Estimation:

Tabulation unit:

ACES uses the company as the tabulation unit. The sampling unit is also the company, and in all but a limited number of large companies, the company is also the reporting unit.

Estimation and sampling variance:
Each sampled company has an initial sampling weight to reflect how it will be used in making inferences back to the population. Each sampled company becomes a respondent, a nonrespondent, or declared an out-of-scope case. A sampled company can be defined as out-of-scope if it is found to have been out of business prior to the survey year or is a duplicate to another record in the sample. Companies that went out of business during the survey year are still in-scope, and efforts are made to collect data for the portion of the survey year that the company was active. Companies with mergers or acquisitions during the survey year are handled by attempting to capture all the data in a single record.

A company that receives the ACE-1 collection instrument is considered a survey respondent if the companies reports some value of capital expenditures in either item 1A, row11 (total Capital Expenditures), or in some rows in item 2 (more detailed Capital Expenditures). The company is considered a respondent even if the reported value is zero. A company that receives the ACE-2 collection instrument is considered a respondent if it reports data for some rows in item 1 (Capital Expenditures). Similarly, that company is considered a respondent even if the reported value is zero.

To account for those companies that did not respond, or the nonrespondents, the sampling weights of respondents were increased. The increase to respondent weight values is called the nonresponse weight adjustment. This is done so that the set of respondent companies can be used to make an inference back to the entire population. This increase is made to the original sampling weights that all the sampled companies (both respondents and nonrespondents) had initially.

The nonresponse weight adjustment for ACE-1 respondents is based on the outstanding payroll of nonrespondents within their ACES industry and substrata. The ACE-1 respondents are all companies with employees, and have payroll as well as reliable indications of their business activity. The adjustment for ACE-2 respondents is based solely on the percentage of companies not reporting, regardless of size, within their strata. The ACE-2 companies are those without employees, and their strata is based on general categories only. In addition, companies who are deemed 'extreme outliers' may have their weights further adjusted to minimize the mean squared error of the estimates.

The following paragraphs describe how this nonresponse adjustment and how the estimates are created.

ACE-1 Nonresponse Adjustment. The following discussion assumes 660 substrata, which is the approximate number given about 132 ACE code divisions of business activity, and 5 divisions of each business activity. Those divisions include the one substrata of the certainty cases based on having 500 or more employees, then four other noncertainty substrata divided by the size of their payroll. The substrata are designated h = 1, 2. . . 660. In any given year, the total number of substrata is usually a bit smaller than 660, as it can be more efficient to collapse some of the four payroll substrata at times.

A company in the certainty stratum has a sampling weight of one, which means its data only represents itself. Those companies selected in the other strata usually have weights greater than one to represent themselves and many other similar companies so that the sample can be used to make inference back to the entire population. In some situations, these sampling weights can grow very large (up to several hundred), which can become problematic during estimation. All substratum-sampling weights, W_h, are the same within each substratum h, equaling the ratio of the substratum population size, N_h, to its sample size, n_h.

The ACE-1 respondent sampling weights are adjusted within their particular substrata for nonresponse based on payroll in the following way:

$$W_{h(adj)} = W_h * \frac{P_{hr} + P_{hn}}{P_{hr}}$$

Where,

$W_{h\ (adj)}$: adjusted substratum weight of the h^{th} substratum

W_h: substratum-sampling weight of the h^{th} substratum

P_{hr} : sum of total company payroll for respondents in substratum h

P_{hn}: sum of total company payroll for nonrespondents in substratum h

ACE-2 Nonresponse Adjustment. The ACE-2 segment initially was stratified into four strata based on four categories. Two of these groups are defined by being companies without employees and their legal form of organization, while the other two are derived from being possible companies without employees based on assembly the ACE-1 frame. These two latter strata are further divided, or poststratified into four groups after survey data collection, based on updated administrative record data showing the presence or absence of payroll. The population sizes, sample sizes, response counts, and adjusted weights for the four new strata resulting from the poststratification are modified accordingly. This combination of four sampling strata, with two of those split into four poststratification strata, results in six ACE-2 strata (strata designation h = 1, 2…6) for nonresponse adjustment.

The ACE-2 stratum weights (W_h) are adjusted to compensate for nonresponse based on number of respondents in that stratum:

$$W_{h(adj)} = W_h \left(\frac{n_h}{r_h}\right) = \frac{N_h}{r_h}$$

Where,

$W_{h\ (adj)}$: adjusted stratum weight of the h^{th} stratum

W_h : stratum weight of the h^{th} stratum

N_h : population size of the h^{th} stratum

n_h : sample size of the h^{th} stratum

r_h : number of respondents in the h^{th} stratum

Publication estimation

Publication cell estimates are computed by obtaining a weighted sum of reported values for in-scope respondents. The adjusted respondent weight values are the sampling weights increased to account for eligible sampled units that were nonrespondents. In this way, estimates can make inference back to the entire population, although the precision of those estimates is reduced.

ACE-1 Estimation: The ACE-1 estimates $\hat{X}_j$ are (where substrata h = 1 to k, and k=660) calculated as:

$$\hat{X}_j = \sum_{h=1}^{k} \sum_{i \in h} (W_{h(adj)} * X_{(j),i,h})$$

Where,

$W_{h\ (adj)}$: adjusted weight of the h^{th} substratum

$X_{(j),i,h}$: value attributed to the i^{th} company of substratum h, where j is the publication cell of interest.

N.B. ACES allows a company to report capital expenditures in various business activities. Although a company is assigned to and sampled from a single ACES industry thought to be its primary business activity, it can report capital expenditures in several ACES industries. Larger companies commonly do so. The data for all reported industries are inflated by the weight of the sample industry of the respondent. This means that similar sized companies could influence a common industry differently based on which business activity they were initially assigned to as sampling business activity.

ACE-2 Estimation: The ACE-2 estimates $\hat{X}_j$ are (with k=6) are calculated as:

$$\hat{X}_j = \sum_{h=1}^{k} \sum_{i \in h} (W_{h(adj)} * X_{(j),i,h})$$

Where,

$W_{h\ (adj)}$: adjusted weight of the h^{th} stratum

$X_{(j),i,h}$: value attributed to the i^{th} company in stratum h, where j is the publication cell of interest

N.B. There are no industry level estimates from the ACE-2 companies. Companies without employees only contribute to Table 1, which has estimates only at the economy wide level. Therefore, j becomes a constant and the estimate will always represent an economy wide estimate.

Benchmarking:

This survey is not benchmarked to any other program.

Seasonal adjustment:

This survey does not use seasonal adjustment.

Disclosure avoidance:

The Census Bureau operates under Title 13, U.S. Code, which prohibits the Census Bureau from making "any publication whereby the data furnished by any particular establishment or individual under this title can be identified". This rule prohibits the Census Bureau from publishing a summary table that enables a data user to derive detailed information from an individual respondent. To ensure our tables do not violate disclosure rules implied by Title 13, they must be subjected to an analytical procedure referred to as disclosure avoidance.

Estimates are examined based on the individual contributions and contributors to that estimate. When the estimate for a specific data item might disclose sensitive information for an individual company, based on a set of rules and parameters, that estimate is called sensitive. A sensitive cell is an estimate which a data user could use to calculate another company's data. Sensitive cells are not published. Sensitive cells are also called primary suppressions. The process of not publishing a sensitive cell in a table is called cell suppression. Allowing the value of a sensitive cell to be closely estimated would be called a disclosure.

Disclosure is the release of data that reveals information or permits deduction of information about a particular survey unit through the release of either tables or microdata. Disclosure avoidance is the process used to protect each survey unit's identity and data from disclosure. Using disclosure avoidance procedures, the Census Bureau modifies or removes the characteristics that put information at risk of disclosure. Although it may appear that a table shows information about a specific survey unit, the Census Bureau has taken steps to disguise or suppress a unit's data that may be "at risk" of disclosure while making sure the results are still useful. The cells that must be protected are called primary suppressions.

In addition to not publishing table cells that contain sensitive data, other cells are also suppressed to protect the sensitive cell from being analytically determined to within a proscribed amount. Cell suppression is a disclosure avoidance technique that protects the confidentiality of individual survey units by withholding cell values from release and replacing the cell value with a symbol, usually a "D". If the suppressed cell value were known, it would allow one to estimate an individual survey unit's too closely.

The cells that must be protected are called *primary suppressions*. An estimate is considered a primary suppression if it fails a primary suppression rule. For ACES, the primary suppression rule is the p% rule.

To make sure the cell values of the primary suppressions cannot be closely estimated by using other published cell values, additional cells may also be suppressed. These additional suppressed cells are called *complementary suppressions.*

The process of suppression does not usually change the higher-level totals. Values for cells that are not suppressed remain unchanged. Before the Census Bureau releases data, computer programs and analysts ensure primary and complementary suppressions have been correctly applied.

The Census Bureau has reviewed the data product for unauthorized disclosure of confidential information and has approved the disclosure avoidance practices applied. (Approval ID: CBDRB-FY20-376).