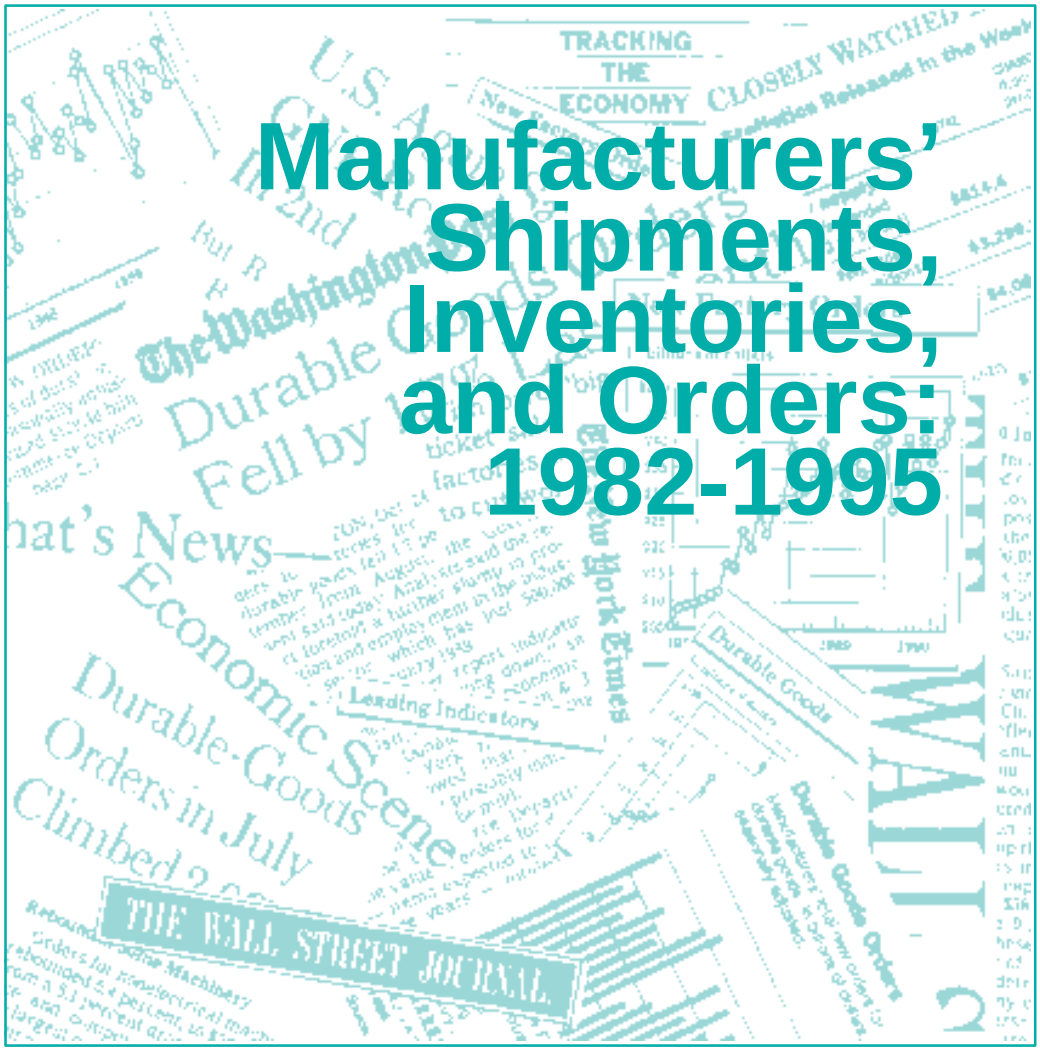
CURRENT INDUSTRIAL REPORTS

M3-1(95)

Manufacturers' Shipments, Inventories, and Orders: 1982-1995



U.S. Department of Commerce
Economics and Statistics Administration
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Manufacturers' Shipments, Inventories, and Orders: 1982-1995

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Summary of Revisions

GENERAL

The revisions to the historical data from the Manufacturers' Shipments, Inventories, and Orders survey, as shown in this publication, are the result of:

- Benchmarking the shipments and inventory data to the revised, drift adjusted[1], 1988-1991 Annual Survey of Manufactures (ASM); 1992 Census of Manufactures; and 1993-1994 Annual Survey of Manufactures (ASM).
- Benchmarking the defense shipments series to the 1992 MC9675, ''Shipments to Federal Government Agencies.''
- Adjusting new and unfilled orders to be consistent with the benchmarked shipments and inventory data.
- Correcting monthly data for late receipts, reclassification of reported data, and revisions to previously reported data.
- Updating the trading day adjustment factors for the shipments series.
- Updating the seasonal adjustment factors for all series, including re-evaluating options used.

Table A summarizes the results of the first three procedures for 1988 through 1994 in the form of annual level and year-to-year percent change revisions. Table B shows the revisions attributable to late or revised data, and trading day and seasonal adjustment factor updates as they affected the more recent month-to-month trends in the seasonally adjusted data. The section on Description of Adjustments of Historical Benchmark Data (1988-1991) beginning on page X includes a description of the adjustments made to the previously published 1988 through 1991 ASM data.

[1]Explained in Description of Adjustments of Historical Benchmark Data (1988-1991) beginning on page X.

SPECIFIC

Appendix F includes a discussion of the trading day adjustment methodology and an updated set of daily weights for each shipments series. The tables in appendix G provide updated diagnostic information on the characteristics and quality of the seasonal adjustment for all series. Table B indicates the effects of updating the trading day and seasonal adjustment factors, as well as correcting the monthly data for late or revised data reports, on the month-to-month percent changes for 1995 for the aggregates and major industrial categories.

DATA AVAILABILITY

In addition to this report, historical data from 1958 through 1995 are available on compact disc at a cost of $125.00. To order, contact Customer Services, Bureau of the Census, Washington, DC 20233. Data from this report are also available on the Internet; please call 301-457-4804 for the Internet address.

The monthly press releases for the M3 survey are issued around the 18th working day of the month following the statistical period for the advance report on durable goods and the 23rd working day for the full report. These are available in hard copy or by a fax transmission service, both on a subscription fee basis. To subscribe to this service, call 301-457-4832. The publication also is available on the Internet; the address is http://www.census.gov/ftp/pub/indicator/www/M3adv.html for the advance publication. The full report address is the same as above except for the ending, M3prel.html. These reports are also available the day of issue through the Department of Commerce's online Economic Bulletin Board (N-8-1) (202-482-3870) and through the Census Bureau's online information service CENDATA. CENDATA is available from Dialog Information Services, Inc. (1-800-334-2464) and CompuServe (1-800-848-8199).

Description of Survey

The Manufacturers' Shipments, Inventories, and Orders (M3) survey provides broad-based, monthly statistical data on economic conditions in the domestic manufacturing sector. The survey measures current industrial activity and provides an indication of future business trends. Data are used by the Executive Branch of the Government for developing economic, fiscal, and monetary policy; the Bureau of Economic Analysis as components of the gross domestic product estimates; and trade associations, corporate economists, and other members of the business community as an analytical tool for assessing the current and future economic condition of the country.

COMPOSITION OF INDUSTRY CATEGORIES

There are 80 separately tabulated industry categories in the M3 survey. These categories are groupings of the 459 manufacturing industries as defined in the *1987 Standard Industrial Classification (SIC) Manual*.[1] Appendix B lists these categories.

Because companies provide data on a voluntary basis, reporting in many of these 80 categories is not sufficient to warrant separate publication of the data. Consolidated reporting by some large companies also limits the quality of the data in some categories. A company which reports on a consolidated basis (entire company or a division) is included in the M3 category in which the reporting unit as a whole is classified and has no influence on the movement of the other industries which may be included in its combined report.

As a result, it has been necessary to combine the 80 industry categories into 45 publication levels for shipments and total inventories. For new and unfilled orders and inventories by stage of fabrication, it has been necessary to introduce further combinations because of the lower response rates for those items.

COMPOSITION OF THE SURVEY PANEL

The monthly M3 estimates are based on information obtained from most manufacturing companies with $500 million or more in annual shipments. In order to strengthen the sample coverage in individual industry categories, the survey includes selected smaller companies. The sources of the companies for the survey are the quinquennial censuses of manufactures and the annual surveys of manufactures in the interim years.

For firms that operate in a single M3 industry category, the reporting unit typically comprises all operations of the company. Most large, diversified companies, however, file separate reports for divisions with significant activity in different industrial areas.

The composition of each company or reporting unit of a company in the survey usually includes more than one plant or establishment and frequently includes industry activities outside the M3 category in which it is classified. The survey methodology described later in this chapter assumes that the month-to-month changes of the total operations of the reporting units classified in each industry category effectively represent the month-to-month movements of all establishments which make up the category.

In 1962, the initially selected sample for this survey included all companies with more than 1,000 employees and smaller companies selected with probabilities proportional to their employment size within each industry category. As there was some deterioration in response rates for companies with between 100 and 1,000 employees, in January 1975, the staff selected a supplemental sample of approximately 1,000 companies from the universe of companies in this size range in order to strengthen the estimates. Although the response rate was only about 60 percent for this group, beginning in January 1978 these data were added to the panel and included in the calculations of the monthly estimates. Because of poor response rates, the survey no longer included companies with less than 100 employees; instead, data for these companies were estimated by using overall industry month-to-month movements based on data reported by the larger companies.

In recent years, the size of the value of shipments of the company or reporting unit rather than the employment size has influenced the selection of companies to increase response rates. Using this criterion, census staff visit or otherwise contact large companies that did not report in the survey to request their participation or reconsideration of a previous decision not to participate. Also, staff request data for large diversified reporting companies to provide additional industry categories not previously provided.

Another method used for improving response has been contacting nonreporting companies by letter. Staff send letters on an ongoing basis to companies in industry

[1] *Standard Industrial Classification Manual: 1987.* For sale by Superintendent of Documents, U.S. Government Printing Office, Washington, DC. Stock No. 041-001-00314-2.

categories with low response rates. In 1990, staff selected a probability sample and mailed requests to about 400 midsize companies in the plastics industry. The purpose was to test the viability of probability sampling, especially in industries comprised primarily of smaller, less diversified companies.

As a result of these efforts, we increased response by adding about 45 to 55 percent of the companies contacted to the panel. However, respondent dropouts frequently offset these increases. The current coverage levels in the survey show that reported data represent approximately 55 percent of the shipments estimates at the total manufacturing level, while the individual coverage rates for the 20 two-digit major SIC industries vary from about 20 to 99 percent.

LIMITATIONS OF THE DATA

The monthly data presented in this publication are subject to both sampling and nonsampling errors. Sampling errors occur because reports are received from a sample rather than from the complete universe of manufacturing companies. Because the present composition of the panel is not based on a probability sample, the amount of sampling error cannot be quantified. Nonsampling errors, on the other hand, are attributable to many sources. The use of company or divisional reports to estimate the monthly change for establishments is one source of nonsampling error. The use primarily of large companies to represent the month-to-month movement of all companies is another potential source. In addition, response and processing errors may be present, although computer edits and analytical review of the data detect the most significant errors of this kind prior to tabulation.

MONTHLY ESTIMATION PROCEDURE

A link relative procedure derives the monthly universe estimates of shipments, unfilled orders, and total inventories for each industry category. The universe estimate for the previous month is multiplied by the monthly ratio of change tabulated for reporting companies in the current month to arrive at a universe estimate for current month.

When an individual company reports unusually large changes from the previous month, or when a particular company has unique data patterns differing substantially from the movement shown by the rest of the reporting panel in a particular industry category, the company is excluded from the ratio of change calculation but included in the universe estimate of level. The effect of this procedure is to restrict the estimation for nonrespondents and firms not in the survey panel to the general trend of the industry.

The universe estimate of new orders is derived from the monthly estimate of shipments plus the change in unfilled orders between the current and prior period. The estimate includes orders that are received and filled in the same month as well as orders that have not yet been filled. It also includes the effects of cancellations and modifications of previously reported orders.

The standard ratio estimate procedure is not followed for new orders because not all companies report new orders, and some that do report this item limit their reporting to specific products for which long lead times are required in the production cycle. These companies, in effect, exclude new orders received for products that are shipped from inventory.

A modified procedure also is used to estimate the stage of fabrication inventory data. In this procedure, the total inventory data estimated for each tabulated industry category are retabulated to the appropriate two-digit SIC major group levels and serve as control totals for the stage of fabrication data. Initial estimates are made for each of the stages of fabrication at the two-digit SIC level using the ratio estimation procedure. The differences between the sum of the stage of fabrication detail and total inventories at the two-digit SIC level are then allocated proportionally to the stage of fabrication figures to form the estimates. The reasoning behind this procedure is that a significant number of companies report total inventories but cannot report inventories by stage of fabrication.

Trading Day Adjustment

Variations in the rate of manufacturing activity resulting from different numbers of trading days in the same month for different years and variations in the length of months can be an important cause of month-to-month fluctuations in the shipments data. For many industries, these irregularities can be identified approximately and removed so that the underlying trend cycle stands out clearly.

Recent software and data processing improvements have facilitated research and implementation of unique trading day adjustment factors for each series. These improvements include refinements to the trading day analysis in the X-11 seasonal adjustment program[2], additions to diagnostic software[3] that identifies progressively unstable data patterns, and redesign of the monthly survey data processing system.

Most of the shipments series have trading day factors calculated in the trading day regression analysis routine of the X-11 software. The adjustment of 1987 to 1992 shipments used these new factors. Table F–1 of M3-1(90) shows the factors used before 1987. However, eight of the shipment series did not have identifiable trading day patterns and are only being adjusted for length of month

[2]The X-11 ARIMA Variant of Census Method II Seasonal Adjustment from Statistics Canada is the program used to calculate trading day weights and to seasonally adjust data in this publication.

[3]"Sliding Spans Diagnostics for Seasonal and Related Adjustments," Findley, Monsell, and Shulman, Bureau of the Census, Washington, DC. 1986.

variations. Appendix F comprises the set of daily weights for each shipments series and a more detailed discussion of the methodology.

Seasonal Adjustment Methodology

The monthly data are adjusted for seasonality at the most detailed level tabulated in the survey, using the X-11 ARIMA version of the Census Bureau's seasonal adjustment program.[4] The seasonally adjusted estimates for shipments, unfilled orders, and total inventories for M3 industry categories are calculated by dividing the unadjusted estimates by seasonal adjustment factors computed by the X-11 ARIMA seasonal adjustment program. Seasonally adjusted new orders are computed by adding the changes between current and prior period seasonally adjusted unfilled orders to the current month's seasonally adjusted shipments.

The inventory by stage of fabrication data are seasonally adjusted at the two-digit SIC major group level for each stage. If the sum of the adjusted stage of fabrication does not equal the major group totals resulting from summing the seasonally adjusted total inventories for the individual industries, the difference is proportionally allocated to the stage of fabrication detail.

Staff calculate seasonal factors concurrently and include the current period observation in the calculation of the seasonal factor for that month. The factors reflected in this report are based on using data from January 1982 through December 1995 for shipments, unfilled orders, and inventories. Appendix G shows reliability measures regarding the adequacy of the seasonal adjustment of specific series. For information on specific measures used in the seasonal adjustment analysis, selection of options within the X-11 program for the individual industry series, and tests for the presence of seasonality, contact the Manufacturing and Construction Division, U.S. Census Bureau, Washington, DC 20233, or call 301-457-4749.

BENCHMARK PROCEDURE

The M3 survey data are benchmarked to reduce both sampling and nonsampling errors. The relatively small monthly sample size as well as the differences that result from collecting the monthly data on a divisional basis as compared to the benchmark data on an establishment basis account for most of the revision. Also, some monthly reports received too late to be included in the monthly publications are added to improve the revised estimates of change of the historical monthly data.

The benchmarking process for this report included comparing monthly data reported by large companies with their annual data submitted in the 1992 Census of Manufactures and the 1993 and 1994 Annual Survey of Manufactures (ASM).

[4]See footnote 2.

Estimates of annual shipments and end-of-year total and stage of fabrication inventories calculated in the monthly survey were benchmarked directly to the data compiled in the quinquennial censuses of manufactures and the interim ASM's. The benchmarking also included adjusting the monthly data to the drift adjusted 1988-1991 Annual Survey of Manufactures. An explanation of this is included in the following section. The unfilled orders levels were adjusted based on changes in the ratio of unfilled orders to shipments of companies reporting in the monthly survey and the ratio of the ASM shipments estimate to the summed monthly survey data. Since new orders are defined as the change in unfilled orders between the current and prior periods plus the current period shipments, implicit benchmark estimates for new orders were derived.

DEFINITION OF TERMS

Value of Shipments

The value of shipments data in the M3 survey represents net selling values, f.o.b. plant, after discounts and allowances and excluding freight charges and excise taxes. The ASM uses the same definition. However, the data reported in the two surveys frequently are not equal because of differences, discussed earlier, in the reporting unit. For multiestablishment companies, the M3 reports typically are company- or divisional-level reports that encompass groups of plants or products. The data reported are usually net sales and receipts from customers and do not include the value of interplant transfers. The reported sales are used to calculate month-to-month changes which bring forward the universe estimates developed from the ASM.

The value of products made elsewhere under contract from materials owned by the plant is also included in shipments as well as receipts for contract work performed for others, resales, miscellaneous activities such as the sale of scrap and refuse, installation and repair work performed by employees of the plant, and the receipts for research and development performed at the plant.

In the shipbuilding industry, the value of work done in a given year varies considerably from the value of shipments because of the long lead time between the start and completion of a large vessel. In both the annual survey and the M3, the value of work done during the year, rather than the value of shipments, is requested. The same procedure is followed for aircraft produced on a cost-plus contract. Aircraft produced on a fixed-price contract are reported in the usual manner when the products are shipped. Where value of work done is reported in place of shipments, the work-in-process inventories are normally charged to the customer as costs are incurred and are not accumulated as finished goods inventories by the shipyard or the aircraft producer.

The value of shipments figures developed from the ASM contain duplication at the M3 industry category and higher level aggregates, since the products of some four-digit SIC

industries are used as materials by other industries within the same M3 industry aggregate. The significance of the duplication within the specific M3 industry categories varies depending on their four-digit industry composition. It is most pronounced in a few highly integrated industry areas, such as primary metals and motor vehicles and parts.

INVENTORIES

Inventories in the M3 survey are collected on a current cost or pre-LIFO (last in, first out) basis. Because different inventory valuation methods are reflected in the reported data, the estimates differ slightly from replacement cost estimates. Companies using the LIFO method for valuing inventories report their pre-LIFO value; that is, the adjustment to their base-period prices is excluded.

In the ASM, inventories are collected according to this same definition. However, there are discontinuities in the historical data in both surveys. Until 1982, respondents were asked in the ASM to report their inventories at book values; that is, according to whatever method they used for tax purposes (LIFO, FIFO, and so forth.) Because of this, the value of aggregate inventories for an industry was not precise. Effective with the 1982 Census of Manufactures, instructions for reporting inventories changed. LIFO users were asked to report inventories prior to the LIFO adjustment, as well as the LIFO reserve and the LIFO value after adjustment for the reserve. Because of this change, the 1982 census data for inventories were published on both bases. Inventory data in subsequent ASM's are available only on a pre-LIFO basis, with no book value estimates comparable to the earlier data.

This change in instructions for reporting current cost inventories was carried to the monthly survey beginning in January 1987. The data for 1982 to 1987 were previously redefined (but not recollected) on a pre-LIFO or current cost basis. As described in the section on benchmarking methodology, the procedure used in adjusting these monthly estimates from a book-value basis to the pre-LIFO levels used the pre-LIFO end-of-year levels from the ASM as constraints and the same general procedure for minimizing revisions to the month-to-month change in the monthly book-value data .

Inventory data are requested from respondents by stage of fabrication; that is, finished goods, work in process, and raw materials and supplies. There are several limitations to the quality of these data for two reasons. First, response to the stage of fabrication inquiries is lower than for total inventories because all companies do not keep their data monthly at this level of detail; those companies which do maintain monthly detailed records frequently do not have data for all three stages of fabrication or have quantity (physical volume) data only. Second, a product considered to be a finished good in one industry, such as steel mills shapes, may be reported as a raw material in another industry, such as stamping plants. Therefore, within the two-digit SIC major groups the same type of inventory may be included under different stage of fabrication categories. Like total inventories, stage of fabrication inventories are also benchmarked to the ASM pre-LIFO data, but the stage of fabrication data are benchmarked at the two-digit major group level.

NEW ORDERS RECEIVED AND UNFILLED ORDERS

New orders, as reported in the monthly survey, are net of order cancellations and include orders received and filled during the month as well as orders received for future delivery. They also include the value of contract changes which increase or decrease the value of the unfilled orders to which they relate. Orders are defined to include those supported by binding legal documents such as signed contracts, letters of award, or letters of intent, although in some industries this definition may not be strictly applicable. In the case of letters of intent, the full amount of the sales value is included if the parties are in substantial agreement on the amount; otherwise, only the funds specifically authorized to be expended are included.

Unfilled orders include orders (as defined above) that have not been reflected as shipments. Generally, unfilled orders at the end of the reporting period are equal to unfilled orders at the beginning of the period plus net new orders received less net shipments.

DESCRIPTIONS OF ADJUSTMENTS OF HISTORICAL BENCHMARK DATA (1988-1991)[5]

The goal of the ASM is to produce estimates that represent the portion of the manufacturing universe of establishments with paid employees. During census years, ASM estimates generated from the same data set have typically been low in comparison to the census data. In 1987 and 1992, the ASM estimates for shipments at the all manufacturing level were 2.0 and 3.5 percent lower than the census values, respectfully. For 1992, the initial ASM estimate for shipments was approximately 3.7 percent lower.

Preliminary analyses of the 1992 Census of Manufactures data also suggested that the 1988-91 ASM estimates understated the true levels. An interagency task force, comprised of representatives from the Bureau of Economic Analysis (BEA), the Federal Reserve Board (FRB), and the Census Bureau, was formed to investigate this issue and provide recommendations. After examining the evidence, the consensus opinion was that the understatement in the ASM estimates from 1988-91 was sufficient to warrant a revision to the ASM historical time series. The task force

[5]See appendix H for a description of the annual survey of manufactures methodology.

recommended that the ten general statistics (GS) variables published in the *Statistics for Industry Groups and Industries* publication (AS-1) be revised for 1988-91.

The major factors contributing to this decision were as follows:

1. The classification of new single-establishment companies continued to be a problem between 1988 and 1992. The number of totally unclassified companies in our master universe file grew significantly through 1991 and then declined sharply in 1992 due to special census processing. A portion of these unclassified companies became classified as manufactures for the first time in 1992, despite having been in operation for up to 4 years. These cases were not represented in the originally published ASM estimates for 1988-91 because of their lack of classification. In addition, it appeared that a significant number of new manufacturing companies were initially classified as nonmanufacturing and, therefore, not subjected to our birth supplementation. Beginning with the 1993 ASM, we have introduced procedures to address both these issues.
2. The 1992 ASM was processed within the census survey processing system. While similar to the regular ASM processing system, there were subtle differences in data collection, editing, imputation, and analyst review that could not be totally eliminated. Hence, the 1992 ASM estimates were not totally comparable to the 1988-91 ASM estimates. It is believed that the understatement in the 1992 ASM estimates because of processing differences to be between 1 and 1.5 percent. For the 1997 ASM, we are redeveloping components of the processing system.
3. The originally published 1989 ASM estimates appeared to be uniformly low in comparison to other comparable time series and our own internal analysis. This suggests that the original 1989 ASM sample was not as representative as expected or that there were undetected operational errors in producing the estimates.
4. As with all sectors of the economy, the manufacturing sector is continually changing. Despite tightly controlled procedures for maintaining the ASM sample, some deterioration in coverage and representation was unavoidable.

   The revised estimates for 1988-91 were derived from a series of distinct steps. Essentially, a ''smoothing'' procedure was used to allocate the difference between the 1992 ASM estimates and the corresponding census values over the 5 year span. However, before applying this procedure, revised ASM estimates for 1989 and 1992 were developed to address problems 2 and 3 described above.

Generating Revised 1989 Estimates

The 1989 ASM estimates were separated into industries for which the ASM estimates reliably represented the population and industries for which the estimates were suspect. In the suspect industries, the change from 1987 to 1989 was re-estimated using the information reported by establishments in these 2 years. A change ratio estimator was used rather than the difference estimator usually used for ASM estimation. This procedure was not as rigorous as the usual estimator but offered the advantage of not being as sensitive to the factors that were felt to have caused the original understatement. After the re-estimation, the total value of shipments for all manufacturing industries in 1989 was 0.8 percent higher than originally published.

Adjustment to 1992 ASM Estimates

As noted above, the initial 1992 ASM estimates were compiled by the census processing system rather than by the usual ASM system. The initial difference between the 1992 ASM estimate of shipments and the census value was approximately 3.7 percent. At the four-digit SIC level, an estimate of the processing bias was determined, and the initial 1992 ASM estimates were adjusted accordingly. This adjustment was made to improve the comparability between the 1992 and the 1988-91 ASM estimates. The adjustment procedure raised the initial 1992 ASM estimate for shipments approximately 1.6 percent, thereby reducing the understatement of the 1992 ASM estimate of shipments to approximately 2.1 percent at the all manufacturing level. Similar differences existed between the 1992 ASM estimates of the other general statistics variables and the 1992 census values.

Historical Revision

This 2.1 percent underestimate of the census by the 1992 ASM is defined as the ''drift'' and is felt to be an accurate measure of the cumulative degradation of the quality of the estimates due to erosion in the representativeness of the sample and processing error. To improve the historical ASM time series, the difference between the adjusted 1992 ASM estimate and the census value was computed for each GS variable at specific industry group levels. This difference was divided by five and the result added to the industry group level estimate for that variable for 1988. Twice the difference was added to the re-estimated industry group level estimate for 1989. Three times the difference was added for 1990 and four times the difference for 1991. Revised estimates for other variables and for other levels of aggregation (geographical) were not calculated. The percentage revision in each variable for each year was calculated for each industry group level and that percentage revision was made to each four-digit SIC within the industry group.

The chart below shows the ASM originally published inventories and shipments estimates at the total manufacturing level and the comparable estimates after the adjustment process for 1988-91. The 1987 and 1992 values represent census statistics, not ASM estimates.

Finally, the complete set of 1993 ASM general statistics and product class estimates have been revised. They were revised to reflect late data corrections made to both the 1992 census and 1993 ASM data resulting from the review of the 1994 survey data.

Year	End-of-year inventories (billion dollars)		Value of shipments (billion dollars)	
	Published	Adjusted	Published	Adjusted
1992	374.9	374.9	3,004.7	3,004.7
1991	379.9	387.1	2,826.2	2,878.2
1990	392.5	397.9	2,873.5	2,912.2
1989	380.5	384.5	2,792.7	2,840.4
1988	361.5	363.3	2,682.6	2,695.4
1987	332.6	332.6	2,475.9	2,475.9

QUALIFICATIONS OF THE DATA

The estimates developed from the sample are apt to differ somewhat from the results of a survey covering all companies in the sample lists but otherwise conducted under essentially the same conditions as the actual sample survey. The estimates of the magnitude of the sampling errors (the difference between the estimates obtained and the results theoretically obtained from a comparable, complete-coverage survey) are provided by the standard errors of estimates.