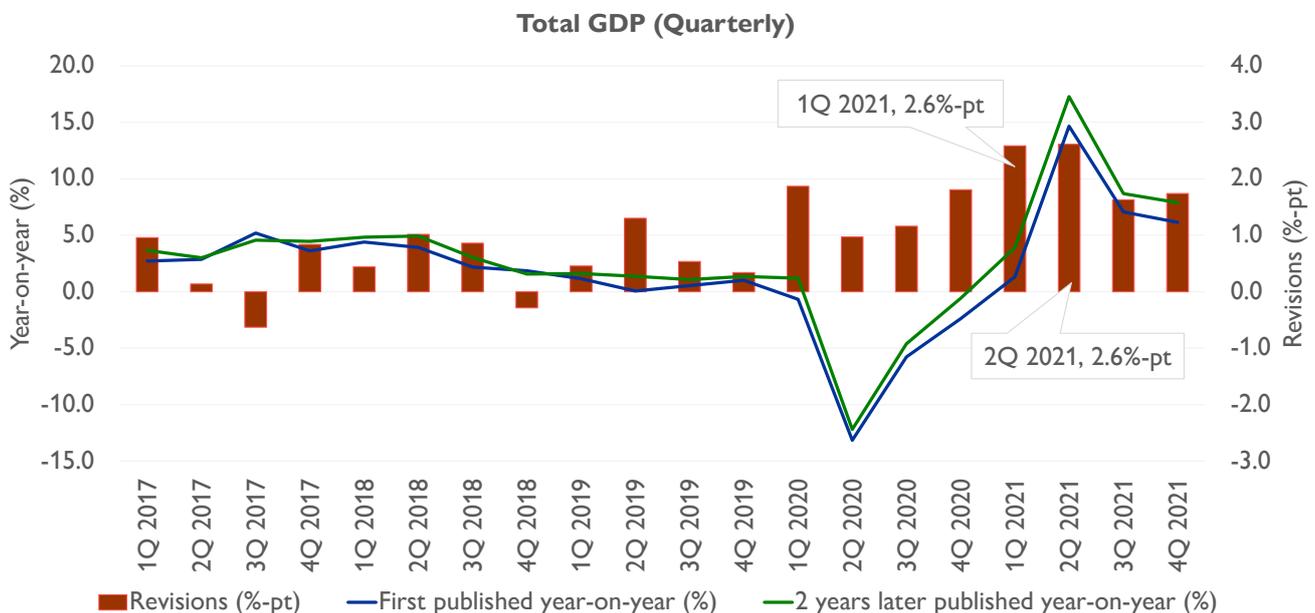
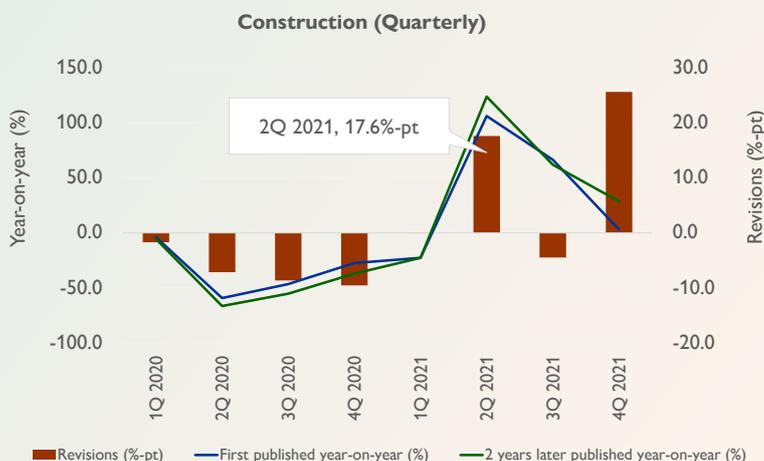


CHART 2 PRELIMINARY GDP GROWTH RATES AND REVISIONS 2 YEARS LATER (CONT'D)

For reference quarters in 2020 and 2021, growths for the Construction industry were revised following the incorporation of data benchmarks from the Census of the Construction Industry. The Census showed that the level of construction activities in 2020 was lower than estimated with stoppage of works due to the tightening of COVID-related restrictions. On the other hand, the level of activities in 2021 was generally higher than estimated with the resumption of works after the relaxation of restrictions.

CHART 2A
PRELIMINARY GROWTH RATES AND REVISIONS 2 YEARS LATER FOR CONSTRUCTION



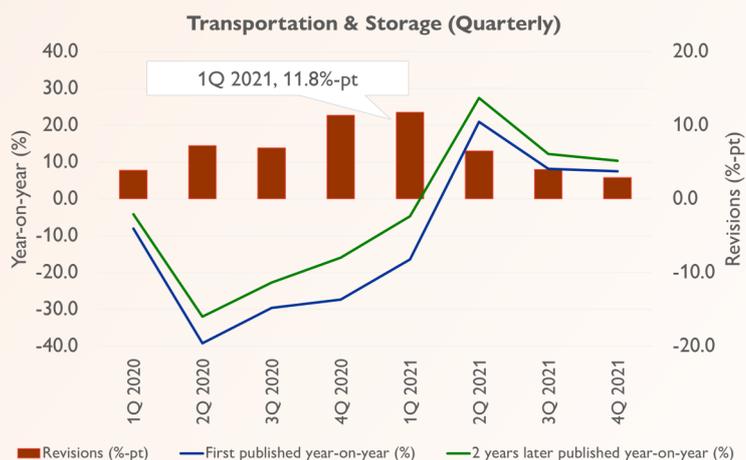
For reference quarters in 2021, the annual survey benchmark showed that wholesalers trading in machinery, equipment and supplies expanded more strongly than estimated, following the surge in telecommuting since 2020.

CHART 2B
PRELIMINARY GROWTH RATES AND REVISIONS 2 YEARS LATER FOR WHOLESALE TRADE



Growth revisions to the Transportation & Storage industry in 2021 were largely attributed to better performance of water transport as the annual survey returns showed that demand for shipping services was stronger than estimated.

CHART 2C
PRELIMINARY GROWTH RATES AND REVISIONS 2 YEARS LATER FOR TRANSPORTATION & STORAGE



Revisions to the seasonally-adjusted (SA) quarter-on-quarter (q-o-q) GDP growth for the reference period 4Q 2008 to 4Q 2023 are presented in Table 2⁶. The mean absolute revision recorded as at the AES one year and two years later are 0.46 and 0.62 percentage points respectively. The SA q-o-q GDP growth are used as the basis of comparison with other countries.

TABLE 2
MEAN ABSOLUTE REVISIONS TO SEASONALLY-ADJUSTED QUARTERLY GDP GROWTH ESTIMATES (Q-O-Q)

Real GDP SA Growth (quarter-on-quarter)	Mean Absolute Revisions (%)	
Reference Period	Year 1	Year 2
4Q 2008 to 4Q 2023	0.46	0.62

International Comparison

Revision practices and policies, including when comprehensive benchmarking exercises are conducted, vary across countries.

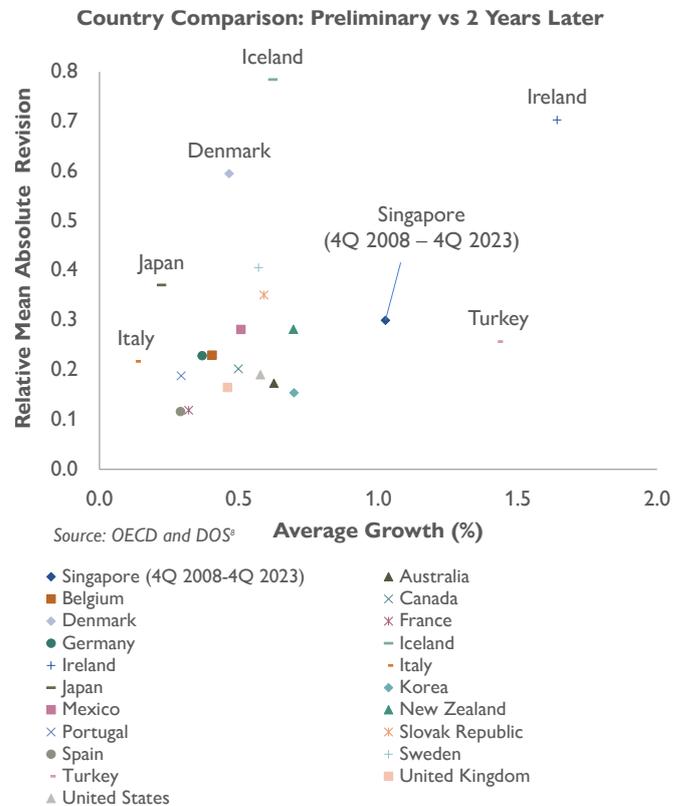
Chart 3 shows the relative mean absolute revisions (RMAR)⁷ to the SA q-o-q real GDP growth, two years after the release of preliminary data for Singapore and selected countries.

Most of the countries recorded an average SA q-o-q real GDP growths of between 0.3 to 0.7 per cent, with RMAR under 0.4. Italy and Japan experienced the slowest average growths of 0.13 and 0.22 per cent respectively, while Turkey and Ireland registered the fastest average growths of more than 1.4 per cent.

Despite having a similar average growth with most countries, Iceland recorded an exceptionally high RMAR of close to 0.8, which was more than double that of most other countries.

With an average growth of 1.0 per cent, Singapore’s RMAR is comparable to that of most other developed countries.

CHART 3
COUNTRY COMPARISON OF RELATIVE MEAN ABSOLUTE REVISIONS TO SEASONALLY-ADJUSTED QUARTERLY GDP GROWTH ESTIMATES (QUARTER-ON-QUARTER, %)



Concluding Remarks

Singapore’s GDP estimates are regularly revised to refine the initial estimates, incorporating new and more complete data and improvements to compilation methodology. These revisions make the GDP estimates more reliable and ensure that they can be compared across different time periods, helping users make better economic judgments based on consistent and reliable data.

The Singapore Department of Statistics (DOS) regularly updates GDP estimates by including the latest and most comprehensive data, consistent with international best practices. Singapore's RMAR is comparable to that of other developed countries. Revisions may become larger with greater global economic and political uncertainties. DOS will continue to monitor these revisions to the GDP estimates as part of its quality assurance process.

6 Real GDP SA data are only available from reference period 4Q 2008.

7 Relative mean absolute revision (RMAR) statistic corrects the mean absolute revision by the size of the growth rates. This measure facilitates comparability across countries as revisions are expected to be larger in periods of high growths than in periods of slow growths, and vice-versa.

8 The countries’ revisions are compiled based on published data for reference period 1Q 2010 to 3Q 2023, subject to data availability. Only seasonally-adjusted data are available for comparison. For Singapore, RMAR and average growth remain unchanged at 0.30 and 1.0% respectively if the reference period is shortened to only cover from 1Q 2010 to 3Q 2023.