EXPLANATION OF REVISIONS

Not adjusted estimates of monthly sales are revised for January 2013 through April or May 2019[1] (if an advance sales estimate is computed), as well as end-of-month inventory estimates for January 2011 through April 2019. Not adjusted estimates of quarterly retail e-commerce sales are revised for first quarter 2011 through first quarter 2019.

Revisions to not adjusted estimates were made in two parts:

First, revisions were made to prior Monthly Retail Trade (MRTS) estimates to reflect historical corrections. For most NAICS industries, these revisions were made to the current sample back to January 2018. For select detail NAICS codes, corrections were made to prior sample estimates to reflect data received after last year's revision report, with the earliest year affected being 2013. Finally, revisions were made when benchmarking the Monthly Retail Trade estimates to the 2017 Annual Retail Trade Survey (ARTS) and Service Annual Survey (SAS) estimates.

Revisions to seasonally adjusted estimates were made based on the revised not adjusted estimates and revised seasonal adjustment factors. Adjusted estimates of monthly sales are revised for January 2010 through April or May 2019[1] (if an advance sales estimate is computed), as well as end-of-month inventory estimates for January 2008 through April 2019. Adjusted estimates of quarterly retail e-commerce sales are revised for first quarter 2008 through first quarter 2019.

Reasons for Revisions

We revised the not adjusted estimates to:

- Reflect corrections to data for the MRTS and ARTS samples. Corrections are made to replace previously reported data with more accurate data received at a later date or to replace imputed data with reported data obtained from the company.
- Introduce the results from the 2017 ARTS and SAS.
- Link the previously published estimates from the prior MRTS sample to estimates from the current MRTS sample.

We revise the seasonally adjusted estimates to:

- Reflect revisions to the not adjusted estimates.
- Incorporate changes to the seasonal adjustment factors based on the annual review of the seasonal adjustment models.

Benchmarking to 2017 ARTS and SAS estimates

There are several reasons for benchmarking estimates from the Monthly Retail Trade Survey to the Annual Retail Trade Survey and Service Annual Survey:

- **Timing**. The respondents have more time to prepare their annual and census reports than they do for their monthly reports. The annual and census responses are requested at a time when many firms have already compiled audited book figures for their own use. The timing of the annual survey is such that we are also able to obtain independent verification of the reported data from such sources as a company's annual report. On the other hand, respondents to the monthly survey have just a few weeks to provide reports of their sales and end-of-month inventories. Sometimes these reports are based on incomplete or unaudited records and may include estimates made by respondents to represent their understanding of their business.

- **Sampling.** As described in more detail in the Technical Documentation, the estimates derived from the annual survey are based on a sample that is much larger than the samples used to produce the monthly sales and inventory estimates. MRTS estimates are benchmarked to the results from the 2017 ARTS and the 2017 SAS, which have both been indirectly benchmarked using the final results of the 2012 Economic Census. See ARTS and SAS methodology pages for more information: <https://www.census.gov/programs-surveys/arts/technical-documentation/methodology.html>. <https://www.census.gov/programs-surveys/sas/technical-documentation/methodology.html>

- **Response.** The annual estimates are based on more reported data than are the monthly estimates. The responses to the ARTS and SAS are required by law, while the MRTS is voluntary. This requirement results in a total quantity response rate (TQRR) of approximately 92 percent for retail sales and 90 percent for inventories in ARTS and approximately 76 percent for food services and drinking places sales in SAS, and a rate of approximately 69 percent for sales and 67 percent for inventories for MRTS. An imputation process accounts for the sales and inventories data that fail edits or are missing because of nonresponse. For MRTS, this process assumes that non-responding firms have similar month-to-month changes to the responding firms of a similar size in the same industry. However, the ARTS and SAS imputation processes rely heavily on administrative data and relationships of these data for each individual firm, which could result in different data being tabulated for the MRTS and ARTS/SAS for non-responding firms.

Estimates of Monthly Sales

For detailed NAICS codes, corrections are applied to the monthly retail and food service sales estimates for February 2018 through April 2019. Then, for each detailed NAICS code, the monthly retail and food service sales estimates are linked to the estimates derived from the prior sample. The linkage is performed at each detailed NAICS level by multiplying the sample-based estimates prior to March 2018 (including prior sample revisions for the select detail NAICS) by a geometric mean. The geometric mean is computed as the square root of the product of two ratios. The numerators of the ratios are the Horvitz-Thompson sales estimates for February and March 2018 from the current sample. The denominators of the ratios are the Horvitz-Thompson estimates for February and March 2018 from the prior sample.

After performing the above linkage, the resulting sales estimates for December 2015 through April 2019 are input to the benchmarking program. The estimates for a given detailed NAICS code are revised in a manner that—

- For 2016 through 2017, constrains the sum of the 12 monthly sales estimates to equal the corresponding annual sales estimate from the 2017 ARTS or SAS,

- Minimizes the sum of the squared differences between the month-to-month changes of the input and revised estimates for December 2015 through April 2019.

- Uses the previously published December 2015 sales estimate as a constraint, linking the revised estimates to the previously published sales estimates and resulting in no revision to the December 2015 estimate.

For the select detail NAICS codes with revisions to prior sample estimates, the above benchmarking procedure was performed using the annual constraints of the years affected by the corrections and fixing the December estimate from the previous year so no revisions to earlier years will occur. The earliest month affected by these corrections was January 2013.

A mathematical result of the benchmarking methodology is that, for a given NAICS code, all published monthly sales estimates after December 2017 are derived by multiplying the Horvitz-Thompson estimates by the ratio of the benchmarked-to-input estimate for December 2017. This ratio, which is called a carry-forward factor, remains the same and is used to derive published monthly sales estimates until the next benchmarking operation.

Revised estimates for aggregate industry levels are computed by summing the revised estimates for the appropriate detailed industries comprising the aggregate.

Estimates of End-of-Month Inventories

For detailed NAICS codes, corrections are applied to the end-of-month inventory estimates for February 2018 through April 2019. Then, for each detailed NAICS code, the end-of-month inventory estimates are linked to the estimates derived from the prior sample. The linkage is performed using a procedure similar to the one used for sales, except the geometric mean is based on end-of-month inventory.

After performing the above linkage, the resulting end-of-month inventory estimates for December 2010 through April 2019 are input to the benchmarking program. The estimates for a given detailed NAICS code are revised in a manner that—

- For 2010 through 2017, constrains the December end-of-month inventory estimates to equal the corresponding end-of-year inventory estimate from the 2017 ARTS

- Minimizes the sum of the squared differences between the month-to-month changes of the input and revised estimates for December 2010 through April 2019.

- Uses the restated December 2010 sales estimate as a constraint, linking the revised estimates to the previously published sales estimates and resulting in no revision to the December 2010 estimate.

For a given detailed NAICS code, end-of-month inventory estimates subsequent to December 2017 are derived by multiplying the input estimates by the ratio of the benchmarked-to-input estimate for December 2017. This ratio is the carry-forward factor for inventory, and it remains the same until the next benchmarking operation.

Revised estimates for aggregate industry levels are computed by summing the revised estimates for the appropriate detailed industries comprising the aggregate.

Estimates of Quarterly E-commerce Sales

For select detailed NAICS codes, corrections are applied to the quarterly e-commerce sales estimates for first quarter 2018 through first quarter 2019. Then, for select detail NAICS codes (usually at the 3-digit NAICS level), these quarterly retail e-commerce sales estimates are linked to the estimates derived from the prior sample. The linkage is performed at these select detail levels by multiplying the sample-based estimates prior to first quarter 2018 by a ratio. The numerators of the ratios are the Horvitz-Thompson e-commerce sales estimates for first quarter 2018 from the current sample. The denominators of the ratios are the Horvitz-Thompson e-commerce sales estimates for first quarter 2018 from the prior sample. Monthly e-commerce estimates are also linked at these select detail levels using a procedure similar to the one used for sales, except the geometric mean is based on monthly e-commerce sales estimates.

After performing the above linkage, the resulting e-commerce sales estimates for fourth quarter 2010 through first quarter 2019 are input to the benchmarking program. The estimates for the select detailed NAICS code are revised in a manner that—

- For 2011 through 2017, constrains the sum of the 4 quarterly e-commerce sales estimates to equal the corresponding annual sales estimate from the 2017 ARTS

- Minimizes the sum of squared differences between the quarter-to-quarter changes of the input and revised estimates for fourth quarter 2010 through first quarter 2019.

- Uses the restated fourth quarter 2010 e-commerce estimate as a constraint, linking the revised estimates to the restated sales estimates and resulting in no revision to the fourth quarter 2010 estimate.

For a given detailed NAICS code, e-commerce estimates subsequent to 4th quarter 2017 are derived by multiplying the input estimates by the ratio of the benchmarked-to-input estimate for 4th quarter 2017. This ratio is the carry-forward factor for e-commerce, and it remains the same until the next benchmarking operation.

Similarly, the monthly e-commerce sales estimates at these select detail levels for December 2010 through April 2019 are input into the benchmarking program. These estimates for the select detail levels are revised in a manner that—

- For first quarter 2011 through first quarter 2019, constrains the sum of the 3 months in a given quarter to equal the corresponding quarterly e-commerce sales estimate which has been benchmarked to the 2017 ARTS.

- Minimizes the sum of squared differences between the month-to-month changes of the input and revised estimates for December 2010 through March 2019.

- Uses the restated December 2010 e-commerce estimate as a constraint, linking the revised estimates to the restated sales estimates and resulting in no revision to the December 2010 estimate.

For a given detailed NAICS code, e-commerce estimates subsequent to March 2019 are derived by multiplying the input estimates by the carry-forward factor for e-commerce described above, which remains the same until the next benchmarking operation.

The revised estimates for the total retail quarterly e-commerce sales are computed by summing the revised estimates for the appropriate detailed industries comprising the aggregate.

Seasonally Adjusted Estimates

New seasonal, trading-day, and holiday factors are computed and used to adjust sales for January 2010 through April or May 2019 (if an advance sales estimate is computed). For inventories, new seasonal factors are computed and used to adjust inventories for January 2008 through April 2019. For quarterly e-commerce sales, new seasonal factors are computed and used to adjust e-commerce sales for first quarter 2008 through first quarter 2019. For sales, inventories, and e-commerce sales, the new seasonal factors are computed using the revised unadjusted estimates as input to the Census Bureau's X-13ARIMA-SEATS software, version 1.1 build 48, and using the X-11 filter-based adjustment procedure.

A different seasonal adjustment model specification exists for select NAICS detail levels for sales, inventory, and quarterly e-commerce. Part of that specification defines a model span, which is the span of time used to calculate trading-day and holiday factors for the given time series. In general, the model span should not be too long since trading-day and holiday patterns can change over time. All model spans for sales, inventory, and e-commerce begin no earlier than January 2001 (or first quarter 2001). All model specifications are available upon request.

REVISIONS OF SALES AND INVENTORIES

The following table shows a comparison of the revised sales and inventories to the previously published estimates for 2018:

<https://www.census.gov/retail/mrts/www/benchmark/2019/excel/introtable.xls>

ADDITIONAL INFORMATION

Survey Questionnaires

The ARTS questionnaires can be found on the Census Bureau Web site at <https://www.census.gov/retail/arts/get_forms.html>. The MRTS questionnaires can be found on the Census Bureau's Web site at <http://www.census.gov/retail/mrts/get_forms.html>.

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1 Advance sales estimates are computed for selected kinds of business and are based on a small subsample selected from the larger MRTS sample.

Related Links:

<https://www.census.gov/retail/>
<https://www.census.gov/programs-surveys/arts.html>
<https://www.census.gov/programs-surveys/e-stats.html>

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