A Preliminary Evaluation of New Response Metric Calculations for the 2017 Economic Census

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Abstract
The U.S. Census Bureau conducts a mandatory economic census every five years, collecting establishment level financial and product data. The 2017 Economic Census featured changes in data collection and statistical methodology, including updated calculations of several response metrics, enabling a more effective assessment of data quality. Implementation of these new metrics relied on documentation of sources used for correcting estimated or inconsistent data. Correction sources included respondents' revisions, administrative data, other survey(s) or reliable secondary sources for the same reference period, or estimates by industry analysts based on prior year data, industry averages, or other alternative reliable sources. This paper presents a preliminary evaluation of key updated response metrics, such as the Total Quantity Response Rate and the Imputation Rate. We compare analogous 2012 Economic Census metrics with those from 2017 using data and methodologies from each period, and provide an initial assessment of the impact of various correction sources on data quality. We will discuss next steps for research and implications for future Economic Censuses.

Key Words: total quantity response rate, imputation rate, data quality, alternative data sources

1. Introduction

The Economic Census (EC) is a mandatory, self-administered survey of U.S. business establishments in the eight major business trade areas: manufacturing, construction, mining, retail, services, wholesale, finance-insurance-real estate (FIRE), and utilities-transportation. The EC provides timely information on the health of the U.S. economy by gathering the most extensive collection of data related to business activity. The data from the EC provides policymakers with information to make programmatic decisions. The Gross Domestic Product, National Income and Product Accounts, and the Producer Price Index all rely on the data collected by the EC.

Generally collected at the establishment level, past economic censuses featured multi-mode data collection strategies. The 2017 Economic Census was conducted using Web data collection. Self-administered electronic forms were tailored by industry, resulting in approximately 800 different form versions for the 2017 Economic Census.

Multi-unit companies and single unit establishments received an initial mail invitation, providing a URL and their own unique online authentication information, and they entered

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the electronic instrument by way of a secured portal. While many previously used nonresponse follow-up strategies were implemented in the 2017 Economic Census, an intensive research program based on randomized experiments helped to identify and evaluate various contact strategies for their cost-effectiveness, including implementation of adaptive design techniques as seen in Tuttle et al (2018) and Kaputa and Thompson (2016) respectively. Assuring the effectiveness of data-driven, adaptive nonresponse follow-up strategies motivated the development of improved response metrics associated with data quality, which are described in this paper. These new metrics were also developed to meet the Census Bureau's (2010, see https://www.census.gov/about/policies/quality/standards.html and the Office of Management and Budget's requirements for data quality (2017, see Statistical Policy Directive #2: Standards & Guidelines for Statistical Surveys, Office of Information & Regulatory Affairs, Office of Management & Budget, Washington D.C. https://obamawhitehouse.archives.gov/omb/inforeg_statpolicy).

2. Response Metrics

2.1 "Plain Vanilla Rate"

The Census Bureau differentiates nonresponse into two categories: unit nonresponse and item nonresponse. Unit nonresponse is when any substantive measurements about a unit cannot be obtained. Item nonresponse derives from an unanswered question or the reported data are unusable. The Census Bureau mitigates nonresponse by estimating or imputing missing data where imputation is defined as the replacement of a missing or incorrectly reported item with another value derived from logical edits or statistical procedures.

The Census Bureau uses an imputation rate to indicate the quality of data used to produce estimates of key items produced from the Economic Census data. These key items are total or aggregate values of revenue, employment, and payroll. Prior to the development of new metrics, the Economic Census used an imputation rate, which we will refer to as the "Plain Vanilla Rate" (PVR) to differentiate it from the redefined imputation rate discussed in this paper. The PVR measures the weighted (weight is equal to one for the EC) proportion of a key estimate (receipts or revenue, payroll, and employment) imputed by various Economic Census methods, such as hot deck imputation, cold deck imputation, and using an industry average. The PVR is defined as

$$PVR(t) = \frac{\sum_{i=1}^{N} p_{ti} t_i}{\sum_{i=1}^{N} t_i} \times 100,$$

where
p_{ti} is the indicator variable for imputed data for tabulation unit i and data item t,
t_i is the data value for unit i, and
N is the total number of eligible tabulation units.

2.2 New Response Metrics

The new metrics introduced for the 2017 Economic Census were the Total Quantity Response Rate (TQRR), Quantity Response Rate (QRR), Administrative Data Rate (ADR), and the Imputation Rate (IR) (2020, see U.S. Census Bureau (2020). Economic Census Methodology. https://www.census.gov/programs-surveys/economic-census/technical-

documentation/methodology.html). To increase the efficacy of the new metrics, the 2017 Economic Census procedures introduced a new, detailed method of tracking the data source of analyst-corrected edits to key item values. Previously for the 2012 Economic Census, if an analyst made a correction to one of these values, the data source behind the correction was not detailed. These changes could come from two methods, a global change (G) or an analyst change (C). A global change is an automated process that edits the data. An analyst change is an edit to the data from an analyst editing data on a per case basis. For the 2017 Economic Census, a new variable called a correction source flag was introduced to store this information.

The correction source flag has five possible values:

R – correction obtained directly from respondents,
A – data from administrative sources,
S – data from other survey(s) with the same reference period,
O – data from another reliable secondary source for the same reference period,
E – estimates by industry analysts based on, for example, prior year data, industry averages, or other alternative sources.

With this new documentation, the data from corrections can be more accurately parsed with respect to data sources considered valid for inclusion in the numerator of the various new response metrics. To understand how this happens, we first need to understand the definitions of the new metrics.

The TQRR is defined as

$$TQRR = \frac{\sum_{i=1}^{N}(q_i + r_i)w_i t_i}{\sum_{i=1}^{N} w_i\, t_i} \times 100,$$

where
w_i is the design weight of tabulation unit i,
r_i is the indicator variable for reported data for tabulation unit i,
q_i is the indicator variable of data from an alternative source deemed to be of sufficient quality for tabulation unit i,
t_i is the data value for unit i, and
N is the total number of eligible tabulation units.

TQRR is the proportion of the weighted total of a data item directly reported by a respondent or obtained from an alternative source deemed to be of sufficient quality. Note that the numerator and denominator include a weighting adjustment factor, w_i, which equals one if the unit was selected with certainty. Note also that $q_i + r_i \leq 1$, because q_i and r_i are mutually exclusive. A TQRR is typically calculated for each of a survey's key data items. Three key data items were identified for the Economic Census: receipts, payroll, and number of employees.

The above formula makes the distinction between reported data and alternative source data. Reported data can come from two sources: data originally reported by the respondent and data corrected using data obtained from a respondent, say by telephone or based on other EC response data, and thus are documented with a correction source flag of R. Alternative source data typically come from one of three sources: a survey or census with the same

reference period; administrative records; or some other validated source, such as company annual reports, trade association statistics, or Securities and Exchange Commission filings. Administrative data is the primary source of alternative source data for the Economic Census. Administrative data on receipts, payroll, and number of employees are maintained and updated regularly from sources such as federal tax records. When analysts use these sources for corrections, they receive correction source flags of A, S, or O, respectively.

Another useful metric is the QRR, which is a derivative of the TQRR, defined as

$$QRR = \frac{\sum_{i=1}^{N} w_i r_i t_i}{\sum_{i=1}^{N} w_i t_i} \times 100.$$

The QRR represents the proportion of the weighted total of a data item from data directly reported by respondents or from data corrected using response data as described previously.

The ADR varies from the TQRR in that it only accounts for the data obtained from administrative records or data corrected using administrative data, excluding data obtained from other alternative sources and data received by direct response. The formula for ADR is defined as

$$ADR = \frac{\sum_{i=1}^{N} w_i d_i t_i}{\sum_{i=1}^{N} w_i t_i} \times 100$$

where

d_i is the indicator variable for administrative data for tabulation unit i and item t.

The imputation rate is the percentage of the estimated total that is not obtained from directly reported or alternative source data or more simply,

$$IR = 100 - TQRR.$$

Unlike the other correction source values which contribute to the TQRR and its derivatives, analysts' corrections made via estimation (a correction source flag of E) contribute to the IR.

Due to these methodological and definitional changes, response metrics for the 2012 and 2017 Economic Censuses cannot be directly compared. Rather, a few assumptions and adjustments must be applied to the data to facilitate such a comparison, particularly with respect to definition and documentation of the data sources used for analysts' corrections. We now turn our attention to explaining these procedures and their results, focusing on creating and comparing TQRRs for the two censuses. We end with some conclusions and discussion of how attention to the new response metrics, and details about correction sources for errant data, can be used for assessing data quality, with an eye towards identifying areas for improvement.

3. PVR from 2012 and 2017

Before comparing the 2012 EC data and the 2017 EC data using the new methodology, the data were used to compare the PVR of 2012 and 2017. No additional assumptions needed

to be applied, as all the information necessary for the calculations is present in the 2017 EC data. So using the formula,

$$PVR(t) = \frac{\sum_{i=1}^{N} p_{ti} t_i}{\sum_{i=1}^{N} t_i} \times 100,$$

the difference between the 2012 PVR and the 2017 PVR is compared in the table below.

Table 1: Percentage point difference of the PVR between the years 2012 and 2017[1], By Industrial Sector (2-digit NAICS-level)

Sector	***PVR Difference (2017 minus 2012)[2]***
All	**7.4**
Mining	5.5
Utilities	2.1
Construction	13.7
Manufacturing	13.8
Wholesale Trade	2.9
Retail Trade	6.2
Transportation and Warehousing	9.7
Information	15.3
Finance and Insurance	5.4
Real Estate and Rental and Leasing	9.3
Professional, Scientific and Technical Services	19.6
Management of Companies and Enterprises	7.1
Administrative and Support, Waste Management and Remediation Services	12.0
Educational Services	8.6
Health Care and Social Assistance	13.9
Arts, Entertainment and Recreation	(0.7)
Accommodation and Food Services	9.8
Other Services (except Public Administration)	5.0

[1]Source: 2012 EC and 2017 EC data taken from 2019 Business Register and associated databases.
[2]Negative values are shown in parentheses.

Table 1 shows a 7.4 percentage point increase in the overall PVR from the 2012 EC to the 2017 EC. Besides Arts, Entertainment and Recreation, all sectors experienced an increase in the PVR from 2012 to 2017. The increases ranged from 2.1 (Utilities) to 19.6 (Professional, Scientific and Technical Services) percentage points. The primary reason

for this is that the 2017 EC had a higher nonresponse rate (i.e. fewer businesses responded) than the 2012 EC, which then required more imputation in the 2017 EC data.

Several factors can possibly explain the higher nonresponse rates in the 2017 EC. The 2017 EC had a reduced budget, and it was the first time the EC operated with an all-electronic data collection. The data collection period was also disrupted via a later start for data collection and a government shutdown during the final weeks of collection.

It isn't feasible to edit the 2012 EC data to add the correction source flag to the changed records. Thus, a portion of the difference between the 2012 TQRR and the 2017 TQRR would be an artifact of the change in methodologies. To better understand the difference in the quality of data between 2012 and 2017, the 2012 data needed an adjustment in order to calculate a TQRR for 2012.

4. TQRR for 2012 and 2017

4.1 Simulating AROSE Methodology for 2012

To create a comparable TQRR for the 2012 EC data, the contribution to TQRR from the correction source flag with a value of 'E' (estimates by analysts) must be simulated from the 2017 EC data. To do so, we assume that analysts' behavior used to apply the correction source flags in 2017 would have been the same in 2012. Under this assumption, the distribution of the contribution from the correction source flag values for a specific value of the receipt flag from the 2017 EC may be applied to the same value of the receipt flag from the 2012 EC. The analysis needs the distribution from the receipt flag values 'C' (changes from an analyst) and 'G' (changes from an automated process). Since the analysis is broken down to the two-digit NAICS level, the necessary distributions are calculated within these two-digit NAICS levels for each receipt flag value. To calculate the distribution of the contribution from the correction source flag values for a specific value, the normal TQRR formula will be used with redefined parameters. For instance, the $TQRR^{2017}_{(\alpha,\beta)}$ contribution for the correction source flag value of β for the receipt flag value of α would be calculated as follows:

$$TQRR^{2017}_{(\alpha,\beta)} = \frac{\sum_{i=1}^{N_\alpha} s_i t_i}{\sum_{i=1}^{N_\alpha} t_i} \times 100,$$

Where
α is the variable for the receipt flag value and is in (C, G),
β is the variable for the correction source flag value and is in (A,R,O,S,E),
s_i is the indicator variable for a tabulation unit i that has a receipt flag value of α with a corresponding correction source flag of β,
t_i is the receipt value for unit i, and
N_α is the total number of eligible tabulation units with RCPTOT_F = α.

Table 2 shows the $TQRR^{2017}_{(C,\beta)}$ contribution for all of the correction source values for the receipt flag of 'C'. Table 3 shows the $TQRR^{2017}_{(G,\beta)}$ contribution for all of the correction source values for the receipt flag of 'G'.

Table 2: Distribution of $TQRR^{2017}_{(C,\beta)}$, By Industrial Sector (2-digit NAICS-level)[1]

	Correction Source Flag (β)[2]				
Sector	***'E'***	***'S'***	***'O'***	***'R'***	***'A'***
Mining	7.5%	0.0%	8.7%	83.7%	0.1%
Utilities	3.5%	17.4%	3.6%	75.1%	0.4%
Construction	51.6%	0.1%	1.4%	24.6%	22.3%
Manufacturing	47.9%	6.4%	0.3%	42.8%	2.6%
Wholesale Trade	28.1%	59.8%	5.0%	3.9%	3.3%
Retail Trade	6.8%	51.3%	0.1%	36.4%	5.4%
Transportation and Warehouse	41.9%	22.6%	9.4%	23.4%	2.7%
Information	9.7%	63.9%	10.6%	14.7%	1.0%
Finance and Insurance	2.9%	53.6%	30.2%	10.6%	2.7%
Real Estate and Rental and Leasing	16.5%	49.0%	17.9%	11.9%	4.7%
Professional, Scientific and Technical Services	19.2%	48.3%	13.7%	9.3%	9.5%
Management of Companies and Enterprises	25.4%	2.8%	49.1%	14.6%	8.1%
Administrative and Support, Waste Management and Remediation Services	6.3%	54.1%	1.2%	29.5%	8.9%
Educational Services	38.0%	24.3%	0.7%	29.5%	7.6%
Health Care and Social Assistance	32.9%	22.0%	4.7%	6.7%	33.8%
Arts, Entertainment and Recreation	9.7%	16.9%	34.8%	26.7%	11.9%
Accommodation and Food Services	22.0%	27.9%	0.9%	43.7%	5.5%
Other Services (except Public Administration)	11.6%	17.9%	46.5%	8.8%	15.3%

[1]Source: 2017 EC data taken from 2019 Business Register and associated databases.
[2]Rows may not sum to 100.0% due to rounding

Table 3: Distribution of $TQRR^{2017}_{(G,\beta)}$, By Industrial Sector (2-digit NAICS-level)[1]

	Correction Source Flag (β)[2]				
Sector	***'E'***	***'S'***	***'O'***	***'R'***	***'A'***
Mining	0.0%	0.0%	0.0%	47.5%	52.5%
Utilities	2.2%	6.9%	0.3%	90.5%	0.1%
Construction	96.8%	0.0%	0.0%	0.3%	2.8%
Manufacturing	0.0%	0.0%	0.0%	0.0%	100.0%
Wholesale Trade	10.8%	62.9%	4.8%	17.1%	2.9%
Retail Trade	18.8%	22.9%	5.1%	18.3%	33.8%
Transportation and Warehouse	54.5%	3.6%	1.0%	31.9%	4.8%
Information	11.0%	54.9%	1.2%	30.9%	0.9%
Finance and Insurance	2.3%	41.1%	6.5%	43.3%	5.8%
Real Estate and Rental and Leasing	18.7%	21.8%	17.7%	21.3%	15.5%
Professional, Scientific and Technical Services	16.9%	14.2%	3.2%	46.2%	16.8%
Management of Companies and Enterprises	21.0%	1.3%	46.2%	10.9%	16.6%
Administrative and Support, Waste Management and Remediation Services	29.5%	1.1%	1.7%	43.3%	8.0%
Educational Services	15.4%	32.9%	0.0%	28.9%	22.8%
Health Care and Social Assistance	26.8%	7.5%	3.0%	31.6%	30.2%
Arts, Entertainment and Recreation	4.0%	22.4%	32.3%	32.2%	8.3%
Accommodation and Food Services	24.9%	30.2%	0.0%	16.4%	4.1%
Other Services (except Public Administration)	4.8%	20.8%	34.4%	20.3%	19.6%

[1]Source: 2017 EC data taken from 2019 Business Register and associated databases.
[2]Rows may not sum to 100.0% due to rounding

The next step is to calculate a new numerator for the $TQRR^{2012}$ from the 2012 EC data. Since the records from the 2012 EC did not have any correction source flags assigned to records with a receipt flag value of 'C' or 'G', the proportion of $TQRR^{2012}$ for these records that would have had a correction source flag value of 'E' needs to be estimated. Under the assumption that analyst behavior in assigning the correction source flag value in 2017 would have been the same in 2012, this estimate can be obtained by multiplying the TQRR contribution of records with a receipt flag value of 'C' or 'G' by $TQRR^{2017}_{(C,E)}$ and $TQRR^{2017}_{(G,E)}$ respectively. With this change, the new TQRR formula would look as follows:

$$TQRR^{2012} = \frac{(1 - TQRR^{2017}_{(G,E)}) \sum_{i=1}^{N_G} v_i t_i + (1 - TQRR^{2017}_{(C,E)}) \sum_{i=1}^{N_C} s_i t_i + \sum_{i=1}^{N_O} (q_i + r_i) t_i}{\sum_{i=1}^{N} t_i} \times 100,$$

Where
v_i is the indicator variable for a tabulation unit *i* that has a receipt flag value of 'G',
s_i is the indicator variable for a tabulation unit *i* that has a receipt flag value of 'C',
r_i is the indicator variable for reported data for tabulation unit *i* that does not have a receipt flag value of 'C' or 'G',
q_i is the indicator variable of data from an alternative source deemed to be of sufficient quality for tabulation unit *i* that does not have a receipt flag value of 'C' or 'G'
t_i is the data value for unit *i*,
N_O is the total number of eligible tabulation units that do not have a receipt flag value of 'C' or 'G',
N_G is the total number of eligible tabulation units that have a receipt flag value of 'G',
N_C is the total number of eligible tabulation units that have a receipt flag value of 'C', and
N is the total number of eligible tabulation units

4.2 Comparing the Simulated 2012 TQRR to the Observed 2017 TQRR
With the simulated calculation of TQRR for the 2012 EC data, a better comparison of data quality can be made using the TQRR between the 2012 EC data and the 2017 EC data. The comparison of the simulated 2012 TQRR and the observed 2017 TQRR removes the effects of the introduction of the correction source flags. With the removal of the correction source flag effect, the effects of the other factors contributing to nonresponse can be analyzed more accurately.

Since IR follows the equation

$$IR = 100 - TQRR,$$

an increase in the IR from 2012 to 2017 is the same as a decrease in the TQRR from 2012 to 2017. Table 4 shows the percentage point differences between the simulated 2012 TQRR and the observed 2017 TQRR. Other than Management of Companies and Enterprises, Arts, Entertainment and Recreation, and Retail Trade, all sectors had a percentage point decrease in their TQRR from 2012 to 2017 ranging from 1.5 to 17.3 percentage points. Arts, Entertainment and Recreation, and Retail Trade had slight percentage point increases in their TQRR with increases of 0.5 and 0.3 percentage points respectively. The 21.0 percentage point increase in the TQRR in the Management of Companies and Enterprises from 2012 to 2017 is an artifact of an abnormally low TQRR in 2012 rather than a large effect from the other nonresponse contributing factors.

The differences vary between the PVR and TQRR depending on the sector. For instance, both Construction and Manufacturing showed 13.7 and 13.8 percentage point PVR increases from 2012 to 2017 respectively. Their TQRR differences increased to 16.2 and 15.6 percentage points. Educational Services had a larger difference in its PVR calculations (8.6) than its TQRR difference (5.0). Whether a sector had a larger PVR or TQRR difference is a factor of two different components, the total amount of receipts attributed to a change in 2012 and the proportion of receipts from changes via estimation in 2017. As an example, if a sector had a large amount of receipts from changes in 2012 and a large amount of the receipts via changes in 2017 were from a change source of 'E',

and then a relatively large value of the numerator of the 2012 TQRR would have been removed, creating a small simulated 2012 TQRR.

Table 4: Percentage point difference of the simulated 2012 TQRR and the observed 2017 TQRR, By Industrial Sector (2-digit NAICS-level)[1]

Sector	***TQRR Difference (Simulated 2012 minus observed 2017)***[2]
All	**6.7**
Mining	6.2
Utilities	1.5
Construction	16.2
Manufacturing	15.6
Wholesale Trade	3.6
Retail Trade	(0.3)
Transportation and Warehouse	2.6
Information	13.6
Finance and Insurance	5.1
Real Estate and Rental and Leasing	7.0
Professional, Scientific and Technical Services	17.3
Management of Companies and Enterprises	(21.0)
Administrative and Support, Waste Management and Remediation Services	11.6
Educational Services	5.0
Health Care and Social Assistance	11.3
Arts, Entertainment and Recreation	(0.5)
Accommodation and Food Services	9.2
Other Services (except Public Administration)	5.7

[1]Source: 2012 EC and 2017 EC data taken from 2019 Business Register and associated databases.
[2]Negative values are shown in parentheses.

5. Benefits of AROSE Methodology

The treatment of the simulated 2012 TQRR shows that adding the AROSE methodology will always remove items from the numerator, thus lowering TQRR. If the records with a correction source flag of 'E' were treated the same as 'A', 'R', 'O', and 'S' then the TQRR for all sectors would be greater than or equal to the TQRR in the current methodology. In this methodology, records with a correction source value of 'E' are not considered to be of the same quality as records with a correction source value of 'A', 'R', 'O', or 'S'. So how can the added granularity of the AROSE methodology benefit and improve the EC?

By adding the additional layer to the documentation of changes, improvements to collection methods or data editing processes could be identified by examining records or a group of records with a correction source value of 'E'. An easy way to display this possibility is with an example.

5.1 Targeting Areas of Improvement

The first step of this process is to identify the records or groups of records that would benefit from further examination. We can compare the 2017 TQRR to a simulated version of the 2017 TQRR. The simulated 2017 TQRR would be calculated with all of the records with a correction source value of 'E' included in the numerator. This would provide a hypothetical TQRR with the assumption that records with changes, both global and analyst, via estimation were of good enough data quality to be included in the calculation. If the 2017 TQRR and the simulated 2017 TQRR are compared, then the areas where there is a large percentage point difference would equate to the areas where there is a greater need for improvement to data collection methods and processes. We can demonstrate this at the sector level using the following table.

Table 5: Percentage point difference of the observed 2017 TQRR and the simulated 2017 TQRR, By Industrial Sector (2-digit NAICS-level)[1]

Sector	***TQRR Difference (Simulated 2017 minus observed 2017)***
All	**5.6**
Mining	2.8
Utilities	0.7
Construction	3.6
Manufacturing	8.0
Wholesale Trade	10.2
Retail Trade	1.0
Transportation and Warehouse	14.7
Information	3.3
Finance and Insurance	1.0
Real Estate and Rental and Leasing	4.1
Professional, Scientific and Technical Services	1.6
Management of Companies and Enterprises	1.6
Administrative and Support, Waste Management and Remediation Services	1.5
Educational Services	4.3
Health Care and Social Assistance	4.9
Arts, Entertainment and Recreation	2.0
Accommodation and Food Services	0.9
Other Services (except Public Administration)	1.5

[1]Source: 2017 EC data taken from 2019 Business Register and associated databases.

Under the constraint of limited resources designated for research into the EC, the percentage point differences in the table can identify sectors for researchers to focus on improving. In the table, the Wholesale Trade and Transportation and Warehouse sectors have the largest percentage point differences with 10.2 and 14.7 respectively. Researchers can use this information to examine those sectors for areas of improvements in data quality. This could equate to finding ways in those sectors to gather more responses. It could also show that these sectors would benefit from an expanded use of administrative data. Both the increased response data and the increased use of administrative data would lead to higher data quality as indicated by the TQRR calculated after these changes would be implemented.

6. Conclusion

The Economic Census produces the most detailed benchmark data available about the U.S. economy. It is not like other survey programs with respect to design or magnitude of information collected. The breadth and depth of the EC data as well as its wide-ranging use necessitates the highest level of data quality that can be provided with the resources assigned. The TQRR calculates the proportion of a key item's estimated total obtained from response or from alternative sources considered to be of sufficient quality, in particular, administrative data. The introduction of the TQRR produces a better and standardized indicator of data quality that follows OMB and Census Bureau standards.

With the introduction of the TQRR, the EC introduced a new, detailed method of tracking the data source of analyst or globally corrected edits to key item values. This new documentation allows the data from corrections to be more accurately parsed with respect to data sources considered valid for inclusion in the numerator of the new metrics. The methodological change in the definition of imputation rates disrupts the continuity of comparing imputation rates for 2017 and beyond with the imputation rates for 2012 and earlier. However, by simulating these methodological changes with the previous EC data, we can generate a simulated metric that allows for a more accurate comparison of the imputation rates and other response metrics.

With limited resources available in between collection years, introducing the new documentation methodology gives researchers more information of the source of the data values to inform possible high-reward areas of improvement. With this understanding, we can make more informed changes to data collection processes and editing processes with the reward of higher data quality throughout the EC.

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