Converting Historical Industry Time Series Data from SIC to NAICS

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I. Introduction

The introduction of the North American Industry Classification System (NAICS) in the late 1990's offered the promise of more relevant U.S. industry time series data for the 21st century. NAICS improved on the long-standing Standard Industrial Classification (SIC) system because it provided greater detail for the fast-growing services and high-tech manufacturing sectors and it more consistently classified establishments into industries based on similar production processes. U.S. statistical agencies faced major challenges, however, implementing NAICS for their on-going statistical programs. Perhaps an even greater challenge, given the lack of NAICS source data before 1997, was the need to convert historical industry time series data from SIC to NAICS.

Shortly before the introduction of NAICS, the U.S. experienced an acceleration of economic growth that was driven partly by increased production of information and communications technology (ICT). This faster growth helped to revive sluggish productivity growth and spurred talk among economists about a "new economy." Because the growth surge appeared to originate in a few key economic sectors, research interest started to focus more on specific industries as parts of the broader aggregate economy, especially the ICT-producing and consuming industries. While the SIC-based industry data were initially used for this research, the way these data were organized obscured some of the more important contributors to the growth acceleration. NAICS was designed partly to more clearly identify these industries in economic statistics.

While researchers were generally pleased that the new industry data that were classified on a NAICS basis better reflected the changing structure of the dynamic U.S. economy at the turn of the century, they were also disappointed that consistent historical industry data were no longer available. Consistent industry time series data are critical for studying industry contributions to economic growth, structural change, and productivity. One of the key datasets for studying these issues are the annual GDP-by-industry accounts prepared by the U.S. Bureau of Economic Analysis (BEA), which provide time series data on output and employment for industries going back to 1947. These data have been widely used by researchers studying the sources of output and productivity growth at the industry level in the postwar U.S. economy and are now available on a NAICS basis back to 1947. [1]

[1] Output estimates on a NAICS basis for 1987-97 were released in November 2004 (Yuskavage and Pho) and output estimates for 1947-76 were released in December 2005 (Yuskavage and Fahim-Nader). Employment estimates on a NAICS basis were released in October 2006. To obtain these data, go to http://bea.gov/industry/gdpbyind_data.htm and look under Historic Data.

In describing the data sources and the methodology that were used to convert the published SIC industry estimates for 1947 through 1997 to NAICS, this paper focuses on how BEA developed dynamic (time-varying) concordances that capture changes over time in the relative importance of new and emerging industries. As will be shown, this feature of the conversion process was quite important to the overall reliability of the NAICS estimates. The remainder of the paper is presented in three sections. Section II provides background on NAICS, including the motivation for its development, how it differs from the SIC system, and issues raised by its implementation. Section III provides background on the GDP-by-industry accounts, how they are used for historical time series analysis, and why it was important to recast these accounts on a consistent industry classification basis. Section IV discusses the methodology that was used for the conversion, how it compares to the methods used by other statistical agencies, and how the resulting estimates were evaluated. Section V is a summary and conclusion.

II. Industry Classification and NAICS

Properly designed industry classification systems serve valuable purposes but they also suffer from limited useful lives in a dynamic, changing economy. With such systems, a trade-off exists between data that are relevant for recent periods and data that are consistent over long periods. Industry classification systems allow statistical data for an economy's producing units (establishments or enterprises) to be aggregated into meaningful categories (sectors), such as manufacturing, trade, and services. Aggregate data are used by industry analysts and economic researchers to determine the relative sizes of sectors, changes over time in their importance in the economy, their contributions to economic growth, and their performance compared with similar sectors in other countries.

Industry classification systems can become increasingly irrelevant, however, as the economy grows and as the relative importance of sectors changes. New and emerging products and processes may not be recognized either because they did not exist or were very small when the classification system was first developed. The high degree of aggregation often used by statistical agencies for reporting the data, due to resource or reliability constraints, is another limitation. Even if new or emerging products have a clearly defined place in the classification system, their growth may be obscured if they are a relatively small part of an aggregate that includes other types of products.

Limitations of the SIC System

For more than 50 years, the SIC system was the framework used by the U.S. to classify establishments into industries for the purpose of producing economic statistics. The SIC coding system, which grouped establishments by their primary activity, was periodically revised to better reflect the U.S. economy's changing industrial organization and structure. The most recent revision was in 1987. Despite ongoing efforts to maintain its relevance, the SIC system was subject to criticism about the length of time between revisions, inadequate representation of the fast-growing services and high-tech sectors, and the lack of a clear conceptual rationale. These concerns were addressed at the 1991 International Conference on the Classification of Economic Activities in Williamsburg, Virginia. A direct outcome of the conference was the creation the following year of the Economic Classification Policy Committee (ECPC) by the Office of Management and Budget. The ECPC was charged with taking a fresh look at how to design an industrial classification system for a rapidly-changing economy.

The Bureau of Economic Analysis (BEA) chaired the ECPC, which included representatives from the Census Bureau and the Bureau of Labor Statistics (BLS). Ultimately, the ECPC decided to participate

in a joint effort with the statistical agencies of Canada and Mexico to develop the North American Industrial Classification System (NAICS). The passage of the North American Free Trade Agreement in 1994 was also a motivating force for developing a more up-to-date, uniform classification system because it would allow more relevant comparisons of economic and financial statistics across countries. NAICS was formally adopted as the new U.S. industrial classification system in 1997. Subsequent revisions resulted in the 2002 version of NAICS and a revised 2007 version was released earlier this year.

Advantages of NAICS

In general, NAICS improves on the SIC as an industry classification system because it more consistently classifies establishments into industries on the basis of similar production processes, it recognizes new and emerging industries, and it provides greater detail for the services sector. Some of its more valuable features are the establishment of an "information" sector that includes software publishing and other new types of communications services, the classification of auxiliaries according to the services they provide rather than the industry they serve, and a clearer separation of different types of high-tech goods and services such as computers and electronic products and information services. The ECPC decided on a production-oriented classification structure for two reasons. First, as a matter of principle, an industry classification system should be based on producing units rather than products or services. Second, a supply-based conceptual framework enables more accurate comparisons among industries because data are consistently classified according to factors related to the production process, such as outputs, inputs, and employment.

Implementation of NAICS posed many considerable statistical and logistical obstacles because the scope of the changes was much greater than previous changes to the SIC system. The 1997 version of NAICS was first implemented in the 1997 economic censuses conducted by the Bureau of the Census, and these were released starting in 1999. Afterwards, the samples for the Census Bureau's annual, quarterly, and monthly surveys were re-drawn and these surveys were then conducted on a NAICS basis. The Internal Revenue Service (IRS) Statistics of Income program incorporated NAICS for tax year 1998 data that were released in 2000. BLS followed shortly afterwards in early 2003 with the conversion of its monthly employment and earnings surveys to the 2002 version of NAICS. BLS producer price indexes were converted in 2004. These primary data sources then started filtering into downstream industry programs such as BEA's input-output (I-O) accounts, the BLS productivity programs, and the Federal Reserve Board's index of industrial production. Most industry economic programs were fully converted to NAICS by 2004, seven years after the NAICS reference year.

III. GDP by Industry and the Annual Industry Accounts

BEA's annual industry accounts (AIAs) include the integrated GDP-by-industry and annual input-output (I-O) accounts. In these accounts, industries are defined on an establishment basis according to NAICS. Estimates are published for 61 private industries and four government classifications. The GDP-by-industry accounts feature estimates of nominal and real value added by industry. Value added is defined as an industry's gross output (sales or receipts and other operating income) minus its intermediate inputs (energy, materials, and purchased services). Value added summed over all industries equals GDP. Intermediate inputs are goods and services acquired from either domestic or foreign sources (imports). Price and quantity indexes of gross output, intermediate inputs, and value added are published for

industries, industry groups, and broad sectors in the GDP-by-industry accounts. Several estimates of employment by industry from the national income and product accounts (NIPAs) are also provided.

Uses of BEA's Industry Accounts

The GDP-by-industry accounts are used to study structural change and sources of growth in the U.S. economy, to compare U.S. industrial performance with other countries, and to assess the contributions of industries and sectors to aggregate productivity growth. Because these accounts are conceptually and statistically consistent with the estimates of gross domestic product (GDP) from the NIPAs, they can be used to determine the contributions of industries and sectors to aggregate economic growth and inflation. These accounts have been widely used by academic researchers studying the contribution of industries to the U.S. productivity acceleration of the late 1990's and to the recent acceleration since 2001. (See Corrado et. al., Nordhaus, Stiroh, and Triplett and Bosworth for examples.) By providing annual estimates of nominal and real gross output, intermediate inputs, and value added for all industries, these accounts allow researchers to understand changes over time in the relative importance of industries. The nominal (current-dollar) value added estimates provide measures of industry size relative to GDP, and the real value added estimates provide measures of industry contributions to real GDP growth.

The annual I-O accounts, which are integrated with the GDP-by-industry accounts, provide a time series of detailed, consistent information on the flows of goods and services that are inputs into industry production processes and that are included in final expenditures. These accounts are presented in standard make and use tables and several supplementary tables, and they provide more detail than the GDP-by-industry accounts on the commodities included in gross output and intermediate inputs. The make table shows the commodities (goods and services) that are produced by each industry. The use table shows the commodity inputs to industry production and the commodities that are consumed by final users.

BEA released the NAICS-based integrated GDP-by-industry and annual I-O accounts for the years 1998-2003 in June 2004 (Moyer, Planting, Kern, and Kish). The new methodology featured innovative procedures that were designed to increase consistency among the estimates in BEA's economic accounts. The quality of the estimates was also improved by the use of annual commodity (product) data in a balanced input-output framework. One of the key data sources for implementing the new methodology was the 1997 benchmark I-O use table that was available for the first time on NAICS basis. This I-O use table was adjusted to incorporate the 2003 comprehensive revision of the NIPAs.[2]

Challenges Raised by NAICS

Preparing the estimates on a NAICS basis for the first time, however, also posed challenges. The GDP-by-industry accounts use source data from a wide variety of federal economic statistics programs and other sources. The estimates are prepared using source data collected by other agencies and the data are adjusted by BEA to meet NIPA and industry accounts definitions and conventions. For example, the initial estimates of the gross operating surplus portion of nominal value added by industry are based largely on tax return data from the IRS Statistics of Income program, compiled on a company basis rather than an establishment basis. Estimates of wages and salaries by industry are largely based on data from BLS, as are the consumer price indexes and producer price indexes used for deflation. Estimates

[2] See Lawson, Bersani, Fahim-Nader, and Guo for information about the 1997 benchmark I-O accounts.

of nominal gross output by industry are estimated using data from Census Bureau annual surveys, but also use data from regulatory agencies and trade associations. While some of the required source data were available on a NAICS basis, BEA needed to convert other source data from SIC to NAICS for the initial set of integrated estimates.

At the time the integrated estimates were released, GDP-by-industry estimates for years before 1998 were available only on the SIC basis and were not based on the new integrated methodology. As a result, it was not possible for researchers to conduct industry-level research and analysis for long time periods using consistent methodology and classifications. This was especially troublesome given the degree of structural change that took place during the 1980's and 1990's. Members of BEA's Advisory Committee and academic and non-academic researchers strongly urged BEA to develop a consistent historical time-series of industry data on a NAICS basis. This was considered important not only for the sake of reliable economic time series data, but also to take advantage of the special features of NAICS that more clearly show the sources of growth in the services sector and in high-tech goods-producing industries.

IV. Conversion of the GDP-by-Industry Accounts

Conversion of the GDP-by-industry accounts from SIC to NAICS for years before 1998 posed several major challenges for BEA. As described above, BEA uses a wide variety of data sources, mostly from other agencies, to compile the industry estimates of nominal and real value added, and it was not feasible to request that all of these data sources be converted from SIC to NAICS on a historical basis. As a result, because the methodology that was used for 1998 forward could not be used for years before 1998, BEA conducted research into using indirect "backcasting" techniques that extrapolate recent estimates into the past based on historical relationships.

Backcasting Issues

In designing a strategy to overcome the source data limitations, BEA faced a variety of issues, such as the time span covered, the number of data items to be provided, and the level of industry detail. Trade-offs abounded among these issues, and their resolution partly depended on the desired degree of accuracy in the converted series. In making key decisions, BEA relied on both its own research and suggestions from academic and business users with a strong interest in industry time series. These suggestions included providing data for as many years as possible, making maximum use of available historical SIC-based data, focusing on the most important data items, and considering aggregation as an acceptable means of dealing with both source data limitations and reliability concerns for distant years. The backward extrapolation (i.e., backcasting) methodology was ultimately designed to provide historical annual estimates that are consistent over time, that preserve the broad patterns observed in the previously published SIC-based estimates, and that incorporate the latest results from BEA's input-output accounts and national income and product accounts.

In general, when historical source data classified on a new basis are not available, statistical conversion procedures tend to rely heavily on concordances developed for a single year that show the relationship between data items classified on both the old basis and the new basis. Such single-year static concordances are reliable for a limited number of years before the reference year, but they become increasingly unreliable over time as relationships change among the industries. Concordances that capture changes over time in the relative importance of new industries yield more reliable results. The

rest of this section describes the procedures that were used to develop dynamic time-varying concordances and how these concordances were used to develop the historical NAICS-based estimates. It also describes the special challenges that were involved in converting both current-dollar and real (inflation-adjusted) estimates.

Other Agency Conversions

In converting the indices of industrial production for manufacturing from SIC to NAICS back to 1972, the Federal Reserve Board (FRB) largely avoided the source data problem described above by assigning NAICS industry codes to manufacturing establishments in the quinquennial economic censuses and then calculating SIC to NAICS conversion factors that varied over time for detailed manufacturing industries (Bayard and Klimek, 2003). Separate conversion factors were calculated for shipments, value added, inventories, capital expenditures, employment, and other key variables, and these factors were used in conjunction with annual survey data for manufacturing industries to develop NAICS-based industry time series (Corrado, 2003). This procedure was feasible due to the availability of longitudinal plant-level product data for manufacturing and the large number of one-to-one matches at detailed levels within the manufacturing sector. Exact matching techniques were used for more than 90 percent of manufacturing shipments in each of the economic census years.

Unfortunately, similar data for developing SIC to NAICS conversion factors were not readily available for non-manufacturing industries, which accounted for about 80 percent of private-sector GDP in 1997. Consequently, agencies that converted SIC data to NAICS for these industries tended to rely on fixed conversion factors from 1997 or other recent years. The Bureau of the Census converted its monthly and annual series for wholesale trade and retail trade sales and inventories to NAICS starting with 1992 partly by assigning NAICS industry codes to employer establishments in the 1992 economic census (Shimberg, Detlefsen, and Davie, 2002). In addition, BLS reconstructed its monthly payroll, employment, and related series from SIC to NAICS back to 1990 for all detailed NAICS industries. For certain higher-level industry aggregates, the conversion went back to 1939. These conversions were primarily based on employment ratios computed by assigning both NAICS and SIC codes to establishment microdata for March 2001 in the BLS Longitudinal Database (Morisi, 2003).[3]

BEA Procedures

For BEA, the conversion of historical SIC data to NAICS relied heavily, by necessity, on concordances that were developed from tabulations of aggregate data classified according to both SIC and NAICS. The methodology for converting the nominal (current-dollar) SIC industry estimates to NAICS was basically the same for the entire period 1947-97, but there were some important differences for the sub-periods 1987-1997 and 1947-1986. The conversion methodology was more extensive and included more variables for 1987-1997 for two reasons. First, the SIC-based series available for conversion were more complete and second, BEA decided that more detailed results could be provided for this period without a significant loss of accuracy. This section describes the conversion methodology for current-dollar estimates and for employment for 1987-97 in detail, followed by briefer descriptions of first the current-dollar and employment estimates for 1947-86 and then the real (constant-price) estimates for all periods.

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[3] In October 2004 BLS completed a release of employment and earnings on a NAICS 2002 basis back to 1990 from its Quarterly Census of Employment and Wages (QCEW, formerly ES-202) program. These data were later used by BEA for its estimates of employment by NAICS industry.

Current-dollar and Employment Estimates for 1987-97

The conversion methodology for 1987-97 for each of the industry current-dollar and employment estimates can be summarized by the following six-step procedure:

Step 1: Develop a 1997 benchmark concordance between SIC and NAICS
Step 2: Extrapolate the benchmark concordance annually back to 1987
Step 3: Develop an annual time series of SIC to NAICS conversion matrices
Step 4: Convert the published SIC estimates to NAICS
Step 5: Extrapolate the 1997 benchmark NAICS levels back to 1987
Step 6: Adjust the extrapolated estimates to NIPA control totals.

Each step is described in more detail below.

Step 1: Develop a 1997 benchmark concordance between SIC and NAICS. A 1997 benchmark concordance between NAICS 97 and SIC 87 was developed from the detailed 1997 benchmark I-O accounts, which include data for about 850 private industries at approximately the six-digit NAICS level. Each detailed six-digit NAICS industry code was mapped to both a detailed SIC code and a higher-level (aggregated) SIC code that corresponds to the GDP-by-industry publication level on the SIC basis (approximately 2-digit SIC). For each detailed NAICS industry, the benchmark I-O data set included estimates of gross output, intermediate inputs, compensation of employees, taxes less subsidies, and gross operating surplus. Summing the last three components yields nominal value added. At a later stage, estimates of full-time and part-time employment were added to the file. This concordance was based on an unpublished version of the 1997 benchmark I-O use table that was adjusted to incorporate the results of the 2003 NIPA comprehensive revision.

The benchmark concordance included data for 12 different types of auxiliaries that are recognized by NAICS, although most auxiliary activity is accounted for by one type: corporate, subsidiary, and regional managing offices (NAICS 55114). These auxiliaries were defined as central administrative offices in the SIC system. Data for each of the 12 types of auxiliaries were distributed to publication-level SIC industries in the benchmark concordance. These allocations were based on special tabulations from the 1997 economic census that showed the distribution of auxiliary expenses, payroll, and employment according to the SIC industry served.

Table 1 is an extract from the detailed 1997 benchmark concordance simplified for illustrative purposes. The first two columns show the detailed and aggregated NAICS industry codes and the third and fourth columns show the detailed and aggregated SIC industry codes. The next four columns indicate that, for each detailed NAICS industry identified in the first column, 1997 dollar values were available for gross output, compensation of employees, taxes less subsidies, and gross operating surplus. The aggregated NAICS and SIC industry codes correspond to the publication level for private industries in BEA's Annual Industry Accounts for 1998 forward and in the GDP-by-industry accounts for 1947-97. Tables A, B, and C in the appendix present the publication-level industry descriptions for private industries and the related industry codes for the 1997 NAICS, the 1987 SIC, and the 1972 SIC.

Table 1.-- Extract of 1997 Benchmark Concordance

Detailed NAICS Industry Code	Aggregated NAICS Industry Code	Detailed SIC Industry Code	Aggregated SIC Industry Code	1997 Gross Output	1997 Compen-sation of Employees	1997 Taxes less Subsidies	1997 Gross Operating Surplus
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
111910	111, 112	0132	01-02	$	$	$	$
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
113310	113-115	2411	24	$	$	$	$
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
211111	211	1311	13	$	$	$	$
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
713930	713	4493	44	$	$	$	$
721310	721	7021	70	$	$	$	$
722000	722	5812	52-59	$	$	$	$
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
812930	81	7521	75	$	$	$	$
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮

Table 1 indicates that the logging industry (NAICS 113310, SIC 2411) is included in the lumber and wood products industry (SIC 24) in the SIC system but in the forestry, fishing, and related activities industry (NAICS 113-115) under NAICS. Similarly, the eating places industry (NAICS 722000, SIC 5812) is included in the retail trade industry (SIC 52-59) in the SIC system but in the food services and drinking places industry (NAICS 722) under NAICS.

Step 2: Extrapolate the benchmark concordance annually back to 1987. Detailed concordances were developed for each year 1987-1997 by extrapolating back in time the detailed 1997 NAICS industry estimates, including employment. For each detailed NAICS industry, an SIC-based value or employment series for the period 1987-1997 was matched using the detailed SIC code. Shipments, sales, or receipts were used to extrapolate the 1997 benchmark levels of gross output and the value added components. These SIC-based series were obtained from the underlying detail used for the GDP-by-industry program, and are generally based on Census Bureau annual surveys. The employment series

for most of the industries were obtained from the BLS ES-202 program, which were also available at the four-digit SIC level. [4]

Table 2 is an extract of the extrapolated benchmark concordance for the variable gross output, simplified for illustrative purposes, for the period 1987-1997. Because of the detailed nature of the data, most of the matches between the six-digit NAICS level and the detailed SIC level were exact (one-to-one). Sometimes the SIC data had to be combined, and occasionally the SIC data had to be split because the NAICS industry was more detailed. These splits were based on data from the 1997 Census NAICS-SIC concordance, which has more industries and is more detailed than the 1997 I-O benchmark concordance. Employment for NAICS 55114 was extrapolated back to 1988 using data for central administrative offices collected as part of the 1987, 1992, and 1997 economic censuses.

Table 2.-- Extract of Extrapolated Benchmark Concordance for Gross Output

Detailed NAICS Industry Code	Aggregated NAICS Industry Code	Detailed SIC Industry Code	Aggregated SIC Industry Code	1987 Gross Output	…	1997 Gross Output	1987 Industry Ship-ments	…	1997 Industry Ship-ments
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
111910	111, 112	0132	01-02	$	$	$	$	$	$
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
113310	113-115	2411	24	$	$	$	$	$	$
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
211111	211	1311	13	$	$	$	$	$	$
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
713930	713	4493	44	$	$	$	$	$	$
721310	721	7021	70	$	$	$	$	$	$
722000	722	5812	52	$	$	$	$	$	$
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
812930	81	7521	75	$	$	$	$	$	$
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮

The first four columns are the detailed and aggregated NAICS and SIC industry codes from table 1. The next three columns indicate that nominal gross output values were estimated for each year 1987-97. The

[4] Employment data were extrapolated back to 1988 (rather than 1987) due to difficulties with matching data at the four-digit SIC level for 1987, which BLS classified on the 1972 SIC basis.

last three columns indicate that industry shipments data were included in the concordance for each detailed NAICS industry. These shipments data were matched based on the SIC code and were used for the extrapolation of gross output for years before 1997. For example, for detailed NAICS industry 113310 (logging), gross output for 1997 from the benchmark concordance was extrapolated back to 1996 and each year back to 1987 using the annual series of shipments for SIC 2411. This series was based on the Census Bureau's Annual Survey of Manufactures (ASM). Shipments and gross output are not exactly the same but are very similar.

Step 3: Develop an annual time series of SIC to NAICS conversion matrices. The detailed annual concordances developed in step 2 were cross-tabulated by the publication-level NAICS industry codes and the publication-level SIC industry codes. The resulting annual "conversion matrices" consist of 61 private SIC-based industries in the columns and 61 private NAICS industries along the rows. Using the cross-tabulated dollar and employment amounts, column coefficients (which sum to 1.0) were calculated that show the percentage of a publication-level SIC industry's estimate that should be allocated to a specific publication-level NAICS industry.

Table 3 is a sample hypothetical conversion matrix for any year and any variable. Publication-level SIC industry codes (s=61) are shown at the top of the columns and publication-level NAICS industry codes (n=61) are shown at the beginning of the rows. Column coefficients sum to 1.0 and some of the hypothetical cell coefficients are shown for illustrative purposes. When a one-to-one match exists

Table 3.-- Sample Conversion Matrix for Publication-level Industry Estimates

	s = 61															
n = 61	SIC →	01, 02	…	13	…	24	…	44	…	52	…	70	…	75	…	88
	NAICS ↓															
	111,112	1.0														
	113-115					.25										
	⋮															
	211															
	⋮															
	⋮															
	44,45									.65						
	⋮															
	⋮															
	⋮															
	621															
	⋮															
	⋮															
	713															
	⋮															
	721											.85				
	⋮															
	722									.35		.15				
	⋮															

	⋮															
	⋮															
	⋮															
	⋮															
	81															
	Total	1.0	...	1.0	...	1.0	...	1.0	...	1.0	...	1.0	...	1.0	...	1.0

between an SIC industry and a NAICS industry, the coefficient in the cell where the industries intersect equals 1.0. The farming industry (s=01,02 and n=111,112) is an example of such a one-to-one match. In this case, estimates for the SIC industry are allocated entirely to the NAICS industry, and the NAICS industry does not include estimates from any other SIC industry in whole or in part.

Conversion matrices are compiled for each variable in each year by cross-tabulating the data for that variable in the extrapolated benchmark concordance. Conversion matrices with annual weights--as opposed to fixed reference-year weights--capture changes over time in the shares used to convert from SIC to NAICS. Below is an example that shows the percentages that were used to distribute employment for the SIC retail trade industry to the corresponding NAICS industries for 1988 and for 1997.

NAICS Industry	1988	1997
Retail trade	62.9	60.9
Food services & drinking places	34.7	36.7
Management of companies	1.7	1.7
Other industries	0.7	0.7

If the 1997 conversion matrix shares had been held constant and used for 1988, then employment in the NAICS food services and drinking places industry would have been overstated in 1988 and would have shown slower growth over the period 1988-97. In contrast, employment in the NAICS retail trade industry, which excludes eating and drinking places, would have been understated and would have shown faster growth over this period.

Another way to highlight the impact of using variable versus fixed shares in the conversion matrix is to compare the growth rates of gross output for selected industries using the two sets of shares as weights. Table 4 presents the annual average growth rate of nominal gross output for 1987-97 for fast-growing industries connected with computer equipment, software, and business and professional services. Column (1) shows the growth rate using fixed 1997 shares and column (2) shows the growth rate using variable annual shares. The third column shows the effect of using variable shares rather than fixed shares. Average annual growth rates are significantly higher for the 10-year period using variable shares, especially for the computer systems design and related services industry.

Table 4.-- Nominal Gross Output for Selected Industries
Fixed vs. Variable Shares, 1987-97
(Average annual growth rate)

Industry	Fixed (1997) Shares (1)	Variable (Annual) Shares (2)	Effect of Variable Shares (2) - (1)
Computer and electronic products	6.3	7.1	0.8
Publishing industries (includes software)	6.4	7.8	1.4
Computer systems design & related services	12.2	15.6	3.4
Administrative and support services	5.4	7.6	2.2

Step 4: Convert the published SIC estimates to NAICS. Estimates for each of the 61 published private SIC industries for 1987-1997 were distributed to the 61 publication-level NAICS industries by multiplying the published SIC industry estimates by the column coefficients in the annual conversion matrices and summing the allocations along the NAICS rows.[5] The published SIC industry estimates for gross output, compensation of employees, taxes less subsidies, gross operating surplus, and full-time and part-time (FTPT) employment incorporated the results of the 2003 comprehensive NIPA revision. The NIPA statistical discrepancy was first distributed among private nonfarm non-housing industries in proportion to each industry's gross operating surplus. Adjustments were also made to impute gross output for auxiliaries because such output was not recognized in the SIC system.

Equation (1) summarizes the conversion of the published SIC-based dollar and employment levels to NAICS-based levels (converted estimates) for each variable (data item) in each year. C_t^k represents an n x s conversion matrix for variable k in year t, where n is the number of NAICS industries (61) and s is the number of SIC industries (61). Matrix elements c_{ns} represent column coefficients that sum to 1.0. S is an s x 1 column vector of SIC values for variable k in year t. Multiplying C by S yields N, an n x 1 column vector of NAICS industry values for variable k in year t.

(1) $$\underset{(n \times s)}{C_t^k} \cdot \underset{(s \times 1)}{S_t^k} = \underset{(n \times 1)}{N_t^k}$$

Step 5: Extrapolate the 1997 and 1998 NAICS levels back to 1987. The NAICS industry series derived in step 4 were used to extrapolate the 1997 benchmark gross output and value added component levels for 1997 back to 1987. This step adjusts for differences in the estimate levels for 1997 between the converted estimates from step 4 and the benchmark estimates. The actual backcasting procedure is summarized by equation (2), which indicates that the dollar value (V) of a value-added component k (k=1,...,3) for NAICS industry i in year t-p equals the value in the following year (t-p+1) multiplied by the ratio of the converted values for industry i from vector N^k for both years. For example,

(2) $$V^k_{i,\,t-p} = V^k_{i,\,t-p+1} \cdot (n^k_{i,\,t-p} / n^k_{i,\,t-p+1}) \quad \text{where} \quad \begin{array}{l} i = 1,\ldots,n \\ t = 1997 \\ p = 1,\ldots,10 \end{array}$$

and where $V^k_{i,\,t}$ = benchmark values.

[5] SIC employment for 1987 was distributed to NAICS industries using the conversion matrix for 1988.

For example, the value of compensation of employees for the NAICS computer and electronic products industry (NAICS 334) in 1997 is obtained from the 1997 benchmark file. The value in 1996 equals the 1997 value multiplied by the ratio of compensation for NAICS 334 from the 1996 conversion matrix to compensation for NAICS 334 from the 1997 conversion matrix. The converted value from the 1997 conversion matrix can differ from the benchmark value for various reasons, but these differences are usually small.

In addition to the value-added components, gross output and employment were also converted from SIC to NAICS using similar procedures. These variables are not indexed by superscript k because they are not part of the value-added summation. The estimation of their backcast values is described by equations (2a) and (2b). Superscript *go* refers to gross output and superscript *emp* refers to full-time and part-time employment:

(2a) $$V^{go}_{i,\,t-p} = V^{go}_{i,\,t-p+1} \cdot (n^{go}_{i,\,t-p} / n^{go}_{i,\,t-p+1}) \text{ and}$$

(2b) $$V^{emp}_{i,\,t-p} = V^{emp}_{i,\,t-p+1} \cdot (n^{emp}_{i,\,t-p} / n^{emp}_{i,\,t-p+1}).$$

For employment, t = 1998 and $V^{emp}_{i,\,t}$ is obtained from published NIPA estimates. At a later stage, the employment extrapolators obtained from the conversion matrices for 1990-1998 were replaced by the actual NAICS employment estimates from the BLS conversion of the Quarterly Census of Employment and Wages data. These converted BLS data were used directly for consistency with the estimates of employment by industry from BEA's regional economic accounts.

Step 6: Adjust the extrapolated estimates to NIPA control totals. For each year 1987-1997, for each extrapolated industry value added component and for employment, the sum over private industries was adjusted so that it equals the independent NIPA total for the private sector. The revised SIC estimates were used directly for government enterprises and for general government. The aggregate NIPA estimates were used as control totals for private industries because NAICS did not affect the definition of the private sector. Adjustments to match the controls were made for compensation of employees, taxes less subsidies, gross operating surplus, and employment. Value added by industry was then obtained as the sum of the three adjusted value-added components for each industry. Intermediate inputs by industry were obtained as the difference between gross output and value added. These adjustments to controls insure that, in each year, each component separately equals the aggregate NIPA amount and that the aggregate value added components sum to GDP. Research has demonstrated that conversion of the three components separately yields better overall results than converting nominal value added directly.

Equations (3) through (6) describe these adjustments. In any give year, V^k_T represents the aggregate NIPA total for a value-added component, such as compensation of employees. An adjusted value for each NAICS industry ($V^{k'}_i$) is obtained by multiplying the unadjusted estimate from the backcast procedure in step 5 by a scaling factor. The scaling factor equals the ratio of the NIPA total to the sum of the value-added component over private industries:

(3) $$V^{k'}_i = V^k_i \cdot (V^k_T / \textstyle\sum_i V^k_i).$$

Summing the adjusted values of each value added component over all industries yields aggregate values that equal the published NIPA totals:

(4) $$\sum_i V^{k'}_i = V^k_T.$$

For a given NAICS industry, summing the three adjusted value-added components yields nominal value added for the industry. Summing value added over all industries equals GDP.

(5) $$\sum_{k=1}^{3} V^{k'}_i = VA_i \quad \text{and}$$

(6) $$\sum_{i=1}^{n} VA_i = \text{GDP}.$$

Nominal and Employment Estimates Before 1987

As noted above, the conversion for the years before 1987 was more limited than that for the period 1987-97. This difference in treatment was partly due to the more limited detail available in the SIC data before 1987 and partly due to BEA's concerns about the reliability of more detailed industry estimates for the earlier years. Annual conversion matrices with variable shares for value added were developed for 1977-86 on the 1972 SIC basis. The 1977 conversion matrix for value added was held constant for 1947-76 because of the limited availability of SIC-based source data for extrapolation, especially in the non-manufacturing sector. For the years 1947-86, only estimates of value added and employment were prepared. Components of value added, gross output, and intermediate inputs were not estimated. Estimates for 65 industries were provided for the period 1977-86, but for the period 1947-76 estimates were provided for only 22 broad industry groups.

Real Value-Added by Industry Estimates

One of the most important uses of industry output measures, both gross output and value added, is for time series analysis of economic growth and productivity change at the industry level. These types of analyses require inflation-adjusted (real) estimates of outputs and inputs by industry in order to identify the impact of changes in quantities or real magnitudes. Price indexes are needed for deflation of both industry outputs and inputs. The preferred method for calculating real value added by industry is the double-deflation method, in which real value added is estimated as the difference between real (deflated) gross output and real (deflated) intermediate inputs. BEA uses a Fisher index number formula for this calculation.

Developing historical real value added by industry estimates on a NAICS basis was very challenging because of the need to develop both industry and commodity price indexes on a NAICS basis, and to determine the commodity (product) composition of intermediate inputs for deflation. The latter required input-output use tables on a NAICS basis before 1997, which were not available at the time. As a result of these source data limitations, BEA took different approaches for different time periods. In all periods, the price and quantity indexes for farms, government enterprises, and general government were obtained directly from the revised SIC-based estimates, since NAICS did not affect the definitions of these industries. The different approaches for the different time periods are described below.

Real Estimates for 1987-97. Real estimates (chain-type quantity indexes) of gross output, intermediate inputs, and value added were prepared for each of the 65 detailed industries and for related industry groups and aggregates, including private industries and "all industries." Real value-added estimates were computed using the double-deflation method after first computing Fisher price indexes for industry gross output and for intermediate input commodities. These aggregate price indexes were calculated using the detailed SIC-based price index series that were matched to the benchmark concordance. The price indexes were generally available at the same level of detail as the shipments, sales, and receipts data used to extrapolate the benchmark concordance (see table 2.) The unpublished NAICS-based chain-type quantity indexes for 1997 from the June 2004 release were extrapolated back to 1987 using the Fisher quantity relatives computed from the current-dollar values and price indexes.

The double-deflation procedure used for these estimates is a close approximation of the procedure used for the revised SIC-based estimates, and it is similar to the procedure currently used for the annual integrated estimates. However, the level of commodity detail for the deflation of intermediate inputs is less than in either of those other methodologies. For the deflation of intermediate inputs for 1987-97, I-O use tables were prepared that show the commodity composition of intermediate inputs--based on about 130 commodities--for each detailed published NAICS industry. The use table for 1997 was based on the published 1997 benchmark I-O accounts. Use tables were developed for 1992 and for 1987 by converting the published I-O benchmark use tables for those years from SIC to NAICS at the summary level of detail (about 130 industries and commodities). Use tables for the other years were developed by linear interpolation between benchmark years. Commodity price indexes were compiled for about 130 commodities from the price index detail in the benchmark concordance.

Real Estimates for 1947-86. Because of the limited availability of price indexes and input-output tables on a NAICS basis before 1987, real value added estimates for 1977-86 were computed using a single-deflation method as opposed to the more data intensive double-deflation method. Single-deflation is an alternative deflation method recommended by international statistical organizations when the data needed for the preferred double-deflation method are not available. Real estimates (chain-type quantity indexes) of value added were prepared for each of the industries and for related industry groups and aggregates, including private industries and "all industries."

Real value-added estimates were computed using a single-deflation method after first converting SIC-based value-added price indexes to NAICS-based price indexes using the same set of annual conversion matrices that were used to convert the current-dollar value added estimates. This procedure computes the value-added price index relative for each NAICS industry as a weighted average of the value-added price index relatives for each of the SIC industries that contribute to the NAICS industry. The weights, which were obtained from the annual conversion matrices described above, represent the share of a NAICS industry's current-dollar value added accounted for by a specific SIC industry (row coefficients). The following equation describes how the weighted-average value-added price index relative for period t-1 to t was computed for each NAICS private nonfarm industry:

$$\left(\frac{VA_t^P}{VA_{t-1}^P}\right)_n = \sum_{s=1}^{60} w_{ns}\left(\frac{VA_t^P}{VA_{t-1}^P}\right)_s$$

where $w_{ns} = VA_{ns}^{PQ} / \sum_{s=1}^{60} VA_{ns}^{PQ}$ for each n = 1,...60 and

VA^{P}_{t} represents an industry's value added price index for period t ,
VA^{PQ} represents an industry's nominal value added,
n represents a NAICS industry and *s* represents an SIC industry and
ns represents a cell in the nominal value added conversion matrix.

The SIC-based value-added price indexes for 1977-87 are the revised indexes that were released in June 2004 as part of the comprehensive revision of the annual industry accounts. The SIC-based value-added price indexes for 1947-76 were calculated from previously published SIC industry estimates that were last updated in July 1988, before the introduction in 1991 of changes in methodology for real value-added estimates. The published NAICS-based chain-type quantity indexes for 1987 were extrapolated (chained) back to 1947 using the value-added quantity relatives computed from the current-dollar values and price indexes.

Evaluating the results

The converted NAICS estimates were evaluated for reasonableness and consistency primarily by comparison with other related estimates. Comparisons were made with the revised SIC-based estimates at aggregate levels and with more detailed industry groups whose definitions were not significantly affected by the conversion to NAICS. For 1987-97, when the converted results are expected to be the most reliable, the average growth rates of real value added and the shares of current-dollar GDP were about the same before and after the conversion to NAICS (table 5). Manufacturing's real growth rate was slightly larger under NAICS, but this difference is partly due to the shift of publishing industries from nondurable-goods manufacturing to the information sector. As expected, the GDP share of goods-producing industries and of manufacturing is lower under NAICS than under the SIC. The NAICS-based estimates also show the decline in goods-producing industries' share of GDP that was seen in the SIC-based estimates. Also as expected, the share of GDP for goods-producing industries is similar to but slightly lower under NAICS than under the SIC over the longer 1947-87 period (chart 1).

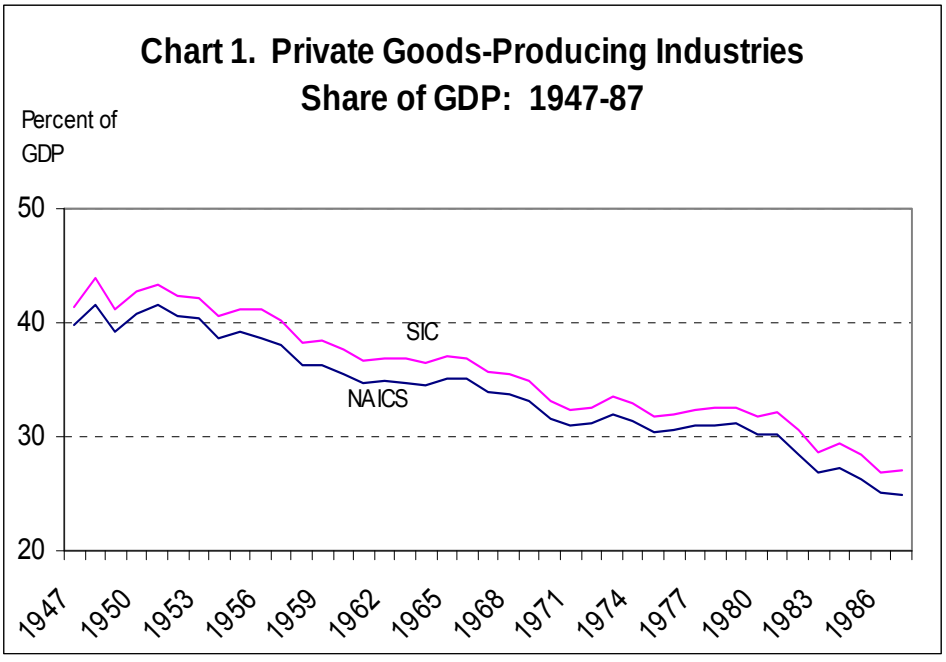
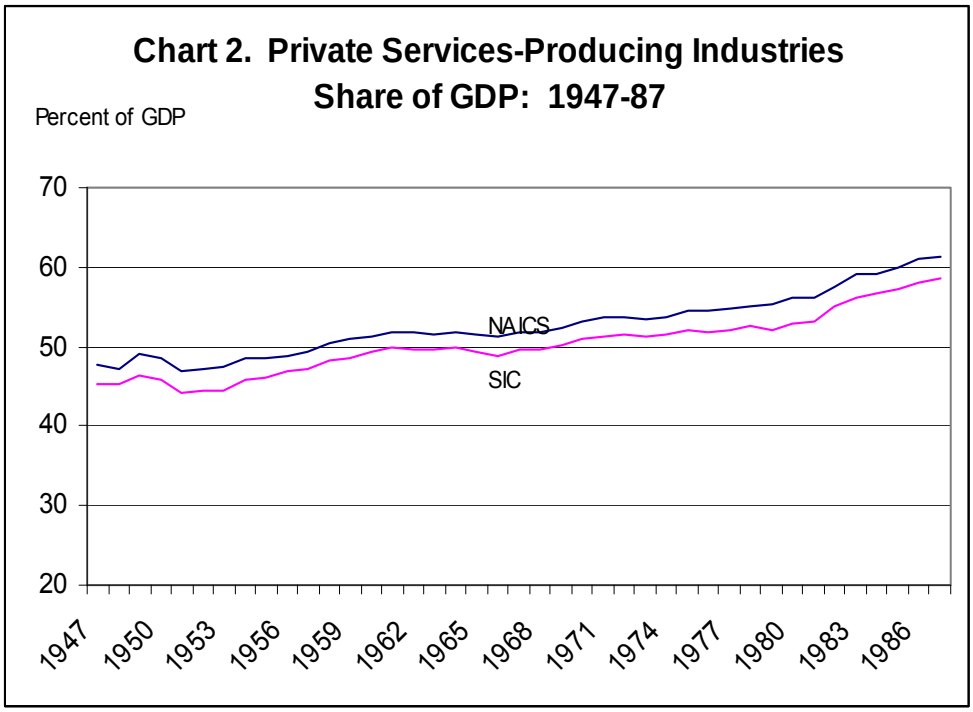


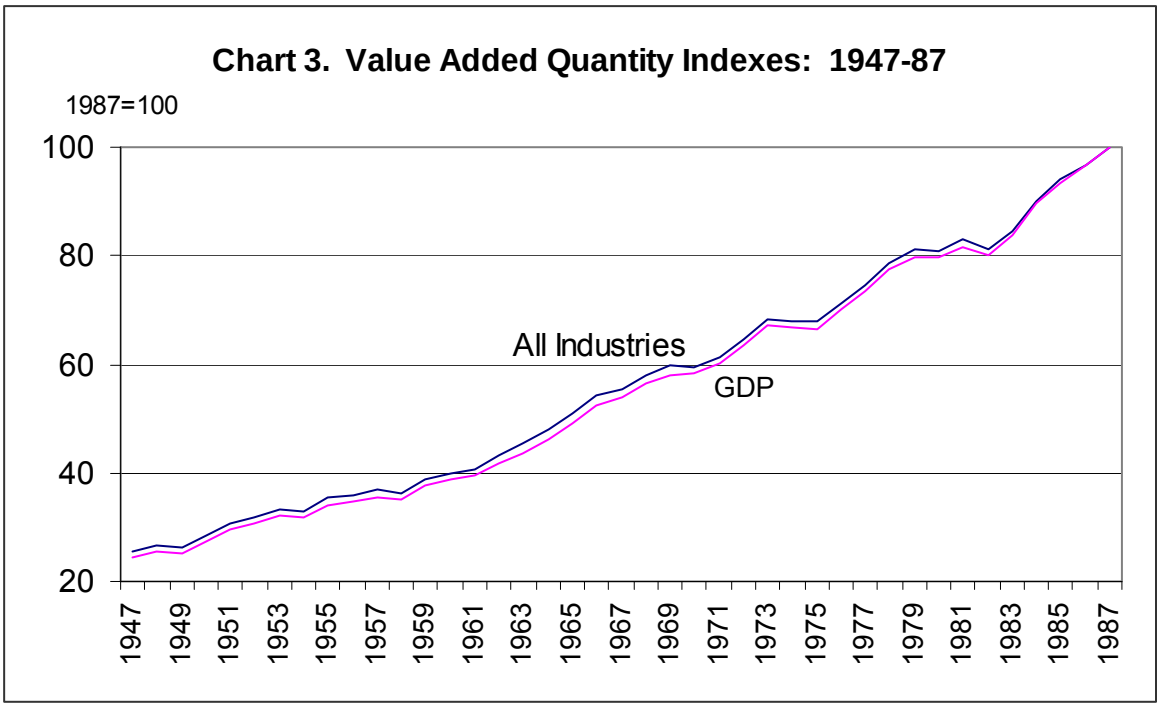
Table 5.--Comparison of NAICS and SIC Nominal Shares and Real Growth Rates, 1987-97

Description	Average Real Growth Rate 1987 - 1997			Share of Nominal GDP 1987			Share of Nominal GDP 1997		
		SIC			SIC			SIC	
	NAICS	Revised	Previous	NAICS	Revised	Previous	NAICS	Revised	Previous
Gross domestic product	3.0	3.0	2.9	100.0	100.0	100.0	100.0	100.0	100.0
All industries	3.0	3.0	2.9	100.0	100.0	100.0	100.0	100.0	100.0
Private industries	3.3	3.3	3.2	86.1	86.1	86.1	87.3	87.3	87.2
Private goods-producing industries	2.8	2.9	N/A	24.9	27.0	27.2	21.9	24.1	23.6
Manufacturing	3.4	3.2	2.9	17.1	18.6	18.7	15.4	16.9	16.6
Durable goods	4.4	4.6	4.2	10.2	10.8	10.9	9.1	9.8	9.5
Nondurable goods	1.9	1.4	1.2	6.9	7.8	7.8	6.3	7.1	7.1
Private services-producing industries	3.5	3.4	N/A	61.2	58.6	58.8	65.3	62.3	63.2
Government	1.0	1.0	1.0	13.9	13.9	13.9	12.7	12.7	12.8

The converse is true for private services-producing industries (chart 2). The NAICS-based estimates also show the long-term decline in goods-producing industries' share of GDP that was seen in the SIC-based estimates. The conversion matrix shares that were used to allocate SIC-based industry estimates to NAICS industries were held constant for years before 1977. However, because allocations to more than one detailed NAICS industry from a single SIC industry usually fell within the same higher-level NAICS industry group, errors in the allocation matrix tended to cancel one another at the published industry group level.



Real estimates before 1977. Because the previously published real estimates for years before 1977 were based on fixed 1982 relative price weights, they are subject to substitution bias for earlier years that are far from 1982. However, the Fisher aggregation procedures that were used to prepare the quantity indexes for NAICS industry groups for 1947-76 reduced the impact of the substitution bias. For example, real value added estimates for the manufacturing industry group for 1947-76 are not affected by substitution bias to the same degree as the estimates for specific manufacturing industries. In addition, the aggregation of the NAICS-based estimates over "all industries" yields an estimate that very closely matches BEA's Fisher-index measure of real GDP growth (chart 3). The correlation is much closer than it was using the previously published constant 1982 dollar SIC-based estimates. This closer correspondence indicates greater consistency of the industry real value added estimates with real GDP.



V. Summary and Conclusion

The introduction of NAICS in the late 1990's offered the promise of more relevant U.S. industry time series data for the 21st century, but the transition from the SIC system was difficult for both data producers and data users, and conversion was not completed for current economic programs until 2004. For data producers such as BEA, part of the difficulty was that statistical agencies that provide source data used different approaches and were on different time schedules for the conversion to NAICS. Even after current programs were fully converted to NAICS, however, the research community was left without consistent historical industry time series data for many of the most important economic programs.

For most programs, NAICS could not be implemented on a historical basis due to the absence of NAICS-based source data before 1997. This problem was especially difficult for BEA's GDP-by-industry accounts program because it uses data from a wide variety of sources along with complex estimation procedures. BEA met the need for historical industry time series data by developing backcasting procedures that took full advantage of the existing SIC-based data, used time-varying concordances with variable shares as far back as possible, and used aggregation as a means of dealing with limitations in the methodology, especially for early years. Other U.S. statistical agencies faced similar problems and addressed them in various ways.

Conversion to NAICS has raised new challenges for developing industry time series data, especially for complex programs such as the industrial production index, GDP-by-industry, and the BLS industry production accounts that are used for productivity research, but it has also presented some opportunities for improving methodologies and changing procedures to incorporate better source data. With the release of the historical employment estimates in October 2006, BEA completed the conversion of its

industry series from the SIC system to NAICS.[6] BLS has since released manufacturing sector data for production accounts back to 1987. Extending production accounts to the non-manufacturing sector and to years before 1987 requires joint work between BEA and BLS. BEA has initiated work to develop gross output estimates back to 1972 that could be used to prepare integrated input-output use tables. BLS plans to develop output measures for non-manufacturing industries on a NAICS basis as part of the effort to extend production accounts, and will work closely with BEA to insure consistency among the historical industry output measures.

[6] BEA released estimates of net capital stock, depreciation, and investment by NAICS industry in April 2006. For more information, see http://bea.gov/national/FA2004/index.asp.

References

Bayard, Kimberly and Shawn Klimek, 2003, "Creating a Historical Bridge for Manufacturing between the Standard Industrial Classification System and the North American Industrial Classification System," The Proceedings of the Annual Meeting of the American Statistical Association, August.

Corrado, Carol, 2003, "Industrial Production and Capacity Utilization: The 2002 Historical and Annual Revision." *Federal Reserve Bulletin*. April.

Corrado, Carol, Paul Lengermann, Eric J. Bartelsman, and J. Joseph Beaulieu, 2006, "Modeling Aggregate Productivity at a Disaggregate Level: New results for U.S. sectors and industries," Paper presented at the Conference on Research on Income and Wealth NBER Summer Institute, July 19.

Klimek, Shawn and David Merrell, 2000, "On Reclassifying Industries from Standard Industrial Classification System to the North American Industrial Classification System," The Second International Conference on Establishment Surveys Proceedings, June.

Kort, John R., 2001, "The North American Industry Classification System in BEA's Economic Accounts," Survey of Current Business, May, pp.7-13.

Lawson, Ann M., Brian C. Moyer, Sumiye Okubo, and Mark A. Planting, 2006, "Integrating Industry and National Economic Accounts: First Steps and Future Improvements." *A New Architecture for the U.S. National Accounts,* NBER Studies in Income and Wealth, edited by Dale W. Jorgenson, J. Steven Landefeld and William D. Nordhaus. University of Chicago Press.

Lawson, Ann M., Kurt S. Bersani, Mahnaz Fahim-Nader, and Jiemin Guo, 2002, "Benchmark Input-Output Accounts of the United States, 1997," Survey of Current Business, December, pp. 19-108.

Morisi, Teresa. 2003. "Recent Changes in the National Current Employment Statistics Survey." *Monthly Labor Review*. June.

Moulton, Brent R., Yvon Pho, and Robert E. Yuskavage, 2003, "Major Changes in the Presentation of the U.S. National Accounts," Paper prepared for the OECD National Accounts Experts Meeting Session on National Accounts and Economic Statistics, September.

Moyer, Brian C., Mark A. Planting, Paul V. Kern, and Abigail M. Kish, 2004, "Improved Annual Industry Accounts for 1998-2003: Integrated Annual Input-Output Accounts and Gross-Domestic-Product-by-Industry Accounts," Survey of Current Business, January, pp. 21-57.

Nordhaus, William D., 2002, Productivity Growth and the New Economy," *Brookings Papers on Economic Activity* 2002(2): 211-265.

Shimberg, Michael, Ruth E. Detlefsen, and William C. Davie, Jr., 2002, "Methods Used to Develop Retail and Wholesale Time Series Under the North American Industry Classification System." Paper presented at the 2002 annual meeting of the American Statistical Association.

Smith, George M., Matthew J. Gruenberg, Tameka R. L. Harris, and Erich H. Strassner, "Annual Industry Accounts: Revised Estimates. 2001-2003," Survey of Current Business, January, pp 9-43.

Stiroh, Kevin J., 2002, "Information Technology and the U.S. Productivity Revival: What Do the Industry Data Say?," *American Economic Review*, 92(5), December 2002b, 1559-1576.

Stiroh, Kevin J., 2006, "The Industry Origins of the Second Surge of U.S. Productivity Growth," Federal Reserve Bank of New York, Mimeo, July 2006b.

Triplett, Jack E. and Bosworth, Barry P. 2004. *Productivity in the U.S Services Sector: New Sources of Economic Growth*. Brookings Institution Press: Washington, DC.

Yuskavage, Robert E. and Yvon H. Pho, 2004, "Gross Domestic Product by Industry for 1987-2000," Survey of Current Business, November, pp. 33-53.

Yuskavage, Robert E. and Mahnaz Fahim-Nader, 2005, "Gross Domestic Product by Industry for 1947-86," Survey of Current Business, December, pp. 70-84.

Table A.--1997 NAICS Codes Corresponding to Published Industry Descriptions

1997 NAICS Code(s)	Annual Industry Accounts industry description
111,112	Farms
113-115	Forestry, fishing, and related activities
211	Oil and gas extraction
212	Mining, except oil and gas
213	Support activities for mining
22	Utilities
23	Construction
321	Wood products
327	Nonmetallic mineral products
331	Primary metals
332	Fabricated metal products
333	Machinery
334	Computer and electronic products
335	Electrical equipment, appliances, and components
3361-3363	Motor vehicles, bodies and trailers, and parts
3364-3366,3369	Other transportation equipment
337	Furniture and related products
339	Miscellaneous manufacturing
311, 312	Food and beverage and tobacco products
313, 314	Textile mills and textile product mills
315, 316	Apparel and leather and allied products
322	Paper products
323	Printing and related support activities
324	Petroleum and coal products
325	Chemical products
326	Plastics and rubber products
42	Wholesale trade
44,45	Retail trade
481	Air transportation
482	Rail transportation
483	Water transportation
484	Truck transportation
485	Transit and ground passenger transportation
486	Pipeline transportation
487, 488, 492	Other transportation and support activities
493	Warehousing and storage
511	Publishing industries (includes software)
512	Motion picture and sound recording industries
513	Broadcasting and telecommunications
514	Information and data processing services
521, 522	Federal Reserve banks, credit intermediation, and related activities

Table A.--1997 NAICS Codes Corresponding to Published Industry Descriptions

1997 NAICS Code(s)	Annual Industry Accounts industry description
523	Securities, commodity contracts, and investments
524	Insurance carriers and related activities
525	Funds, trusts, and other financial vehicles
531	Real estate
532, 533	Rental and leasing services and lessors of intangible assets
5411	Legal services
5415	Computer systems design and related services
5412-5414,5416-5419	Miscellaneous professional, scientific, and technical services
55	Management of companies and enterprises
561	Administrative and support services
562	Waste management and remediation services
61	Educational services
621	Ambulatory health care services
622, 623	Hospitals and nursing and residential care facilities
624	Social assistance
711, 712	Performing arts, spectator sports, museums, and related activities
713	Amusements, gambling, and recreation industries
721	Accommodation
722	Food services and drinking places
81	Other services, except government

Table B.--1987 SIC Codes Corresponding to Published Industry Descriptions

1987 SIC Code(s)	GDP by industry description
01-02	Farms
07-09	Agricultural services, forestry, and fishing
10	Metal mining
12	Coal mining
13	Oil and gas extraction
14	Nonmetallic minerals, except fuels
15-17	Construction
24	Lumber and wood products
25	Furniture and fixtures
32	Stone, clay, and glass products
33	Primary metal industries
34	Fabricated metal products
35	Industrial machinery and equipment
36	Electronic and other electric equipment
371	Motor vehicles and equipment
372-379	Other transportation equipment
38	Instruments and related products
39	Miscellaneous manufacturing industries
20	Food and kindred products
21	Tobacco products
22	Textile mill products
23	Apparel and other textile products
26	Paper and allied products
27	Printing and publishing
28	Chemicals and allied products
29	Petroleum and coal products
30	Rubber and miscellaneous plastics products
31	Leather and leather products
40	Railroad transportation
41	Local and interurban passenger transit
42	Trucking and warehousing
44	Water transportation
45	Transportation by air
46	Pipelines, except natural gas
47	Transportation services
481,482,489	Telephone and telegraph
483-484	Radio and television
49	Electric, gas, and sanitary services
50-51	Wholesale trade
52-59	Retail trade
60	Depository institutions

Table B.--1987 SIC Codes Corresponding to Published Industry Descriptions

1987 SIC Code(s)	GDP by industry description
61	Nondepository institutions
62	Security and commodity brokers
63	Insurance carriers
64	Insurance agents, brokers, and service
65	Real estate
67	Holding and other investment offices
70	Hotels and other lodging places
72	Personal services
73	Business services
75	Auto repair, services, and parking
76	Miscellaneous repair services
78	Motion pictures
79	Amusement and recreation services
80	Health services
81	Legal services
82	Educational services
83	Social services
86	Membership organizations
84,87,89	Other services
88	Private households

Table C.--1972 SIC Codes Corresponding to Published Industry Descriptions

1972 SIC Code(s)	GDP by industry description
01-02	Farms
07-09	Agricultural services, forestry, and fishing
10	Metal mining
12	Coal mining
13	Oil and gas extraction
14	Nonmetallic minerals, except fuels
15-17	Construction
24	Lumber and wood products
25	Furniture and fixtures
32	Stone, clay, and glass products
33	Primary metal industries
34	Fabricated metal products
35	Machinery, except electrical
36	Electric and electronic equipment
371	Motor vehicles and equipment
372-379	Other transportation equipment
38	Instruments and related products
39	Miscellaneous manufacturing industries
20	Food and kindred products
21	Tobacco products
22	Textile mill products
23	Apparel and other textile products
26	Paper and allied products
27	Printing and publishing
28	Chemicals and allied products
29	Petroleum and coal products
30	Rubber and miscellaneous plastics products
31	Leather and leather products
40	Railroad transportation
41	Local and interurban passenger transit
42	Trucking and warehousing
44	Water transportation
45	Transportation by air
46	Pipelines, except natural gas
47	Transportation services
481,482,489	Telephone and telegraph
483-484	Radio and television
49	Electric, gas, and sanitary services
50-51	Wholesale trade
52-59	Retail trade
60	Banking

Table C.--1972 SIC Codes Corresponding to Published Industry Descriptions

1972 SIC Code(s)	GDP by industry description
61	Credit agencies other than banks
62	Security and commodity brokers
63	Insurance carriers
64	Insurance agents, brokers, and service
65	Real estate
67	Holding and other investment offices
70	Hotels and other lodging places
72	Personal services
73	Business services
75	Auto repair, services, and parking
76	Miscellaneous repair services
78	Motion pictures
79	Amusement and recreation services
80	Health services
81	Legal services
82	Educational services
83	Social services
86	Membership organizations
84,89	Miscellaneous professional services
88	Private households