Industrial Production and Capacity Utilization

Performance Evaluation of the Federal Reserve G.17 (419) Statistical Release

June 2011

Industrial Output Section
Division of Research and Statistics
Board of Governors of Federal Reserve System
Washington, D.C. 20551

Report Submitted to the Office of Management and Budget,
pursuant to Statistical Policy Directive No.3 for the Federal Reserve
G.17 (419) Statistical Release, Industrial Production and Capacity Utilization, a
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I.   OVERVIEW

The Federal Reserve statistical release "Industrial Production and Capacity Utilization" G.17 (419) is published monthly, about 15 days after the reference month ends; for example, preliminary estimates for May are released in mid-June. The release reports monthly measures of output (IP) for major market and industry groups in the industrial sector; monthly measures of capacity and capacity utilization for major industry groups are provided as well. More detailed industry data for these indicators are published concurrently in a supplement to the G.17. Data from both the G.17 and the supplement to the G.17 are made available online through the Federal Reserve's Data Download Program. The Federal Reserve defines the industrial sector as the manufacturing, mining, and electric and gas utilities industries. The component IP and capacity indexes are aggregated into market and/or industry groups with weights that are derived from their proportion in the total value added of all industries. The production and capacity indexes are expressed as percentages of output in 2007. The release also includes gross values of industrial products expressed in billions of chained (2005) dollars, diffusion indexes of industrial production, and supplementary data on motor vehicle assemblies in millions of units. (A copy of a recent release and the supplement are provided as attachments.)

        The production indexes and utilization rates are widely reported in the media and are used by analysts in government, businesses, and universities to follow current developments and trends in real output and operating rates in the industrial sector. The production indexes are also used by the Bureau of Labor Statistics (BLS) to estimate manufacturing productivity and by the Bureau of Economic Analysis (BEA) to estimate investment in computers for the national income and product accounts.

        Since mid-2008, when the Federal Reserve last reported to the Office of Management and Budget (OMB) on the G.17 statistical release, the methods for estimating a number of industrial production indexes and capacity series were changed in response to either the availability of new data or the discontinuance of previous data

sources.[1] In addition, the 2010 revision rebased the output and capacity statistics to a new reference year; these measures are now expressed as percentages of output in 2007 instead of 2002.

The annual revision issued in 2008 incorporated annual benchmark data for manufacturing production from the 2006 *Annual Survey of Manufactures* (ASM). In 2009, an annual revision that used detailed benchmark data from the *2007 Census of Manufactures* (COM) could not have been issued until at least the fourth quarter of 2009 due to the timing of the release of the COM. Instead, an annual revision was issued in March 2009 that incorporated a variety of methodological changes and comprehensive annual data for other sectors, and the release of the annual revision in 2010 was delayed until late June so that complete data from 2008 ASM would be available for inclusion, as well as revisions and industry totals from the 2007 COM. Data from the 2009 ASM were incorporated in 2011, and the annual revision release date returned to late March of that year.

Although it did not incorporate any new comprehensive annual data for manufacturing, the annual revision issued in early 2009 did feature the incorporation of the detailed input-output tables for 2002 that had been issued by the BEA in September 2007. The input-output tables are used to refine the industrial composition of the stage-of-process production aggregates as well as the IP market group aggregates. In particular, the use table of the input output system provides information on the purchaser of a product. The market group for a product depends on whether it is sold to a final demand or is an intermediate, while the industries that purchase an intermediate are fundamental to its allocation into a multi-level stage-of-process system. The revision also updated the method used to estimate the effect on manufacturing output of changes in employment for the temporary help supply industry. The methods and source data for a number of IP indexes covering high-technology goods, aircraft, and carpeting were also modified in the 2009 revision.

In addition to incorporating comprehensive source data for 2007 and 2008, the annual revision issued in 2010 introduced a revised method for interpolating monthly

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1. A description of the current methodology for estimating industrial production indexes is described beginning on page 59.

indexes from quarterly source data for data network equipment along with some new data for high-technology industries and glass products. The source data for four series, however, were changed to production-worker hours, primarily because of the discontinuance of the product data that were used previously. In addition, with the release of the benchmark data on employment by the BLS in February 2010, significant amounts of industry detail on production-worker hours was discontinued. Employment data, however, generally remained available for most detailed industries so those data were used to allocate the more aggregate production-worker hour measures to the more detailed industries published in IP. These changes were folded into the estimates for the February 2010 release of the G.17. The annual revision issued in March 2011 featured relatively few changes in methods or source data.

No major changes to the capacity and utilization measures were implemented since late 2008, but the source data for several series were changed and capacity estimates were developed for components of a couple industries. In the 2009 annual revision, the source data underlying the capacity estimates for electric utilities (NAICS[2] 2211), nonferrous metals except aluminum (NAICS 3314), and natural gas extraction (NAICS 211111 part) were changed. In the revision published in 2010, detailed capacity indexes were developed for veneer, plywood, and engineered wood products (NAICS 3212); other wood products (NAICS 3219); alkalies and chlorine (NAICS 325181); and basic inorganic chemicals excluding alkalies and chlorine (NAICS 32512-7, 325182, and 325188). Previously capacity indexes were only constructed for plywood and miscellaneous wood products (NAICS 3212 and 3219) and for basic inorganic chemicals (NAICS 32512-8).

With regard to publications and other user services, the pages for the G.17 on the Board's website were given an updated style in early 2011 and access to historical releases was improved.

Supplements to the G.17 that described revisions were issued on March 27, 2009, June 25, 2010, and March 25, 2011. Subsequently, an article in the *Federal Reserve Bulletin* expanded the description of the 2009 revision and an article posted on the G.17 pages of the Board's website discussed the 2010 revision more extensively

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2. North American Industry Classification System.

Announcements about the annual revisions to the G.17 appear at least three months before the publication of the revised data in each year. Besides the regular annual revisions, users were notified in the G.17 of any significant interim changes, such as any midyear updating of seasonal factors or capacity indexes; notifications are now also provided online via RSS feeds.

For each annual revision, the new data and updated documentation were available at the time of issue on the website of the Federal Reserve Board. On a monthly basis, the G.17 release is also available on the website of the Federal Reserve Board. The G.17 was also posted on the STAT-USA site of the Department of Commerce until it was closed down in October 2010. Print copy and physical computer-readable media of the revised data are available upon request.

II.   CHANGES IN INDEXES SINCE JUNE 2008

II.A.   *Changes to the Methodology for Adjusting for Temporary Help Supply Employees*

The compilation of the initial IP estimate for a given month relies heavily on the hours worked by production workers in the manufacturing sector when the availability of the other IP source data is limited. The hours data are adjusted to account for the labor input of temporary help supply (THS) employees who work in the manufacturing sector; this adjustment is necessary because these workers are on the payrolls of companies that are classified in the service sector of the economy by the BLS. These adjusted detailed hours series are used in making (1) estimates for those IP series based on labor input for the period for which benchmark output indexes are not yet available and (2) preliminary estimates of those IP series based on physical product data for which the current source data are not yet available.

The procedure for implementing this adjustment is as follows. An estimate is made of the component of THS employment that is allocated to manufacturing. This estimate begins with a baseline figure projected from the Current Population Survey but varies based on the cyclical movements of the manufacturing sector and the rest of the economy—THS employment has a cyclical pattern similar to that of manufacturing.[3]

The THS employment in manufacturing is then allocated among the NAICS three-digit industries based on each industry's use of THS workers as reported in the Census Bureau's Annual Survey of Plant Capacity (ASPC) and on each industry's cyclical patterns. With this revision, the allocation of THS employment among industries within manufacturing was updated based on data from the ASPC for 2002 through 2005.[4]

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3. See Marcello Estevão and Saul Lach (1999), "Measuring Temporary Labor Outsourcing in U.S. Manufacturing," Finance and Economics Discussion Series 1999-57 (Washington: Board of Governors of the Federal Reserve System, October), www.federalreserve.gov/pubs/feds/1999/index.html.

4. For several years, the ASPC collected information about the share of production-workers that consisted of temporary workers; this information is not collected in the Quarterly Survey of Plant Capacity, which replaced the ASPC in 2007.

The 2009 annual revision updated the method for estimating each industry's monthly baseline share of temporary help employment use in manufacturing. Previously, this share was held constant for each industry at the level estimated according to the method just described. With the 2009 revision, the share is allowed to evolve based on the industry's share of total manufacturing employment. THS employment is multiplied by assumptions on hours worked and on the productivity of a THS worker relative to a permanent worker to estimate the effective hours contributed by THS workers for each three-digit manufacturing industry. The THS hours are added to the reported production-worker hours for each industry to produce an adjusted production-worker hour series. The percentage adjustment for each three-digit industry's hours is then applied to the hours series for each of its component industries.

II.B.   *Adaptation to Less Detailed Production-Worker Hour Data*

In February 2010, the BLS issued a benchmark revision to their employment report. The report included new estimates of overall hours worked for many industries, but data on production worker hours for numerous detailed industries were discontinued. Prior to the benchmark revision, the Federal Reserve would receive from the BLS production-worker hour data for 327 industries (at all levels of aggregation), while after the revision data were only available for 217 industries. Most of the industries for which data were discontinued were at the 5-digit NAICS level or below. Production-worker hour data were discontinued for 7 out of the 89 4-digit industries that were previously available, but data were discontinued for 103 of the 213 5-digit NAICS and below industries that had previously been received.

The loss of the production-worker hour data for many detailed industries mainly did not carry over to overall employment data. After the benchmark revision, overall employment was still available for all but 24 of the industries for which data on production-worker hours were discontinued. The more detailed employment data was used in a two-step process to estimate production-worker hours at the detailed level necessary for IP. First, the employment data was used to extrapolate the discontinued detailed production-worker hour series. Second, the still-available more-aggregate production-worker hour series were shared out to their components based on shares from

the extrapolated detailed series.

II.C.   2002 Input-Output Data

The outputs of most industries are inputs to multiple markets. Although data that directly split the output of an industry by its purchaser are sometimes available, most industry output measures do not provide that detail. With the 2002 annual revision, weights that allocate individual IP indexes into multiple market groups were derived from the 1997 input-output tables from the BEA.[5] With the 2009 annual revision, the weights for 2002 were updated using estimates for the 2002 input-output tables; years subsequent to 2002 were assumed to have weights identical to those for 2002. The weights for the period up through 1997 were still computed from the 1997 tables, and the weights between 1997 and 2002 were linear combinations of the 1997 and 2002 weights.

II.D.   Improvements to the Production Indexes for Communications Equipment

The annual revision issued in 2009 included the incorporation of additional detail into the price indexes for two product classes of communications. The price index for enterprise and home voice equipment (part of NAICS 33421) was updated. A price index for telephones and answering machines, one of the two product categories in this industry, was previously calculated using average selling prices for two types of phones (corded and cordless) but became a matched-model index constructed using detailed data, beginning in 1997, from the Consumer Electronics Association on transmission frequency, number of lines, and presence of other features such as caller identification, speakerphone, and integrated answering machine. The price index for wireless system equipment (part of NAICS 33422), which covers mobile phone infrastructure, was improved by folding in additional detail on base-station radio transmission capacity using data from the Dell'Oro Group, a market research firm. The resulting mobile infrastructure price index fell 4 percentage points faster per year, on average, from 2000 to 2008.

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5. See Carol Corrado (2003), "Industrial Production and Capacity Utilization: The 2002 Historical and Annual Revision," *Federal Reserve Bulletin,* vol. 89 (April), pp. 151-76, www.federalreserve.gov/pubs/bulletin/2003/03index.htm.

The annual revision issued in 2010 featured the incorporation of quarterly data on nominal shipments at the detailed product level from the Census Bureau's relevant Current Industrial Reports (CIR) from 2007 forward for each of the six product-based indexes for communications equipment. The quarterly CIR for communications equipment began in 2006 and in 2010 had enough history available to incorporate these data on a seasonally adjusted basis. Real output indexes are computed by dividing the nominal shipments data for each of the six product groups by price indexes that are constructed or are taken from other sources. Previously, four of the six communications equipment output indexes had used data from other sources on nominal domestic absorption (shipments less net exports) combined with price deflators constructed from detailed product information, and the other two indexes had been based on production-worker hour data. Nominal CIR shipments more closely reflect domestic output, and by using these data, we get a more accurate measure of U.S. production than with the data on domestic absorption.

II.E.   Revised Interpolation Method for Data Network Equipment

The incorporation of the data from the CIR for communications equipment required a methodological change in the procedure used in IP for smoothly interpolating monthly indexes from quarterly data. Quarterly data from the 2007 CIR for communications equipment indicated that the output of data networking equipment dropped more than 85 percent between the second and third quarters of 2007 (not at an annual rate), as manufacturers moved their operations abroad. The standard procedure for smoothly interpolating a monthly IP series from a quarterly IP series did not handle this dramatic drop well and produced a monthly series for data networking equipment whose index value was negative for one month.

For the typical series that is based on quarterly physical product data, a seasonally adjusted quarterly output index is computed from a quarterly indicator and then interpolated to a monthly frequency using a cubic spline. For series that also have a monthly indicator, the ratio of the quarterly output index to the quarterly average of the seasonally adjusted monthly indicator is converted to a monthly frequency using a cubic spline. The resulting monthly series is then multiplied by the monthly indicator to

construct the final monthly index. For series that have no monthly indicators, such as data networking equipment, the interpolation assumes the monthly indicator is a constant.

Because the results of this procedure were unacceptable in the presence of the large drop in IP for data networking equipment, the interpolation procedure for this product was changed to a two-step process. First, an initial interpolation of the logarithm of the quarterly index was computed in the same fashion as in the previous paragraph. Second, the exponent of the interpolated series was used as a monthly indicator for interpolating the original quarterly series. The resulting series showed smaller percentage swings around the large downturn and did not venture into negative territory.

II.F.   *Improvements to the Production Indexes for Computers*

With the 2009 annual revision, a change to the method for estimating the domestic shipments share of domestic absorption in electronic computer manufacturing (NAICS 334111) was introduced. The six product-based indexes for computer manufacturing are derived from quarterly data on nominal domestic absorption from International Data Corporation (IDC), an industry research group. For each product, an estimate of the domestic shipments share of domestic absorption—derived from the Census Bureau's CIR for computers and peripheral equipment—was used to convert the IDC domestic absorption data to a domestic shipments concept.[6]

The domestic shipments share for each of the six indexes was constructed by dividing the relevant annual measure of domestic product shipments from the CIR by the corresponding measure of annual domestic absorption from IDC. Each of these shares is converted to a quarterly frequency and projected forward for more-recent quarters when the CIR data are not yet available. Prior to the 2009 revision, projections of the individual domestic shipments shares were based on monthly data on foreign trade in computers from the Census Bureau. Specifically, domestic absorption for the industry (NAICS 334111) was adjusted by net exports to obtain domestic shipments; the change in the ratio of domestic shipments to domestic absorption was applied to the shipments

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6. Prior to 2006, the CIR for computers and peripheral equipment was released annually. Beginning in 2006, the Census Bureau began to issue quarterly reports along with annual summaries. For the construction of the domestic shipments share for 2006 onward, the Federal Reserve used only the annual summaries, not the quarterly reports.

share for each of the six product indexes. With the 2009 revision, the foreign trade data were no longer used. Instead, the CIR-based individual domestic shipments shares were extended out with a model-based trend for quarters when the annual CIR data are not yet available. Examination of all relevant data sources suggests that the shares derived from model-based trends lead to more-accurate measures of domestic production than the shares derived from trade data.

The annual revision issued in 2010 based the production indexes for computer storage device and computer terminal manufacturing (NAICS 334112 and NAICS 334113) and for other computer peripheral equipment manufacturing (NAICS 334119) on nominal shipments data from the Census Bureau's quarterly CIR for computers deflated by the relevant BLS producer price indexes for 2007 to the present. As with the CIR for communications equipment, the CIR for computers was introduced in 2006, and the data now have enough history to be seasonally adjusted. Previously, the IP indexes for these series were based on statistical models that predicted changes in output based on changes in the production of personal computers and of servers.

The 2011 revision featured updates to the methods used to calculate four IP series for computers (business desktop computers, consumer desktop computers, business mobile computers, and consumer mobile computers). These four IP series are all components of NAICS 334111. The source data for computers come from IDC and measure quarterly domestic absorption of computers. Up through the third quarter of 2009, the Federal Reserve received detailed information on the absorption of desktop and mobile computers by businesses and by consumers. Beginning with the fourth quarter of 2009, the Federal Reserve acquired information on absorption of only total desktops and total mobiles but did not acquire detailed information on the business and consumer components for these platforms.

With the issuance of the annual revision in Spring 2011, a new method was introduced to calculate the share of total desktops (or mobiles) that should be attributed to business absorption and the share that should be attributed to consumer absorption. Data from the BEA's national income and product accounts for consumer and business spending on computers were used to extend the business and consumer shares of computer output beyond the end of the IDC data. A strong historical relationship exists

between the business and consumer splits in the IDC data and the ratio of personal consumption expenditures on computers to business expenditures on computers.

II.G.   *Improvements to the Production Indexes for Semiconductors*

The source data for the price index for MOS (metal-oxide semiconductor) memories (NAICS 334413, part) was changed with the annual revision issued in 2010. Within semiconductors, the output index for other MOS memories is constructed from nominal domestic absorption data deflated by a matched-model price deflator that is built from detailed product information from the Semiconductor Industry Association (SIA). Previously, the price deflator for this index was constructed from product data from iSuppli that were discontinued. .

With the revision issued in 2010, the translation of worldwide sales data to U.S. production for most types of semiconductors for 2007 and after was also changed. As in previous years, the index for the production of semiconductors was based on worldwide sales data from the SIA, adjusted for net trade using a domestic production share estimated from various government and industry sources. Prior to 2007, shares for most products with the exception of microprocessor units (MPUs) were based on data from CIRs issued by the Census Bureau; shares for MPUs were based on private data on capacity and location for specific plants. Because of the difficulty of aligning the product detail provided in the CIR for 2007 and 2008 with total industry output reported by the *Annual Survey of Manufactures* (ASM) for those years, information on plant capacity and location formed the basis for the domestic production shares for all semiconductor product classes.

II.H.   *Changes to Other Individual IP and Capacity Series*
Since 2008, significant changes to a number of other individual IP series have been introduced, most of which resulted from the development of new or improved direct measures of production for specific industries.

Introduced in the 2009 Annual Revision:[7]

New source data for the output measures for the following products:

Carpet and Rug Mills (NAICS 31411): The index for carpet and rug mills (NAICS 31411) is based on quarterly data on unit shipments from the Carpet and Rug Institute with a model-based inventory adjustment.[8] Formerly, it was based on monthly data from the same source. A cubic spline is used to interpolate monthly values from the quarterly figures, a method similar to that used for the other series for which only quarterly physical product data are available.[9]

Civilian Aircraft (NAICS 336411): With the 2009 revision, a change to the methods used for the calculation of the index of industrial production for civilian aircraft (part of NAICS 336411) was introduced. Production in the civilian aircraft industry is estimated by combining data on aircraft deliveries with an assumption about the time required to build a plane and the intensity of activity during that period. Previously, the production index for aircraft was based on a 10-month build period, during which 43 percent of production was assumed to have occurred in the three months immediately before the delivery and 57 percent was assumed to have occurred in the seven preceding months. Based on discussions with contacts in the aircraft industry, the new indexes assume a shorter build period. Specifically, they now assume that commercial aircraft take either two or three months to build. The new assumptions were applied to the entire history of aircraft models that are still in production; the data for models that are no longer in production were left unrevised.

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7. Anne Hall, "Industrial Production and Capacity Utilization: The 2009 Annual Revision," *Federal Reserve Bulletin*, vol 95, 2009, pp. A125–A145.

8. Factory production is calculated as shipments plus the change in factory inventories. When only shipments are available, a model-based inventory adjustment is applied. See Charles Gilbert and Kimberly Bayard (2005), "Industrial Production and Capacity Utilization: The 2004 Annual Revision," *Federal Reserve Bulletin*, vol. 91 (winter), pp. 9-25, www.federalreserve.gov/pubs/bulletin/2005/05index.htm.

9. Richard D. Raddock (1993), "Industrial Production, Capacity, and Capacity Utilization since 1987," *Federal Reserve Bulletin*, vol. 79 (June), pp. 590-605.

Data sources for the following capacity series were also changed:

Electric utilities (NAICS 2211): With the 2009 revision, the capacity index for electric power generation, transmission, and distribution was based on generation capability data from the Department of Energy (DOE); previously it was based on electricity generation capacity data from the North American Electric Reliability Corporation (NERC). The change was made because the DOE data are compiled using a more consistent definition over time. However, because the DOE data are published with a lag, the capacity projection for the most recent year or two is estimated by extending the DOE generation capability series by the rate of change shown for the NERC electricity generation capacity data.

Nonferrous metals (except aluminum) (NAICS 3314): With the 2009 revision, the capacity index for nonferrous metal (except aluminum) production and processing was based on copper smelting, copper refining, and zinc smelting data from the U.S. Geological Survey (USGS). Formerly the capacity index was based on the USGS data on just copper smelting and copper refining.

Natural gas extraction (part of NAICS 211111): Because the DOE discontinued publication of physical capacity estimates for natural gas extraction, the basis for capacity estimates for recent years was changed to trend-through-peak estimates of capacity using the IP index and output projections from the Short-Term Energy Outlook (STEO) and Annual Energy Outlook (AEO) reports of the DOE.

Introduced in the 2010 Annual Revision:[10]

Discontinued product data that had been used as monthly output indicators for several IP indexes were replaced by production-worker hours for 2007 forward. The industries

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10. Maria Otoo (2011), *Industrial Production and Capacity Utilization: The 2010 Annual Revision* (Washington: Board of Governors of the Federal Reserve System, April), www.federalreserve.gov/releases/g17/articles/revision_2010_article.htm.

affected were industrial gas manufacturing (NAICS 32512), electric housewares and household fan manufacturing (NAICS 335211), and household vacuum cleaner manufacturing (NAICS 335212). In addition, production-worker hours replaced physical product data as the indicator for the IP index for audio and video equipment manufacturing (NAICS 3343) because of changes in the concentration of domestic production. The previous physical product data source for this index predominantly covered sales of products such as digital televisions. Newly available information from the COM indicated that these products now represent a smaller fraction of domestic production (about 20 percent in 2007 and 2008 compared with about 40 percent between 2002 and 2006). Consequently, the production-worker hours were able to provide a more accurate indicator of output.

With this revision, a new product indicator was developed for:

Glass Containers (NAICS 327213): The basis for the index for glass containers was changed to monthly data on unit production from the Glass Packaging Institute (GPI). Formerly, this index was based on monthly data from the Census Bureau's CIR for glass containers, which was discontinued after December 2008. The GPI data begin in January 2008, and the year of overlap was used to raise the GPI data to the CIR level going forward. In 2008, the level of production shown by the CIR was about 14 percent higher than the level reported by the responders to the GPI survey, but otherwise the two series showed very similar monthly movements.

New capacity measures were introduced for the following industries:

Plywood and Miscellaneous Wood Products (NAICS 3212 and 3219): The capacity index for plywood and miscellaneous wood was split into two series— veneer, plywood, and engineered wood product (NAICS 3212) and other wood products (NAICS 3219)—from 1987 onward. The capacity indicator for veneer, plywood, and engineered wood products is particleboard capacity and fiberboard

capacity, both from the Composite Panel Association. The capacity indicator for other wood products is based on utilization rates from the Census Bureau's

Basic Inorganic Chemicals (NAICS 32512-8): The capacity index for basic inorganic chemicals (NAICS 32512-8) was split into two series—alkalies and chlorine (NAICS 325181) and basic inorganic chemicals excluding alkalies and chlorine (NAICS 32512-7, 325182, and 325188). The capacity indicator for alkalies and chlorine is chlorine capacity from the Chlorine Institute. The capacity indicator for basic inorganic chemicals excluding alkalies and chlorine is based on utilization rates from the Census Bureau's Quarterly Survey of Plant Capacity (QSPC).

Introduced in the 2011 Annual Revision:

With most of the work in this revision related to high-technology industries, no other new product indicators were developed, but discontinued product data used as an indicator for the output of aluminum foundries (NAICS 331521,4) were replaced production-worker hours from 2007 forward.

II.I. Dissemination of Data

The Board's public website meets the requirements of section 508 of the Rehabilitation Act of 1973 (amended). Section 508 requires federal agencies to provide comparable access to persons with disabilities (both employees and members of the public) to electronic and information technology developed, procured, maintained, or used by the agency unless an undue burden would be imposed on the agency. Electronic and information technology is broadly defined and covers web pages.

Two noteworthy features were added to the Board's electronic dissemination of the G.17 since 2008. First, with the release of the G.17 release in October 2010, the announcement distributed through RSS (Really Simple Syndication) began to include the summary paragraph from the release. That paragraph highlights the rates of change for total IP and the major industry aggregates for the latest month, any substantial revisions

to IP for previous months, the rate of change of total IP for the past 12 months, and the capacity utilization rate in the latest month. It also may note unusual events such as hurricanes and strikes that affected IP in recent months. Second, in December 2010, the Data Download Program provided a tool to create customized charts from the data available through the program. In addition to the new features providing enhanced capabilities for users, redesigned web pages that provided a more up-to-date look for the G.17 were introduced with its release in the April 2011.

The web page with the current release of the G.17 in html format averaged about 18,000 hits per month in 2009, about 13,000 hits per month in 2010, and about 9,000 hits per month through the first three months of 2011. With the widespread availability of the G.17 release and its data in electronic form, the number of releases mailed for the public has continued to shrink and is now 19 per month (11 paid and 8 for free). Three years ago, 36 releases were mailed; more than 1,500 monthly G.17 releases were mailed to subscribers as few as 15 years ago.

We continued to provide the G.17 to the Department of Commerce's STAT-USA website (www.stat-usa.gov) until that site was closed in late 2010.

III.   REVISIONS

III.A.   Annual Revisions since June 2008

Supplements to the G.17 that describe revisions were issued on March 27, 2009, June 25, 2010, and March 25, 2011. The description for the first revision, in expanded form, was subsequently published as an article in the on-line *Federal Reserve Bulletin* in August 2009. The expanded description for the second revision was published as a staff paper on the Board's public website in April 2011. Because, the revision published in 2011 primarily featured the incorporation of another year of benchmark data, an expanded version of its description is not necessary. Announcements about the revisions appeared in the G.17 before and after publication of the revised data.[11] For example, in the monthly G.17 releases from September 2008 through December 2008, the announcement of the upcoming annual revision was as follows:

> The Federal Reserve Board plans to issue its annual revision to the index of industrial production (IP) and the related measures of capacity utilization in late March of 2009. The revised IP indexes will incorporate data from selected editions of the U.S. Census Bureau's 2007 Current Industrial Reports. Detailed data from the 2007 Economic Census, however, are not expected to be available. Annual data from the U.S. Geological Survey regarding metallic and nonmetallic minerals (except fuels) for 2007 will also be incorporated. The updating will include revisions to the monthly indicator (either product data or input data) and to seasonal factors for each industry as well as changes in the estimation methods for some series. Any changes to the methods for estimating the output of an industry will affect the index from 1972 to the present.
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> Capacity and capacity utilization will be revised to incorporate data from the Census Bureau's Quarterly Survey of Plant Capacity, which covers manufacturing, along with new data on capacity from the U.S. Geological Survey, the Department of Energy, and other organizations.
>
> Once the revision is published, it will be available on the Board's website at www.federalreserve.gov/releases/G17. The revised data will also be available through the website of the Department of Commerce. Further information on the revision can be obtained from the Board's Industrial Output Section (telephone number 202-452-3197).

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11. Advance notices of the revision issued on March 27, 2009, appeared in the G.17 release published mid-month from September 2008 through March 2009. Notices of the June 25, 2010, annual revision were in the G.17 releases published in October 2009 through June 2010. A notice of the March 25, 2011, revision was in the G.17 releases for November 2010 through March 2011.

The monthly releases in January 2009 through March 2009 contained a similar notice, except the exact date of the annual revision release (March 27, 2009) was specified.

After the publication of each annual revision, notices appeared in several subsequent monthly G.17 releases. In the April 2009, May 2009, and June 2009 monthly releases, the post-revision announcement was as follows:

> The Federal Reserve Board released its annual revision to the index of industrial production (IP) and the related measures of capacity utilization on March 27, 2009. The revision affected the data from January 1972 through February 2009, with most of the changes for the period beginning in 2004 (the index levels for IP, but not the rates of change, may have been changed before 1972 to maintain consistency with the revised indexes for 1972 and after). The revised IP indexes incorporated data from selected editions of the U.S. Census Bureau's 2007 Current Industrial Reports. Detailed data from the 2007 Economic Census, however, were not available. Annual data from the U.S. Geological Survey regarding metallic and nonmetallic minerals (except fuels) for 2007 were incorporated. Utilization rates were updated to incorporate data from the U.S. Census Bureau's Quarterly Survey of Plant Capacity through 2008 as well as data from other government and trade sources.
>
> The published revision release and revised data are available on the Board's website at www.federalreserve.gov/releases/G17. The revised data are also available through the website of the Department of Commerce. Further information on the revision can be obtained from the Board's Industrial Output Section (telephone number 202-452-3197).

III.B.   Highlights of the Annual Revisions

Each of the G.17 releases for the three annual revisions since 2008 and the two articles with extended discussion are included in the attachments. Each revision (1) updated monthly and quarterly source production data and seasonal factors and (2) introduced newly available annual data that are used to determine the annual levels of both the production and capacity indexes. For both the industrial production and capacity indexes, the value-added weights that govern the aggregation of individual series into groups were advanced annually. In the 2009 revision, new value-added information was only available for utilities, but two years of value-added data for manufacturing (along with one year of data for utilities and a quinquennial read for mining from the Economic Census) were incorporated in the 2010 revision. The 2011 revision saw the addition of an

additional year of value-added data for both manufacturing and utilities. The indexes are currently expressed as percentages of output in 2007.

The March 2009 Annual Revision: On March 27, 2009, revisions were issued to the industrial production and the related measures of capacity and capacity utilization for the period from January 1972 through February 2009, with most of the changes for the period beginning in 2004. For the period since 1972, both the levels and the rates of change were revised. For years before 1972, the levels, but not the rates of change, were also revised. Overall, the changes to total industrial production were small.

The overall contour of total IP was little changed by the revision. Industrial output rose steadily at an average annual rate of 2.3 percent from 2004 through 2007, then fell sharply in 2008 at a rate of negative 6.7 percent. Relative to earlier estimates, measured from fourth quarter to fourth quarter, IP was reported to have increased 0.3 percentage point more slowly in 2007 and to have decreased 0.6 percentage point more rapidly in 2008.

The revision showed that the rates of capacity utilization for total industry in the fourth quarters of 2007 and 2008 were both about ½ percentage point lower than previously estimated. Utilization in 2007 was 80.4 percent, about ½ percentage point below its long-run (1972 through 2008) average, and, in 2008, it was 74.2 percent, 6.7 percentage points below its long-run average. The operating rate for manufacturing was revised down 0.6 percentage point in 2007 and 0.8 percentage point in 2008; for the fourth quarter of 2008, the factory operating rate stood at 70.9 percent, 8¾ percentage points below its long-run average. The utilization rate for mines was revised down about ½ percentage point in 2006 but was little revised in other years; at the end of 2008, it stood at 89.6 percent, about 2 percentage points above its long-run average. The operating rate for utilities was revised down 0.7 percentage point in both 2006 and 2007; in 2008, it was revised down 0.6 percentage point, to 83.6 percent, and was 3.2 percentage points below its long-run average.

Compared with the previous estimates, total industrial capacity was reported to have risen 0.4 percentage point less in 2008 and is expected to fall 0.6 percentage point more in 2009. The smaller increase in 2008 reflected a substantial downward revision to capacity in the high-technology manufacturing industries; the capacity indexes for

mining, for utilities, and for manufacturing outside of the high-technology industries were all reported to have been higher in 2008 than stated previously. The larger decrease in total industrial capacity in 2009 reflected downward revisions to the indexes for both durable and nondurable manufacturing and for mining; the capacity indexes for other manufacturing (logging and publishing) and utilities were little changed from their previous estimates.

Although comprehensive benchmark production data for manufacturing for 2007 were not yet available, the updated measures of production incorporated several other newly available sources of data. Estimates of manufacturing (NAICS) production were updated with data from selected 2007 CIRs from the U.S. Census Bureau. Estimates of other manufacturing (logging and publishing) were updated with annual data on logging for 2007 from the U.S. Forest Service and with annual data on the publishing industry from the Census Bureau's *Service Annual Survey*. The index for mining was updated with new annual data on mineral extraction for 2006 and 2007 from the U.S. Geological Survey (USGS). The weights that allocate individual production indexes into multiple market groups were previously derived from the 1997 input-output tables from the BEA; with this revision, these weights were updated using data from the BEA's recently released input-output tables for 2002. Updated price deflators from the BEA were used in the construction of the revised production estimates. Finally, the new monthly production estimates also reflected the incorporation of updated seasonal factors and monthly source data that became available (or were revised) after the closing of the reporting window

Results from the Census Bureau's QSPC for the fourth quarters of 2007 and 2008 were used to update the capacity indexes and capacity utilization rates. In addition, the revisions to the capacity indexes and capacity utilization rates incorporated the revised production indexes and newly available data on industrial capacity from the USGS, the Energy Information Administration of the DOE, and other organizations.

The changes to the individual production and capacity measures have been discussed extensively above. The main improvements introduced with the 2009 revision included a modified method for estimating the impact on IP of the hiring of temporary

help by manufacturers, additional detailed data brought to underlie the communications equipment indexes, and a new method of translating data on domestic absorption to production for computers. For capacity, new data or methods were introduced for electricity generation, nonferrous metals, and natural gas extraction. .

The June 2010 Annual Revision: On June 25, 2010, revisions were published for industrial production and the related measures of capacity and capacity utilization. Although the revision affected the data from 1972 through May 2010, most of changes appeared in the portion of that interval beginning in 2006. Besides the revisions to the monthly data for IP and capacity utilization, the comparison base year for all production and capacity indexes was changed: The indexes were updated to be expressed as percentages of output in 2007 instead of 2002.

The overall contour of total IP in recent years was little changed by this revision. The index increased at a moderate rate in 2006 and 2007; it fell sharply in 2008 and declined further in the first half of 2009. The trough in IP in the recession that started in 2007 occurred in June 2009: IP advanced in every month of the second half of that year and continued improving throughout 2010, though the pace of recovery slackened in the second half of 2010.

The revision had its largest effect on data from 2006 through 2009, and the largest sources of revision were annual data from the 2007 COM and the 2008 ASM. These data implied noticeably stronger output in 2007 (mostly in durable goods industries) and a larger drop in output in 2008 (mostly in nondurables). Relative to earlier estimates, measured from fourth quarter to fourth quarter, total IP was reported to have increased 0.7 percentage point and 0.5 percentage point more rapidly in 2006 and 2007 respectively. The decrease in total IP in 2008 was shown to have been 0.9 percentage point greater than estimated earlier, but the decrease in 2009 was 0.9 percentage point less.

Capacity utilization for total industry was not altered appreciably, overall, by the revision. Utilization was 0.7 percentage point higher in the fourth quarter of 2007 but was within 0.2 percentage point of the previous estimates for the fourth quarters of 2006,

2008, and 2009. At 71.1 percent, overall utilization in the fourth quarter of 2009 was more than 10 percentage points below its 1972-2009 average.

The revised IP indexes incorporated detailed data from the 2007 COM and the 2008 ASM, both conducted by the U.S. Census Bureau. Data from selected editions of the Census Bureau's 2008 and 2009 CIRs were also incorporated along with annual data for 2008 on metallic and nonmetallic minerals (except fuels) from the USGS. The revised indexes reflect updated price deflators from the BEA. In addition, monthly indicators (either product data or input data) were revised, and the estimation methods for some series were changed. The monthly production estimates reflect the incorporation of updated seasonal factors and monthly and quarterly source data that became available (or were revised) after the close of the reporting window.

Capacity and capacity utilization were revised to incorporate data from the Census Bureau's QSPC for the fourth quarter of 2009, which covered manufacturing, along with new data on capacity from the USGS, the DOE, and other organizations.

As discussed extensively above, the 2010 revision introduced new output indicators based on data from the recently established quarterly CIRs on communications equipment and computers. In addition, more detailed capacity indexes were developed both for plywood and miscellaneous wood products and for basic inorganic chemicals.

The March 2011 Annual Revision: Revisions to IP and the related measures of capacity and capacity utilization were published on March 25, 2011. Although rates of change from January 1972 through February 2011 were affected, the revision had its largest impact on data from 2008 onward. Measured from fourth quarter to fourth quarter, total IP was reported to have declined 1.4 percentage points and 1.7 percentage points more sharply in 2008 and in 2009, respectively, and to have risen 0.5 percentage point more rapidly in 2010. Even so, the broad contour of total IP in recent years was similar to previous estimates, and the dates of the recent peak (September 2007) and the recent trough (June 2009) were unchanged from the earlier estimates. However, the peak-to-trough decline in total IP, at 17.1 percent, was 2.0 percentage points larger than previously estimated. As of February 2011, total IP was shown to have reversed about 55 percent of its peak-to-trough decline, somewhat less than previously reported.

The revised IP indexes incorporated detailed data from the Census Bureau's 2009 ASM, which showed a lower level of annual output than had been previously estimated. In addition to the 2009 ASM, data from selected editions of the Census Bureau's 2009 CIRs and annual data from the USGS regarding metallic and nonmetallic minerals (except fuels) for 2009 were used in the revised estimates. The monthly estimates of production were updated to incorporate late-arriving or revised monthly indicator data (either product data or input data), and they also reflect recalculations of seasonal factors.

The revisions show that the rate of capacity utilization for total industry was about 3/4 percentage point lower than previously estimated in the fourth quarters of 2008 and 2009, as downward revisions to IP were only partly mirrored by downward revisions to estimates of industrial capacity. In contrast, overall capacity utilization in the fourth quarter of 2010, at 76.2 percent, was 0.6 percentage point higher than previously reported.

The revised estimates of capacity and capacity utilization incorporated data from the Census Bureau's QSPC for the fourth quarter of 2010, which covered the manufacturing sector, along with new data on capacity in the energy and mining sectors from the USGS, the DOE, and other organizations.

Announcements

In addition to the three annual revisions reviewed earlier, announcements in the G.17 have kept users informed of changes introduced at other times. Between July 2008 and May 2011, seven such events occurred. Most of these involved capacity and capacity utilization; in addition, two of these included the announcement of the discontinuance of the electric power survey. The specific announcements were as follows:

A note on page 3 of the G.17 release of September 15, 2008, read:

> Capacity utilization rates for October 2007 through February 2008 have been updated with this release. In April 2008, a six-month reporting window was instituted for the industrial production indexes in the G.17 Statistical Release; however, the capacity utilization rates inadvertently continued to be calculated for only a four-month window. Table 7A shows the revised rates for the affected

months. The data download program and the historical data files on the Federal
Reserve Board's website have been updated with revised data.

A note on page 3 of the G.17 release of February 18, 2009, read:

The data in this release include preliminary estimates of industrial capacity for
2009. Measured fourth quarter to fourth quarter, total industrial capacity is
projected to decrease 0.3 percent this year after having expanded 1.5 percent in
2008. Manufacturing capacity is estimated to decline 0.6 percent in 2009 after
having risen 1.7 percent last year. In 2009, mining capacity is estimated to
expand 0.8 percent, about the same as in 2008, and utilities capacity is projected
to rise 1.7 percent, which is 0.5 percentage point slower than it had last year.
With the publication on March 27, 2009, of the annual revision to industrial
production, capacity, and capacity utilization, these estimates will be updated to
reflect more-comprehensive source data, including the U.S. Census Bureau's
Survey of Plant Capacity for the fourth quarter of 2008, which covers
manufacturing.

A note on page 3 of the G.17 release of September 16, 2009, read:

This release includes the G.17 publication schedule for 2010.

A note on page 3 of the G.17 release of February 17, 2010, read:

The data in this release include preliminary estimates of industrial capacity for
2010. Measured fourth quarter to fourth quarter, total industrial capacity is
projected to decrease 0.8 percent this year after having declined 0.9 percent in
2009. Manufacturing capacity is estimated to decline 1.0 percent in 2010 following
a decrease of 1.2 percent last year. Mining capacity is estimated to move up 0.3
percent in 2010 after having declined 0.7 percent in 2009, and utilities capacity is
projected to expand 2.1 percent this year, which is 0.3 percentage point faster than
it had last year. These estimates will be updated with the publication in late June
2010 of the annual revision to industrial production, capacity, and capacity
utilization.

A note on page 3 of the G.17 release of October 18, 2010, read:

 With this release, seasonal factors for motor vehicle assemblies were revised for
the period beginning in April 2010.

A note on page 3 of the G.17 release of February 16, 2011, read:

The data in this release include preliminary estimates of industrial capacity for
2011. Measured fourth quarter to fourth quarter, total industrial capacity is
projected to rise 1.2 percent this year after having declined 0.3 percent in 2010.
Manufacturing capacity is estimated to increase 0.7 percent in 2011 following
decreases of 0.2 percent last year and 1.2 percent in 2009. Mining capacity is

estimated to rise 2.0 percent in 2011 after having been unchanged in 2010, and utilities capacity is projected to expand 3.6 percent this year, which is 2.1 percentage points faster than the rate of expansion recorded last year. These estimates will be updated with the publication on March 25, 2011, of the annual revision to industrial production, capacity, and capacity utilization.

III.C.   *Analysis of Revisions and Related Issues*

The monthly indexes of industrial production are first estimated on the basis of incomplete monthly samples; they are revised to incorporate more complete monthly data that become available over the newly established six-month window (discussed above) and then again to more comprehensive information and annual data in an annual revision that may affect data for several years.

The Explanatory Note section of the G.17 will continue to highlight the revisions over the previous four-month reporting window until a sufficient history under the new six-month reporting window is available.   The average revision to the *level* of the total IP index, without regard to sign, between the first and the fourth estimates was 0.26 percent during the 1987–2009 period. The average revision to the *percent change* in total IP, without regard to sign, from the first to the fourth estimates was 0.21 percentage point during the 1987–2009 period. In most cases (about 85 percent), the direction of change in output indicated by the first estimate for a given month is the same as that shown by the fourth estimate. The monthly revision history for total IP back to 1972 is available on the Board's public website.

On a monthly basis, utilization rates are updated to reflect revisions to the underlying production series during the usual reporting window of the production index. From 1983 to 2006, the average revision between the first and second estimates of total industry capacity utilization (except where the second estimate is the publication of an annual revision) was 0.02 percentage point, and the average revision without regard to sign was 0.15 percentage point. Between the second and third estimates, the average revisions with and without regard to sign were 0.02 and 0.11 percentage point, respectively. And between the third and fourth estimates, the average revisions with and without regard to sign were 0.01 and 0.07 percentage point, respectively. The average cumulative revision over the four-month reporting window, if no annual revision

occurred during the window, was 0.04 percentage point, and without regard to sign, the average cumulative revision was 0.22 percentage point.

On a longer-term basis, the revisions to the measures of capacity utilization were examined by comparing the capacity utilization rates published in the last 13 annual revisions of industrial production and capacity utilization with their pre-revision levels. For each of the 13 annual revisions, the revisions to the operating rates for total industry were calculated for the final quarters of the three most recent years: For example, in the annual revision published in March 2011, the total industry capacity utilization rate revised up 0.5 percentage point in the fourth quarter of 2010, down 0.8 percentage point in the fourth quarter of 2009, and down 0.7 percentage point in the fourth quarter of 2008. Over the last 13 years, the average revision to most recent three years of total industry capacity utilization has been 0.05 percentage point; the average revision without regard to sign has been about 0.38 percentage point.

III.D.   Revision Planned for 2012

The schedule for the 2012 annual revision to the statistics in the G.17 is still undetermined, but the target date will likely be late March 2012. The date of publication and scope of the revision will depend on when data from the 2010 ASM will become available. A plan for the revision will be developed this summer. One important event that likely will be affecting industrial production is the planned discontinuance in the summer of 2011 of the Census Bureau's CIR program. Data from the CIRs feed into 24 production indexes, about 3 percent of IP, within six 3-digit NAICS industries.

IV.   BACKGROUND[12]

IV.A. The Industrial Production Index

Almost from its founding the Federal Reserve Board has reported on current business conditions. The first issue of the *Federal Reserve Bulletin*, in May 1915, included digests of business conditions in the twelve Federal Reserve Districts. By 1919, the *Bulletin* included monthly "data relative to the physical volume of trade," published both in actual amounts (tons, feet, and so on) and as indexes. By 1922, the tables on the physical volume of trade contained more than 100 series that measured the current activity of business. From these monthly physical volume data, Federal Reserve staff developed aggregate production indexes to study trends in business activity in a more compact and coordinated form. Since 1922, the Federal Reserve's monthly indexes of production have evolved by incorporating new data and techniques. The present index incorporates techniques for compiling monthly indexes, such as seasonal adjustment, along with techniques developed at Harvard University, the National Bureau of Economic Research (NBER), and elsewhere for compiling annual real output measures.

The evolution of the monthly index of production reflects a number of stages. In the pioneer stage during and after World War I, the economics profession built on the work of Wesley Mitchell at the War Industries Board, and articles on production indexes appeared in academic journals. By December 1922, the Federal Reserve had developed "The Index of Production in Selected Basic Industries." It was seasonally adjusted by the ratio-to-moving-average method and was available by the 25th day following the reference month. In 1927, "A New Index of Industrial Production" was published. This index on a 1923-25 comparison base used value-added weights for combining manufacturing series and value produced for minerals. Moving seasonal factors were introduced, and daily average output was used instead of output per month. This index gained wide national acceptance.

During the 1930s, Frederick Mills, Arthur Burns, and Solomon Fabricant at the NBER studied and developed production data for manufacturing from the COM; the

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12. The historical portion of this section is based on the "History of the Index," a chapter in *Industrial Production─1986 Edition, with a Description of the Methodology* (Board of Governors of the Federal Reserve System, 1986). A copy has been previously provided to OMB.

NBER researchers found that the available physical volume data, used in production indexes up to that time, understated the growth of output in manufacturing because the data did not cover new, rapidly expanding industries. The Federal Reserve staff used the broader annual NBER production indexes to benchmark the monthly production indexes in the revision of 1940. At that time, the staff also began to use monthly production-worker hours with productivity adjustments to estimate output in industries for which monthly physical product data were lacking. To maintain continuity in the index, the new broader monthly index was linked to the older index that was based solely on physical indicators. The index was seasonally adjusted by the ratio-to-freehand-curve method.

Important developments occurred after World War II. In the 1953 revision, the number of series in the index was expanded from 100 to 175 series, monthly indexes were benchmarked to comprehensive annual indexes of output, and value-added weights were used for both the mining and manufacturing series. In 1959, the coverage of the index was expanded to include electric and gas utilities along with manufacturing and mining to bring the coverage of the index into closer accord with recommendations made by the United Nations. Market groups were introduced for consumer goods, equipment, and materials. Computerized computation began.

In the 1960s, the staff found that electric utilities had and were willing to supply data on monthly sales of electric power to industry classified by Standard Industrial Classification (SIC) category. In 1971, kilowatt-hour series were introduced to replace or supplement many of the production-worker-hours series in the index; the total number of series increased to 227. At that time, the market groups were refined further, and the staff developed supplementary gross value of products series for comparison with gross value aggregates, such as shipments, foreign trade, and GNP final expenditure categories. In 1985, intervention analysis was included as part of seasonal adjustment, and the number of series rose to 252.

The primary purpose of the 1990 revision was to include the latest available benchmark and annual information on the levels of the 250 basic series that made up the index. In addition, the value-added weights used to combine the series were updated: 1982 weights were used for 1982-86, and 1987 weights were used for the period since

1987. To improve consistency with other measures of output, the revised index for office and computing machines incorporated the price deflator (based on a combination of matched-model and hedonic components) developed jointly by IBM and the BEA for use in the National Income and Product Accounts. A restructuring of the textiles series resulted in a net loss of two series.

In the 1993 revision, the 1987 weight and comparison base was maintained, and the broad structure of the major market and industry groups remained basically the same. The detailed industry structure, however, was modified to conform to the 1987 SIC, and many refinements to the compilation of individual series were made. The introduction of new series increased the number of individual series to 255.

Quarterly production data in physical units were introduced to maintain the representation of physical product measures. (Currently, the number of IP series that are based on quarterly production data represent about 6 percent of the total industrial production index in value added terms.) A cubic spline generally is used to interpolate monthly values from the quarterly figures.

Beginning with the 1993 revision, an annual or historical revision was issued each year, usually in the fall; the total number of individual series continued to expand. The most important improvement for the revision issued in January 1997 (the 1996 revision) was the introduction of new chain-type aggregation methods from 1977 onward, a significant modification in the index. As before, however, the contribution of an individual industry to total output was based on the value added by that industry. The sources of these figures are the same as those used for the periodic updating of weights for the earlier measures.[13] The newly introduced aggregation method, a version of the Fisher-ideal index number, was more firmly rooted in economic theory and eliminated a source of upward bias in the previous estimates. For the weights used in aggregating the

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13. Annual value added are reported in the quinquennial *Census of Manufactures* and the *Annual Survey of Manufactures* of the Bureau of the Census. Value added for electric and gas utilities are computed from annual revenue and expense data reported by the Department of Energy and the American Gas Association. Value-added data for mining industries are available only every five years from the *Census of Mineral Industries*. Estimates of unit value added for intervening years are derived from related final product prices, either a producer price index from the Department of Labor's Bureau of Labor Statistics or a spot price for selected commodities such as crude, oil, gold, or silver. Annual data on the total value of production (shipments plus inventory change, including the value of excise taxes) required for the gross value of product aggregates are derived from these same resources.

IP and capacity indexes, a refinement to the scheme first used in the 1996 revision was introduced in the 2000 revision. In the 1996 revision, annual chain weighting was introduced into the aggregation method used to construct IP from 1977 to the present. With the 2000 revision, the annual unit value-added measures used to aggregate IP were linearly interpolated to the monthly frequency, and the IP index became a chain-type index with monthly weights.

Although the introduction of a chain-type index formula followed a similar reformulation of the featured measure of real output published by the BEA, the Federal Reserve introduced a method in which weights were estimated through the most current periods, even though comprehensive data on value added lag a few years. The Federal Reserve also addressed the problem of the aggregation of ratios, such as capacity utilization. As a result, the aggregation of capacity and capacity utilization was done with a generalization of the method introduced in the 1990 revision of those series.[14] (The background of capacity utilization is described below.)

Another significant development in the late 1990s was the incorporation of new real output measures for high-technology industries in the IP index.[15] In the 1997 revision, a new monthly measure of semiconductor output was introduced from 1992 onward; the measure was further refined in the 1998 revision and followed the earlier introduction of an improved annual benchmark index for the industry from 1977 onward.[16] Following the introduction of a new output index for semiconductors in the 1998 revision, new or improved high-technology output measures were introduced for computers (1999 revision) and communications equipment (2000 revision). These initial efforts at improving the measurement of high-technology goods were followed up by annual improvements in the measures for at least one of these product categories. As

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14. The generalized method is discussed more fully in the article in the February 1997 *Federal Reserve Bulletin*.

15. The Federal Reserve's effort to improve the measurement of high-technology industry output was featured in a speech by former Chairman Alan Greenspan, "The Challenge of Measuring and Modeling a Dynamic Economy," at the Washington Economic Policy Conference of the National Association for Business Economics, Washington, D.C., March 27, 2001.

16. The benchmark quantity index for the semiconductor industry was constructed based on newly available quality-adjusted price indexes for selected semiconductor components developed by the BEA. See Grimm, Bruce T. "Price Indexes for Semiconductors, 1974–1996," *Survey of Current Business*, February 1998, pp. 8–24.

discussed above, improvements to the measures for all three categories were even introduced in the 2011 annual revision.

The fundamental strategies used to estimate output and prices for these categories were similar. First, data on prices and shipments for numerous technologically distinct products were obtained from private market research firms. The shipments data were often either worldwide shipments or shipments to the United States. In that case, these data were transformed to an estimate of U.S. production, either based on adjustment estimates from foreign trade data or based on annual data on U.S. production by manufacturer or by detailed product class.

This basic approach was also applied to the measurement of pharmaceutical production.[17] Specifically, the 2000 revision introduced a new method for estimating the production of pharmaceutical preparations. The new production index was a chain-type quantity index developed principally from data provided by IMS-Health on the prices and quantities of shipments to dispensers of prescription and non-prescription drugs in the United States for about 500 product classes. Information from the Census Bureau's CIR was the basis for the adjustment of these data to estimates of actual U.S. production.

Changes to other individual IP series in the late 1990s and 2000s also involved the use of very detailed product data, including the revised production measures for coal, completed commercial aircraft, and motor vehicles. For motor vehicles, the monthly production indexes for autos and light trucks were improved to capture shifts in the mix and relative values of different models produced on a more timely basis. This change was introduced in the 1999 revision and reviewed in an article in the March 2000 issue of the *Federal Reserve Bulletin*.[18] The article explained that the monthly indicator for the production of autos and light trucks from 1992 forward became an annually-weighted Fisher quantity index; the calculations use monthly data on the number of assemblies by model and the annual list price for each model at the start of the new model year.   Before the change, the monthly indicator for the production of autos and for light trucks was the simple count of units assembled.

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17. The basic research that underlay the development of the new measures was presented at conferences and workshops sponsored by NBER's Committee on Research on Income and Wealth.

18. Charles Gilbert, Norman Morin, and Richard Raddock, "Industrial Production and Capacity Utilization: Recent Developments and the 1999 Revision," p. 192.

A method used to estimate the initial IP figures, where appropriate, that accounts for changes in the number of temporary employees who work in the industrial sector was introduced in 2001 and refined in 2002 and again in 2009. With limited data available, the compilation of the initial IP estimate for a given month relies heavily on the hours worked by production workers in the manufacturing sector. However, this approach had ignored the use of temporary workers in manufacturing, which surged in the 1990s.[19] At the Federal Reserve's request, the *Survey of Plant Capacity* (SPC) included questions on temporary help from 1998 through 2006. The data from this report and the 1999 *Current Population Survey* were used to model the share of temporary help employment that was sited at manufacturing establishments. This adjustment to manufacturing employment is allocated by industry based on the SPC information and on the relative rates of change in hours for directly employed workers.[20]

The monthly processing of the source data for industrial production and the monthly compilation of the index were streamlined and significantly improved in the 1990s and 2000s. Seasonal adjustment procedures incorporated regression-based holiday and other calendar effects; the monthly electric power data used in IP were automatically adjusted for systematic influences of the weather.[21] In addition, the statistical tables in the monthly G.17 release were revised with its February 2001 publication, and new, high-technology-related aggregates for production and capacity were introduced. Another important refinement was the compilation of the seasonally adjusted aggregates from the seasonally adjusted individual series; this improvement was introduced in the 1993 annual revision. Prior to that, the aggregates were independently seasonally adjusted and, as a result, did not always equal the sum of the seasonally adjusted individual series.

The most significant change to IP and the related measures of capacity and capacity utilization since 2000 was the reclassification to a NAICS basis from a SIC

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19. In the IP methodology up to this point, the effect of the use of temporary workers would be indirectly captured, to some extent, in the updating of near-term productivity estimates.

20. When overall manufacturing employment is declining (increasing), no adjustment is made to industries where production-worker hours are increasing (decreasing).

21. Staff research indicated that the usual seasonal adjustment techniques did not adequately capture the influence of the weather on electric power usage for numerous industries. The new adjustment procedure uses data on heating and cooling degree days to model the effects of weather more accurately in those industries.

basis, which was the cornerstone of the 2002 annual revision.[22] Individual and aggregate

series for production and capacity indexes were reclassified back to 1972 on a NAICS

basis, which made them the first major economic indicators issued with substantial

history on a NAICS basis.[23]   The issuance of these revised indicators marked a major

advance within the statistical community. The historical continuity afforded by

consistent time series data is particularly important to economists concerned about low

frequency events, such as business cycles, where each observation is quite important.[24]

The key to developing historical NAICS indexes, therefore, was to determine the

share of each SIC industry that should be assigned to each of its corresponding NAICS

industries. The Census Bureau took care of this problem for 1997 by publishing

industry-level statistics, such as shipments and value-added, on both an SIC and a NAICS

basis in the COM. The underlying establishment-level data for 1997 were dual-coded.

For many industries, however, the shares derived from the 1997 data would not

accurately reflect the industrial distribution of activity in earlier years. To develop this

information, historical plant-level data, or microdata, in the Census Bureau's

Longitudinal Research Database were used. Historical SIC-to-NAICS shares for

industry-level COM variables (value added, shipments, and the like) were calculated that

assigned a NAICS industry code to each establishment in the microdata files of the

historical censuses back to 1963.

Along with the reclassification to NAICS, the 2002 revision featured a

modification to the composition of the IP market groups. The market groups split up

production on the basis of how it is used: as a consumer good, as an investment good, as

an intermediate input for businesses outside of the industrial sector, or as an intermediate

input for businesses within the industrial sector. Previously, only about 25 industries

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22. Carol Corrado, "Industrial Production and Capacity Utilization: The 2002 Historical and Annual Revision," *Federal Reserve Bulletin,* vol. 89, April 2003, pp. 153–76, contains a description of the reclassification methods and results.

23. Kimberly Bayard and Shawn Klimek, "Creating a Historical Bridge for Manufacturing Between the Standard Industrial Classification System and the North American Industry Classification System," *2003 Proceedings of the American Statistical Association, Business and Economic Statistics Section [CD-ROM]* (2004), pp. 478-84, contains a description of the methodology used to reclassify historical data from an SIC basis to a NAICS basis.

24. John Stevens, "Overhauling Industrial Production: The 2002 Historical and Annual Revision," *2003 Proceedings of the American Statistical Association, Business & Economic Statistics Section [CD-ROM]* (2004), pp. 4072-4078, contains a description of the conversion of the IP, capacity, and utilization data from an SIC-basis to a NAICS-basis.

were disaggregated based on detailed product and end-use statistics so that their output could be assigned to multiple market groups. With the 2002 revision, when appropriate, *all* industries in the IP index have their output allocated to multiple market groups. Market group shares for the industries represented by individual series in the industrial production index were derived using relationships in the 1992 input-output (I-O) tables issued by the BEA. In addition, input-output methods were used to classify the industries in the IP index into four stages of processing—crude, primary, semifinished, and finished. IP indexes for these stages replaced the primary and advanced processing aggregates that were previously published.

Another significant change to IP in the 2000s was the discontinuance of its use of survey data of industrial electric power use at the end of 2005. The survey, discussed a bit earlier in this section, was initiated in the 1960s to collect data on electricity use-- which tends to be highly correlated with production in capital-intensive industries--as an alternative indicator of output. These survey data were used directly as the production indicators for some industries (particularly those with highly automated assembly operations and a diverse product mix) for which product-based data were unavailable. However, by 2004, the electric power usage covered by the survey had dropped nearly 40 percent from its peak in 1993, and several regions and industries had significant gaps. The 20 industry indexes that previously relied on electric power use data were recalculated using production-worker hours as the underlying source data for the period 1997 forward.

Another change in methods for the IP indexes was the establishment of a method for estimating the production of an industry for which only shipments data were available. The procedure was first developed and implemented for the machine tool industry in the 2004 annual revision. The use of the procedure, which adjusts shipments by an estimated the change in inventories at manufacturers, was extended considerably in the subsequent three years. In total, about 40 industrial production indexes are now computed from shipments data augmented by a model-based estimate of their inventory swings.

Beginning with the annual revision issued in March 2008, the data of annual revisions began being targeted for the end of March. This timing allowed for the

inclusion of data from ASM (often issued by the Census Bureau around the end of a year) and from annual benchmark releases for the BLS *Current Employment Survey* (issued in early February) as soon as possible after their availability. The 2010 release of the annual revision to the G.17 was delayed until June of that year in order to incorporate the 2008 ASM.

Also beginning in 2008 after the release of the annual revision, the monthly G.17 releases were based on a six-month reporting window: One month of new data is reported, and the previous five months of data are revised. Previously, the monthly releases were issued with a four-month reporting window, which covered one month of new data and revisions to the previous three months of data. The incorporation of a six-month window allowed for the inclusion of additional data before an annual revision.

IV.B.   Capacity and Capacity Utilization

The capacity and utilization estimates evolved somewhat independently from IP. The Board of Governors began to study data on capacity and capacity utilization data in conjunction with the indexes of production in order to analyze both the demand for capital goods and inflationary pressures. In the absence of monthly surveys of industrial capacity or capacity utilization, the Federal Reserve Board derived estimates of monthly utilization by dividing a monthly industrial production index by a related capacity index. This approach of providing an integrated system of output, capacity, and utilization measures has three advantages over surveys of utilization alone: (1) It provides a more complete picture of industrial developments and allows the user to see which industries are growing and which are declining, and at what rates. (2) It provides more current estimates of utilization rates because the production indexes for a given month are available about fifteen days after the end of the month. (3) It provides estimates of utilization that appear to reflect the cyclical movements in production more accurately than the rates based solely on the judgments of respondents to surveys.

The beginnings of the development of capacity and utilization measures date back to the 1950s. During the economic expansion in the middle of that decade, the Board's staff developed indexes showing output and capacity levels for several major manufactured materials. These estimates, based on measures of physical volume from government and trade sources, were used internally as part of an effort to analyze current business

conditions, primarily inflationary pressures and the demand for capital goods. Charts of capacity and output for major materials were included in articles on price and production developments in the *Federal Reserve Bulletin* (the November 1956 and May 1957 issues, respectively). Frank de Leeuw described the major manufactured materials capacity index in an internal Federal Reserve Board memorandum from August 1957.

Interest in capacity constraints was great in the booming 1960s, and the Federal Reserve maintained estimates of output, capacity, and utilization for manufacturing and for selected industrial materials. The estimates of manufacturing capacity and utilization appeared in articles published in *Econometrica* and in publications of the American Statistical Association in the 1960s; in 1966, the U.S. Council of Economic Advisers published the manufacturing estimates in the statistical appendix to its annual report. An article in the November 1966 issue of the *Bulletin* described the methods used to calculate the capacity and utilization series. The Board began to publish quarterly series for two subgroups of manufacturing—primary-processing industries and advanced-processing industries—and for total manufacturing in the quarterly statistical release, E.5; total manufacturing operating rates have been included in the *Bulletin*'s Selected Business Indexes since 1968. Unlike the unpublished major materials index, the estimates for manufacturing industries were not constructed from physical volume data.

The quarterly capacity indexes were produced in three general steps: (1) End-of-year utilization rates from the McGraw-Hill survey of capacity utilization were divided into December values of Federal Reserve indexes of production. (2) These "implied" capacity indexes were then smoothed and extrapolated based on regressions involving alternative indicators of capacity expansion, a McGraw-Hill index of capacity and a perpetual inventory measure of gross capital stocks. (3) The resulting estimates were linearly interpolated to the quarterly frequency.

Pressures on capacity again became a concern in the early 1970s, when many industrial materials were reported in short supply and prices were soaring. During this period, the Federal Reserve reconstructed its (formerly internal) measure of capacity utilization for major materials industries (a subset of the broader "materials" group of industrial production). The major materials utilization measure, detailed in the August 1973 *Bulletin*, was based on twelve component materials industries. In the April 1974

Bulletin, the major materials index was revised and its component industries were expanded to eighteen in number; in addition to the aggregate, six industry groups of materials series were published. Quarterly indexes of materials capacity and output and quarterly utilization rates were included in the G.12.3 "Industrial Production" statistical release from 1974 through August 1977; from July 1976 through August 1977, the G.12.3 release also contained utilization rates at the monthly frequency.

The November 1976 *Federal Reserve Bulletin* article "New Estimates of Capacity Utilization: Manufacturing and Materials" marked the completion of a major expansion of the measures and a substantial revision of previous estimates for manufacturing. The manufacturing series were reestimated in greater detail—fifteen components instead of two—to conform to the industry detail in the McGraw-Hill survey. The manufacturing series were substantially revised back to 1948. The materials index was greatly expanded in scope to cover the entire materials grouping of industrial production (ninety-six materials series in total, split among eight materials subgroups, in addition to the total materials index), whereas the former "major" materials index covered less than one-quarter of the materials group. The new materials capacity series were derived from data on capacity or utilization rates from an expanded range of sources, primarily the new SPC[25] from the Bureau of the Census, in addition to measures of physical volume from government and trade sources. Data on investment expenditures and industrial equipment production were used to refine the cyclical movements of the estimated materials capacity series.

The new monthly Federal Reserve statistical release (G.3), "Capacity Utilization," began in January 1977. The release included monthly utilization rates, as well as quarterly data on output, capacity, and utilization, for manufacturing and industrial materials (and their major component series). In 1979, estimates of net capital stocks from the Bureau of Labor Statistics were incorporated in the methodology used to refine the year-to-year movements in capacity for many of the 96 individual series in the total

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25. The *Survey of Plant Capacity* asked questions related to fourth-quarter plant operations. It was an annual survey from 1974 through 1988, biannual 1990 through 1996, and annual from 1997 to 2006. Prior to the 1995/1996 survey, the survey forms were sent to about 9,000 establishments; from the 1995/1996 survey to 2006, the survey forms were sent to 16,000 to 17,000 plants. In 2007, the sample was reduced to about 5,500 establishments in conjunction with the move to a quarterly survey.

materials group. As a result, the methods used to estimate materials capacity became more akin to the techniques used to estimate capacity for manufacturing.

In 1983, the scope of the capacity system was increased to cover mining and utilities. Estimates for these new series plus total industry (the aggregate of manufacturing, mining, and utilities were) were added for the period back to 1967. In 1985 the number of manufacturing components was increased to 24 from 15, largely at the level of two-digit Standard Industrial Classification (SIC) groups.   In April 1990, the G.3 "Capacity Utilization" and the G.12.3 "Industrial Production" releases were combined; since then, the monthly G.17 release "Industrial Production and Capacity Utilization" has been published on or around the fifteenth of the month and contains data on industrial production, capacity, and utilization rates up to the month just ended.

The aim of the 1990 capacity revision, described in the June 1990 *Federal Reserve Bulletin*, was to create an integrated, more detailed system of output, capacity, and utilization measures for total industry and a variety of market and industry sub-aggregates. This entailed several changes to the overall capacity system. Most importantly: (1) The materials system was discontinued as a separate entity, and those components of the materials system that were based on physical unit counts were included in the expanded system of capacity measures for manufacturing, mining, and utilities; (2) The primary source of utilization rates for manufacturing industries became the Bureau of the Census's SPC. The SPC-based capacity and utilization estimates were adjusted to maintain historical continuity with those from the defunct McGraw-Hill survey;[26] (3) The manufacturing capacity measures, previously comprising 24 individual series, were expanded to 54 individual series. (The Census survey provided more detailed data on industry utilization rates than had been available previously.)

The revisions in the early 1990s essentially continued the structure that was introduced in the 1990 revision; the elimination or addition of some individual series reflected changes in related production indexes. From 1990 to 2002, manufacturing comprised 55 individual series; mining comprised 19 series and utilities, two series. Since 1993, capacity indexes have been revised annually and are published in conjunction with the revisions to industrial production. The revised capacity indexes

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26. The McGraw-Hill utilization survey was discontinued in 1988.

arise from new and revised industrial production indexes (the numerator for the implied capacity indexes); new utilization rate data (the denominator for the implied capacity indexes) from the SPC or in physical units; and updated estimates of industry capital spending. The general structure and methods for the construction of capacity and capacity utilization were relatively unchanged in the 1990s, although several important refinements to the methods were introduced.

The 1993 annual revision introduced new measures of industry-level capital stocks. The new estimates better reflected the incremental loss of economic efficiency that results from the aging of investments, and they better captured the asset composition of detailed industry-level stocks. The new estimates of net stocks were derived using a perpetual inventory method from (1) time series of new investments in plant and equipment by three- and four-digit SIC manufacturing industries; (2) decompositions of industry investment into 28 (currently 35) asset categories; (3) deflators and service lives for each type of asset; and (4) estimates of losses of capital efficiency as assets age due to discards and economic decay.[27]

For the 1995 annual revision, the capital measures were further refined to reflect the flow of services derived from the net stocks of productive assets. The estimates are obtained using a method similar to the one used by the BLS to calculate multi-factor productivity. The capital input measures are rental-price, or user-cost, weighted Tornqvist indexes of the asset-level net stocks; that is, the indexes weight rates of change in the net stock of an individual asset by an estimate of that asset's share of the aggregate marginal product of the industry's capital.

In addition to incorporating the Fisher-ideal index methodology in the 1996 revision, the procedures for estimating capacity were enhanced further. The regression models that relate SPC-based implied capacities to alternative indicators of capacity expansion were made more flexible. Previously, the logarithm of the ratio of an industry's implied capacity to its capital stock or input—a capital productivity measure—was regressed on a series of deterministic trends and dummy variables. In this

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27. The detailed methodology is explained in "Capital Stock Estimates for Manufacturing Industries: Methods and Data" by Mike Mohr and Charles Gilbert (1996).

revision, the implicit restriction of a unit elasticity on the capital measure was relaxed so that the determinants of capital productivity could be studied and modeled more directly.

The March 2000 *Bulletin* described two refinements to the construction of capacity introduced in 1999. First, a new interpolation procedure was introduced for estimating monthly time series of capacity based on the fourth-quarter baseline capacity estimates produced by the regression models. The new procedure allowed capacity rates of change to evolve smoothly over time. Second, for the capacity estimates derived from the SPC, the models relating implied capacity to alternative indicators of capacity were expanded to include variables that capture the age profile of the capital stock. In several studies, age variables have been used to capture the effect of embodied technological change—that productivity augmenting technological change is vintage specific, that is, it is embodied in the design of new equipment and structures, rather than affecting all existing inputs in the production process.

New capacity measures for semiconductors, light motor vehicles, and natural gas extraction were developed in the 1999–2001 period. In the November 1999 revision, improved methods for estimating capacity for light motor vehicles were introduced. Capacity indexes for autos and light trucks are constructed from plant-level data (estimates of the peak historical line speed and the number of hours that can be worked at each plant in the United States; an annual capacity count for a plant is calculated by multiplying the peak line speed by the hours per year that the plant could run.) With the 1999 revision, the plant-level data were aggregated using estimates of plant-level prices.[28] The new approach indicates a shift over time toward capacity for the more expensive light trucks.

The method for estimating the capacity index for semiconductors was improved with the 1999 revision. The semiconductor capacity model is based on an implied capacity index constructed by dividing the number of chips produced (based on data from the Semiconductor Industry Association and the Bureau of the Census) by the utilization rate for the industry from the *SPC*. This implied capacity index, not the standard one computed using the IP index, is then fitted using the alternative capacity indicators, such

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28. If a plant produces multiple models on one assembly line, the model price attributed to the plant is computed as a weighted average of model prices according to estimated production levels at the plant.

as capital input; the fitted values from the regression are then multiplied by the ratio of semiconductor IP to the chip count to obtain a capacity index comparable to the IP index.

In the November 2001 revision, newly available estimates from the Energy Information Administration (EIA) were used to derive the capacity index for the extraction of natural gas; the new data substantially lowered the estimate of the industry's capacity for the 1995–99 period. The new EIA figures better reflect the ability of producing wells to deliver gas into the gathering and pipeline system; the previous EIA figures measured capacity at the wellhead only.

In 2007, the Federal Reserve worked with the Census Bureau to implement a QSPC with the plan to incorporate information from the survey into its estimation of production indexes for capital-intensive industries and to use them in the estimation of capacity utilization.[29]

The QSPC collects data on the factory workweek; like electric power use, the workweek is an indicator of the level of operations in capital-intensive industries. From 1974 to 2006, utilization rate data at the most detailed industry level for the fourth quarter of the year were collected by the annual SPC, but the lack of coverage for other quarters rendered them insufficient for use as high-frequency indicators. Studies using these data suggested they do nearly as well as electric power use as a proxy for capital services delivered.[30]

IV.C. Summary

The index of industrial production and the rate of capacity utilization, as presently constituted, reflect an historical evolution—lessons learned and methods developed out of a need to understand current developments in the economy. Each stage in the evolution of the index of production and the related measure of capacity utilization has received professional scrutiny and has been documented by research papers, internal memoranda,

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29. Although the Federal Reserve and the Department of Defense jointly pay for the collection of these data and collaborate with the Census Bureau on the survey questions, the Census Bureau clears this survey under the Paperwork Reduction Act (OMB No. 0607-0175).

30. Charles Gilbert and Norman Morin, "Estimating Actual Production from Inputs to Production: Moving from using Electric Power to data from an Expanded Survey of Plant Capacity," internal Federal Reserve memo, September 29, 2006.

articles in the *Bulletin*, or by books that accompany revisions of the measures. The attached bibliography lists these publications.

V.   DATA PUBLICATION AND AVAILABILITY

V.A.   Description of the Statistical Release, G17 (419)

The statistical release "Industrial Production and Capacity Utilization" is usually 19 pages. It provides timely monthly data on industrial production and capacity utilization on a regular schedule. The release includes a text summary of the latest changes in output and utilization by market group (IP) and by industry group (IP and utilization), special announcements, a summary table and related charts, and more detailed tables showing seasonally adjusted industrial production classified by market and industry groups. In addition, special analytical aggregates, such ones for as high-technology, energy, and motor vehicles, are shown; industries grouped into stage of processing are reported as well. (IP indexes for more detailed industries and market groups are available in the printable supplement to the G.17 on the Board's website; not seasonally adjusted indexes are available as well.) Indexes of capacity and capacity utilization also are presented, and supplementary information on motor vehicle assemblies, the gross value of products, and diffusion indexes of IP are published.[31]

On the first page, a short text describes the recent data and provides perspective for users. A summary table shows (1) for the total index and major industry and market groups index levels and monthly changes for the most recent six months, (and, for total industry and manufacturing, the values that were reported a month earlier), as well as changes from twelve months earlier, and (2) by major industry divisions, monthly utilization rates, previous cyclical highs and lows in utilization, and capacity growth from twelve months earlier. Three pages of charts follow the text and summary table. The charts on the first page show monthly seasonally adjusted production indexes, capacity indexes and utilization rates for total industry and for manufacturing from 1967 to the latest month available. Other analytically useful charts are shown on the next two pages. On the second page of charts, the top and middle panels graph (starting in 1997) the seasonally adjusted indexes for the major market groupings. The bottom two panels plot

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31. Motor vehicles assemblies (annual rates, seasonally adjusted) are published in the G.17. Not seasonally adjusted data for capacity, utilization, and the diffusion indexes are not available.

utilization by stage of processing starting in 1997. On the third page of charts, the top

panel plots (on a monthly basis beginning in 1967) total industrial production and the

total excluding high-technology industries.[32] The middle panel plots the year-over-year

changes for these two series. The bottom panels graph output for the three

high-technology industries and utilization for the high-technology aggregate and for all

other industries.

A set of tables follow the charts. In general, most tables include a series

description, market or industry (NAICS) classification, current proportions in total IP,

and recent statistics; these statistics may include the index levels, percent changes for

monthly indexes, changes for quarterly indexes at an annual rate, year-over-year change

for the most recent month and/or fourth-quarter to fourth-quarter changes for recent

years. Following the tables is an "Explanatory Note." The note provides prospective on

the output and capacity measures and summarizes how these indexes are calculated. The

note as of May 17, 2011, reads as follows:

Explanatory Note

The **Industrial Production and Capacity Utilization** statistical release, which is
published around the middle of the month, reports measures of output, capacity,
and capacity utilization in manufacturing, mining, and the electric and gas utilities
industries. More detailed descriptions of industrial production and capacity
utilization are available on the Board's website at
www.federalreserve.gov/releases/G17. In addition, the website includes files
containing data shown in the release, more detailed series that are published in a
monthly supplement to the G.17, and historical data. Instructions on searching for
and downloading specific series are provided as well.

Industrial Production

Coverage. The industrial production (IP) index measures the real output of the
manufacturing, mining, and electric and gas utilities industries; the reference
period for the index is 2007. Manufacturing consists of those industries included
in the North American Industry Classification System (NAICS) definition of
manufacturing *plus* those industries—newspaper, periodical, book, and directory
publishing plus logging—that have traditionally been considered to be
manufacturing. For the period since 1997, the total IP index has been constructed
from 312 individual series based on the 2002 NAICS codes. These individual

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32. The high-technology industries are defined as semiconductors and related electronic components
(NAICS 334412–9), computers (NAICS 3341), and communications equipment (NAICS 3342).

series are classified in two ways: (1) market groups, and (2) industry groups. Market groups consist of products and materials. Total products are the aggregate of final products, such as consumer goods and equipment, and nonindustrial supplies (which are inputs to nonindustrial sectors). Materials are inputs in the manufacture of products. Major industry groups include three-digit NAICS industries and aggregates of these industries—for example, durable and nondurable manufacturing, mining, and utilities. A complete description of the market and industry structures, including details regarding series classification, relative importance weights, and data sources, is available on the Board's web site (**www.federalreserve.gov/releases/G17/About.htm**).

Source data. On a monthly basis, the individual indexes of industrial production are constructed from two main types of source data: (1) output measured in physical units and (2) data on inputs to the production process, from which output is inferred. Data on physical products, such as tons of steel or barrels of oil, are obtained from private trade associations and from government agencies; data of this type are used to estimate monthly IP wherever possible and appropriate. Production indexes for a few industries are derived by dividing estimated nominal output (calculated using unit production and unit values or sales) by a corresponding Fisher price index; the most notable of these fall within the high-technology grouping and include computers, communications equipment, and semiconductors. When suitable direct measures of product are not available, estimates of output are based on production-worker hours by industry. Data on hours worked by production workers are collected in the monthly establishment survey conducted by the Bureau of Labor Statistics. The factors used to convert inputs into estimates of production are based on historical relationships between the inputs and the comprehensive annual data used to benchmark the IP indexes; these factors also may be influenced by technological or cyclical developments. The annual data used in benchmarking the individual IP indexes are constructed from a variety of source data, such as the quinquennial *Censuses of Manufactures and Mineral Industries* and the *Annual Survey of Manufactures*, prepared by the Bureau of the Census; the *Minerals Yearbook*, prepared by the United States Geological Survey of the Department of the Interior; and publications of the Department of Energy.

Aggregation Methodology and Weights. The aggregation method for the IP index is a version of the Fisher-ideal index formula. (For a detailed discussion of the aggregation method, see the *Federal Reserve Bulletins* of February 1997 and March 2001.) In the IP index, series that measure the output of an individual industry are combined using weights derived from their proportion in the total value-added

output of all industries. The IP index, which extends back to 1919, is built as a chain-type index since 1972. The current formula for the growth in monthly IP (or any of the sub-aggregates) since 1972 is shown below. An output index for month m is denoted by I_m^A for aggregate A and I_m for each of its components. The monthly price measure in the formula (p_m) is interpolated from an annual series of value added divided by the average annual IP index.

$$\frac{I_m^A}{I_{m-1}^A} = \sqrt{\frac{\sum I_m p_{m-1}}{\sum I_{m-1} p_{m-1}} \times \frac{\sum I_m p_m}{\sum I_{m-1} p_m}}$$

The IP proportions (typically shown in the first column of the relevant tables in the G.17 release) are estimates of the industries' relative contributions to overall growth in the following year. For example, the relative importance weight of the motor vehicles and parts industry is about 4 percent. If output in this industry increased 10 percent in a month, then this gain would boost growth in total IP by 4/10 percentage point (0.04 x 10% = 0.4%). To assist users with calculations, the Federal Reserve's web site provides supplemental monthly statistics that represent the exact proportionate contribution of a monthly change in a component index to the monthly change in the total index (**www.federalreserve.gov/releases/G17/ipdisk/IPWeightsSa.txt**).

Timing.   The first estimate of output for a month is published around the 15th of the following month. The estimate is preliminary (denoted by the superscript "p" in tables) and subject to revision in each of the subsequent five months as new source data become available. (Revised estimates are denoted by the superscript "r" in tables.) For the first estimate of output for a given month, about 70 percent of the source data (in value-added terms) are available; the fraction of available source data increases to 84 percent for estimates in the second month that the estimate is published, 93 percent in the third month, 97 percent in the fourth month, 98 percent in the fifth month, and 99 percent in the sixth month. Data availability by data type in late 2009 is summarized in the table below:

Availability of Monthly IP Data in Publication Window (Percent of value added in 2009)						
Type of data	Month of estimate					
	1st	2nd	3rd	4th	5th	6th
Physical product	25	39	48	52	53	53
Production-worker hours	45	45	45	45	45	45
IP data received	70	84	93	97	98	98
IP data estimated	30	16	7	3	2	2

The physical product group includes series based on either monthly or quarterly data. As can be seen in the first line of the table, in the first month, a physical product indicator is available for about half of the series (in terms of value added) that ultimately are based on physical product data (25 percent out of total of 53 percent). Of the 25 percent, about two-thirds (19 percent of total IP) include series that are derived from weekly physical product data and for which actual monthly data may lag up to several months. On average, quarterly product data are received for the fourth estimate of industrial production. Specifically, quarterly data are available for the third estimate of the last month of a quarter, the fourth estimate of the second month of a quarter, and the fifth estimate of the first month of a quarter.

Seasonal adjustment. Individual series are seasonally adjusted using Census X-12 ARIMA. For series based on production-worker hours, the current seasonal factors were estimated with data through January 2011; for other series, the factors were estimated with data through at least December 2010. Series are pre-adjusted for the effects of holidays or the business cycle when appropriate. For the data since 1972, all seasonally adjusted aggregate indexes are calculated by aggregating the seasonally adjusted indexes of the individual series.

Reliability. The average revision to the *level* of the total IP index, without regard to sign, between the first and the fourth estimates was 0.26 percent during the 1987-2009 period. The average revision to the *percent change* in total IP, without regard to sign, from the first to the fourth estimates was 0.21 percentage point during the 1987-2009 period. In most cases (about 85 percent), the direction of change in output indicated by the first estimate for a given month is the same as that shown by the fourth estimate.

Rounding. The published percent changes are calculated from unrounded indexes, and may not be the same as percent changes calculated from the rounded indexes shown in the release.

Capacity Utilization

Overview. The Federal Reserve Board constructs estimates of capacity and capacity utilization for industries in manufacturing, mining, and electric and gas utilities. For a given industry, the capacity utilization rate is equal to an output index (seasonally adjusted) divided by a capacity index. The Federal Reserve Board's capacity indexes attempt to capture the concept of *sustainable maximum output*─the greatest level of output a plant can maintain within the framework of a realistic work schedule, after factoring in normal downtime and assuming sufficient availability of inputs to operate the capital in place.

Coverage. Capacity indexes are constructed for 89 detailed industries (71 in manufacturing, 16 in mining, and 2 in utilities), which mostly correspond to industries at the three- and four-digit NAICS level. Estimates of capacity and utilization are available for a variety of groups, including durable and nondurable manufacturing, total manufacturing, mining, utilities, and total industry. Manufacturing consists of those industries included in the North American Industry Classification System, or NAICS, definition of manufacturing *plus* those industries─logging and newspaper, periodical, book, and directory publishing─that have traditionally been considered to be manufacturing and included in the industrial sector. Also, special aggregates are available, such as high-technology industries and manufacturing excluding high-technology industries.

Source Data. The monthly rates of capacity utilization are designed to be consistent with both the monthly data on production and the periodically available data on capacity and utilization. Because there is no direct monthly information on overall industrial capacity or utilization rates, the Federal Reserve first estimates annual capacity data from data. Capacity data reported in physical units from government sources (primarily from the U.S. Geological Survey and the Department of Energy's Energy Information Administration) and trade sources are available for portions of several industries in manufacturing (e.g., paper, industrial chemicals, petroleum refining, motor vehicles), as well as for electric utilities and mining; these industries represent about 25 percent of total industrial capacity. When physical product data are unavailable for manufacturing industries, capacity indexes are based on responses to the Bureau of the Census's *Quarterly Survey of Plant Capacity* (SPC); these industries account for a bit less than 70 percent of total industry capacity. In the

absence of utilization data for a few mining and petroleum series, capacity is based on trends through peaks in production (roughly 5 percent of total industry capacity). A description of the methodology used to construct the capacity indexes is available on the Board's website (www.federalreserve.gov/releases/G17/CapNotes.htm).

Aggregation Methodology. Monthly capacity aggregates are calculated in three steps: (1) utilization aggregates are calculated on an annual basis through the most recent full year as capacity-weighted aggregates of individual utilization rates; (2) the annual aggregate capacity is derived from the corresponding production and utilization aggregates; and (3) the monthly capacity aggregate is obtained by interpolating with a Fisher index of its constituent monthly capacity series. Utilization rates for the individual series and aggregates are calculated by dividing the pertinent monthly production index by the related capacity index.

Consistency. A major aim is that the Federal Reserve utilization rates be consistent over time so that, for example, a rate of 85 percent means about the same degree of tightness that it meant in the past. A major task for the Federal Reserve in developing reasonable and consistent time series of capacity and utilization is dealing with inconsistencies between the movements of the industrial production index and the survey-based utilization rates. The McGraw-Hill/DRI Survey, now discontinued, was the primary source of manufacturing utilization rates for many years. This was a survey of large companies that reported, on average, higher utilization rates than those reported by establishments covered by the Census Bureau's annual Surveyof Plant Capacity (the predecessor to the QSPC) for the fourteen years they overlapped. Adjustments have been made to keep the industry utilization rates currently reported by the Federal Reserve roughly in line with rates formerly reported by McGraw-Hill. As a consequence, the rates reported by the Federal Reserve tend to be higher than the rates reported in the QSPC.

Perspective. Over the 1972-2010 period, the average total industry utilization rate is 80.4 percent; for manufacturing, the average factory operating rate has been 79.0 percent. Industrial plants usually operate at capacity utilization rates that are well below 100 percent: none of the broad aggregates has ever reached 100 percent. For total industry and total manufacturing, utilization rates have exceeded 90 percent only in wartime. The highs and lows in capacity utilization shown in table 7 are specific to each series and do not all occur in the same month.

References and Release Dates

References.   The release for the annual revision that was published on June 25, 2010, is available on the Board's website (**www.federalreserve.gov/releases/g17/revisions/Current/DefaultRev.htm**). The annual revision published in March 2009 is provided in the *Federal Reserve Bulletin*, vol. 95 (August 2009), pp. A125–A145. The annual revision published in March 2008 is described in an article published in the *Federal Reserve Bulletin*, vol. 94 (August 2008), pp. A41–A60. A summary of the annual revision that incorporated back to 1972 production and capacity indexes reclassified according to the North American Industry Classification System is available in an article in the *Federal Reserve Bulletin*, vol. 89 (April 2003), pp. 151–176. A description of the aggregation methods for industrial production and capacity utilization is included in an article in the *Federal Reserve Bulletin*, vol. 83 (February 1997), pp. 67–92. The Federal Reserve methodology for constructing industry-level measures of capital is detailed in "Capital Stock Estimates for Manufacturing Industries: Methods and Data" by Mike Mohr and Charles Gilbert (1996), which can be obtained at www.federalreserve.gov/releases/g17/CapitalStockDocLatest.pdf.

Industrial Production—1986 Edition contains a more detailed description of the other methods used to compile the industrial production index, plus a history of its development, a glossary of terms, and a bibliography. The major revisions to IP and capacity utilization from 1990 have been described in the following issues of the *Federal Reserve Bulletin* (April 1990, June 1990, June 1993, March 1994, January 1995, January 1996, February 1997, February 1998, January 1999, March 2000, March 2001, March 2002, April 2003, Winter 2004, Winter 2005, Winter 2006, May 2007, August 2008).

Release Schedule
At 9:15 a.m. on
2011: January 14, February 16, March 17, April 15, May 17, June 15, July 15, August 16, September 15, October 17, November 16, and December 15.

V.B.   G.17 Webpage

The Federal Reserve Board webpage for the G.17 (www.federalreserve.gov/releases/g17) displays a release schedule for the current year with a link to the current release, a link to a page showing historical release dates back to 1947, and links to historical releases. In addition, right below the heading near the top of this page that says "Industrial production and Capacity Utilization - G.17" are links to other main sections (or pages): the current release, the supplement to the G.17 with additional detail, the latest annual revision release, historical data files in text format, documentation, announcements, and the data download program.

Monthly IP releases are available starting in December 1997. Annual revision releases are available starting in January 1997. In addition to the current format of the G.17, which was introduced in February 2001, a supplemental release, which provides more detailed industry data, for each month is available. All of these releases are available in ASCII, and PDF formats. A "screen reader" version (compliant with section 508 of the Rehabilitation Act of 1973, amended) is available for releases beginning with the one issued September 14, 2001.

Historical data may be downloaded from the Data Download Program (DDP) and the Historical data pages on the site. The DDP, inaugurated in 2006 and discussed above, allows the user to selectively download any of the statistics published in the G.17 using a variety of formats, including a comma-separated-value file (.csv), an Excel 2003 spreadsheet (.xls), or an Extensible Markup Language file (.xml) based on the Statistical Data and Metadata Exchange (SDMX) schema). The user can also download predetermined packages, including one that includes all new or revised data in the latest G.17.

The Historical data pages provide text files of data, documentation on how to access the data, and information on file format and directions for loading the data into an Excel spreadsheet. Relative importance weights also are provided; users were given an example of their use in the "Aggregation Methodology and Weights" subsection of the Explanatory Note section of the release (see page 47 of this document).

Seasonal factors for motor vehicle production also are available, as are past and prospective IP publication dates. Data and documentation relating to revisions to IP from initial to final (after five rounds of monthly updates and revisions) estimates are provided as well.

The Documentation page provides links to the *Federal Reserve Bulletin* articles related to each annual revision since 1995. In addition, documentation on the methods and source data used to compile the industrial production and capacity utilization statistics are found on this page.

For each monthly production and capacity series, the series source and pertinent meta-data are detailed in tables listed under "Source and Description Information." This material is updated with each annual revision and appears as part 2 of a volume available with each revision. (Copies of the tables that were posted in March 2011 are included in the attachments).

The Source and Description tables are as follows: Table 1 covers the "Industry structure of industrial production: classification, value-added weights, and description of series." For each series and NAICS industry group, the following attributes are shown: the industry name, the market and industry classifications, the value-added weights in 2009 dollars and as proportions of the total index, the type of data (product or production-worker hours), and the units of measure, source for the series, and the beginning date. Table 2, "Market structure of industrial production: classification and weights" shows the individual production series arranged by major market group. It includes 2009 value added in dollars and proportions for all series, as well as gross value weights in 2009 dollars for product series. Table 3, "Industry structure of capacity and capacity utilization: classification, value-added proportions, and description of series" shows sources used to compile each individual capacity index. Stage-of-processing classifications and starting dates for each capacity and utilization series are shown as well.

The explanatory note published as part of the release is also provided on the G.17 Documentation page. Moreover, its section on capacity and capacity utilization contains an expanded description of the methods used to construct the capacity indexes.

Documentation regarding capital stock estimates, used in constructing the capacity figures, is available as well.

V.C.   Publication Statistics

With the growing popularity of Internet access and improvements to the Federal Reserve Board website, most of the inquiries for industrial production and capacity utilization data are electronic. From the Board's public website, www.federalreserve.gov, the link to the G.17 press release is www.federalreserve.gov/Releases/G17/Current/default.htm. For March 2011 (a representative month for 2011), there were about 10,000 "hits" to this G.17 webpage. The RSS feeds webpage saw about 17,000 hits that month. In addition, the website offers the option of making outside inquiries via email. Over the past year, we have averaged about 10 such contacts per month. Though no longer requested by the public, computer-readable physical media containing historical data and the data published in the release may be obtained by contacting the Federal Reserve Publications Services, 202-452-3245.

At the same time, the demand for printed copies of the G.17 from outside users has declined further. Currently, only 19 copies of the G.17 are mailed outside of the Board. In addition, we send via e-mail data for selected IP series (typically unpublished series) to about 25 users each month and provide the United Nations with not seasonally adjusted data on an ISIC (International Standard Industrial Classification) basis.

V.D.   Other Reports

IP measures are published in the Council of Economic Advisers' Statistical Appendix tables for the *Economic Report of the President,* and the Census Bureau's *Statistical Abstract of the United States.*

V.E.   Release Schedule

The industrial production index is released in mid-month, typically at 9:15 a.m. A schedule is included in the explanatory note in the G.17. On no occasion in the past three years was the regular monthly release delayed.

On only two occasions (within memory) has the monthly release come out later than indicated in the preliminary schedule: (1) In January 1996, the release of the G.17,

which had been scheduled for January 17, was delayed until January 24—a delay of one week. Budget stalemates had forced the closing of the BLS, which provided the data on production-worker hours, a key element of the preliminary estimate of industrial production. The release of the BLS employment report was delayed two weeks from January 5 to January 19. (2) The industrial production release was also delayed in November 1987 due to a snowstorm. Some years ago the index had occasionally been issued early, when it was possible, prior to a meeting of the Federal Open Market Committee. In recent years, the publication schedule has been designed to take account of Open Market Committee meetings.

Advance notices of the revision issued on March 27, 2009, appeared in the G.17 release published mid-month from September 2008 through March 2009. Notices of the June 25, 2010, annual revision were in the G.17 releases published in October 2009 through June 2010. A notice of the March 25, 2011, revision was in the G.17 releases for November 2010 through March 2011.

The 2009 annual revision was initially announced on September 15, 2008, as being scheduled for late March 2009. In the monthly release issued on January 16, 2009, the final date for the publication of the annual revision was set for March 27, 2009. The 2010 annual revision was initially announced as being scheduled for late March 2010 in the monthly release of October 16, 2009. Soon after that, however, it was learned that the release of the 2008 ASM was to be delayed. A delay of the release until the second quarter of 2010 was announced in the monthly release of November 17, 2010. A release date in late June was announced in the release of February 17, 2010, and the final date of June 25, 2010, was announced in the release of April 15, 2010. The 2011 annual revision to the G.17 was initially announced as being scheduled for the end of March 2011 in the monthly G.17 issued on November 16, 2010. The final date for publication of the annual revision, March 25, 2011, was announced in the monthly G.17 release of February 16, 2011.

V.F.   *Inquiries about IP or Capacity Utilization*

The Industrial Output Section receives outside requests for information about the index of industrial production or the rate of capacity utilization. Most requests come by phone or

e-mail. These requests are generally for data, for interpretation of the data, or for information regarding other related statistics.

The requests for data frequently involve data availability and access. In a typical month, a few e-mails and outside phone calls are received on or near the day of release. Outside inquiries are often received between release dates from users wanting to know more about the structure and detail of the index; many of these requests are satisfied by directing users to information available on the G.17 website. Owing to the widespread availability of the data in public and private databases, these users typically have not seen the explanatory notes to the G.17 or the methodologies in previously published detailed material, such as *Industrial Production--1986 Edition, with a Description of the Methodology* or various relevant *Federal Reserve Bulletin* articles. For most questions, we e-mail a response within a day if possible.

VI. SECURITY OF DATA AND PRIOR DISCLOSURE

The G.17 is a bundled component of the General Support System for the Divisions of Research and Statistics (R&S) and Monetary Affairs, which is continuously monitored for compliance with the Federal Information Security Management Act (FISMA) and the Federal Reserve Board's Information Security Program. In addition, the operations involved in producing the G.17 were reviewed by the Office of the Inspector General of the Federal Reserve Board in the summer of 2005. Once the compilation of current IP has begun, internal access to the IP data files is limited to a pre-determined group of individuals within the Industrial Output Section. Individual user access of the division's systems requires a password which must be changed every 60 days.

During the monthly IP process, interim reports may be provided to division officers, Chairman Bernanke, and a select few other members of the R&S division. Once IP is finalized, senior division staff members are briefed, usually in the morning of the day prior to the release day, and Chairman Bernanke is provided with summary tables after this meeting. All of these updates are treated as "Internal FR" within the Board. The press release text and summary tables are provided to a member of the Economic Editing Section and to the Office of Public Affairs for review on the day prior to publication. Early afternoon on the day prior to the release day, encrypted tables are e-mailed to the Council of Economic Advisers; later that day, encrypted copies of the release are e-mailed to them.

On the morning of the publication of IP, the Office of Public Affairs sends the monthly G.17 release to the Treasury Press Room, where the data are officially released at 9:15 a.m. Reporters have access to the release, on an embargoed basis, about 30 minutes prior to 9:15 a.m. in order to prepare reports that are made available at the time of the release.

To the Federal Reserve's knowledge, there have been no occasions in the past three years in which someone within the Federal Reserve System disclosed to the public the G.17 or its predecessors prior to the scheduled release. The sole instance of such an event in earlier years occurred on April 15, 2005, when the G.17 was inadvertently posted to the Federal Reserve's public website 15 minutes prior to its official release time of 9:15 a.m. that morning.

On a few occasions, individuals who have access in the Treasury Press Room have released information to their wire services prior to the end of the embargo. However, there have been no such incidents in at least the past nine years. The Office of Public Affairs does not provide the individuals in the Treasury Press Room with explicit written instructions. However, press members are expected to abide by the release time on the G.17. In the event of a violation, the news agency also is expected to immediately notify the Board's Office of Public Affairs and the other news services in the Treasury Press Room; the intent of the latter requirement is to minimize any advantage a news organization might reap from its error. Also, when a violation occurs, the Office of Public Affairs communicates, usually by letter, asking the offending news organization to describe how the mistake was made and what changes in its procedures it will implement to prevent a recurrence.

VII. IP AND CAPACITY METHODOLOGY

VII.A. Industrial Production[33]

Basic concepts. The index of industrial production covers mining (NAICS major groups 211-213), manufacturing (NAICS major groups 311–316; 321–327; 331–337; and 339; and industries 1133 and 5111), and electric and gas utilities (NAICS 2211,2).[34] Production has been defined as the "the process of creating economic values or utilities needed to satisfy human wants."[35]

Production in the mining industry includes exploration and development of mineral properties and extraction of minerals in the form of solids (such as coal and ores), liquids (such as crude oil), or gases (such as natural gas). Milling and other preparation customarily done at the mine (well) site is also included. Manufacturing, according to the NAICS, relates to the mechanical, physical, or chemical transformation of materials, substances, or components into new products. Production by utilities refers to electric power generation, transmission, and distribution for sale and to natural gas distribution.

Summary of Methods. Individual IP series are derived from (1) annual indexes of real industry output that are calculated from comprehensive information sources and (2) monthly and, in a few cases, quarterly production indicators that are available for inclusion in the monthly index within the regular six-month reporting window. The annual index determines the trend for a series from one year to the next, and the production indicator determines the monthly changes for a series within each year. Each series is seasonally adjusted, and the contribution of the change in an IP series for an industry to the monthly change in the overall IP index is based on the value added by that industry.

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33 . This summary is derived from recent articles from the *Federal Reserve Bulletin* and from chapters in *Industrial Production─1986 Edition.*

34. Manufacturing consists of those industries included in the North American Industry Classification System, or NAICS, definition of manufacturing *plus* those industries─logging (NAICS 1133) and newspaper, periodical, book, and directory publishing (NAICS 5111)─that have traditionally been considered to be manufacturing and included in the industrial sector.

35. Donald W. Miffed, *Economics Dictionary* (American Elsevier, 1976). p. 209.

The annual indexes for individual IP series are derived from detailed industry data. For each six-digit NAICS industry in manufacturing, an annual chain-type measure of the real gross output of an industry is compiled. The value of the production is Census data on the industry's value added plus its cost of materials minus the cost of resales (when the data are available); the real output measure is obtained by deflating the value of production by an annually weighted chain-type price index compiled from detailed information on the composition of the industry's products.[36] Most of these price indexes are obtained from the BEA, but some are calculated by the Federal Reserve. Because an individual IP series may be a combination of several six-digit NAICS industries, the annual indexes for many manufacturing IP series are constructed from a number of industry gross output measures; for these indexes, the contribution of each component industry to the annual index is based on the value added by that industry.

For many IP series, the production indicators are compiled from monthly (or quarterly) product data. The indicator may be the output of a product in physical terms (for example, tons of portland cement or barrels of distillate fuel oil); or the indicator may be data on the output of several types of a product (for example, unit counts of assemblies of crawlers, wheel loaders, skid steer loaders, and the like, with each having a fixed weight.) Alternatively, for selected series, the indicator is a chain-type quantity index that is compiled each month (or quarter) from very detailed data on the prices and quantities of specific products produced by an industry. This method is used for the monthly IP indexes for semiconductors, computers, pharmaceuticals, machine tools, and autos and light trucks.[37]

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36. The definition of the nominal value of production was changed in the 2004 annual revision and implemented from 1997 through 2002. Previously, it was computed as value added plus the cost of materials. The cost of resales is the amount spent to purchase goods that are then resold without any material transformation. Data on the cost of resales for detailed NAICS industries are unavailable, however, for 2004, so the traditional calculation is being employed after 2002 until those data become available.

37. The method was introduced for the monthly measurement of semiconductors in the 1998 annual revision, for computers and motor vehicles in the 1999 annual revision, and for pharmaceuticals in the 2000 annual revision. For semiconductors, computers, and pharmaceuticals, the method consists of (1) estimating the value of U.S. production for the industry from monthly and quarterly data on highly detailed unit counts and values of individual products produced by industry and (2) deflating the value of production by a chain-type matched-model price index constructed, for the most part, from the same data.

For motor vehicles, detailed monthly data on the production of each vehicle model are aggregated using annual prices as weights. For a few other series in the IP index, the production indicator is obtained by

For non-energy mining, most annual and monthly indexes are developed from product data issued by the USGS; the IP series on refined petroleum products and electric and gas utilities are developed from comprehensive monthly and annual data from the DOE. For most IP series in these groups, the monthly data are measures of a product in physical terms, such as barrels of motor gasoline; for other series, the indicator is more complex. For example, coal production is the tonnage output of four geographic regions, weighted by the Btu content of the variety mined in each region.[38]

When high-frequency data on the physical quantity of production are unavailable, the Federal Reserve uses monthly data on the inputs to production, primarily the BLS's monthly data on production-worker hours, as the production indicator (some indexes use the Federal Reserve's monthly data on electric power use for the period up to 1997). The production indicator is combined with a productivity factor calculated from the annual output index to obtain the monthly IP index.

Comparison base and index calculation. The Federal Reserve reports the quantity of output as an index number─current output expressed as a percentage of production in a comparison base period. Currently, the base period is the year 2007.

Beginning in 1972, the aggregation method for the current IP index is a version of the Fisher-ideal index formula. The weights used to combine the individual industry output indexes are monthly "unit value added" measures ("or prices"), which are derived from annual data on industry value added. The formula for the change in monthly IP (or a monthly IP sub-aggregate) is the geometric mean of the change in output computed using current month weights and the change computed using weights for the previous month:

$$\frac{I_m^A}{I_{m-1}^A} = \sqrt{\frac{\sum I_m p_{m-1}}{\sum I_{m-1} p_{m-1}} \times \frac{\sum I_m p_m}{\sum I_{m-1} p_m}}$$

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deflating detailed data on the value of production or shipments from a trade source by a corresponding BLS producer price index.

38. This method was introduced in the 1998 revision.

where I_m is an individual production index for a month and p_m is the unit value added in month m.

Classification system. The 312 individual series are indexed and combined into industry groups as indicated in the NAICS and are also aggregated in the major market groups of the index. The market groups are arranged according to the expected use of the output as final products (consumer goods and equipment); intermediate products (construction and business supplies, which are items that are used as inputs outside of the industrial sector); and materials (including fuel and power that are further processed or used in factories, mines and utilities).[39] All industries in the IP index have their output allocated to multiple market groups. The market group shares for the individual IP series are derived using relationships in the input-output tables issued by the BEA.[40]

Monthly and annual production series. The main task in preparing the index is estimating the monthly changes in the real output of an industry. The underlying data used in these estimates are obtained, to the extent possible, from basic statistical series that express output in physical quantities (steel in tons, crude oil in barrels, and so on). The movements in such *physical product* series indicate the monthly changes in production without regard to movements in prices of the items involved. The monthly production of complex items like computers, machinery, and nuclear submarines, however, cannot be expressed meaningfully by reference to monthly movements in weight, length, or simple unit counts of production. Consequently, changes in the monthly output of such items are estimated on the basis of either: (1) the changes observed in relevant inputs, expressed in physical units, expended in the process of production; or (2) a chain-type index of real output developed from highly detailed and reasonably comprehensive price and quantity data. In the production index, the main monthly input data used are *production-worker hours* employed in industrial establishments; currently, the monthly movements in 121 series are based on input-type measures only. The main monthly series that are based on detailed price and quantity

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39. The detailed composition of the industry and market structures of the index is shown in the "Source and Description Information" tables found on the Board's website and included in the attachments.

40. This refinement was introduced in the 2002 annual revision. Prior to that, an individual IP series was assigned to the market grouping based on its highest share.

data include pharmaceuticals, semiconductors, computers, data networking equipment, autos, light trucks, and completed commercial aircraft.

Physical product series (both monthly and quarterly) cover about one-half of industrial production by weight. Of the 191 product series, about half come from government agencies, such as the Departments of Energy and Agriculture and the Census Bureau; the other half come from a variety of private sources, primarily trade associations, such as the American Iron and Steel Institute and the American Forest and Paper Association. Ward's Communications provides data covering automobiles and trucks.

While the data on physical product are taken from a variety of public and private sources, the data on production-worker hours come from a survey by the BLS. The BLS employment survey covers only a portion of the month, the pay period containing the 12th of the month; for manufacturing firms, this pay period is typically only one week long.

A number of steps may be required to convert the monthly data into the final output indexes. Daily averages (based on the number of working days in the month) of physical product series are calculated and then converted into relatives, expressed as a percentage of the daily average in 2007.[41] Similarly, monthly averages are used for the production-worker series. (Daily averages are not used for these series because the employment series cover only one week in each month.)

After the basic data are expressed as index relatives, they may be multiplied by factors that correct them for cyclical or secular biases due to sampling or trends in productivity. These "benchmark adjustment factors" (BAFs) are typically derived by comparing the monthly data with more comprehensive annual benchmarks that primarily are taken from the ASM, the *Censuses of Manufactures and Mineral Industries*, and *Mineral Yearbooks*. The BAFs are re-estimated during annual revisions of the index, but are studied during each year and may be modified if conditions have changed importantly. For instance, productivity per production-worker hour tends to rise faster in

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41. The number of working days in the month varies by industry. Some industries, such as wood pulp, work around the clock, seven days per week; other industries work five or six days per week.

expansions than in recessions. Seasonal factors are applied to the indexes to generate the seasonally adjusted indexes; seasonal adjustment methods are discussed below.

Weighting, aggregation, and linking. In creating aggregate indexes, a suitable method for combining the individual indexes of output is needed. Changes in the number of items produced—barrels of oil, pairs of socks, or automobiles—are not of equal significance. Clearly, the relative significance of the items must be taken into account in calculating the aggregates. Market prices are suitable for combining items at one stage of processing, but lead to double-counting when adding items from different stages, such as materials and products.

Because the industrial production index is based on estimates of real gross output at different stages of production—such as iron ore, raw steel, steel mill products, motor vehicle parts, and automobiles—value-added weights are used to combine the individual series; thus, double counting of the contributions of earlier stages to aggregate output is avoided. The census value added of an industry is used to represent the contribution of that industry to total industrial output. Implicitly then, constant-dollar value added for each series is assumed to move with gross output. This assumption is also relevant to the input-based series, because each input index is converted, through the use of the production factor coefficients, to an index of gross output before the individual series are aggregated into market and industry groups.

The value-added data are taken from the ASM, the COM, and *Census of Mineral Industries*. For utilities, the weights are based on the income statements of utilities. Care is taken to allocate the NAICS-based census value added to physical product series that do not precisely follow the NAICS.

IP market group aggregates for products, as well as stage-of-processing aggregates, are also calculated using gross value weights. Because the market group for products is the final stage of production within the industrial sector and the output of each stage-of-processing group is not generally used as an input to an industry in the same group, final goods prices can be used without double counting. Compiling the IP index using gross-value weights facilitates comparison with other dollar-based data. The gross-product weights are derived from data collected in the COM and ASM.

Monthly compilation practices. Preliminary estimates of industrial production are published about 15 days after the end of the relevant month. Beginning with the G.17 issued in April 2008, revisions may appear in the successive five months after the preliminary estimate. For each month the index is subject to estimation for six successive months. Thereafter, revisions of the indexes may occur in annual or benchmark revisions.

For the first estimate of a given month, the BLS's production-worker hours data are available along with about half of the physical product data.[42] By the time of the second estimate, the bulk of the product data and revised worker-hour data have been received. Revisions and most of the missing physical product data are received in time for the third and fourth estimates, but additional data may arrive in time for the fifth and sixth estimates. The table that summarizes the flow of information during a typical six-month IP window in 2009 was shown earlier (in the "Description of the Statistical Release" section). As the table indicates, in making the first estimate of IP, about 30 percent of the index is estimated (as primary source data are not yet available for that month). As a result, a variety of information is used to supplement the basic data base, particularly for the first estimate. Consequently, the estimation of the index of industrial production sometimes involves the use of judgment and information about production other than the available monthly data base. The main sources of such editing, or adjustments, are as follows: missing observations, extreme preliminary values, and input data that are unrepresentative of output in a particular month. The last step involves the incorporation of an adjustment for hours worked in manufacturing by workers on assignment from THS firms, if applicable.

Missing observations. The Federal Reserve compiles the production index from a variety of sources that become available at different times. For the first estimate, production-worker hours, weekly physical product data, and some of monthly physical product data are available; for the second estimate, much more of the monthly physical product data become available. Most of the remaining physical product data become available by month six and revisions to all types of sources are received as well. Given

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42. For some series based on monthly physical product data, available weekly physical product data are used as a proxy for the monthly series in the initial estimate.

the flow of data, most of the estimates for missing observations are for the current IP month. These estimated values are based on relevant data that are available, particularly the corresponding production-worker hour data, changes in the employment of THS workers, reports of strikes or unusual conditions, trade and industry news, and analysis of near-term productivity trends, cycles, and seasonal patterns in production.[43]

Extreme and unrepresentative values. Occasionally preliminary data appear to be extremely inconsistent with past experience, other current data, and information about current business conditions. Judgmental adjustments are sometimes made to such outliers, and experience has shown that revised data typically support the direction, if not the degree, of most of these adjustments.

Adjustments are also occasionally made because unusual conditions make the input-based indexes unrepresentative of actual production. The production-worker hour data cover only the pay period that includes the 12th of the month, not the entire month. If the survey reference period is not representative of the month because of a strike or severe storm, for example, then an adjustment is made so that the production index reflects the average level of activity in the month.

Seasonal Adjustment. The seasonal adjustment of the index dates back to the 1920s, when the Federal Reserve adopted the ratio-to-moving-average method. This method has been refined over time and gained wide acceptance. The Census Bureau has developed computer programs, including the X-11 and X-12 versions, that have permitted its application to a vast number of series, including the production index. All individual series are now adjusted with the Census X-12 ARIMA seasonal adjustment method using the computer program developed at the Census Bureau. This is supplemented by a prior de-trending procedure and by interventions and alternative holiday adjustment when appropriate.

The intervention method developed by Box and Tiao is applied to not seasonally adjusted production data to allow for replacement of "outlier" data patterns that bias the X-12's computations of seasonal factors. Once outliers are identified, the intervention

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43. For example, an "initial" estimate of a given IP series for which the source data are not yet available is based upon the monthly change in the corresponding production-worker hour series, seasonally adjusted, coupled with the recent estimated trend in productivity for that series. This estimate may be refined further taking into account the other relevant factors already mentioned.

program fits a nonlinear regression equation to the unadjusted data. Once the model has been fit, with the iterative use of least squares, the outlying data points are replaced by their estimated values. The production series, adjusted for holidays, outliers, and forecasts, is then processed through the ratio-to-moving-average part of the standard X-12 program to yield seasonal adjustment factors, which may be combined with holiday factors to calculate the final seasonally adjusted series. During annual revisions, the seasonal adjustment factors may be revised for a number of years.

VII.B. Capacity and Capacity Utilization

The Federal Reserve Board's capacity indexes attempt to capture the concept of *sustainable maximum output*, the greatest level of output a plant can maintain within the framework of a realistic work schedule after factoring in normal downtime and assuming sufficient availability of inputs to operate the capital in place. The concept itself generally conforms to that of a full-input point on a production function, with the qualification that capacity represents a sustainable maximum, rather than some higher unsustainable short-term maximum.

In general, to calculate an individual capacity index, preliminary, implied end-of-year indexes of industrial capacity are calculated by dividing a production index by a utilization rate obtained from a survey for that end-of-year period. These ratios are expressed, like the indexes of industrial production, as percentages of production in a comparison base year, currently 2007, and they give the general level and trend of the capacity estimates. Each implied capacity index number is an estimate of a sustainable maximum level of output expressed as a percentage of actual output in 2007. Thus, if in December 2007 the production index is 100 and a related utilization rate from a survey is 80 percent, then the implied capacity index is 100/0.8 = 125.

Summary of Methods. The individual capacity indexes for a year are derived from (1) preliminary, implied end-of-year indexes of capacity obtained by dividing a production index for an industry by a corresponding utilization rate obtained from a survey and (2) additional measures that, for most industries, are economic determinants of an industry's annual capacity growth. The capacity indexes, like the IP indexes, are expressed as percentages of production in 2007. Once the preliminary, implied capacity

indexes are calculated, they are related to the additional measures in a regression model. The final capacity indexes for a year are derived from the fitted values of these regressions. The preliminary, implied capacity indexes thus give the general level and trend of annual changes from one year to the next. For most manufacturing industries, estimates of industry capital input and a variable related to the average age of the industry's capital stock are used as the additional measures.[44] For mining, utilities, and selected manufacturing industries, measures of physical capacity are available and are used to determine the final capacity indexes.[45]

The capital input figures are estimates of the flow of services derived from an industry's net stocks of physical assets; the net stocks are developed principally from investment data reported in issues of the ASM and COM. Also used are estimates of business investment and price deflators by asset type, as well as the composition of an industry's capital spending by asset type, all from the BEA.

Editing and Current Estimates. In general, the capacity indexes are estimated from annual data. Estimates for the current year are largely extrapolations. The monthly capacity estimates are interpolated between the year-end estimates and are rarely adjusted. Monthly utilization is derived by dividing a production index by a capacity index. The utilization ratio is not adjusted. If the utilization rate published by the Federal Reserve begins to diverge from a related utilization rate recently reported by a trade source, such as the American Iron and Steel Institute, the appropriate capacity estimate may be revised and notice is given in the G.17 release.

Source Data and Updating. Capacity indexes for industries that account for about 20 percent of total industry capacity are based on capacity and output data reported in physical units from government and trade sources, primarily in mining and electric utilities. In manufacturing, most capacity indexes are based on responses to the Census Bureau's SPC; these industries account for a bit less than 75 percent of total industry

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44. The age variable is the ratio of the age of an industry's capital stock relative to its expected service life, given the mix of assets that compose the stock. A fuller description of the models that are used to develop the Federal Reserve's capacity estimates was reported in Gilbert, Morin, and Raddock, "Industrial Production and Capacity Utilization," pp. 194–97.

45. The industry structure and documentation of the sources used to compile each individual capacity index can be found in table 3, "Industry structure of capacity and capacity utilization: classification, value-added weights, and description of series," on the "Documentation" page of the Board's website for the G.17 release: www.federalreserve.gov/releases/g17/About.htm.

capacity. Capacity estimates in physical units are available for significant portions of several major industries, however; these include paper, industrial chemicals, petroleum refining, primary metals, and motor vehicles. In the absence of utilization data for a few mining series, capacity is based on trends through peaks in production (roughly 5 percent of total industry capacity). Overall, capacity indexes are constructed for 89 detailed industries (71 in manufacturing, 16 in mining, and two in utilities), which mostly correspond to industries at the three- and four-digit NAICS level.

With the change to a spring annual revision schedule, an initial estimate of capacity for a year is released in February, and then the annual revision to capacity is issued in with the annual revision to IP, which is usually targeted for late March.

In compiling the estimates of manufacturing capacity from 1972 on, every effort has been made to achieve continuity with the estimates before 1972. The McGraw-Hill/DRI survey was the primary determinant of the level of utilization series in manufacturing from 1955 through the mid-1970s. Continuity is achieved by applying a level adjustment to series whose data source changed from the McGraw-Hill/DRI survey to the Census survey to maintain consistency with the historical levels based on the earlier survey. (The two surveys overlapped for 14 years.) Generally, utilization rates from the Census survey, now the main source for manufacturing utilization rates, were lower, on average, than those of the discontinued McGraw-Hill/DRI survey; thus, the Federal Reserve's utilization rates for major industry totals and subtotals differ from those issued by the Census Bureau.

VII.C. Summary of Monthly Procedures

The IP and capacity utilization monthly processing can be presented as six identifiable steps:

Step 1. Receipt of data: by computer for the worker hours; by computer (including e-mail), phone, FAX, or mail for physical product data. Daily averages of the product data are calculated, and not seasonally adjusted indexes are derived from the raw data. Production factor coefficients are applied, when appropriate, to develop indexes of production (not seasonally adjusted) and seasonal factors are applied to compute seasonally adjusted indexes.

Step 2. The data are reviewed: estimates provided for missing values; improbable values replaced; inconsistencies analyzed; help supply adjustments, if appropriate, are incorporated.

Step 3. Market and industry aggregates are calculated, both seasonally adjusted and unadjusted.

Step 4. The data are further reviewed and utilization rates are calculated.

Step 5. The industrial production staff reviews the results with senior staff members of the Division, reports major numerical results to the Chairman, and prepares a draft of the text for the press release. The text is cleared with the senior staff of the Division and the Board's Office of Public Affairs.

Step 6. The G.17 is released in mid-month at 9:15 a.m. Eastern time.

VIII. DOCUMENTATION

The publication of the Federal Reserve's monthly index of industrial production began in the 1920s; since then, the measures have grown in scope and complexity. Each stage of development has been documented by the Federal Reserve in *Bulletin* articles, staff articles posted on the Federal Reserve's website, revision books (such as *Industrial Production, 1986 edition*), journal articles, professional working papers, and monographs.[46] These items are listed in the bibliography that follows. An annotated bibliography of articles on Federal Reserve measures of capacity and utilization is also included. Copies of documents published since the last report to the OMB and other relevant memos are attached.

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46. An update to the 1986 manual, which will consolidate the information in more recent *Federal Reserve Bulletin* articles, is underway.

IX.   BIBLIOGRAPHY

IX.A.   *Industrial Production and Capacity Utilization: Recent Bulletin articles and other references (1996–2011)*

Articles in the *Federal Reserve Bulletin* and Related Revision Summary Articles:

Otoo, Maria. *Industrial Production and Capacity Utilization: The 2010 Annual Revision.* Washington: Board of Governors of the Federal Reserve System, www.federalreserve.gov/releases/g17/articles/revision_2010_article.htm (April 2011).

> → Summarizes a revised interpolation method for data network equipment, new source data used to estimate capacity, and changes to methods for high-technology indexes.

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> → Summarizes the method for adjusting indexes for the effects on output of temporary help services; discusses methods of estimating the effect of hurricanes on production and of estimating the capacity of light vehicle producers.

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> → Summarizes the improvements in the indexes for communications equipment over the previous several years as well as the changes to the computer and semiconductor indexes in this revision.

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> → Summarizes improvements to the indexes for communications equipment, unitary air conditioners, ethanol, audio and video equipment, and semiconductors.

Bayard, Kimberly, and Charles Gilbert. "Industrial Production and Capacity Utilization: The 2005 Annual Revision," *Federal Reserve Bulletin*, vol 92, (2006), pp. A39–A58.

→ With this revision, the data from the survey of industrial electric power use are replaced as monthly indicators for industrial production by data on production-worker hours from 1997 forward.

_____, and _____. "Industrial Production and Capacity Utilization: The 2004 Annual Revision," *Federal Reserve Bulletin*, vol. 91 (Winter 2005), pp. 9–25.

→ Switches the source data for eleven industries from electric power use to production-worker hours. The revision to the capacity indexes used updated information for the publishing industry, for which there had been a gap in the collection of operating rates.

_____, and Norman Morin. "Industrial Production and Capacity Utilization: The 2003 Annual Revision," *Federal Reserve Bulletin*, vol. 90 (Winter 2004), pp. 9–25.

→ Includes a rearrangement of the market groups based on the 1997 input-output tables issued by the Bureau of Economic Analysis. Updates value-added weights used in aggregating individual indexes.

Corrado, Carol. "Industrial Production and Capacity Utilization: The 2002 Historical and Annual Revision," *Federal Reserve Bulletin*, vol. 89 (April 2003), pp. 173–87.

→ Incorporates the reclassification back to 1972 of production and capacity indexes for individual industries from the Standard Industrial Classification System to the North American Industry Classification System. Expresses production and capacity indexes as percentages of output in 1997; previously the reference year was 1992. Improves methods for measuring the real output of communications equipment.

_____, Charles Gilbert, and Norman Morin. "Industrial Production and Capacity Utilization: The 2001 Annual Revision," *Federal Reserve Bulletin*, vol. 88 (March 2002), pp. 173–87.

→ Reviews the use of new methods for calculating value added in electric utilities and the introduction of new source data for natural gas extraction capacity. Includes updated results for the unpublished series for the production of LAN equipment.

_____. "Industrial Production and Capacity Utilization: the 2000 Annual Revision,"

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→ Includes a brief description of data sources and methods for compiling
monthly IP. A technical note explaining how the newly introduced
production series for LAN equipment was derived and a table showing the
results for the new series are provided. A refinement of the aggregation
method introduced in the 1996 revision, a new series for the production of
drugs and medicines, the introduction of improved source data for series
for the production of computer printers and bearings, and a modification to
the definitions of advanced-processing and primary-processing industries
are also reviewed.

Gilbert, Charles, Norman Morin, and Richard Raddock. "Industrial Production and

Capacity Utilization: Recent Developments and the 1999 Revision," *Federal

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→ Includes a review of improved methods and models used to estimate
capacity and capacity utilization. Refinements to the methods for
calculating the capacity series for motor vehicles and semiconductor are
also discussed.

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→ Includes a description of new methods and new source data for
measuring the output of the semiconductor industry and the output of the
coal industry.

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→ Includes a description of a redesigned series measuring oil and gas field
services.

Corrado, Carol, Charles Gilbert, and Richard Raddock. "Industrial Production and

Capacity Utilization: Historical Revision and Recent Developments" *Federal

Reserve Bulletin*, vol. 83 (February 1997), pp. 67–92.

→ Reviews the introduction of new aggregation methods for IP and
Capacity; a technical note on aggregation of production and capacity
utilization and a description of the derivation of weights for the current

year are provided. The introduction of new source data for two equipment
series, farm and construction and mining equipment, and for stone, sand,
and gravel mining, as well as refinements to other individual production or
capacity series are reviewed. The article contains an appendix on a major
revision of the electric power data.

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Science Association, New Orleans (January 2002).

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Between the Standard Industrial Classification System and the North American
Industry Classification System," *2003 Proceedings of the American Statistical
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pp. 478–84.

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Association for Business Economics, Washington, D.C. (March 27, 2001).

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Capacity, and Capacity Utilization," *2003 Proceedings of the American Statistical
Association, Business and Economic Statistics Section [CD-ROM],* (2003),
pp. 2910–15.

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IX.B. Industrial Production: Historical Bibliography and Other References

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   and Historical Revision," *Federal Reserve Bulletin*, vol. 76 (April 1990),

   pp. 187–204.

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     and Statistics, Board of Governors of the Federal Reserve System,

     December 1995, unpublished).

     $\rightarrow$ The paper is a thorough review of methods used to estimate
     "productive" capital stocks by industry.

Raddock, Richard D. "Recent Developments in Industrial Capacity and Utilization,"

     Federal Reserve Bulletin, vol. 76 (June 1990), pp. 411–35.

     $\rightarrow$ This article documents the revision and restructuring of the capacity
     indexes for manufacturing, mining, and utilities for the period since 1967.
     The appendix includes a discussion of concepts, a summary of the
     methodology, and a table of the new industry structure, series
     composition, and the sources of capacity data. In this revision, the
     separate set of capacity estimates for industrial materials was eliminated,
     and many of its former components were included in the new estimates for
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     Measurement of Capacity Utilization: Problems and Tasks, Federal Reserve Staff

     Study 105, Board of Governors, Washington, D.C., July 1979. 259 pages.

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     Topics: Why and how utilization rates differ, capacity concepts and
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    → Charts of output and capacity for selected major materials, metals, and
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    construction of the measures.   Pressure on materials capacity was related
    to upward pressures on prices and wages rates, and growth in capacity was
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    p. 1159.

    → A chart of major materials capacity and output was included in a
    discussion relating "capacity operations in many basic industries since late
    1955, exerting upward pressures on prices and reinforcing claims for
    higher rates of pay." A brief note explained the construction of the
    estimates.

X.   LIST OF ATTACHMENTS

Monthly Release:

A1 & A2: *Industrial Production and Capacity Utilization*. G.17 (419) Federal Reserve Statistical Release: June 15, 2011 (PDF and Screenreader)

B1 & B2: *Industrial Production and Capacity Utilization, Supplement*. G.17 (419) Federal Reserve Statistical Release: June 15, 2011 (PDF and Screenreader)

C1 & C2: *Industrial Production and Capacity Utilization,* Annual Revision, March 25, 2011. G.17 (419) Federal Reserve Statistical Release (PDF and Screenreader)

D: *Industrial Production and Capacity Utilization,* Annual Revision, June 25, 2010. G.17(419) Federal Reserve Statistical Release (PDF)

E: *Industrial Production and Capacity Utilization,* Annual Revision, March 27, 2009. G.17 (419) Federal Reserve Statistical Release (PDF)

Source and Description tables:

F: *Industrial Production and Capacity Utilization,* Historical and Source and Description Information, G.17 (419) Federal Reserve Statistical Release (PDF)

Federal Reserve Bulletin **and Staff Studies**:

G: Maria Otoo, "Industrial Production and Capacity Utilization: The 2010 Annual Revision," Staff Study, April 15, 2011. (PDF)

H: Anne Hall, "Industrial Production and Capacity Utilization: The 2009 Annual Revision," *Federal Reserve Bulletin*, vol. 95, August 2009, pp. A125-A145. (PDF)

I: Kimberly Bayard and Charles Gilbert, "Industrial Production and Capacity Utilization: The 2008 Annual Revision," *Federal Reserve Bulletin*, vol. 94, August 2008, pp. A41-A60. (PDF)

J: **Pages for the G.17 on Federal Reserve website**

Current Release
Release dates
Monthly Supplement
Annual Revision
Documentation

       Historical data (text files)
       About the G.17
       Announcements (RSS Feeds)

K: **Data Download Project**

       Screen sequence for downloading pre-formatted package and documentation
       pages.

**Displays of the data on industrial production, capacity, and capacity utilization
from:**

L: *Economic Report of the President,* Council of Economic Advisers. February 2011 pp.
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M: *Statistical Abstract of the United States,* U.S. Census Bureau: 2011, Section 15,
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N: *Business Cycle Indicators,* The Conference Board. February 2010 Volume 5 Number
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