EXPLANATION OF REVISIONS

Not adjusted estimates of monthly sales are revised for January 2008 through March or April 2018[1] (if an advance sales estimate is computed), as well as end-of-month inventory estimates for January 2005 through March 2018. Not adjusted sales and end-of month inventories for NAICS 443 (Electronics and Appliance Stores) and NAICS 451 (Sporting Goods, Hobby, Musical Instrument, and Book Stores) are revised back to January 1992. Not adjusted estimates of quarterly retail e-commerce sales are revised for fourth quarter 1999 through first quarter 2018.

Revisions to not adjusted estimates were made in three parts:

First, revisions were made to restate estimates into terms of 2012 NAICS definitions. Then, revisions were made to prior Monthly Retail Trade (MRTS) estimates to reflect historical corrections. Finally, revisions were made when benchmarking the Monthly Retail Trade estimates to the 2016 Annual Retail Trade (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 2005 through March or April 2018[1] (if an advance sales estimate is computed), as well as end-of-month inventory estimates for January 2002 through March 2018. Adjusted sales and end-of month inventories for NAICS 443 (Electronics and Appliance Stores) and NAICS 451 (Sporting Goods, Hobby, Musical Instrument, and Book Stores) are revised back to January 1992. Aggregates containing NAICS 443 or 451 also are revised back to 1992. Adjusted estimates of quarterly retail e-commerce sales are revised for fourth quarter 1999 through first quarter 2018.

Reasons for Revisions

We revised the not adjusted estimates to:

- Reflect corrections to data for the prior 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.

- Reflect 2012 NAICS definitions. Previously, MRTS estimates have been published in terms of 2007 NAICS definitions. This directly affects NAICS 443 (and its details), NAICS 451, and the former NAICS 7221 and 7222, which are now contained in the new NAICS 7225. This also indirectly affects NAICS 4412 and 45431.

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- Introduce the results from the 2016 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 2016 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 2016 ARTS and the 2016 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) above 91 percent for retail sales and inventories in ARTS and above 83 percent for food services and drinking places sales in SAS, and a rate of approximately 67 percent for sales and 66.0 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.

Restatement to 2012 NAICS definitions

Previous monthly retail and food service estimates for all items were in terms of 2007 NAICS definitions. With the introduction of the new sample, which was designed using 2012 NAICS definitions, those earlier estimates must be restated into terms of the 2012 NAICS definitions. This restatement is applied as the first step of the revision process. The following NAICS are affected:

- 2007 NAICS 441221 and 441229 are now combined into 2012 NAICS 441228. This indirectly revises published estimates because it is a change to detailed NAICS codes used for the calculation of geometric means, described below.

- 2007 NAICS 443111 is now defined as 2012 NAICS 443141. Other than the NAICS code change itself, the definition remains the same.

- All other 2007 NAICS details of NAICS 443 were eliminated and rolled into the 2012 NAICS 443142, along with 2007 NAICS 45122. This also changes geometric means calculations, as well as revises estimates for NAICS 443 upward, since the new NAICS 443 contains more industries than it did under the old definition.

- Also with the reclassification of 2007 NAICS 45122 into the 2012 NAICS 443142, estimates for NAICS 451 will revise down, since the new definition contains fewer industries than the old definition did.

- The 2012 NAICS definitions no longer separate detail levels below NAICS 45431. This indirectly revises published estimate because it is a change to detailed NAICS codes used for the calculation of geometric means, described below.

- 2007 NAICS 7221 and 7222 are now both part of 2012 NAICS 7225. Each detail NAICS is the same under 2007 and 2012 definitions, only with

different codes.

Estimates of Monthly Sales

For select detailed NAICS codes, corrections are applied to the monthly retail and food service sales estimates for February 2013 through March 2018. Then, for each detailed NAICS code, the monthly retail and food service sales estimates for January 1992 (the beginning of the series) through February 2013 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 2013 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 2013 from the prior sample. The denominators of the ratios are the Horvitz-Thompson estimates for February and March 2013 from the earlier sample.

After performing the above linkage, the resulting sales estimates for December 2007 through March 2018 are input to the benchmarking program. The estimates for a given detailed NAICS code are revised in a manner that—

- For 2008 through 2015, constrains the sum of the 12 monthly sales estimates to equal the corresponding annual sales estimate from the 2015 ARTS, restated into terms of 2012 NAICS definitions (the 2015 ARTS report was published in terms of 2007 NAICS definitions).

- Minimizes the sum of the squared differences between the month-to-month changes of the input and revised estimates for December 2007 through March 2018.

- Uses the previously published December 2007 sales estimate as a constraint, linking the revised estimates to the previously published sales estimates and resulting in no revision to the December 2007 estimate.

The above procedure completes the process of restating older sales estimates into terms of 2012 NAICS definitions. After doing this, for each detailed NAICS code, the monthly retail and food service sales estimates for January 1992 (the beginning of the series) through February 2018 are linked to the estimates derived from the current sample. The linkage is performed at each detailed NAICS level by multiplying the sample-based estimates prior to March 2018 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 second linkage, the resulting sales estimates for December 2014 through March 2018 are again input to the benchmarking program. The estimates for a given detailed NAICS code are revised in a

manner that:

- For 2015 and 2016, constrains the sum of the 12 monthly sales estimates to equal the corresponding annual sales estimate from the 2016 ARTS (or 2016 SAS for food service sales estimates)

- Minimizes the sum of the squared differences between the month-to-month changes of the input and revised estimates for December 2014 through March 2018.

- Uses the restated December 2014 sales estimate as a constraint, linking the revised estimates to the previously published sales estimates and resulting in no revision to the December 2014 estimate.

A mathematical result of the benchmarking methodology is that, for a given NAICS code, all published monthly sales estimates after December 2016 are derived by multiplying the Horvitz-Thompson estimates by the ratio of the benchmarked-to-input estimate for December 2016. 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 select detailed NAICS codes, corrections are applied to the end-of-month inventory estimates for February 2013 through March 2018. Then, for each detailed NAICS code, the end-of-month inventory estimates for January 1992 (the beginning of the series) through February 2013 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 2004 through March 2018 are input to the benchmarking program. The estimates for a given detailed NAICS code are revised in a manner that—

- For 2004 through 2015, constrains the December end-of-month inventory estimates from MRTS to equal the end-of-year inventory estimates derived from the 2015 ARTS, restated into terms of 2012 NAICS definitions (the 2015 ARTS report was published in terms of 2007 NAICS definitions).

- Minimizes the sum of squared differences between the month-to-month changes of the input and revised estimates for December 2004 through

February 2018.

- Uses the previously published December 2004 estimate as a constraint, linking the revised estimates to the previously published estimates and resulting in no revision to the December 2004 estimate.

The above procedure completes the process of restating older inventory estimates into terms of 2012 NAICS definitions. After doing this, for each detailed NAICS code, the monthly retail and food service sales estimates for January 1992 (the beginning of the series) through February 2018 are linked to the estimates derived from the current 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 second linkage, the resulting end-of-month inventory estimates for December 2010 through March 2018 are again input to the benchmarking program. The estimates for a given detailed NAICS code are revised in a manner that:

- For 2010 through 2016, constrains the December end-of-month inventory estimates to equal the corresponding end-of-year inventory estimate from the 2016 ARTS

- Minimizes the sum of the squared differences between the month-to-month changes of the input and revised estimates for December 2010 through March 2018.

- 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 2016 are derived by multiplying the input estimates by the ratio of the benchmarked-to-input estimate for December 2016. 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 2013 through first quarter 2018. Then, for select detail NAICS codes (usually at the 3-digit NAICS level), quarterly retail e-commerce sales estimates for fourth quarter 1999 through fourth quarter 2012 are linked to the estimates derived from the prior sample.

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The linkage is performed at these select detail levels by multiplying the sample-based estimates prior to first quarter 2013 by a ratio. The numerators of the ratios are the Horvitz-Thompson e-commerce sales estimates for first quarter 2013 from the prior sample. The denominators of the ratios are the Horvitz-Thompson e-commerce sales estimates for first quarter 2013 from the earlier 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 1999 through first quarter 2018 are input to the benchmarking program. The estimates for the select detailed NAICS code are revised in a manner that—

- For 2000 through 2015, constrains the sum of the 4 quarterly e-commerce sales estimates to equal the corresponding annual sales estimate from the 2015 ARTS, restated into terms of 2012 NAICS definitions (the 2015 ARTS report was published in terms of 2007 NAICS definitions).

- Minimizes the sum of squared differences between the quarter-to-quarter changes of the input and revised estimates for fourth quarter 1999 through first quarter 2018.

Similarly, the monthly e-commerce sales estimates at these select detail levels for October 1999 through March 2018 are input into the benchmarking program. These estimates for the select detail levels are revised in a manner that—

- For fourth quarter 1999 through first quarter 2018, 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 2015 ARTS, restated into terms of 2012 NAICS definitions.

- Minimizes the sum of squared differences between the month-to-month changes of the input and revised estimates for October 1999 through March 2018.

The above procedure completes the process of restating older e-commerce sales estimates into terms of 2012 NAICS definitions. After doing this, for select detail levels, the quarterly retail e-commerce sales estimates for fourth quarter 1999 through fourth quarter 2017 are linked to the estimates derived from the current 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 second linkage, the resulting e-commerce sales estimates for fourth quarter 2010 through first quarter 2018 are input again to the benchmarking program. The estimates for the select detailed NAICS code are revised in a manner that—

- For 2011 through 2016, constrains the sum of the 4 quarterly e-commerce sales estimates to equal the corresponding annual sales estimate from the 2016 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 2018.

- 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.

Similarly, the monthly e-commerce sales estimates at these select detail levels for December 2010 through March 2018 are input again into the benchmarking program. These estimates for the select detail levels are revised in a manner that—

- For first quarter 2011 through first quarter 2018, 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 2016 ARTS.

- Minimizes the sum of squared differences between the month-to-month changes of the input and revised estimates for December 2010 through March 2018.

- 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.

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 2005 through March or April 2018 (if an advance sales estimate is computed). For inventories, new seasonal factors are computed and used to adjust inventories for January 2002 through March 2018. For quarterly e-commerce sales, new seasonal factors are computed and used to adjust e-commerce sales for fourth quarter 1999 through first quarter 2018. 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 span of time used to calculate trading-day and holiday factors for the given time series. This span does not have to be the entire length of the time series, and in general, it should not be too long since trading-day and holiday patterns can change over time. In the latest annual review of seasonal adjustment, it was decided to have the 'model span' for each detailed NAICS code for both sales and inventory begin no earlier than January 2001 (or first quarter 2001), where some models spans previously began as early as January 1995. 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 2017:

<http://www.census.gov/retail/mrts/www/benchmark/2018/excel/introtable.xls>

SUMMARY OF NAICS RESTATEMENT

A summary of the 2012 NAICS restatement and publication table changes can be found at <http://www.census.gov/retail/samp_rev/restatnpubtbls.pdf>.

ADDITIONAL INFORMATION

Survey Questionnaires

The ARTS questionnaires can be found on the Census Bureau Web site at <http://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:
<http://www.census.gov/retail/>
<http://www.census.gov/econ/estats>.

Source: Retail Indicators Branch, U.S. Census Bureau
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