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Industrial Production and Capacity Utilization: The 2013 Annual Revision

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The Federal Reserve published revisions to its index of industrial production (IP) and related measures of capacity and utilization on March 22, 2013. Measured from fourth quarter to fourth quarter, total IP was reported to have increased 0.7 percentage point less in 2011 than was previously published. The revisions to IP for other years were smaller: Compared with the previous estimates, IP fell slightly less in 2008 and 2009 and increased slightly less in 2010 and 2012. Notably, benchmark data from the U.S. Census Bureau's Annual Survey of Manufactures (ASM) for 2011 implied that factory production increased more slowly in 2011 than previously reported. The gains in factory output would have been even slower if not for upward revisions to the production of high-technology goods. Output indexes for high-technology goods that were stronger than previously reported contributed positively to the rates of change in total output in every year since 2008.

Table 1. Industrial Production and Capacity Utilization: 2008-12

	2008	2009	2010	2011	2012
	Industrial production - rates of change				
Revised	-8.9	-5.5	6.2	3.3	2.7
Previous	-9.0	-5.7	6.3	4.1	2.9
	Capacity utilization rates				
Revised	73.5	69.7	75.6	77.1	77.5
Previous	73.2	69.5	75.4	77.9	78.9

Note: Rates of change are from the fourth quarter of the previous year to the fourth quarter of the specified year. Utilization rates are for the fourth quarter of the specified year.

The results from the 2013 annual revision showed a somewhat slower rebound in total IP after the trough of the recent recession than was previously reported. The decline from late 2007 to June 2009 remained around 17 percent; the annual revision indicated that about 15 percentage points of that decrease had been recovered by February 2013, whereas the previous estimates showed that about 16 percentage points had been recovered. At 97.7 percent of its 2007 average, the index in the fourth quarter of 2012 stood 0.4 percent below its previous estimate.

NOTE: Charles Gilbert directed the 2013 revision and, with Kimberly Bayard, David Byrne, Norman Morin, and Daniel Vine, prepared the revised estimates of industrial production. Norman Morin and Justin Pierce prepared the revised estimates of capacity and capacity utilization. Eliot Fuchs provided research assistance.

The revised IP indexes incorporate from the ASM detailed data on factory activity for 2011 and revised data for 2010. In addition, annual data from the U.S. Geological Survey (USGS) regarding metallic and nonmetallic minerals (except fuels) for 2012 were used in the revised estimates. The monthly estimates of production were updated to incorporate late-arriving or revised monthly or quarterly data (either outputs from or inputs to production), and they also reflect recalculations of seasonal factors. New high-frequency indicators were also incorporated for several production indexes.

Total industry utilization rates were revised down for 2011 and 2012. The rate of capacity utilization was 0.8 percentage point lower in the fourth quarter of 2011 and 1.4 percentage points lower in the fourth quarter of 2012 than previously estimated. The decrease resulted both from an IP index that was lower than reported earlier and from a capacity index that increased more rapidly in 2011 (especially for high-tech industries) and in 2012 (especially for mining). Capacity utilization rates for the fourth quarters of 2008 through 2010 were little changed from their previous estimates.

The revised estimates of capacity and capacity utilization incorporated data from the Census Bureau's Quarterly Survey of Plant Capacity Utilization (QSPC) for the fourth quarter of 2012, which covered the manufacturing sector, along with new data on capacity in the energy and mining sectors from the USGS, the U.S. Department of Energy, and other organizations, as well as data on capital spending by industry from the 2011 ASM.

TECHNICAL ASPECTS OF THE REVISION

This revision incorporated comprehensive data for production and value added by manufacturing industries from the newly issued 2011 ASM and a revised 2010 ASM. Revised price indexes from the Bureau of Economic Analysis (BEA) and updated price indexes constructed by the Federal Reserve for a few selected industries were also incorporated.[1] In addition, the updated production indexes included revisions to the measures of employment and production-worker hours from the monthly Current Employment Statistics survey conducted by the Bureau of Labor Statistics (BLS). The benchmark indexes for logging and publishing (included in the IP index for manufacturing but no longer included under manufacturing in the North American Industry Classification System (NAICS)) were updated through 2011 based on data from the U.S. Forest Service and the Census Bureau.

The revised IP indexes incorporated information from the QSPC for 2012 and from other annual industry reports. The indexes also incorporated revised monthly and quarterly source data on production, shipments, and inventories. Historically, the revised IP indexes included information from the Census Bureau's Current Industrial Reports (CIR); however, these reports were discontinued in mid-2011.

[1] Price indexes for pharmaceuticals (NAICS 325412), semiconductors (NAICS 334413), and most components of communications equipment (NAICS 3342) were constructed by the Federal Reserve from alternative sources. A table that lists annual and quarterly price indexes for the networking equipment component of communications equipment can be found in table 14 of the published annual revision.

Annual Benchmark Output Indexes

As part of the annual revision, a benchmark index of real gross output—defined as nominal gross output divided by a price index—was constructed for each six-digit industry defined by the 2007 NAICS.

The benchmark IP measures are Fisher indexes that aggregate the real gross output benchmarks for individual industries using value-added weights. Most of the individual benchmark IP indexes are constructed from data issued by the Census Bureau and by the BEA. The Census Bureau provides annual measures for value added and for the cost of materials, which can be summed to obtain nominal gross output.[2] The benchmark indexes for this revision incorporated new estimates of nominal gross output for 2011 from the ASM as well as revisions to the 2010 estimates. To obtain real gross output, the Federal Reserve staff deflated measures of nominal gross output using annual price deflators. Most of the deflators for the IP benchmarks were derived from industry shipments deflators that were issued by the BEA in December 2012. The BEA deflators were available on a 2002 NAICS basis, so they needed to be converted to the 2007 NAICS structure before being applied to the detailed nominal gross output data.

Since 2003, the ASM has not included separate data for every six-digit manufacturing industry; some industries are accounted for only in the aggregate data for a larger group of industries. The 2007 Economic Census, however, still contained separate data for each six-digit industry. For 2003 through 2006, the IP benchmark indexes were calculated by allocating the data from these combined industries to their six-digit components; the shares for each year were computed from a linear interpolation between the shares reported in the 2002 and the 2007 Economic Censuses. Data from the 2008, 2009, 2010, and 2011 ASMs were allocated to the component six-digit industries solely based on shares from the 2007 Economic Census.

Changes to annual benchmarks for semiconductors

This revision incorporated changes to the methods used to construct the IP indexes for semiconductors; the new methods resulted in significantly stronger gains in output—particularly for microprocessor units (MPUs)—than were reported previously.

The IP indexes for semiconductors are based on monthly shipments data from the Semiconductor Industry Association (SIA) deflated by a price index. This revision updated the methods used to calculate the price index associated with MPUs (NAICS 334413, part). The updated methods also affected the price index for metal-oxide semiconductor (MOS) logic chips excluding MPUs (NAICS 334413, part).

Like other price indexes used in the industrial production statistics, the price index for MPUs is composed of an annual benchmark deflator combined with a monthly price indicator. Prior to this revision, both the annual benchmark deflator and the monthly price indicator for

[2] Historically, the Census Bureau also provided measures of the cost of resales at the six-digit level, and those were included in the nominal benchmark. In recent years, however, the cost of resales has not always been available, so, to maintain consistency, the Federal Reserve has excluded the cost of resales from the rates of change for the benchmark indexes from 2003 forward.

MPUs came from the BLS's producer price index (PPI) for MPUs. With this revision, the Federal Reserve incorporated new data for the annual benchmark deflator for MPUs but continued to use the PPI as the monthly price indicator.

The new annual benchmark deflator for MPUs, which covers the period beginning in 2007, was developed using a hedonic regression. Hedonic regressions relate observed product prices to information on product characteristics; the fluctuations in prices due to changing product characteristics are then extracted from the observed prices to estimate a price index for a product of constant quality. In the case of MPUs, prices for specific models were collected from wholesale price lists published by Intel Corporation. Information on the relative quality of the chips came from MPU performance measures for specific representative tasks estimated by the System Performance Evaluation Corporation (SPEC), a nonprofit corporation that publishes these measures as a service to the technology industry and user communities.

The hedonic model was estimated by running a regression of the log-price of the specific MPU models on a constructed measure of performance that was derived from the SPEC measures along with other control variables and quarterly time indicator variables. The regression coefficients on the time indicators were used to construct a quarterly price index.[3] These quarterly measures were used to obtain the new annual hedonic price index, which falls substantially more than the previously used annual price deflator derived from the PPI. The result was a notable increase in MPU output beginning in 2007.

The price deflator for the IP index for MOS logic excluding MPUs is a geometric mean of a Fisher price index constructed from monthly SIA data for chips in this category, the price index for MPUs, and the price index for MOS memory chips. Because the changes to the price index for MPUs implied more-rapid price declines in recent years, the output index for MOS logic excluding MPUs, which relies on this price deflator, registered stronger gains.

Changes to annual benchmarks for communications equipment

The IP index for communications equipment (NAICS 3342) comprises six individual component indexes. For the years when detailed Census Bureau CIRs were available, the benchmark indexes for each of the six components used disaggregate product information to construct a measure of nominal output. With this revision, some product categories have been reassigned. Previously, products in "other communications systems and equipment" had been assigned to the category for radio and TV broadcasting equipment, the nominal output of which was deflated by the relevant PPI; with this revision, the products in "other communications systems and equipment" were assigned to the wireless system equipment category, the nominal output of which was deflated by a price index developed by the Federal Reserve.

Changes to Individual Production Series

Several production indicators were affected by methodological changes in this revision. In particular, new indicators were found for some industries whose high-frequency movements

[3] Additional details on the construction of the price index can be found on the Board's website at www.federalreserve.gov/releases/g17/MpuPriceIndex.htm.

had been based on data from the discontinued CIR.

Soybean and other oilseed processing

With this revision, the IP index for soybean and other oilseed processing (NAICS 311222 and 311223) used data on soybean and cottonseed products as the primary indicator of output. This revision incorporated monthly production data for soybean oil and for soybean meal from the National Oilseed Processors Association (NOPA) and monthly production data for cottonseed oil and cottonseed meal from the National Cottonseed Products Association (NCPA). For many years, the Federal Reserve used monthly information on soybean and cottonseed products from the CIR. With the 2012 annual revision, the IP index used production-worker hours to extend the CIR data. With this revision, the NOPA and the NCPA information were used to extend the CIR data.

Brick and structural clay tile

The index for brick and structural clay tile (NAICS 327121) is based on monthly data on unit production of bricks from the Brick Industry Association (BIA). For the period through 2006, this index is based on quarterly production data from the CIR. With the 2012 annual revision, the IP index used production-worker hours to extend the CIR data beginning in mid-2011, but now the monthly BIA data are used for the period from 2007 to the present.

Speed changers, drives, gears, and power transmission

This revision incorporated monthly data on shipments of gears from the American Gear Manufacturers Association (AGMA) as the primary measure of output for the index for speed changers, drives, gears, and power transmissions (NAICS 333612 and 333613) for the period beginning in 2004. The AGMA data include information on coarse-pitch and fine-pitch gears, on worm speed reducers and gearmotors, on concentric gearmotors, and on shaft-mounted speed reducers. Previously, the Federal Reserve estimated output for this index from production-worker hours.

Periodical publishers

The IP index for periodical publishers (NAICS 51112) was updated with this revision. Previously, output was inferred from monthly production-worker hour data from the BLS. This revision incorporated quarterly data back to 2003 on total operating revenue for periodical publishers from the Census Bureau's Quarterly Services Survey.

Revised Seasonal Factors

The IP indexes are seasonally adjusted to account for specific timing, holiday, and monthly seasonal patterns. With this revision, the seasonal factors for production-worker hours were updated with data through January 2013. The updated factors for the IP indexes based on physical product data included adjustments for workday patterns and used data through December 2012 where available. Seasonal factors for unit motor vehicle assemblies were updated prior to

the revision and projections are available on the Board's website.[4]

The 2010 annual revision introduced a pre-adjustment to many seasonal factors to account for the effects of the recent recession. The current revision continued those pre-adjustments where necessary. A detailed description of these methods is discussed in the 2012 annual revision article.[5]

Adjustments for Natural Disasters

In late October 2012, Hurricane Sandy struck the Mid-Atlantic region of the United States and caused widespread disruptions to production. In the G.17 release of November 16, 2012, it was reported that these disruptions subtracted nearly 1 percentage point from the rate of change in IP for October.

The Federal Reserve estimated Hurricane Sandy's effect on industrial output using the same procedures employed to assess the effects of previous natural disasters. For some industries, timely high-frequency physical product data exist that reflect the impact of natural disasters. But for other industries, the effect on production was estimated using a three-step procedure.[6]

For the industries without timely data, the first step is to identify the counties that are affected by a particular storm and to make a judgment about the degree of impact. For many storms, the Federal Emergency Management Agency (FEMA) provides useful information on the magnitude of damage caused by the storm, by county. Counties that sustained more severe damage may be declared "major disaster" areas, while counties that were less affected may be designated "emergency" areas. In the calculations that construct the effects of storms on IP, these FEMA designations are often used as a guide to identify the counties that are affected and also to provide a measure of the extent of the effect. A separate source of information on the geographical impact of a winter storm is data on snowfall from the National Oceanic and Atmospheric Administration of the U.S. Department of Commerce. Data on snowfall are available by weather station and can be used to construct indexes of snowfall by county.

Once the affected counties have been determined, the second step is to assess the share of each industry's output that occurs in each county. The Federal Reserve uses information from the Census Bureau's County Business Patterns (CBP) report for this purpose. The CBP is an annual report that contains (among other things) the level of employment by industry for each county in the United States.[7]

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[4] See Board of Governors of the Federal Reserve System, "Federal Reserve Seasonal Factors for Domestic Auto and Truck Production," Board of Governors, www.federalreserve.gov/releases/g17/mvsf.htm.

[5] See Board of Governors of the Federal Reserve System (2014), "Industrial Production and Capacity Utilization: The 2012 Annual Revision," Board of Governors, www.federalreserve.gov/releases/g17/articles/rev2012/industrial12.htm.

[6] For the purposes of this discussion, the terms "storm" and "natural disaster" will be used interchangeably. Most of the natural disasters that warrant special adjustments are indeed storms (typically hurricanes or blizzards). Natural disasters that are not storms include floods and wildfires.

[7] Data on employment are not necessarily available for every industry in every county, but the missing data may be imputed using more aggregate data and information on the distribution by size of establishments for each industry in each county.

The third step is to pool the information on the counties affected by the storm, the information on the share of each industry's presence in each county, and assumptions about the duration of production outages caused by the storm—specifically, the number of foregone workdays within the month.

In practice, the methods used to estimate the effects of natural disasters on IP involve some judgment. As actual measures of industry output become available over time, the initial measures are updated, not unlike IP estimates in nonstorm months. For some storms—notably, hurricanes that affect the Gulf Coast—the effect on output is concentrated in industries for which timely physical product data exist.[8] For many other storms, including Hurricane Sandy, the effects are spread across many industries and are less likely to be captured by high-frequency data sources.

[8] The Gulf Coast region is home to a large share of the output of industries closely related to oil and natural gas production, and many of these industries are covered by high-frequency (daily or weekly) data. See the discussion on the effects of Hurricane Katrina in Anne Hall (2009), "Industrial Production and Capacity Utilization: The 2009 Annual Revision," Federal Reserve Bulletin, vol. 95, www.federalreserve.gov/pubs/bulletin/2009/articles/industrial/default.htm.