Priorities for Industry Accounts at BEA

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Executive Summary

The U.S. economy is undergoing significant structural change that economists and policymakers would like to study from an industry perspective. BEA's industry accounts--the input-output (I-O) accounts, the gross product originating (GPO) accounts, and the gross state product (GSP) estimates--provide much of the relevant data, but further enhancements are possible. BEA has ideas for improving these accounts, but resource constraints require that priorities be established and hard choices made. The impending conversion of BEA's industry estimates to the new North American Industry Classification System (NAICS) offers opportunities to explore these topics in a thorough manner from the ground up, but it also presents challenges with regard to maintaining time-series consistency.

International guidelines recommend full integration of the industry, income, and expenditure estimates in a consistent conceptual framework such as the I-O accounts. This approach is followed by many nations and it yields integrated, consistent industry estimates, but often at the expense of timeliness and accuracy due to the lack of high-quality, timely source data. Benchmarking of these industry accounts to comprehensive economic census data is limited or nonexistent, and the estimates rely heavily on judgement and mechanical procedures. The U.S., on the other hand, relies on the income and expenditure approaches for the national income and product accounts (NIPA's) because these approaches allow maximum use of timely, high-quality economic indicators from BLS and Census. Decoupling industry estimates from the NIPA's would be costly because of the loss of consistency with these important economic indicators.

Producing integrated industry accounts requires BEA to reconcile differences between GPO by industry and value-added from the I-O accounts, which are conceptually equivalent. GPO is based primarily on BLS data for labor income and on IRS data for capital income, whereas I-O is based primarily on Census data. Differences in the industry classifications among these major data sources lead to inconsistencies. In addition, I-O value added is a residual that is critically dependent on good data for purchased goods and services by industry, which are limited. The GPO estimates of capital income depend on the assumption that corporate profits and other company-based income components can be allocated to the establishment level by industry.

BEA is considering a multi-stage approach for improving the industry accounts. The short-run option would explore possibilities for providing more timely industry estimates with fewer resources and with no significant reductions in quality. Any resource savings could be used in the mid-term for research on a partial integration solution and to develop better measures of real output in the services sector. The long-run option would improve accuracy and consistency by working towards full integration after achieving improvements in the quality and consistency of source data through data sharing by statistical agencies and by improved surveys.

Priorities for Industry Accounts at BEA

I. Introduction

Economists and policymakers are struggling to understand the sources of the post-1995 acceleration in productivity growth and other structural changes that characterize the new economy. These developments have been studied largely from a macroeconomic perspective, but interest has grown in understanding their dynamics at a more disaggregated level[1]. Many analysts believe that the new economy reflects fundamental structural changes, and that further insight can be obtained only by careful study of industry behavior and inter-industry relationships. A recent conference on e-business and the new economy partly sponsored by the Department of Commerce and the Brookings Institution highlighted the need for studies that look beneath the surface of the aggregate economy.

BEA's industry accounts are well-suited for studying these issues because of their integrated nature and their close connection with the estimates of gross domestic product (GDP), employment, and capital stock obtained from the national income and product accounts (NIPA's). The industry accounts--the input-output (I-O) accounts, the gross product originating by industry (GPO) accounts, and the gross state product (GSP) by industry estimates--are increasingly used to study important issues about structural change in the U.S. economy, such as e-business, contributions to growth, and industry productivity. Recent improvements to these accounts have resulted in data that are more timely, more accurate, and more relevant for their intended uses. Further improvements are possible, but resource constraints have forced BEA to develop priorities and choose among various options for improving the industry accounts.

Many issues, and important trade-offs related to those issues, must be addressed and resolved before BEA can implement a strategy for improving the industry accounts. Perhaps the single most important issue concerns integration of the GPO and I-O accounts. GPO by industry and I-O value-added by industry are conceptually equivalent but differ due to differences in source data and methodology. The recent reinstatement of the annual I-O program combined with the

[1] For recent examples, see Jorgenson and Stiroh (2000), Corrado and Slifman (1999), and Gullickson and Harper (1999).

recent improvements to the GPO accounts--including more timely annual estimates and the development of an integrated set of industry production accounts with gross output, intermediate inputs, and GPO--provide a potential framework for developing more timelyand more integrated estimates that are consistent with the benchmark I-O accounts. But the focus of both the benchmark and annual I-O programs historically has been to provide "best level" estimates of final expenditures for the annual NIPA revision. Industry value-added estimates from the I-O accounts have been a lower priority and, partly as a result, these value-added estimates have not been consistent with the annual estimates of GPO by industry, which are derived largely from the NIPA income estimates.

BEA is at a critical juncture with respect to the future of the industry accounts. The impending completion of the 1997 benchmark I-O accounts and the ultimate conversion of all BEA industry estimates to the new North American Industry Classification System (NAICS) offer opportunities to address the above issues in a systematic manner. Key questions related to the issues and the trade-offs are listed below:

- Should GPO and I-O value-added estimates be the same? For example, should BEA consider using industry GPO as a "control total" for I-O value added, or consider "benchmarking" GPO to the I-O accounts? Or should these programs remain largely separate to maintain their historical ties to the NIPA's and the I-O accounts, and to maximize the amount of data provided?
- Should the annual I-O accounts be prepared as a consistent time series with regular annual revisions, focusing on industry outputs and inputs? Or should the focus of the annual I-O accounts continue to be "best levels" for final uses, somewhat at the expense of a consistent set of industry value added estimates?
- What level of industry detail is most useful? Should BEA take the opportunity of the conversion to NAICS to reduce the amount of industry detail in the published benchmark I-O accounts? Or is the detail necessary for outside users and consequently a good use of BEA resources? Does the three-digit NAICS structure (88 private industries) provide sufficient industry detail?
- Are annual industry output measures with a release lag of 10 months for a year t-1 estimate acceptable? Or should BEA investigate the feasibility of publishing more

timely "advance" GPO and GSP estimates that are consistent with the latest annual GDP estimates, possibly at the expense of more timely annual I-O tables?

These and other related issues will be more fully explored, and their implications for the industry accounts at BEA will be addressed.

The impending implementation of NAICS deserves special attention. Any strategy for improving the industry accounts at BEA must take into account the serious implications of this change in classification systems. The changes in industrial structure represented by NAICS are much greater than those generated by earlier changes in classification systems. NAICS represents a fundamental rethinking of the principles underlying industrial classification, whereas previous revisions were largely marginal changes to an existing structure. The resources that will be required to maintain time series continuity for long periods prior to 1997 are very large and, as a result, time series consistency for industry data over long periods may be difficult to achieve for some time in the future.[2] BEA's NAICS implementation schedule calls for completion of the conversion of all industry-based estimates by 2004. At this time, it is not clear how far back time series will be revised, but it is not likely BEA will be able to revise estimates prior to 1992, and even revisions prior to 1997 are questionable. The impact of NAICS conversion must be given considerable weight in any decisions about new initiatives for the industry accounts.

The remainder of this paper is presented in five parts. Parts II and III provide background information and may be skipped by readers familiar with the U.S. industry accounts and international practices. Part II describes the industry accounts programs at BEA, including the I-O, GPO, and GSP accounts, and their relationships to the NIPA's. Part III provides a summary of international recommendations for preparing industry accounts and the key features of these accounts in other nations. Part IV discusses issues for the industry accounts such as consistency, detail, timeliness, and accuracy. Part V describes specific actions for improving the

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[2] Approximately one-third of the 812 four-digit SIC industries do not have an exact match in the NAICS system. Conversion procedures that use microdata are feasible, but these procedures are resource-intensive and have limited reliability over long time periods. The issue of time series comparability is recognized in the introduction to the NAICS manual, which states "...it is unproductive to collect and maintain time series data that have questionable value. Thus, it may be preferable to accept a onetime break in historical continuity if the benefits of conversion to a new classification structure are apparent and accepted by users." (U. S. Office of Management and Budget, 1997, p. 23.)

industry accounts that are feasible given BEA's resource constraints. Part VI summarizes, proposes options packages, evaluates their advantages and disadvantages, and makes recommendations for future action.

II. Industry Accounts at BEA

This part of the paper provides background information on the current status of BEA's industry accounts programs. (Readers who are familiar with the industry accounts may want to skip ahead to Part III; those who would like more background information on the industry accounts should see the appendix.) The first section provides an overview of BEA's industry accounts and how they are related conceptually and statistically to the NIPA's. The second section briefly describes the conceptual relationships among the industry accounts, which highlights possible areas for integration. The appendix describes each of the specific industry accounts programs in more detail, including recent improvements, steps toward integration, and a brief comparison of BEA's annual I-O accounts with those prepared by the Bureau of Labor Statistics (BLS).

A. Overview and Relationship to the NIPA's

The centerpiece of BEA's industry accounts is the benchmark input-output (I-O) accounts. These accounts, which are prepared every five years with data from the quinquennial economic censuses, present a detailed picture of how industries interact to provide input to and take output from each other. The benchmark I-O accounts are used in a variety of analytical and statistical contexts, including studies of structural change and as a framework or benchmark for other statistical series. The annual I-O accounts provide periodic updates of the most recent benchmark I-O accounts that are more timely, but that are based on less complete and less reliable source data. Satellite accounts for transportation and for travel and tourism that are based on the benchmark and annual I-O accounts are also prepared periodically.

BEA also prepares annual estimates of gross product originating (GPO) by industry and gross state product (GSP) by industry. GPO is a measure of the contribution of each private industry and of government to the Nation's gross domestic product (GDP). It is defined as an industry's gross output (total sales) less its purchases of intermediate inputs (energy, materials,

and services). The GPO estimates are widely used to assess the relative performance of particular industries, their contributions to economic growth and inflation, and their significance in the overall economy. GSP is a measure of the value added in production by the labor and property located in a State, and it is controlled to national estimates of GPO by industry. GSP for a State is derived as the sum of the GSP originating in all industries in the State.

The industry accounts and the NIPA's share a number of interesting and important relationships. The most important of these is that both the I-O accounts and the NIPA's provide estimates of final expenditures (final uses) by type of product and estimates of incomes originating in production (value added) by type of income. At BEA, the final use estimates from the I-O accounts are used to establish the "best levels" that the NIPA's attempt to match in comprehensive revisions. For example, in the most recent comprehensive revision of the NIPA's that was released in October 1999, the 1992 benchmark I-O estimates of final uses by type of product were used as current-dollar control totals for 1992, and the annual I-O estimates for 1996 were used to derive the commodity composition of personal consumption expenditures for goods. Important relationships also exist on the income side of the accounts. Estimates of labor and property income by type and by industry from the NIPA's are used to prepare the estimates of GPO by industry, which are computed as the sum of the industry distributions of the income components. These GPO estimates in turn are used to prepare the estimates of GSP by industry. However, GPO by industry estimates from the NIPA's are not constrained to match the value-added by industry estimates from the benchmark I-O accounts, which are computed as the difference between industry gross output and intermediate inputs.

B. Relationships Among Industry Accounts

The various industry accounts share several important conceptual relationships separately from their relationships to the NIPA's. Understanding these relationships is important before addressing issues related to integration of the industry accounts. (Readers who are already familiar with these conceptual relationships and would like examples of how empirical problems sometimes confound these relationships should skip ahead to Part IV.) The lower panel of Figure 1 (table A2) is a simplified I-O use table that provides insights into the conceptual relationships among various parts of the industry accounts. Columns in the use table consist of industries and

The Input-Output Accounts for the United States, 1992

Figure 1

Table A1: The Make of Commodities by Industry Aggregates, 1992

[Millions of dollars at producers' prices]

		COMMODITIES									TOTAL INDUSTRY OUTPUT
		Agricultural products	Minerals	Construction	Manufactured products	Transpor-tation	Trade	Finance	Services	Other *	
INDUSTRIES	Agriculture	235,591	0	0	1,022	11	0	0	1,038	0	237,662
	Mining	0	147,001	0	9,716	0	0	0	0	0	156,717
	Construction	0	0	679,330	0	0	0	0	0	0	679,330
	Manufacturing	0	561	0	2,879,654	43	0	0	69,509	1,536	2,951,303
	Transportation	0	0	0	0	874,212	0	0	28,838	542	903,592
	Trade	0	0	0	0	0	1,091,489	0	0	0	1,091,489
	Finance	0	0	0	0	0	0	1,629,618	25,114	0	1,654,732
	Services	0	0	0	8	53	0	666	2,226,302	521	2,227,550
	Other *	0	0	0	37	57,711	3,659	9,132	3,301	846,432	920,272
TOTAL COMMODITY OUTPUT		235,591	147,562	679,330	2,890,437	932,030	1,095,148	1,639,416	2,354,102	849,031	10,822,647

Table A2: The Use of Commodities by Industry Aggregates, 1992

[Millions of dollars at producers' prices]

		INDUSTRIES										FINAL USES (GDP)							TOTAL COMMODITY OUTPUT
		Agriculture	Mining	Construction	Manufacturing	Transpor-tation	Trade	Finance	Services	Other *	Total intermed- iate use	Personal consum-ption expend-itures	Gross private fixed investment	Changes in business inventories	Exports of goods and services	Imports of goods and services	Government consumption expenditures and gross investment	GDP	
COMMODITIES	Agricultural products	55,569	43	4,027	123,104	72	894	6,714	6,861	317	197,601	27,054	0	4,847	19,857	-14,601	833	37,990	235,591
	Minerals	298	25,985	5,445	94,010	54,532	30	6	32	2,688	183,026	107	73	-107	8,202	-43,527	-212	-35,464	147,562
	Construction	2,895	2,670	594	18,133	34,139	7,458	52,999	19,578	21,152	159,618	0	360,278	0	77	0	159,357	519,712	679,330
	Manufactured products	39,370	11,848	202,588	1,019,103	58,598	47,784	16,968	230,979	12,272	1,639,510	842,150	339,058	3,566	342,980	-485,599	208,772	1,250,927	2,890,437
	Transportation	10,119	10,130	18,414	155,345	134,202	44,271	38,723	76,622	13,872	501,698	313,170	11,717	956	54,322	-7,932	58,099	430,332	932,030
	Trade	12,107	2,781	55,297	164,725	14,483	20,219	4,217	45,451	1,171	320,451	629,893	62,525	2,658	44,746	18,317	16,558	774,697	1,095,148
	Finance	15,610	19,209	11,590	48,901	28,778	71,353	229,758	154,263	4,683	584,145	960,078	28,407	0	39,510	-1,412	28,688	1,055,271	1,639,416
	Services	6,394	5,203	67,981	167,180	90,356	128,655	123,583	306,925	8,047	904,324	1,413,094	19,226	-37	19,530	-4,027	1,992	1,449,778	2,354,102
	Other *	124	27	772	12,371	2,282	7,036	12,822	16,629	1,342	53,405	-9,837	-30,293	-6,453	73,385	-2,820	771,644	795,626	849,031
	Noncomparable imports	45	1,160	0	12,322	19,282	4,182	3,837	2,874	1,262	44,964	33,009	0	0	0	-90,036	12,063	-44,964	0
	Total intermediate inputs	142,531	79,056	366,708	1,815,194	436,724	331,882	489,627	860,214	66,806	4,588,742	4,208,718	790,991	5,430	602,609	-631,637	1,257,794	6,233,905	10,822,647
VALUE ADDED	Compensation of employees	28,259	29,714	242,835	698,919	214,389	447,759	285,752	957,682	739,733	3,645,042								
	Indirect business tax and nontax liability	5,765	8,277	3,545	38,348	42,770	174,723	183,005	49,158	0	505,591								
	Other value added **	61,107	39,670	66,242	398,842	209,709	137,125	696,348	360,496	113,733	2,083,272								
	Total	95,131	77,661	312,622	1,136,109	466,868	759,607	1,165,105	1,367,336	853,466	6,233,905								
TOTAL INDUSTRY OUTPUT		237,662	156,717	679,330	2,951,303	903,592	1,091,489	1,654,732	2,227,550	920,272	10,822,647								

* The input-output (I-O) accounts use two classification systems, one for industries and another for commodities, but both generally use the same I-O numbers and titles. "Other" consists of government enterprises and other I-O special industries; for more information see "Appendix A. Industry Classification of the 1992 Benchmark Input-Output Accounts," in "Benchmark Input-Output Accounts for the U.S. Economy, 1992: Make, Use, and Supplementary Tables," Survey of Current Business 77 (November 1997).

** "Other value added" consists of the following national income and product accounts components of gross domestic income: Consumption of fixed capital, net interest, proprietors' income, corporate profits, rental income of persons, business transfer payments, and subsidies less current surplus of government enterprises.

U.S. Department of Commerce, Bureau of Economic Analysis

final uses. Industries are collections of producing units (usually establishments) that share similar production technologies. The column total for an industry is its total (gross) output. Final uses are categories of expenditures by households, businesses, government, and foreign residents that are included in GDP. Rows in the use table consist of commodities and value added. Commodities are the goods and services produced by industries or imported that are consumed either by industries in the production process or by final users. Value added, which is the difference between an industry's gross output and its total use of commodities (total intermediate inputs), consists of compensation of employees, indirect business tax and nontax liability, and other value added. GDP equals value added summed over all industries and it also equals final uses summed over all expenditure categories.

The categories of expenditures shown in the final uses quadrant of table A2 are the same summary categories presented in the quarterly and annual NIPA expenditure estimates. The value added by industry quadrant is conceptually equivalent to the estimates of nominal GPO by industry and the estimates of nominal GSP by industry. Industry definitions are similar in all three sets of industry accounts. The I-O, GPO, and GSP accounts also provide separate information for the three major categories of value added. Total industry output (the industry column total) is conceptually equivalent to the GPO gross output estimates, and total intermediate inputs are conceptually equivalent to the GPO estimates of total intermediate inputs. (The GSP program does not provide estimates of gross output and intermediate inputs by State.) One major difference between the GPO and I-O programs, however, is that the published GPO estimates of intermediate inputs are not disaggregated by type of product as they are in the I-O accounts[3].

III. International Perspectives

Studies of the integration of BEA's industry accounts and discussions of priorities should be informed by international guidelines as well as by the practices of other major industrialized

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[3] As explained in the appendix, the product composition of intermediate inputs from the I-O accounts is used as a set of weights for computing intermediate inputs price and quantity indexes. Research is underway to prepare price and quantity indexes for the following major categories of intermediate inputs: Energy, materials, and purchased services.

nations that prepare similar sets of economic accounts. This perspective is important not only for improving cross-country comparability of data from the industry accounts, but also for allowing BEA to benefit from the experiences of other nations facing similar issues and problems. This section first describes the relevant guidelines from the international System of National Accounts (SNA), and then briefly highlights the practices of selected nations that are relevant to the U.S. situation.

A. System of National Accounts[4]

The 1993 SNA is a set of international guidelines for the preparation of economic accounts. The U.S. NIPA's follow the recommendations of the SNA in many areas, but do not incorporate the SNA in all respects due to practical considerations. The SNA is built around a sequence of interconnected flow accounts for different types of economic activities occurring within a given time period, together with balance sheets that record the values of stocks of assets and liabilities. Current period accounts record the production of goods and services, the generation of incomes by production, the subsequent distribution and redistribution of incomes among institutional units, and the use of incomes for purposes of consumption or saving.

For the issues related to the integration of BEA's industry accounts, the most important entity in the SNA is the production account, which records the activity of producing goods and services in the economy. Its balancing item–gross value added–is defined as the value of output less the value of intermediate consumption, and is a measure of the contribution to GDP made by an individual producer, industry, or sector. Gross value added is the source from which the primary incomes of the System are generated. Closely related to the production account are the SNA supply and use tables. These tables are in the form of matrices and they record how supplies of different kinds of goods and services originate from domestic industries and imports, and how those supplies are allocated between various intermediate or final uses, including exports. These tables involve the compilation of a set of integrated production and generation of income accounts for industries, and they provide an accounting framework and the basic information for the derivation of detailed input-output accounts.

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[4] This section borrows heavily from the System of National Accounts 1993, sections 1.3-1.16

The SNA, like the U.S. NIPA's, defines GDP as the sum of gross value added of all resident producer units (e.g., industries), with value added calculated as the difference between output and intermediate consumption. From this definition follows the production approach to measuring GDP. Of course, GDP is also equal to the sum of final uses of goods and services and the sum of primary incomes earned in production. These definitions lead to the expenditures approach and the incomes approach to measuring GDP, respectively. While the SNA implies that the production approach is preferred on conceptual grounds, it acknowledges that the expenditures approach and the incomes approach may be more realistic in practice.

Earlier guidance on the relative importance of alternative approaches to measuring real GDP was found in United Nations (1979). In a discussion on the measurement of value added and GDP at "constant prices," it noted that the majority of developing countries obtain their estimates of nominal GDP as the sum of value added by industry, and that the same approach is usually the most feasible for measuring real GDP. Later, it concludes that "...In an ideal world real product by kind of activity would always be derived from an input-output table by double deflation...there is little more to be said about the matter.[6]

For the quarterly and annual estimates of GDP, the U.S. NIPA's follow the expenditures approach and the incomes approach. The expenditures approach measures GDP as the sum of final uses of goods and services which consist of personal consumption expenditures, gross private domestic investment, net exports of goods and services, and government consumption expenditures and gross investment. The incomes approach measures GDP as the sum of costs incurred and incomes earned in the production of GDP. The income components include compensation of employees, indirect business taxes, and property-type incomes such as corporate profits, net interest, and proprietors' income. These two approaches are largely independent of one another, and the difference in the results obtained by the two approaches is recorded as the statistical discrepancy. Of the two approaches, however, only the expenditures approach provides a framework for measuring real GDP because it provides both the current-dollar product detail and associated price indexes needed to compute quantity indexes.

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[5] United Nations (1979, p. 55).

The U.S. prefers the expenditures approach to measuring real GDP because of the wide availability of detailed price indexes for deflation of the components of final expenditures, compared to the much more limited availability of price indexes for intermediate inputs, especially for purchased services. The production approach requires the availability of timely I-O accounts that incorporate high-quality source data for intermediate inputs, which have not been available in the U.S. Another reason to prefer the expenditures approach in the U.S. is the need to prepare timely estimates on a quarterly basis with a monthly revision cycle. The GPO accounts provide a framework for preparing annual estimates of real GDP, but BEA views the source data used to estimate the components of real GDP from the expenditures approach more reliable. In addition, the amount of detailed expenditures data available to calculate real GDP is greater than that for the gross output and intermediate inputs available to calculate real GPO.

B. Practices of Selected Nations

Practices vary among other nations with regard to the degree of integration of the industry accounts, their relationship to the national income and expenditure (I&E) accounts, and the role of the input-output accounts as an integrative framework in the nation's statistical system. Most member nations of the Organization for Economic Cooperation and Development (OECD), including the Group of Seven (G-7) nations[6] and the members of the Commission of the European communities (the European Union), attempt to follow SNA guidelines to the extent practicable. Several of these nations, including Canada and Australia, have recently completed transitions to the 1993 version of the SNA, and many others are in the process. Members of the European Union are working on implementation of the new European System of Accounts (ESA 1995), which is the European version of the 1993 SNA.

BEA's Industry Economics Division (IED) conducted a small-scale study of the practices of selected nations in Fall 1996. At that time, IED was exploring options for reinstating the annual I-O accounts program and for better integrating the industry accounts at BEA. The research comparing methods used in other countries was designed to address the degree of integration among the GDP by industry, I-O, and national I&E accounts. Information was

[6] These nations consist of Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States.

compiled on key program features for benchmark I-O accounts, periodic ("annual") I-O accounts, and GDP by industry accounts. The scope of the study included the G-7 nations plus Australia, the Netherlands, Denmark, Norway, and Sweden.

While the amount of detailed information that was readily available about key program features varied considerably among the countries studied, some clear patterns emerged. One major difference between the U.S. and most other nations was the approach taken towards the preparation of the I-O accounts. Only one other nation for which relevant information could be obtained followed the U.S. practice of building a very detailed set of accounts periodically with data from an economic census. Most nations relied on less detailed periodic I-O accounts that were released with a lag of less than two years for preliminary estimates, and that were revised once or twice in subsequent years.

The lack of detailed high-quality source data in many countries has led to the development of timely industry accounts that appear to rely heavily on judgement and mechanical procedures, often resulting in reduced accuracy. These accounts typically are used either as the basis of the quarterly GDP estimates, or are reconciled with the national I&E accounts at some point in the revision cycle. Moreover, in most nations for which information could be obtained, the annual GDP by industry estimates were either derived directly from or controlled to the periodic I-O accounts. In addition, most nations computed industry value-added as a residual and many used the double-deflation method to compute real value added by industry.

Specific findings for certain countries are worth noting. In Canada and the Netherlands, product classification systems for both the I-O accounts and the I/E accounts are the same. Estimates for supply, intermediate uses, final uses, imports and exports, and price change are all prepared with the same set of products and prices. As a result of this high degree of integration, the I-O accounts are an important management tool for improving data consistency and for identifying areas needing improvement. However, because of the limited quality of the source data, the gains in consistency and integration may be offset by reductions in accuracy. Australia recently completed a major conversion of its national accounts with full implementation of the 1993 SNA. As part of this conversion, the quarterly production account estimates were benchmarked to the annual balanced supply and use tables. The Australians noted that while this

benchmarking had little impact on GDP, estimates of capital expenditures on machinery and equipment and the gross operating surplus of private non-financial corporations were significantly revised in some periods. Denmark conducted a pilot project to produce chain volume indices and found such indices feasible, but noted some caveats about the level of detail.

IV. Issues for the Industry Accounts

Further improvements to the industry accounts that would improve consistency, accuracy, detail, and timeliness are possible, but resource constraints have forced BEA to develop priorities and make hard choices. Improvements could occur by resolving existing conceptual and statistical issues that now affect the value of the industry accounts for analytical purposes, both within and outside of BEA. Issues that will be addressed in this part of the paper include consistency of output measures; accuracy of output measures; industry detail; and timeliness. Understanding these issues is important for recognizing the trade-offs among the programs and for determining priorities.

A. Consistency of Output Measures

The resumption of the annual I-O accounts in December 1999, followed by the release in June 2000 of the expanded and improved GPO by industry estimates as a set of integrated production accounts, were two major achievements for BEA's industry accounts. But these initiatives also drew renewed attention to the absence of a single, consistent set of industry output measures from BEA. Differences between GPO and value-added from the I-O accounts and, to a lesser extent, between gross output from the two sets of accounts, have troubled those who have tried to use the industry accounts for analytical studies.

1. GPO vs. I-O Value Added. Perhaps the most troublesome inconsistency in output measures for users of the industry accounts is the persistence of large differences between nominal GPO by industry and nominal value added (VA) by industry from the I-O accounts. In concept, GPO and I-O VA are both defined as industry gross output less industry intermediate inputs. In practice, however, they often differ substantially at the published GPO industry level, partly due to differences in industry definition but mostly due to major differences in methodology. Each of these sources of difference is described more fully below.

a. Industry Definition--Even though the industry classifications for both the GPO and I-O accounts are based on the SIC system, some differences arise due to the requirements and objectives of the programs. The producing units underlying the GPO accounts are generally establishments, which are units--generally at a single physical location--where business is conducted or where services or industrial operations are performed. Establishments are classified into an industry on the basis of their principal product or service. GPO classifications for private industries closely follow the SIC system, with exceptions for farms, construction, and real estate in order to follow NIPA conventions.[7]

The I-O industry classification system for the traditional I-O accounts, however, is a modification of the SIC system designed to facilitate I-O analysis. Modifications to the SIC system include redefinitions, in which the inputs and outputs for a secondary product are moved from the SIC-defined industry in which the activity occurs to the I-O industry in which the activity is primary. Important examples include eating and drinking places activities in the hotels and lodging places industry, and auto repair activities in the retail trade industry. These types of adjustments result in I-O industries with input coefficients that are expected to be stable over short time periods and over limited production levels, which are important assumptions for traditional I-O requirements analysis.

Starting with the 1992 benchmark I-O accounts and continuing with the 1996 annual I-O accounts, BEA prepared an alternative set of make and use tables that conforms more closely to the current SIC establishment-based data collection system. (These alternative tables are not published but are available upon request from BEA.) The alternative tables are particularly useful for comparisons of I-O industry data with the GPO data and with the capital stock and employment data from the NIPA's. Both the traditional and alternative I-O accounts follow the NIPA conventions regarding farms, construction and real estate. The alternative versions of the

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[7] These industries are defined on an "activity" basis rather than an establishment basis. Farm production is classified by type of commodity rather than type of farm. The construction industry includes the value of construction work performed by nonconstruction industries, including new own-account construction. The real estate industry includes the value of all nonfarm rental activities related to structures, land, and intangible assets wherever they occur, including the imputed rental value of buildings and equipment owned by nonprofit institutions serving persons and the imputed rental value of nonfarm owner-occupied housing.

use tables for 1992 and 1996 are used in the comparisons discussed below.

b. Methodology--Differences in methodology are the major reason for the differences between GPO and I-O VA, especially when comparing GPO with the alternative I-O use tables. The differences in methodology are attributable to both source data and estimation approach. GPO relies primarily on the industry distributions of the components[8] of gross domestic income from the NIPA's in order to provide preliminary estimates for the most recent year in a timely fashion, and to maintain consistency with the most recent GDP estimates. These estimates are prepared with a variety of data sources and require several adjustments. Compensation of employees is based primarily on BLS data, while property-type income is based primarily on Internal Revenue Service (IRS) data. I-O VA is computed as the difference between industry gross output and industry intermediate inputs. These estimates are based largely on economic census data but require a number of alternative sources and various assumptions about the industry distribution of intermediate inputs. Each methodology and its limitations is discussed in more detail below.

Gross Product Originating--The components of gross domestic income with industry distributions based on establishment data can be used directly to calculate industry GPO. For those components with industry distributions based on company data, conversion to an establishment basis is needed since most large corporations have establishments in more than one industry. Subsidies are assigned to industries on the basis of the subsidized product, while indirect business taxes and nontax liability are assigned to industries based on a wide variety of sources and methods. The use of different data sources for different income components may result in inconsistencies. For example, the NIPA estimates of wages and salaries by industry are based largely on BLS data, while the largest components of property-type income by industry are based on tabulations of corporate tax returns from the Internal Revenue Service (IRS). Even in

[8] The 16 components of NIPA gross domestic income include consist of wage and salary accruals, supplements to wages and salaries, indirect business tax and nontax liability, corporate profits before tax, corporate capital consumption allowances, corporate inventory valuation adjustment, corporate net interest, proprietors' income, proprietors' inventory valuation adjustment, noncorporate capital consumption allowances, noncorporate net interest, rental income of persons, business transfer payments, subsidies, current surplus of government enterprises, and government consumption of fixed capital.

the absence of company-establishment differences, differences between the BLS data for wages and salaries and the cost of labor deductions reported on tax returns could give rise to inconsistent estimates of corporate profits at the industry level.

Conversion of company data based on tax returns to an establishment basis is another concern with the GPO methodology. Property-type income (capital income) is defined to include all of the detailed income components of GPO excluding wage and salary accruals, supplements to wages and salaries, and indirect business tax and nontax liability. Three income components that are obtained from corporate tax returns--corporate profits before tax, corporate capital consumption allowances, and corporate net interest--account for nearly 80 percent of property-type income. These income components represent company-based returns to corporate capital, and it is not clear conceptually how--if at all--these components should be allocated to the underlying establishments owned by the corporation. Corporations themselves do not attempt to perform such allocations.

The conversion now relies on a procedure that assumes property-type income per employee (for each type of income separately) for an establishment-based industry does not vary by industry of (corporate) ownership. Matrix algebra is used to solve for the vector of PTI by industry that is consistent with a vector of corporate PTI by industry and an enterprise-establishment employment matrix. The Census Bureau provides matrices that cross-classify employment of establishments owned by corporations with the company-industry classifications assigned by the Census Bureau in the economic censuses. The key assumption underlying the company-establishment conversion procedure cannot easily be tested because corporate PTI cannot be separately identified on an establishment basis. In addition, the employment matrices are available only every five years and are usually several years old when they are used in production. For example, the latest matrix available for use in the GPO comprehensive revision was for 1992.

I-O Value Added--In the I-O accounts, value added by industry is derived in a consistent industry production account framework as the difference between gross output and intermediate inputs. I-O value added consists of three components: Compensation of employees, indirect business tax and nontax liability, and other value added (property-type income). Value added

from the benchmark I-O accounts is generally based on the most detailed and most complete source data available for industry outputs and inputs, with the vast majority of the data obtained from the economic censuses. Other value added is a residual derived by subtracting total intermediate inputs, compensation of employees, and indirect business tax and nontax liability from industry gross output. Consistency in industry classifications is achieved by maximum use of economic census data for both gross output and intermediate inputs. Source data and estimating methods for gross output are reliable for most industries, especially for those industries covered by the economic censuses.[9] However, substantial adjustments to economic census source data for the finance, insurance, and real estate sector were needed to match I-O and NIPA concepts.

The area of major concern for I-O VA is the estimation of intermediate inputs by industry. Because of the lack of comprehensive source data for intermediate inputs, the I-O estimates reflect widespread use of indirect techniques. The missing source data are primarily for business purchases of services and purchases of goods by nonmanufacturing industries. Another area of concern is the allocation of trade margins and transport costs on materials consumed by industries, which are initially allocated to consuming industries on a producers' price basis in proportion to their use of the materials.[10] In summary, estimates of the supply of commodities by type and of total intermediate uses by type of commodity are fairly reliable, but the industry distribution of intermediate uses by type of commodity is much less robust. This limitation has a direct impact on the estimates of industry value added.

The methodology used to compute I-O VA for the annual I-O accounts is essentially the same as that used for the benchmark I-O accounts, but the quality of the source data is not as strong and the method for computing intermediate inputs differs. Industry and commodity output

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[9] The 1992 I-O accounts incorporated newly expanded data from the 1992 economic censuses, which covered 95 new industries and marked the most significant expansion in the scope of the census in the past 50 years. Nearly all of the expansion was concentrated in the following two sectors: Finance, Insurance, and Real Estate, and Transportation, Communication, and Utilities.

[10] The I-O accounts are published in producers' prices, which are the prices received by producers (such as manufacturers) plus commodity taxes. Wholesale trade margins, retail trade margins, and transport costs by mode are shown as separate "commodities" consumed by industries and final users. However, purchasers' prices are the prices actually paid by the industries for their inputs.

controls are based largely on Census Bureau annual sample surveys for most industries, but are based on less reliable sources for other industries not covered by the Census, including mining, finance, insurance, real estate, and selected services. The methodology for the estimates of intermediate inputs by industry--which is based on indirect techniques--also raises concerns.[11] These estimates are tied to the estimates from the most recent benchmark I-O accounts, which have their own limitations as described above.

c. Study of Differences. In January 1998, BEA's Industry Economics Division initiated a study of the statistical, methodological, and conceptual differences between the GPO and I-O measures of value added by industry (Industry Economics Division 1998). This study followed the release of estimates from the 1992 benchmark I-O accounts in November 1997. Differences between the I-O and GPO measures of value added were highlighted in Parker (1997). The primary objectives of the study were to (1) identify factors that explain differences between GPO by industry and value-added by industry from the I-O accounts and (2) determine the feasibility of using industry value added from the benchmark I-O accounts as a "best level" benchmark for annual GPO estimates.

The study investigated differences between GPO and I-O VA from the 1977, 1982, 1987, and 1992 benchmark I-O accounts. Most of the research and analysis, however, was focused on 1992 because of the availability of I-O VA estimates by major type of income and because the I-O estimates were classified by industry on the alternative ("near SIC") basis. Comparisons were made for 1992 between GPO and I-O VA in total and also by each major type of income: Compensation of employees, indirect business tax and nontax liability, and property-type income (other value added in the I-O accounts). The comparisons were limited to industries in the private sector because these are the industries most affected by the differences in methodology.

Table 1 presents an updated comparison for 1992 between GPO and I-O value added for each published private GPO industry. The GPO estimates are from the June 2000 comprehensive

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[11] Estimates of intermediate inputs in current prices are derived by assuming that technical input coefficients for producing gross output are fixed from the reference year, and these estimates are then converted from reference year prices to current year prices. After balancing commodities to match industry and commodity output controls, value added is computed as the difference between gross output and intermediate inputs.

Table 1.--GPO vs. I-O, 1992
Value Added by Industry
(Dollar Amounts in Billions)

1987 SIC	Industry Title	GPO	I-O Value Added	Dollar Difference: I-O Less GPO	Percent Difference: Diff./GPO	I-O Gross Output	Difference as Percent of Gross Output
		(1)	(2)	(3)=(2)-(1)	(4)=(3)/(1)	(5)	(6)=(3)/(5)
	Private industries	5369.8	5354.7	-15.1	-0.3	9550.3	-0.2
	Agriculture, forestry, and fishing	111.6	99.2	-12.4	-11.1	244.5	-5.1
01-02	Farms	80.5	74.1	-6.3	-7.9	199.8	-3.2
07-09	Agricultural servs., forestry, & fishing	31.2	25.1	-6.1	-19.5	44.7	-13.6
	Mining	87.4	91.9	4.6	5.2	171.8	2.6
10	Metal mining	5.6	4.5	-1.1	-20.2	10.8	-10.6
11-12	Coal mining	12.0	15.9	3.9	32.5	27.0	14.5
13	Oil and gas extraction	62.0	63.2	1.2	1.9	120.4	1.0
14	Nonmetallic minerals, except fuels	7.7	8.3	0.6	7.7	13.7	4.4
15-17	Construction	234.4	220.9	-13.5	-5.7	664.3	-2.0
	Manufacturing	1070.8	1160.2	89.4	8.3	2955.5	3.0
	Durable goods	587.1	618.5	31.4	5.4	1508.1	2.1
24	Lumber and wood products	32.2	32.3	0.1	0.2	87.1	0.1
25	Furniture and fixtures	16.5	19.9	3.4	20.9	43.4	7.9
32	Stone, clay, and glass products	25.9	29.8	3.9	15.0	61.3	6.3
33	Primary metal industries	39.3	42.9	3.6	9.1	136.5	2.6
34	Fabricated metal products	69.2	71.5	2.3	3.3	163.8	1.4
35	Industrial machinery and equipment	111.5	108.9	-2.7	-2.4	251.7	-1.1
36	Electronic and other electric equipment	106.3	99.0	-7.3	-6.9	209.8	-3.5
371	Motor vehicles and equipment	58.5	51.6	-6.9	-11.8	234.9	-3.0
37 exc. 37	Other transportation equipment	57.2	68.3	11.1	19.3	147.6	7.5
38	Instruments and related products	51.0	76.7	25.7	50.5	131.4	19.6
39	Miscellaneous manufacturing industries	19.5	17.8	-1.6	-8.3	40.7	-4.0
	Nondurable goods	483.8	541.7	58.0	12.0	1447.4	4.0
20	Food and kindred products	105.2	122.9	17.7	16.9	398.3	4.4
21	Tobacco manufactures	13.8	25.7	11.9	86.6	39.9	29.9
22	Textile mill products	25.6	23.8	-1.8	-6.9	70.6	-2.5
23	Apparel and other textile products	27.3	25.4	-1.9	-7.1	71.3	-2.7
26	Paper and allied products	45.3	51.3	6.1	13.4	131.8	4.6
27	Printing and publishing	77.8	93.4	15.6	20.1	168.7	9.3
28	Chemicals and allied products	118.0	125.1	7.1	6.0	299.1	2.4
29	Petroleum and coal products	27.8	20.3	-7.5	-26.9	145.9	-5.1
30	Rubber and miscellaneous plastics products	38.2	50.0	11.9	31.1	112.2	10.6
31	Leather and leather products	4.9	3.7	-1.2	-25.0	9.5	-12.9
	Transportation and public utilities	535.2	496.0	-39.2	-7.3	547.4	-7.2
	Transportation	192.9	193.3	0.4	0.2	20.2	2.1
40	Railroad transportation	21.6	22.1	0.6	2.8	33.8	1.8
41	Local and interurban passenger transportation	10.9	12.4	1.5	13.7	20.2	7.4
42	Trucking and warehousing	74.5	82.4	7.9	10.6	166.0	4.8
44	Water transportation	10.6	13.3	2.7	25.1	32.9	8.1
45	Transportation by air	50.0	42.1	-7.9	-15.8	94.0	-8.4
46	Pipelines, except natural gas	5.5	5.3	-0.2	-3.7	7.2	-2.8
47	Transportation services	19.8	15.7	-4.1	-20.7	28.3	-14.6
48	Communications	162.8	142.1	-20.7	-12.7	243.9	-8.5
481,482,489	Telephone and telegraph	127.8	116.5	-11.3	-8.8	186.8	-6.0
483,484	Radio and television	34.9	25.5	-9.4	-27.0	57.1	-16.5
49	Electric, gas, and sanitary services	179.5	160.6	-18.9	-10.5	283.3	-6.7
50	Wholesale trade	406.4	405.6	-0.9	-0.2	589.0	-0.1
52	Retail trade	547.1	510.1	-37.0	-6.8	827.4	-4.5
	Finance, insurance, & real estate	1126.3	1175.1	48.8	4.3	1657.0	2.9
60	Depository institutions	198.9	165.7	-33.2	-16.7	268.6	-12.3
61	Nondepository institutions	24.8	24.9	0.0	0.1	45.5	0.1
62	Security and commodity brokers	54.2	52.6	-1.6	-2.9	85.8	-1.8
63	Insurance carriers	77.8	63.4	-14.4	-18.5	169.0	-8.5
64	Insurance agents, brokers, & servs	39.2	40.5	1.3	3.3	62.1	2.1
65	Real estate	724.7	820.9	96.2	13.3	1007.6	9.5
	Nonfarm housing services	543.4	NA	NA	NA	NA	NA
	Other real estate	181.3	NA	NA	NA	NA	NA
67	Holding and other investment offices	6.7	7.1	0.4	6.6	18.4	2.4
	Services	1206.9	1203.6	-3.3	-0.3	1893.4	-0.2
70	Hotels and other lodging places	50.3	52.2	1.8	3.6	84.2	2.2
72	Personal services	40.6	37.8	-2.8	-7.0	68.7	-4.1
73	Business services	222.0	229.0	7.0	3.1	325.9	2.1
75	Auto repair, services, and parking	51.3	48.0	-3.2	-6.3	91.3	-3.6
76	Miscellaneous repair services	17.5	24.4	7.0	39.9	36.6	19.1
78	Motion pictures	18.0	18.8	0.8	4.6	43.5	1.9
79	Amusement and recreation services	45.1	43.9	-1.2	-2.7	74.1	-1.6
80	Health services	376.7	371.8	-4.9	-1.3	561.6	-0.9
81	Legal services	92.1	84.2	-7.9	-8.6	116.4	-6.8
82	Educational services	46.4	44.0	-2.4	-5.2	81.0	-3.0
83	Social services	37.3	40.1	2.7	7.4	70.3	3.9
86	Membership organizations	39.9	40.8	0.9	2.3	74.5	1.3
84,87,89	Other services	159.5	158.6	-1.0	-0.6	255.2	-0.4
88	Private households	10.1	10.1	-0.0	-0.4	10.1	-0.4
	Statistical discrepancy	43.7	0.0	-43.7	-100.0	NA	NA
	Inventory valuation adjustment	0.0	-8.0	-8.0	NA	NA	NA

Source: Bureau of Economic Analysis

revision, but they have been adjusted to exclude the impact of the new treatment of software for comparability with the published I-O estimates for 1992. The I-O industry estimates are on the alternative ("near SIC") basis and have been aggregated to the GPO level of industry detail. In addition, adjustments have been made to the I-O estimates to include new own-account construction in the industry performing the work rather than in the construction industry, for consistency with the GPO estimates. The difference for all private industries of $15.1 billion reflects revisions to GDP for 1992 other than the new treatment of software. The statistical discrepancy is included in the total for GPO private industries.

For each industry and industry group, column 3 shows I-O value added less GPO, column 4 shows this difference as a percentage of GPO, and column 6 shows this difference as a percentage of the I-O gross output in column 5. In general, the differences are large as a percentage of GPO for the detailed industries, but much smaller for the aggregated industry groups and also as a percentage of the industry's gross output. To some extent, the differences appear to be offsetting within industry groups, but large differences remain in the aggregates for agriculture, forestry, and fishing, nondurable goods manufacturing, communications, electric, gas, and sanitary services, and real estate. The large difference for real estate partly reflects the more comprehensive definition of real estate in the I-O accounts, in which real estate is defined on an activity basis for both the traditional and alternative versions of the I-O accounts.

Several hypotheses were developed and tested as part of the study, but the conclusion was that no single factor could consistently explain the observed differences over time and across industries. For 1992, the largest differences were due to compensation of employees for some industries, but were due to property-type income for other industries. Differences were generally small for IBT. The largest percentage differences, however, were generally found in property-type income. While the percentage differences were generally smaller for compensation of employees, this component often accounted for most of the dollar difference because of its large share of total industry GPO or VA. Other studies of compensation of employees have shown even larger differences at more detailed industry levels for wages and salaries, primarily due to differences in industry classifications between Census and BLS. For PTI, sources and methods differ considerably, and additional research is needed to determine the relative strengths and

limitations of the alternative approaches. For example, the I-O estimates of intermediate inputs by industry and the GPO estimates of property-type income by industry both have limitations that affect the reliability of the estimates of capital income.

Although no "smoking guns" were found, several research projects were identified that could improve both the GPO and I-O VA estimates. One key finding was that the estimates of purchased business services in the I-O accounts may be understated for manufacturing and overstated for nonmanufacturing. Other sources of difference include the treatment of the statistical discrepancy and the inventory valuation adjustment (IVA). The statistical discrepancy, which BEA includes as a balancing item on the income side of the NIPA's, is not allocated among industries in the GPO accounts, whereas no statistical discrepancy exists in the I-O accounts. The IVA is distributed by industry in the GPO accounts but not in the I-O accounts. For compensation of employees, further reductions in differences will depend on the ability of Census and BLS to more extensively share industry codes from their business lists.

2. Gross Output: GPO vs. I-O. Industry analysts are concerned about the lack of consistency in gross output measures from the industry accounts as well as in the value-added measures. However, until recently the gross output estimates could not be easily compared because of differences in industry definitions between the GPO accounts and the I-O accounts and due to the lack of complete coverage for gross output in the GPO estimates. These series can now be more easily compared because a limited time series of gross output estimates are available from the I-O accounts and the coverage of gross output in the GPO accounts has been expanded to include all industries.

Comparisons of gross output for 1992 were made in the study of value-added differences described above because of the important role played by gross output in determining value added in a production account approach. Differences between GPO and I-O gross output estimates were generally small for 1992, largely because of the use of the benchmark I-O accounts to establish gross output benchmark levels for the GPO program. Most of the differences in gross output were attributable to differences in industry definitions and in the definitions of output. For example, in the GPO accounts new own-account construction is included in the industry performing the construction work on its own behalf, whereas in the I-O accounts it is included in

the construction industry for both the traditional and alternative classification systems.[12] Differences in misreporting and coverage adjustments and in commodity taxes also made small contributions to the overall differences.

It should be noted that the differences in gross output by industry are not a direct contributor to differences between nominal GPO and I-O VA because of the differences in methodology, even in benchmark years. In contrast to the production approach used for the I-O accounts, gross output plays no role in determining nominal GPO by industry, since the latter is determined entirely by the industry distributions of the components of gross domestic income. However, gross output plays a crucial role in determining real GPO by industry because intermediate inputs are derived as a residual in the GPO accounts, and real GPO is estimated in the double-deflation method as a function of real gross output and real intermediate inputs. The significance of these differences will be explained more fully below.

Table 2 presents estimates of GPO gross output and I-O gross output for 1996 from the annual I-O accounts at the published GPO level of industry detail. Column (3) shows I-O gross output less GPO gross output in billions of dollars, and column (4) shows this difference as a percent of GPO gross output. As in table 1, these estimates are shown only for private industries. In contrast to table 1, however, adjustments have not been made to the I-O industry definitions for comparability with the GPO estimates. As a result, the I-O construction industry includes own-account construction and the I-O business services industry includes own-account software production, both of which explain some of the larger observed differences. Remaining differences between GPO and I-O gross output estimates for 1996 primarily reflect different sources and methods for extrapolating nominal gross output levels from the 1992 benchmark. These differences should be resolved in an integrated industry accounts program.

B. Accuracy of Real GPO Estimates

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[12] IED has proposed to change the treatment of own-account construction in the alternative I-O accounts for the 1997 I-O benchmark to parallel the treatment in the GPO accounts. This treatment is followed in the GPO accounts largely because the value-added inputs associated with the construction work are included in the source data used to compute GPO by industry. Similarly, own-account software production work is classified in the industry performing the work in the GPO accounts but in the software industry in the 1996 I-O accounts. IED likewise proposes changing the treatment of own-account software production for 1997.

Table 2.--GPO vs. Annual I-O, 1996
Gross Output by Industry
(Dollar Amounts in Billions)

1987 SIC	Industry Title	GPO Gross Output (1)	I-O Gross Output (2)	Dollar Difference: I-O Less GPO (3)=(2)-(1)	Percent Difference: Diff./GPO (4)=(3)/(1)
	Private industries	12,470.5	12,709.7	239.2	1.9
	Agriculture, forestry, and fishing	278.4	299.9	21.5	7.7
01-02	Farms	222.6	241.8	19.2	8.6
07-09	Agricultural servs., forestry, & fishing	55.8	58.1	2.3	4.1
	Mining	186.6	195.6	9.0	4.8
10	Metal mining	12.6	12.9	0.3	2.0
11-12	Coal mining	27.1	23.0	-4.2	-15.4
13	Oil and gas extraction	129.8	143.1	13.3	10.2
14	Nonmetallic minerals, except fuels	17.0	16.7	-0.3	-1.8
15-17	Construction	554.5	845.4	291.0	52.5
	Manufacturing	3,661.1	3,675.1	14.0	0.4
	Durable goods	1,973.7	1,981.1	7.4	0.4
24	Lumber and wood products	105.6	112.1	6.6	6.2
25	Furniture and fixtures	54.5	55.0	0.5	0.9
32	Stone, clay, and glass products	80.6	80.8	0.3	0.3
33	Primary metal industries	178.7	176.9	-1.8	-1.0
34	Fabricated metal products	210.0	210.4	0.4	0.2
35	Industrial machinery and equipment	371.2	371.8	0.6	0.2
36	Electronic and other electric equipment	313.8	311.4	-2.5	-0.8
371	Motor vehicles and equipment	326.1	327.4	1.3	0.4
37exc.371	Other transportation equipment	136.2	137.9	1.7	1.2
38	Instruments and related products	147.9	147.0	-0.9	-0.6
39	Miscellaneous manufacturing industries	49.1	50.4	1.3	2.7
	Nondurable goods	1,687.4	1,694.0	6.6	0.4
20	Food and kindred products	450.7	453.2	2.5	0.6
21	Tobacco manufactures	39.6	39.5	-0.1	-0.3
22	Textile mill products	79.6	79.3	-0.3	-0.3
23	Apparel and other textile products	75.0	75.2	0.1	0.2
26	Paper and allied products	159.3	158.3	-0.9	-0.6
27	Printing and publishing	197.3	198.6	1.3	0.7
28	Chemicals and allied products	358.6	362.4	3.8	1.1
29	Petroleum and coal products	170.6	170.5	-0.1	-0.1
30	Rubber and miscellaneous plastics products	147.8	148.1	0.3	0.2
31	Leather and leather products	9.0	9.0	-0.0	-0.1
	Transportation and public utilities	1,162.9	1,143.5	-19.4	-1.7
	Transportation	477.9	475.1	-2.8	-0.6
40	Railroad transportation	40.7	38.6	-2.1	-5.1
41	Local and interurban passenger transportation	24.2	28.0	3.8	15.5
42	Trucking and warehousing	213.8	211.2	-2.6	-1.2
44	Water transportation	36.4	35.4	-1.0	-2.8
45	Transportation by air	117.3	118.1	0.8	0.7
46	Pipelines, except natural gas	7.8	7.9	0.1	1.1
47	Transportation services	37.7	35.9	-1.8	-4.8
48	Communications	348.7	338.9	-9.8	-2.8
481,482,489	Telephone and telegraph	270.0	259.9	-10.1	-3.8
483,484	Radio and television	78.8	79.1	0.3	0.4
49	Electric, gas, and sanitary services	336.2	329.4	-6.8	-2.0
50	Wholesale trade	789.8	800.5	10.7	1.4
52	Retail trade	1,070.9	1,055.4	-15.5	-1.4
	Finance, insurance, & real estate	2,247.1	2,151.2	-95.9	-4.3
60	Depository institutions	342.7	329.4	-13.3	-3.9
61	Nondepository institutions	108.4	72.0	-36.4	-33.6
62	Security and commodity brokers	169.3	166.5	-2.8	-1.6
63	Insurance carriers	261.5	221.7	-39.8	-15.2
64	Insurance agents, brokers, & servs	74.0	81.5	7.5	10.2
65	Real estate	1,268.2	1,243.5	-24.7	-2.0
	Nonfarm housing services	747.8	NA	NA	NA
	Other real estate	520.4	NA	NA	NA
67	Holding and other investment offices	23.1	36.6	13.6	58.7
	Services	2,519.3	2,543.1	23.8	0.9
70	Hotels and other lodging places	106.5	104.8	-1.7	-1.6
72	Personal services	84.6	85.1	0.5	0.5
73	Business services	510.6	552.4	41.8	8.2
75	Auto repair, services, and parking	124.3	124.2	-0.2	-0.1
76	Miscellaneous repair services	46.4	45.5	-0.9	-1.9
78	Motion pictures	56.8	57.2	0.5	0.8
79	Amusement and recreation services	110.7	112.7	1.9	1.7
80	Health services	688.0	679.9	-8.1	-1.2
81	Legal services	134.1	133.6	-0.5	-0.4
82	Educational services	103.8	102.0	-1.8	-1.8
83	Social services	98.7	92.0	-6.7	-6.8
86	Membership organizations	96.2	94.8	-1.4	-1.5
84,87,89	Other services	346.6	346.8	0.2	0.1
88	Private households	12.0	12.3	0.3	2.3
	Statistical discrepancy	NA	NA	NA	NA
	Inventory valuation adjustment	NA	NA	NA	NA

Source: Bureau of Economic Analysis

An issue for the industry accounts that may not be as apparent to users concerns the stability of measured input-output ratios (the ratio of nominal intermediate inputs to nominal gross output) and the implications of changes in these ratios for the estimates of real GPO by industry. As noted above, real GPO is computed using the double-deflation method as the difference between real gross output and real intermediate inputs. Chain-type quantity indexes for gross output and for intermediate inputs are combined in the Fisher formula to compute a chain-type quantity index for GPO by industry. Computation of the quantity indexes for gross output and for intermediate inputs requires detailed data for nominal gross output products, nominal intermediate input products, and product prices.

A major difference between the GPO and I-O accounts is the method of computing intermediate inputs by industry, which has a direct bearing on the estimates of real GPO by industry. Figure 2 depicts the difference in methodology by comparing the production account approach with the present BEA approach. In both approaches, real GPO or real value added is computed as the difference between real gross output and real intermediate inputs. The methodologies are very similar for nominal and real gross output, but differ significantly intermediate inputs. In the production account approach, intermediate inputs are either directly measured (as in the benchmark I-O accounts) or derived using assumptions about industry production technology (as in the annual I-O accounts). In the GPO accounts, total nominal intermediate inputs for an industry are obtained as the difference between nominal gross output and nominal GPO. The latter is derived independently from the components of NIPA gross domestic income.[13]

The approach to estimating intermediate inputs for the GPO accounts is driven by the availability of source data from the NIPA's and the need for timely estimates. In concept, either the GPO approach or the I-O approach should yield the same results. In practice, the results can

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[13] Another difference between the two approaches is the estimation of the commodity composition of intermediate inputs to use as weights for intermediate input price and quantity indexes. In the GPO accounts, the commodity composition from the I-O accounts (alternative basis) is used for I-O years, interpolated between I-O years, and held constant since the most recent I-O year. In the I-O accounts, these weights are obtained directly as part of the process of estimating intermediate inputs by industry. At this time, estimates of real intermediate inputs by industry have not been derived from the I-O accounts.

Figure 2.--Alternative Approaches to Measuring Industry GPO

Item	PRODUCTION ACCOUNT APPROACH		PRESENT BEA APPROACH	
	NOMINAL	REAL (1996$)[2]	NOMINAL	REAL (1996$)[2]
Gross Output	A	$A_{96\$}$	D	$D_{96\$}$
Intermediate Inputs	B	$B_{96\$}$	$E \equiv (D-F^1)$	$E_{96\$}$
GPO or Value Added	$C \equiv (A-B)$	$C_{96\$}=(A_{96\$}-B_{96\$})$	F^1	$F_{96\$}=(D_{96\$}-E_{96\$})$

[1] Equals the sum of industry distributions of each of the 16 components of gross domestic income from the NIPAs. These components--grouped into broader categories--include compensation of employees, indirect business tax and nontax liability, and property-type income.

[2] Real GPO or value-added estimates are computed in a Fisher index number formula. The fixed-weight Laspeyres representation is shown here for illustrative purposes.

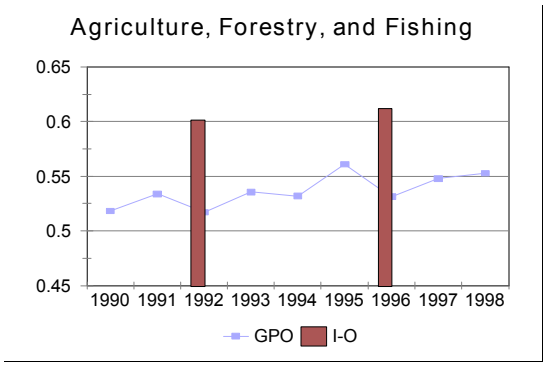
differ substantially due to differences in source data and estimating approach. One of the major reasons for differences in the I-O ratios are the source data for gross output and for GPO in the GPO accounts. The source data for gross output are based primarily on industry classifications from the Census Bureau, whereas the GPO income estimates are based on source data classifications from BLS, IRS, and other sources. As a result, the levels of gross output, intermediate inputs, and GPO are not necessarily consistent with one another, even in a benchmark year.

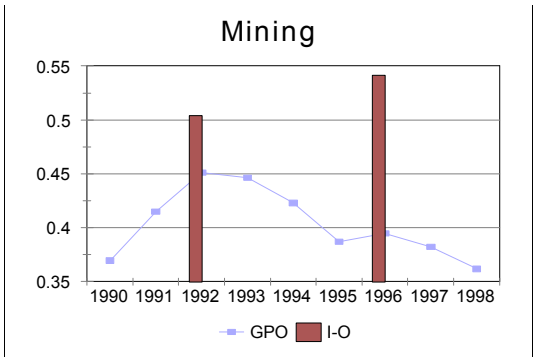
A comparison of input-output ratios and their changes over time from the GPO accounts and from the I-O accounts is presented in Chart 1 for industry groups.[14] The solid bars represent the I-O accounts and the dashed lines represent the GPO accounts. While the broad trends for changes are similar, the levels of the I-O ratios are quite different for most industry groups. Additional industry detail from the GPO accounts is presented in table 3, which shows GPO industries ranked by the magnitude of change in the I-O ratio over the period 1990-98. In some cases, industries with large changes in the I-O ratio are quite small, or have low initial I-O ratios, such that relatively small errors in the estimates of change in either gross output or GPO can have a very large impact on the I-O ratio. In other industries, the range of differences raises questions about the reliability of either nominal gross output, nominal GPO, or both.

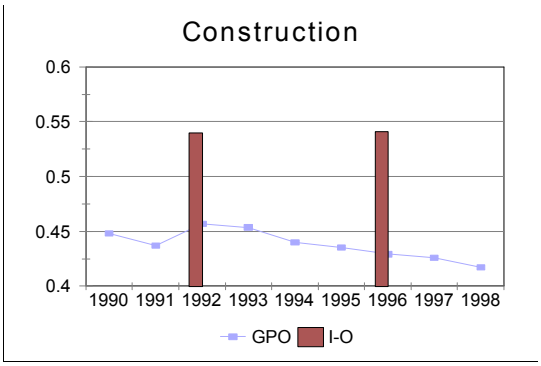
Changes in I-O ratios, combined with the change in thedifference between gross output prices and intermediate inputs prices, are the two key variables for explaining changes in real GPO by industry. A change in the nominal I-O ratio changes the weights for gross output and for intermediate inputs in the double-deflation formula and can exert a major impact on the change in real GPO for an industry, especially when GPO is a relatively small percentage of an industry's gross output. An important issue for integration concerns the degree to which nominal I-O ratios actually change, or would be expected to change, from year-to-year. The presumption for I-O analysis is that technical coefficients are very slow to change over short periods, so that any significant change in nominal I-O ratios would primarily reflect changes in relative prices. When relative prices do not change significantly, large changes in nominal I-O ratios lead to large

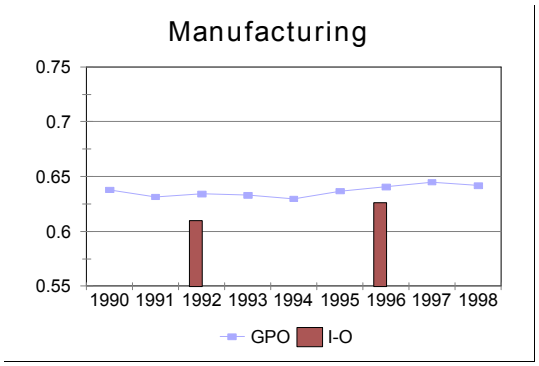
[14] The following chart and table are reproduced from Lawson (2000).

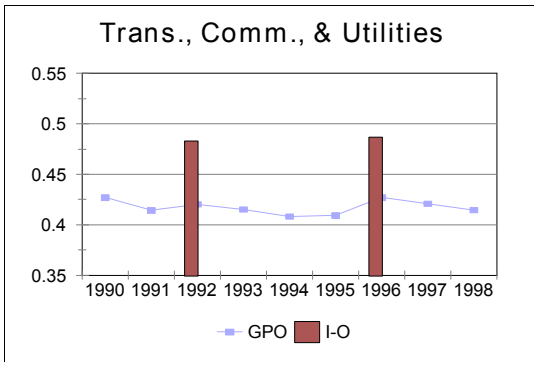
Chart 1.--Comparison of I-O and GPO Ratios of Intermediate Inputs to Gross Output

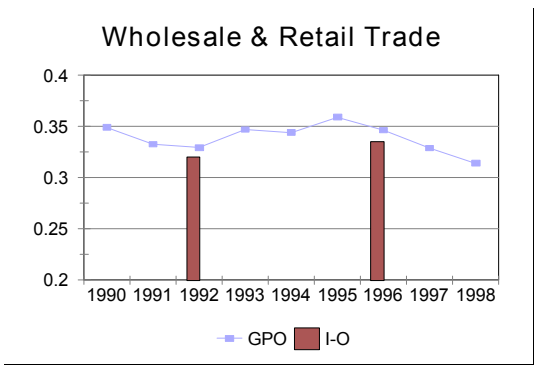


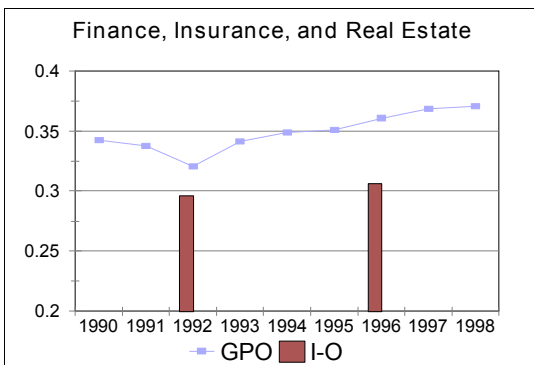












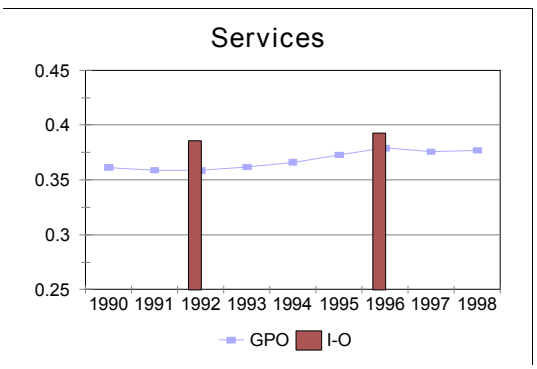


Table 3.--GPO Industries Ranked by Magnitude of Change in Ratios of Intermediate Inputs to Gross Output, 1990-98

Industries	Average Ratio	Minimum Ratio (1990-1998)	Maximum Ratio (1990-1998)	Difference (Max. - Min.)
Pipelines, except natural gas	0.278	0.127	0.423	0.296
Security and commodity brokers	0.400	0.301	0.539	0.238
Nondepository institutions	0.536	0.430	0.645	0.214
Radio and television	0.372	0.283	0.454	0.171
Nonmetallic minerals, except fuels	0.428	0.336	0.486	0.150
Transportation by air	0.424	0.356	0.502	0.146
Local and interurban passenger transit	0.454	0.379	0.523	0.145
Insurance carriers	0.552	0.504	0.643	0.138
Oil and gas extraction	0.340	0.281	0.409	0.128
Leather and leather products	0.474	0.411	0.535	0.123
Electronic and other electric equipment	0.487	0.426	0.541	0.115
Transportation services	0.315	0.258	0.372	0.114
Industrial machinery and equipment	0.594	0.531	0.644	0.113
Government enterprises (Federal)	0.201	0.154	0.265	0.111
Holding and other investment offices	0.681	0.639	0.725	0.086
Depository institutions	0.281	0.236	0.322	0.085
Motor vehicles and equipment	0.727	0.695	0.780	0.084
Amusement and recreation services	0.438	0.390	0.474	0.084
Railroad transportation	0.406	0.359	0.441	0.082
Other transportation equipment	0.625	0.588	0.668	0.080
Legal services	0.225	0.191	0.270	0.079
Telephone and telegraph	0.348	0.315	0.393	0.078
Personal services	0.414	0.375	0.448	0.074
Agricultural services, forestry, and fishing	0.289	0.243	0.314	0.072
Wholesale trade	0.317	0.282	0.349	0.067
Instruments and related products	0.637	0.606	0.672	0.066
Other real estate	0.567	0.534	0.600	0.066
Auto repair, services, and parking	0.430	0.384	0.450	0.065
Social services	0.494	0.468	0.533	0.065
Miscellaneous repair services	0.522	0.488	0.552	0.064
Apparel and other textile products	0.632	0.611	0.673	0.062
Farms	0.598	0.570	0.630	0.060
Metal mining	0.531	0.497	0.556	0.059
Textile mill products	0.669	0.636	0.693	0.057
Lumber and wood products	0.602	0.567	0.622	0.055
Motion pictures	0.571	0.548	0.603	0.055
Insurance agents, brokers, and service	0.354	0.337	0.389	0.051
Miscellaneous manufacturing industries	0.512	0.493	0.542	0.049
Tobacco products	0.632	0.606	0.654	0.048
Electric, gas, and sanitary services	0.380	0.352	0.400	0.048
Water transportation	0.643	0.621	0.665	0.044
Chemicals and allied products	0.590	0.572	0.616	0.044
Stone, clay, and glass products	0.576	0.552	0.596	0.044
Other services	0.381	0.360	0.404	0.044
Printing and publishing	0.550	0.532	0.575	0.043
Membership organizations	0.466	0.447	0.489	0.042
Petroleum and coal products	0.806	0.783	0.823	0.040
Hotels and other lodging places	0.388	0.367	0.407	0.040
Construction	0.438	0.417	0.457	0.040
Government enterprises (State and Local)	0.516	0.494	0.529	0.035
Rubber and miscellaneous plastics products	0.662	0.647	0.679	0.032
Coal mining	0.593	0.574	0.607	0.032
Trucking and warehousing	0.555	0.540	0.569	0.029
Retail trade	0.354	0.337	0.367	0.029
Business services	0.317	0.301	0.329	0.028
Primary metal industries	0.708	0.698	0.725	0.027
Educational services	0.432	0.423	0.450	0.026
Food and kindred products	0.737	0.723	0.746	0.023
Fabricated metal products	0.564	0.552	0.575	0.023
Paper and allied products	0.655	0.645	0.666	0.022
Furniture and fixtures	0.616	0.605	0.627	0.022
Health services	0.335	0.327	0.344	0.017
Nonfarm housing services	0.129	0.122	0.138	0.017
Private households	0.000	0.000	0.000	0.000
General government (Federal)	0.000	0.000	0.000	0.000
General government (State and Local)	0.000	0.000	0.000	0.000

differences in growth rates between real gross output and real GPO. These differences imply substantial substitution between value-added inputs and intermediate inputs over a relatively short period.

Table 4 compares average annual real growth rates by industry for 1987-98 for GPO and gross output. An industry's real GPO growth rate will closely approximate its real gross output growth rate if its nominal I-O ratio does not change and if its gross output and intermediate inputs prices grow at similar rates.[15] Comparing the growth rates of these two series by industry thus sheds some insight into the magnitude of potential bias arising from spurious fluctuations in nominal I-O ratios. For all private industries, the growth in real gross output exceeded the growth in real GPO by 0.3 percentage points (3.7 percent vs. 3.4 percent). This difference varied considerably by industry and even by industry group. For example, real gross output for nondurable goods manufacturing increased 1.7 percent, compared to 0.6 percent for real GPO. For services, real gross output increased 4.7 percent compared to 3.4 percent for real GPO. In contrast, real GPO grew faster than real gross output for wholesale trade and for retail trade.

These differences are more pronounced on an annual basis, when even less fluctuation in nominal I-O ratios would be expected. Clearly, analysis of contributions to growth and output per employee for detailed industries can be very much affected by these methodological concerns. Table 5 extends the results in table 4 to compute real output per full-time equivalent employee (FTE). The differences in output per employee closely mirror the differences in real output, with differences for industry groups ranging from a positive 1.2 percentage points for services to a negative 1.3 percentage points for mining. As noted above, these differences would be even greater on an annual basis.

C. Industry Detail

Many users of the industry accounts are interested in more detailed industry data for the private nonfarm sector in order to better understand contributions to economic growth, output per employee, and other aspects of structural change. While the GPO estimates are fairly detailed in the sense that estimates are provided for most two-digit industries (62 private industries in

[15] In general, differences between gross output price indexes and intermediate inputs price indexes by industry do not change significantly over time.

Table 4.--GPO vs. Gross Output, 1987-98
Real Growth Rate
(average annual rate)

1987 SIC	Industry Title	GPO (1)	Gross Output (2)	Gross Output Less GPO (3)=(2)-(1)
	Private industries	3.4	3.7	0.3
	Agriculture, forestry, and fishing	2.4	2.5	0.1
01-02	Farms	2.3	2.1	-0.2
07-09	Agricultural servs., forestry, & fishing	2.6	4.0	1.4
	Mining	2.3	1.0	-1.3
10	Metal mining	7.4	5.4	-2.0
11-12	Coal mining	5.9	2.4	-3.5
13	Oil and gas extraction	1.4	0.1	-1.3
14	Nonmetallic minerals, except fuels	2.6	1.6	-1.0
15-17	Construction	1.9	1.2	-0.7
	Manufacturing	3.0	3.4	0.4
	Durable goods	4.8	4.9	0.1
24	Lumber and wood products	-1.6	0.3	2.0
25	Furniture and fixtures	1.9	2.6	0.7
32	Stone, clay, and glass products	3.7	2.1	-1.6
33	Primary metal industries	2.5	2.2	-0.2
34	Fabricated metal products	2.3	2.4	0.1
35	Industrial machinery and equipment	9.2	9.1	-0.1
36	Electronic and other electric equipment	13.7	11.9	-1.8
371	Motor vehicles and equipment	1.8	3.6	1.8
37exc.371	Other transportation equipment	-2.5	0.6	3.1
38	Instruments and related products	-1.8	2.4	4.2
39	Miscellaneous manufacturing industries	2.3	3.0	0.6
	Nondurable goods	0.6	1.7	1.1
20	Food and kindred products	0.8	2.0	1.2
21	Tobacco manufactures	-5.9	0.3	6.1
22	Textile mill products	0.9	1.0	0.1
23	Apparel and other textile products	-0.6	0.3	0.9
26	Paper and allied products	0.7	1.6	0.9
27	Printing and publishing	-1.6	0.4	2.0
28	Chemicals and allied products	1.9	2.0	0.1
29	Petroleum and coal products	-1.7	1.6	3.3
30	Rubber and miscellaneous plastics products	5.5	4.2	-1.3
31	Leather and leather products	-1.8	-2.8	-1.0
	Transportation and public utilities	4.2	4.2	-0.0
	Transportation	4.4	4.5	0.1
40	Railroad transportation	2.1	2.9	0.8
41	Local and interurban passenger transportation	1.5	1.8	0.3
42	Trucking and warehousing	3.6	5.7	2.1
44	Water transportation	4.5	2.9	-1.7
45	Transportation by air	7.9	4.2	-3.7
46	Pipelines, except natural gas	-0.8	-1.2	-0.4
47	Transportation services	4.3	6.5	2.2
48	Communications	6.2	6.1	-0.1
481,482,489	Telephone and telegraph	6.7	7.1	0.4
483,484	Radio and television	5.2	2.7	-2.5
49	Electric, gas, and sanitary services	2.1	1.9	-0.2
50	Wholesale trade	5.9	4.9	-1.0
52	Retail trade	4.1	3.5	-0.6
	Finance, insurance, & real estate	2.9	3.6	0.7
60	Depository institutions	1.4	2.1	0.6
61	Nondepository institutions	13.2	10.5	-2.7
62	Security and commodity brokers	11.4	13.7	2.3
63	Insurance carriers	1.5	0.5	-1.0
64	Insurance agents, brokers, & servs	-2.7	-0.6	2.1
65	Real estate	2.8	3.5	0.7
	Nonfarm housing services	NA	NA	NA
	Other real estate	NA	NA	NA
67	Holding and other investment offices	-10.8	-2.2	8.6
	Services	3.4	4.7	1.2
70	Hotels and other lodging places	1.8	2.0	0.2
72	Personal services	1.2	3.1	2.0
73	Business services	7.7	9.6	1.9
75	Auto repair, services, and parking	2.1	3.2	1.0
76	Miscellaneous repair services	0.1	3.6	3.4
78	Motion pictures	2.9	3.8	0.9
79	Amusement and recreation services	5.4	6.8	1.4
80	Health services	1.6	3.0	1.4
81	Legal services	0.8	1.9	1.0
82	Educational services	2.2	3.1	0.8
83	Social services	4.8	5.8	1.1
86	Membership organizations	2.6	3.1	0.4
84,87,89	Other services	4.1	4.9	0.8
88	Private households	2.4	2.4	-0.0
	Statistical discrepancy	NA	NA	NA
	Inventory valuation adjustment	NA	NA	NA

Source: Bureau of Economic Analysis

Table 5.--Real Output per FTE, 1987-98
GPO vs. Gross Output
(average annual growth rate)

1987 SIC	Industry Title	GPO per FTE (1)	Gross Output per FTE (2)	Gross Output Less GPO (3)=(2)-(1)
	Private industries	1.3	1.6	0.3
	Agriculture, forestry, and fishing	0.2	0.3	0.1
01-02	Farms	3.1	2.9	-0.2
07-09	Agricultural servs., forestry, & fishing	-2.0	-0.6	1.4
	Mining	4.0	2.7	-1.3
10	Metal mining	6.4	4.4	-2.0
11-12	Coal mining	11.3	7.6	-3.7
13	Oil and gas extraction	2.8	1.5	-1.3
14	Nonmetallic minerals, except fuels	2.6	1.6	-1.0
15-17	Construction	-0.1	-0.8	-0.7
	Manufacturing	3.0	3.4	0.4
	Durable goods	4.7	4.8	0.1
24	Lumber and wood products	-2.5	-0.5	1.9
25	Furniture and fixtures	1.6	2.3	0.7
32	Stone, clay, and glass products	3.5	1.9	-1.6
33	Primary metal industries	2.8	2.5	-0.2
34	Fabricated metal products	1.5	1.6	0.1
35	Industrial machinery and equipment	8.4	8.4	-0.1
36	Electronic and other electric equipment	14.1	12.3	-1.9
371	Motor vehicles and equipment	0.4	2.1	1.7
37exc.371	Other transportation equipment	-0.1	3.0	3.2
38	Instruments and related products	-0.8	3.5	4.3
39	Miscellaneous manufacturing industries	1.7	2.3	0.6
	Nondurable goods	0.8	1.9	1.1
20	Food and kindred products	0.2	1.4	1.2
21	Tobacco manufactures	-3.0	3.3	6.3
22	Textile mill products	2.6	2.7	0.1
23	Apparel and other textile products	2.7	3.6	0.9
26	Paper and allied products	0.7	1.5	0.9
27	Printing and publishing	-2.2	-0.1	2.0
28	Chemicals and allied products	1.8	1.9	0.1
29	Petroleum and coal products	-0.2	3.1	3.4
30	Rubber and miscellaneous plastics products	3.9	2.6	-1.3
31	Leather and leather products	3.1	2.0	-1.1
	Transportation and public utilities	2.4	2.4	-0.0
	Transportation	1.8	1.9	0.1
40	Railroad transportation	4.9	5.7	0.8
41	Local and interurban passenger transportation	-2.0	-1.8	0.3
42	Trucking and warehousing	2.2	4.3	2.1
44	Water transportation	4.0	2.4	-1.7
45	Transportation by air	1.5	-2.0	-3.5
46	Pipelines, except natural gas	1.5	1.1	-0.4
47	Transportation services	0.5	2.7	2.1
48	Communications	5.0	4.9	-0.1
481,482,489	Telephone and telegraph	5.9	6.3	0.4
483,484	Radio and television	2.9	0.5	-2.4
49	Electric, gas, and sanitary services	2.7	2.5	-0.2
50	Wholesale trade	4.5	3.5	-1.0
52	Retail trade	2.1	1.5	-0.6
	Finance, insurance, & real estate	1.9	2.6	0.7
60	Depository institutions	2.5	3.1	0.6
61	Nondepository institutions	7.5	4.9	-2.6
62	Security and commodity brokers	7.8	10.0	2.2
63	Insurance carriers	0.7	-0.4	-1.0
64	Insurance agents, brokers, & servs	-4.4	-2.4	2.0
65	Real estate	1.4	2.1	0.6
	Nonfarm housing services	NA	NA	NA
	Other real estate	NA	NA	NA
67	Holding and other investment offices	-11.9	-3.4	8.5
	Services	-0.6	0.6	1.2
70	Hotels and other lodging places	-0.1	0.0	0.2
72	Personal services	-0.1	1.9	2.0
73	Business services	0.7	2.5	1.8
75	Auto repair, services, and parking	-1.1	-0.1	1.0
76	Miscellaneous repair services	-1.4	2.0	3.4
78	Motion pictures	-2.3	-1.4	0.9
79	Amusement and recreation services	0.3	1.6	1.3
80	Health services	-1.7	-0.4	1.3
81	Legal services	-0.7	0.3	1.0
82	Educational services	-0.7	0.1	0.8
83	Social services	-0.9	0.1	1.0
86	Membership organizations	-0.8	-0.3	0.4
84,87,89	Other services	-0.0	0.7	0.7
88	Private households	0.7	0.7	-0.0
	Statistical discrepancy	NA	NA	NA
	Inventory valuation adjustment	NA	NA	NA

Source: Bureau of Economic Analysis

total), some frustration has arisen because much of the structural change appears to be occurring in specific three-digit and four-digit industries for which GPO estimates are not available, such as semiconductors, computers, and information technology services. The benchmark I-O accounts, by contrast, provide considerably more industry detail (498 industries for 1992), while the annual I-O accounts publish data for 97 industries, with more industry detail available upon request for the annual I-O accounts.

A recent example of the impact of limited industry detail in the GPO estimates can be found in the Commerce Department report on the digital economy (June 2000). In this study, the authors attempted to measure the contribution of investment in information technology (IT) to economic growth and labor productivity by examining relationships at detailed industry levels. Industries were identified as either IT producing or IT using, and their real GPO was used to compute the contribution of these special industry aggregates to growth and productivity. The lack of greater industry detail for the GPO estimates, however, resulted in the use of various assumptions and indirect techniques to measure the impact of computers, semiconductors, and IT services industries.

Productivity analysis is another policy issue that has been hampered by the lack of more detailed industry data. In a recent study, Gullickson and Harper (1999) used BEA's GPO and gross output data to determine the contributions of industries to multifactor productivity growth in an attempt to determine the impact of possible measurement biases on aggregate productivity. While Gullickson and Harper were able to obtain more industry detail from the BLS I-O accounts, they expressed a preference for using GPO data as much as possible because of its consistency with the GDP estimates. Jorgenson and Stiroh (2000) encountered similar obstacles in a recent study of the impact of IT investment on industry multifactor productivity; their study was limited to 35 industries because of data constraints. The demand for greater industry detail is also partly driven by the availability of more detailed employment and hours data from BLS at the four-digit SIC level.

Methodology is the primary reason for the limited industry detail in the GPO accounts, although resource constraints also play a role. More detailed industrygross output estimates are available for most industries. For manufacturing, estimates of industry shipments and inventory

change are available for 459 industries, and for nonmanufacturing gross output estimates are available for 266 detailed industries, including 175 industries in the services sector.[16] However, because nominal GPO cannot be reliably estimated below the two-digit SIC level from the available NIPA income data, nominal intermediate inputs--which are derived as a residual--are likewise constrained to this level of industry detail; this constraint in turn limits the industry detail for real GPO by industry. Even if nominal GPO estimates could be prepared in greater industry detail, resource constraints would limit the number of industries for which detailed estimates could be evaluated and reviewed.

The methodology for the I-O accounts does not similarly constrain the amount of industry detail. In fact, it encourages a proliferation of industry detail, perhaps beyond what can be supported by source data quality and staff resources for evaluation and review. In the case of the annual I-O accounts, an expansion in the amount of industry detail to 97 industries has already taken place, and more industry detail is feasible. Of course, decisions about the appropriate level of industry detail will depend partly on the coordinated implementation of NAICS across the industry accounts programs. BEA is still in the process of determining the optimal publication structure for NAICS industry data. One possibility that has been discussed is publication at approximately the three-digit NAICS subsector level, which provides detail for 88 private industries, including 21 in manufacturing. This level of detail includes industries that are considered to be major contributors to the high-tech and IT-related sectors of the economy.

D. Timeliness

Improved timeliness has been an important issue for the industry accounts for some time, but its significance has increased in recent years because of the rapid pace of structural change coupled with the increasingly strong interest in knowing more about the industrial sources and impacts of economic growth. Recent innovations in the NIPA's have been somewhat slow to flow through to the industry accounts, and this has been a source of frustration for researchers and policymakers concerned with understanding structural change in the economy and its relationship to aggregate economic change.

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[16] These are the detailed source data that are used for extrapolating published gross output in the GPO accounts. See the BEA web site at www.bea.doc.gov for the estimates.

The industry accounts have become more timely throughout the 1990's. The 1992 benchmark I-O accounts were released in 1997 with a reference year lag of five years, down from seven years for the 1987 accounts and nine years for the 1982 I-O accounts. The resumption of the annual I-O program on a regular production and revision cycle will provide more timely I-O accounts with a lag of less than three years. In November 1997, the GPO estimates were provided for the most recent complete year (1996) for the first time since 1988. The release lag for the most recent comprehensive revision of the GSP estimates was reduced by several months, partly as the result of reengineering of the GPO estimates. Release lags for the industry accounts largely reflect release lags for the major data sources, but also reflect the time needed to incorporate source data and to prepare, review, and evaluate the estimates.

BEA is exploring alternative methods for accelerating production and release of both the GPO accounts and the I-O accounts, perhaps using extrapolation techniques based on preliminary or less complete data. For the GSP estimates, projection techniques that rely on advance estimates of State earnings are being explored as a way to prepare more timely GSP estimates. BEA is also exploring methods to automate processes, especially for preparing the annual I-O and GPO accounts. Streamlining procedures will be particularly important if BEA decides to pursue an integrated GPO/Annual I-O estimation and revision cycle, in which advance estimates for a given year are followed by revised estimates in subsequent years.

Options are also being explored for accelerating release of the existing GPO estimates to the Spring following the reference year, using available data from the NIPA's as indicator series for extrapolating the major components of nominal GPO: Compensation of employees, IBT, and property-type income. Depending on the availability of detailed NIPA income by industry series, a preliminary annual estimate could be released less than six months after the end of the calendar year. This acceleration would allow the release of GPO by industry estimates shortly after release of the final estimates of GDP for the preceding calendar year in March, when the fourth-quarter estimates become final until the next annual revision.

Extrapolators for compensation of employees could be based on BLS data for wages and salaries, which are available for NIPA estimates early in the following calendar year at approximately the same level of industry detail as the published GPO estimates. National

estimates of IBT by type of tax could be used to extrapolate each type of IBT by industry, which would assume that the industry distribution of detailed tax types does not change. Sources for extrapolators of property-type income by industry could be based on corporate profits by industry at the two-digit SIC level. These extrapolation procedures could allow BEA to test the feasibility of computing nominal GPO estimates at the current level of industry detail. Estimates of gross output and intermediate inputs would be more difficult because of the lack of source data for extrapolation. Real GPO estimates could be derived by techniques such as direct deflation or labor input extrapolation.

Another option for accelerating release of the GPO by industry estimates for the year t-1 estimate is to provide less industry detail (e.g., 1-digit SIC) by extrapolating nominal GPO from the most recent annual revision with the estimates of national income without capital consumption adjustment that are prepared for NIPA table 6.1C. Still another option would be to provide expanded industry detail (below the 1-digit SIC level) on an accelerated schedule for a limited set of important or interesting industries based on more robust techniques. Resolution of this issue depends partly on the degree of interest among data users in having industry estimates for the most recent year in the Spring rather than in the Fall. Preliminary results from testing the feasibility of extrapolation procedures for 1-digit SIC estimates are presented in Part V.

V. Actions for Improved Industry Accounts

This part of the paper presents examples of actions that BEA could take to improve the industry accounts that partially address some of the issues described in Part IV. Options packages for consideration are presented in Part VI. The actions described below are *not* options packages but rather are illustrative improvements that provide a flavor for the kinds of changes that could be made, given limited resources. An overall strategy for improving the industry accounts would combine elements from some or all of the following actions in a "package" of options. The four specific actions described below include integrating the annual I-O and GPO accounts; changing the focus of the annual I-O program; reducing the industry detail for the benchmark I-O accounts; and providing more timely GPO and GSP estimates.

A. Integrated Annual I-O and GPO Accounts

In December 1996 BEA's Industry Economics Division (IED) prepared a paper to begin discussions on how to implement a recommendation from BEA's 1995 Mid-Decade Strategic Review to better integrate the I-O, GPO, GSP, and NIPA industry estimates (Yuskavage 1996). At that time, BEA was also reviewing options for resuming its annual I-O program, and was concerned about the relationship of the annual I-O program to the existing industry programs. The key premise underlying the discussion paper was that the GPO estimates should be made as consistent as possible with the benchmark I-O accounts.

Several integration prototypes were developed and compared to the existing GPO program as a baseline.[17] The prototypes represented alternative approaches to measuring a time series of nominal and real GPO by industryin a manner that maintained consistency with the benchmark I-O accounts. The prototypes differed depending on the quality of the source data, the amount of industry detail, the timeliness of the release, and the degree of integration with the I-O accounts. At one end of the spectrum was the "Modified Incomes" approach, which provided more timely but less detailed and (possibly) less accurate GPO estimates for the year t-1 annual estimate. Each major GPO component (compensation, IBT, and PTI) for each industry would be extrapolated from the corresponding estimate in benchmark I-O accounts using the NIPA income by industry estimates that are available before the NIPA annual revision.

At the other end of the spectrum was the "Annual I-O Account" approach that provided estimates with a lag of 2.5 to 3 years, but provided considerably more industry detail and greater overall consistency with the NIPA's and the benchmark I-O accounts. In between these two approaches were variations on the "Production Account" approach. In these approaches either nominal GPO by industry or nominal intermediate inputs by industry were estimated as a residual. For intermediate inputs estimated as a residual, the proposed methodology was essentially similar to the current GPO methodology, with the difference being the benchmarking of GPO major components to the benchmark I-O accounts. For GPO estimated as a residual, only gross output was benchmarked to the I-O accounts and intermediate inputs would be estimated as functions of gross output, as determined by research. Each of these production account approaches--

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[17] The baseline GPO program has since been enhanced to include gross output and intermediate inputs for all industries.

particularly the latter approach in which GPO is estimated as a residual--offered the possibility of more industry detail.

The principal finding of that report was that integration of GPO with the I-O accounts was feasible, and that the benefits of integration would be maximized if integration were achieved within the framework of an annual I-O use table prepared on an establishment-industry basis. However, the accuracy of the resulting estimates benchmarked to the I-O accounts was not addressed. A production cycle was proposed in which the annual I-O approach would be used for the year t-3 estimate and a more limited production account approach would be used for the year t-2 and year t-1 estimates. A disadvantage of this approach would be the loss of detailed income component data by industry, especially for property-type income. However, this was not viewed as a serious limitation that would have a major impact on data users. The methodology for GSP would not be significantly affected as long as BEA continued to prepare industry distributions of noncorporate income. The sources used for State distributions of the major GPO income components would still be applicable in an integrated program.

B. Reduced Industry Detail for Benchmark I-O Accounts

The 1997 benchmark I-O accounts will be prepared on a NAICS basis for both the traditional and alternative sets of accounts. NAICS is based on a production-oriented conceptual framework that consistently classifies producing units that use similar production processes in the same industry. As a result, the boundaries between industries distinguish, to the extent practicable, differences in production functions. NAICS uses a six-digit coding system to identify particular industries, industry groups, subsectors, and sectors. The 1997 version of NAICS identifies 1,170 six-digit U.S. industries, which represents an expansion of 358 industries compared to the four-digit 1987 SIC system. The NAICS more accurately portrays the industrial structure of the economy and provides more industry detail for the services sector. The Census Bureau has collected and published (or will soon publish) data from the 1997 economic census for most of the detailed NAICS industries.

BEA has already determined the appropriate levels of industry and commodity detail for the 1997 benchmark I-O accounts. BEA has traditionally prepared the benchmark I-O accounts at nearly the maximum level of industry detail (four-digit SIC) for manufacturing and at various

levels between the two-digit SIC and the four-digit SIC for nonmanufacturing, depending on source data quality. Detail for commodity (product) data has considerably exceeded detail for industry data due to detailed data on products produced and receipts by type from the economic censuses. Past I-O practice has resulted in a disproportionate representation of manufacturing industries in the benchmark accounts. For example, 436 of the 498 published industries in the 1992 benchmark I-O accounts were classified in manufacturing. One reason for this disparity has been the high degree of detail and reliability in the source data for measuring manufacturing gross output and broad categories of intermediate inputs, such as materials consumed and energy. However, as the volume and types of purchased services have grown, the lack of reliable data on their use by manufacturing industries has reduced the reliability of the estimates of total intermediate inputs by industry.

An action for BEA to consider in preparing the2002 benchmark I-O accounts on a NAICS basis is to considerably reduce the industry detail to a level that increases the reliability of the source data for measuring industry inputs and that allows industry analysts to conduct more research on the size and composition of each industry's intermediate inputs. Improved estimates of intermediate inputs by industry and by type of product would also be valuable for analysis of business-to-business (B2B) transactions in the new economy. One possibility is to limit the industry detail in the I-O accounts for estimation purposes to either the 4-digit industry group level (311 industries, 84 in manufacturing) or the 3-digit subsector level (96 industries, 21 in manufacturing).

Even at the highly-aggregated subsector level, industry detail would be provided for important and fast-growing industries such as Computer and Electronic Product Manufacturing (NAICS 334) and Information and Data Processing Services (NAICS 514). Selected breakouts of important four-digit NAICS industries could be made, and BEA could still limit the number of industries to about 110. A reduction in industry detail could be achieved without any reduction in the level of commodity or product detail used for setting "best levels" for the final expenditures estimates of GDP. BEA would need to consult with its major customers before making decisions about reducing the industry detail in the 2002 benchmark I-O accounts.

C. Refocusing of the Annual I-O Accounts

The current process for producing the annual I-O accounts emphasizes the development of independent estimates of personal consumption expenditures (PCE) and private equipment and structures (PES) for the third annual revision of the NIPA's. For example, preliminary estimates of PCE goods categories from the 1996 annual I-O accounts were used in the October 1999 comprehensive revision of the NIPA's.[18] The methods used to prepare these estimates are similar to those used to prepare the "best level" estimates from the benchmark I-O accounts. These procedures are very labor-intensive and require the estimation, analysis, review, and adjustment of nearly 2,000 estimates–including trade margins and transport costs–for detailed goods and services included in PCE and PES. Partly as a consequence of this requirement, annual I-O accounts are prepared only once for a reference year, without revisions.

An action for BEA to consider is to change the emphasis of the annual I-O program towards producing more timely I-O accounts and expanding the I-O related products available to users, and away from providing "best level" NIPA final expenditure estimates. The annual I-O accounts would begin with the assumption that the NIPA's are correct, rather than assuming the I-O accounts provide the best level estimates of PCE and PES. The focus of IED analysis would move away from estimates of PCE and PES and towards industry production and the structure of the economy. Furthermore, the production of the I-O accounts would rely more heavily on automated data processing techniques that would force row and column controls and final use estimates to match independent control totals from the NIPA's and for gross output. As a result of these changes, the I-O accounts could become a time series of industry output, commodity supply, and inputs to industries and final uses that are consistent with the NIPA's for the most recent years.

D. More Timely But Less Detailed Estimates

One of the remaining limitations in the improved GPO by industry accounts is timeliness. Estimates for the most recent calendar year are available in early November, a lag of nearly 11 months, whereas GDP estimates for the preceding year that incorporate "final" fourth-quarter

[18] The 1997 annual I-O accounts did not provide "best level" estimates for the annual NIPA revision because source data were not available on a timely basis.

estimates are available in April. Some users have expressed interest in having GDP by industry estimates available at that time; these views are often based on the misconception that GDP is estimated using the production approach by industry. Improved timeliness is difficult, however, because the GPO estimates are based on industry distributions of the components of gross domestic income; many of these estimates are not available until the July annual NIPA revision.

An action for BEA to consider is to accelerate the availability of GPO by industry estimates by about six months by providing estimates at approximately the one-digit SIC level in the Spring, based on extrapolations of GPO by industry with estimates of national income by one-digit SIC industry. National income by industry, which is published annually and quarterly in NIPA table 6.1C, differs from GPO by industry because it excludes capital consumption allowances, indirect business tax and nontax liabilities, business transfer payments, the current surplus of government enterprises, and includes subsidies. Estimates of gross output and of intermediate inputs would not be available, and real GPO by industry estimates would not be obtained by double-deflation. This speed-up in the availability of nominal GPO by industry estimates could also help to accelerate release of the GSP estimates.

Tables 6a and 6b present the results of an evaluation of this simple extrapolation procedure for the period 1995-99. In table 6a, the "first published" value represents the GPO figure for the year t-1 that was released in the following Fall, or in the comprehensive revision that superseded a Fall release. The "estimated" advance Spring value was obtained by extrapolating the published value for the year t-2 from the prior Fall update with the annual percent change in the industry's national income. Data to compute the latter percent change are available in March for the year t-1. For example, for 1997 the "first published" value was released in Fall 1998, and the "estimated" value was obtained by extrapolating the published value for 1996 (from Fall 1997) by the 1997 percent change in the industry's national income. In table 6b, the "benchmark" value that was released in June 2000 is used as the standard for comparison with the estimated value. It is not an exact comparison, however, because the benchmark revision incorporates definitional changes that are not reflected in the estimated values.

The upper part of each table presents values and differences in billions of dollars, and the

Table 6a.--First Published vs. Estimated GDP by Industry, 1995-99

Billions of dollars Industry Group	First Published 1995	Estimated 1995	Est.-Pub. 1995	First Published 1996	Estimated 1996	Est.-Pub. 1996	First Published 1997	Estimated 1997	Est.-Pub. 1997	First Published 1998	Estimated 1998	Est.-Pub. 1998	First Published 1999	Estimated 1999	Est.-Pub. 1999
GDP	7265.4	7219.6	-45.8	7636.0	7638.8	2.8	8110.9	8145.9	35.0	8759.9	8537.0	-222.9	9299.2	9301.9	2.7
Private industries	6301.3	6259.6	-41.7	6639.8	6647.9	8.1	7083.3	7113.8	30.5	7659.8	7475.7	-184.1	8140.8	8152.8	12.0
Agriculture, forestry, and fishing	111.0	113.8	2.8	129.8	136.5	6.7	131.7	139.0	7.3	125.2	129.5	4.3	125.4	140.5	15.1
Mining	99.8	91.8	-8.0	113.6	101.6	-12.0	120.5	117.2	-3.3	105.9	116.1	10.2	111.8	98.4	-13.4
Construction	286.4	284.5	-1.9	306.1	305.8	-0.3	328.8	328.0	-0.8	373.2	356.8	-16.4	416.4	407.6	-8.8
Manufacturing	1286.3	1231.0	-55.3	1332.1	1339.0	6.9	1378.9	1404.0	25.1	1432.8	1399.7	-33.1	1500.8	1467.7	-33.1
Durable goods	716.8	692.5	-24.3	749.0	754.6	5.6	784.0	799.2	15.2	842.6	813.5	-29.1	877.8	867.3	-10.5
Nondurable goods	569.5	538.6	-30.9	583.1	584.4	1.3	594.9	604.8	9.9	590.1	586.2	-4.0	623.1	600.4	-22.7
Transportation and public utilities	622.4	647.5	25.1	645.3	650.0	4.7	676.3	669.6	-6.7	759.1	704.2	-54.9	780.6	804.5	23.9
Transportation	228.7	239.8	11.1	235.1	237.3	2.2	255.5	253.2	-2.3	283.9	265.6	-18.4	303.4	297.7	-5.7
Communications	191.6	204.5	12.9	200.3	208.3	8.0	211.6	204.2	-7.4	258.7	226.8	-31.9	260.2	278.3	18.1
Electric, gas, and sanitary service	202.0	203.3	1.3	210.0	204.4	-5.6	209.2	212.2	3.0	216.6	211.9	-4.7	217.0	228.4	11.4
Wholesale trade	484.4	481.1	-3.3	516.8	520.2	3.4	562.8	567.4	4.6	613.8	599.4	-14.4	643.3	647.0	3.7
Retail trade	637.6	644.9	7.3	667.9	674.9	7.0	712.9	713.9	1.0	781.9	761.2	-20.7	856.4	834.0	-22.4
Finance, insurance, and real estate	1361.3	1346.3	-15.0	1448.5	1422.8	-25.7	1570.3	1576.4	6.1	1674.2	1677.7	3.5	1791.1	1820.5	29.4
Services	1440.3	1446.9	6.6	1539.5	1557.0	17.5	1656.8	1654.0	-2.8	1841.3	1778.6	-62.6	1986.9	2004.5	17.6
Statistical discrepancy	-28.2	-28.2	0.0	-59.9	-59.9	0.0	-55.8	-55.8	0.0	-47.6	-47.6	0.0	-71.9	-71.9	0.0
Government	964.1	960.1	-4.0	996.3	990.9	-5.4	1027.6	1032.2	4.6	1100.1	1061.3	-38.8	1158.4	1149.1	-9.3
GDI	7293.6	7247.8	-45.8	7695.9	7698.7	2.8	8166.6	8201.7	35.1	8807.5	8584.6	-222.9	9371.1	9373.8	2.7

Shares of GDP Industry Group	First Published 1995	Estimated 1995	Est.-Pub. 1995	First Published 1996	Estimated 1996	Est.-Pub. 1996	First Published 1997	Estimated 1997	Est.-Pub. 1997	First Published 1998	Estimated 1998	Est.-Pub. 1998	First Published 1999	Estimated 1999	Est.-Pub. 1999
GDP	100.0	100.0	0.0	100.0	100.0	0.0	100.0	100.0	0.0	100.0	100.0	0.0	100.0	100.0	0.0
Private industries	86.7	86.7	-0.0	87.0	87.0	0.1	87.3	87.3	-0.0	87.4	87.6	0.1	87.5	87.6	0.1
Agriculture, forestry, and fishing	1.5	1.6	0.0	1.7	1.8	0.1	1.6	1.7	0.1	1.4	1.5	0.1	1.3	1.5	0.2
Mining	1.4	1.3	-0.1	1.5	1.3	-0.2	1.5	1.4	-0.0	1.2	1.4	0.2	1.2	1.1	-0.1
Construction	3.9	3.9	-0.0	4.0	4.0	-0.0	4.1	4.0	-0.0	4.3	4.2	-0.1	4.5	4.4	-0.1
Manufacturing	17.7	17.1	-0.7	17.4	17.5	0.1	17.0	17.2	0.2	16.4	16.4	0.0	16.1	15.8	-0.4
Durable goods	9.9	9.6	-0.3	9.8	9.9	0.1	9.7	9.8	0.1	9.6	9.5	-0.1	9.4	9.3	-0.1
Nondurable goods	7.8	7.5	-0.4	7.6	7.6	0.0	7.3	7.4	0.1	6.7	6.9	0.1	6.7	6.5	-0.2
Transportation and public utilities	8.6	9.0	0.4	8.5	8.5	0.1	8.3	8.2	-0.1	8.7	8.2	-0.4	8.4	8.6	0.3
Transportation	3.1	3.3	0.2	3.1	3.1	0.0	3.2	3.1	-0.0	3.2	3.1	-0.1	3.3	3.2	-0.1
Communications	2.6	2.8	0.2	2.6	2.7	0.1	2.6	2.5	-0.1	3.0	2.7	-0.3	2.8	3.0	0.2
Electric, gas, and sanitary service	2.8	2.8	0.0	2.8	2.7	-0.1	2.6	2.6	0.0	2.5	2.5	0.0	2.3	2.5	0.1
Wholesale trade	6.7	6.7	-0.0	6.8	6.8	0.0	6.9	7.0	0.0	7.0	7.0	0.0	6.9	7.0	0.0
Retail trade	8.8	8.9	0.2	8.7	8.8	0.1	8.8	8.8	-0.0	8.9	8.9	-0.0	9.2	9.0	-0.2
Finance, insurance, and real estate	18.7	18.6	-0.1	19.0	18.6	-0.3	19.4	19.4	-0.0	19.1	19.7	0.5	19.3	19.6	0.3
Services	19.8	20.0	0.2	20.2	20.4	0.2	20.4	20.3	-0.1	21.0	20.8	-0.2	21.4	21.5	0.2
Statistical discrepancy	-0.4	-0.4	-0.0	-0.8	-0.8	0.0	-0.7	-0.7	0.0	-0.5	-0.6	-0.0	-0.8	-0.8	0.0
Government	13.3	13.3	0.0	13.0	13.0	-0.1	12.7	12.7	0.0	12.6	12.4	-0.1	12.5	12.4	-0.1
GDI	100.4	100.4	0.0	100.8	100.8	-0.0	100.7	100.7	-0.0	100.5	100.6	0.0	100.8	100.8	-0.0
Mean Absolute Error			0.13			0.10			0.06			0.14			0.16

Source: Bureau of Economic Analysis

Table 6b.--Benchmark vs. Estimated GDP by Industry, 1995-99

Billions of dollars Industry Group	Benchmark 1995	Estimated 1995	Est.-Bmk. 1995	Benchmark 1996	Estimated 1996	Est.-Bmk. 1996	Benchmark 1997	Estimated 1997	Est.-Bmk. 1997	Benchmark 1998	Estimated 1998	Est.-Bmk. 1998	Benchmark 1999	Estimated 1999	Est.-Bmk. 1999
GDP	7400.5	7274.4	-126.2	7813.2	7731.6	-81.6	8300.8	8198.6	-102.2	8759.9	8537.0	-222.9	NA	9301.9	NA
Private industries	6411.1	6314.3	-96.8	6792.8	6740.7	-52.1	7241.4	7166.4	-75.0	7659.8	7475.7	-184.1	NA	8152.8	NA
Agriculture, forestry, and fishing	109.8	113.8	4.0	130.4	136.5	6.1	129.7	139.0	9.4	125.2	129.5	4.3	NA	140.5	NA
Mining	95.7	91.8	-3.9	113.0	101.6	-11.4	121.0	117.2	-3.8	105.9	116.1	10.2	NA	98.4	NA
Construction	290.3	284.5	-5.9	316.4	305.8	-10.6	343.1	328.0	-15.1	373.2	356.8	-16.4	NA	407.6	NA
Manufacturing	1289.1	1231.0	-58.0	1316.0	1339.0	22.9	1377.2	1404.0	26.8	1432.8	1399.7	-33.1	NA	1467.7	NA
Durable goods	729.8	692.5	-37.4	748.4	754.6	6.2	798.7	799.2	0.4	842.6	813.5	-29.1	NA	867.3	NA
Nondurable goods	559.2	538.6	-20.7	567.6	584.4	16.8	578.5	604.8	26.3	590.1	586.2	-4.0	NA	600.4	NA
Transportation and public utilities	642.6	647.5	4.9	666.3	650.0	-16.3	713.2	669.6	-43.6	759.1	704.2	-54.9	NA	804.5	NA
Transportation	233.4	239.8	6.4	243.4	237.3	-6.1	262.8	253.2	-9.6	283.9	265.6	-18.4	NA	297.7	NA
Communications	202.3	204.5	2.1	214.7	208.3	-6.4	243.1	204.2	-39.0	258.7	226.8	-31.9	NA	278.3	NA
Electric, gas, and sanitary services	206.9	203.3	-3.6	208.3	204.4	-3.8	207.2	212.2	5.0	216.6	211.9	-4.7	NA	228.4	NA
Wholesale trade	500.6	481.1	-19.5	529.6	520.2	-9.3	572.3	567.4	-4.9	613.8	599.4	-14.4	NA	647.0	NA
Retail trade	646.8	644.9	-1.9	687.1	674.9	-12.2	734.1	713.9	-20.2	781.9	761.2	-20.7	NA	834.0	NA
Finance, insurance, and real estate	1347.2	1346.3	-0.9	1436.8	1422.8	-14.0	1561.6	1576.4	14.8	1674.2	1677.7	3.5	NA	1820.5	NA
Services	1462.4	1446.9	-15.6	1564.2	1557.0	-7.3	1692.5	1654.0	-38.4	1841.3	1778.6	-62.6	NA	2004.5	NA
Statistical discrepancy	26.5	26.5	0.0	32.8	32.8	0.0	-3.2	-3.2	0.0	-47.6	-47.6	0.0	NA	-71.9	NA
Government	989.5	960.1	-29.4	1020.4	990.9	-29.5	1059.4	1032.2	-27.2	1100.1	1061.3	-38.8	NA	1149.1	NA
GDI	7374.0	7247.8	-126.2	7780.3	7698.7	-81.6	8303.9	8201.7	-102.2	8807.5	8584.6	-222.9	NA	9373.8	NA

Shares of GDP Industry Group	Benchmark 1995	Estimated 1995	Est.-Bmk. 1995	Benchmark 1996	Estimated 1996	Est.-Bmk. 1996	Benchmark 1997	Estimated 1997	Est.-Bmk. 1997	Benchmark 1998	Estimated 1998	Est.-Bmk. 1998	Benchmark 1999	Estimated 1999	Est.-Bmk. 1999
GDP	100.0	100.0	0.0	100.0	100.0	0.0	100.0	100.0	0.0	100.0	100.0	0.0	NA	100.0	NA
Private industries	86.6	86.8	0.2	86.9	87.2	0.2	87.2	87.4	0.2	87.4	87.6	0.1	NA	87.6	NA
Agriculture, forestry, and fishing	1.5	1.6	0.1	1.7	1.8	0.1	1.6	1.7	0.1	1.4	1.5	0.1	NA	1.5	NA
Mining	1.3	1.3	-0.0	1.4	1.3	-0.1	1.5	1.4	-0.0	1.2	1.4	0.2	NA	1.1	NA
Construction	3.9	3.9	-0.0	4.0	4.0	-0.1	4.1	4.0	-0.1	4.3	4.2	-0.1	NA	4.4	NA
Manufacturing	17.4	16.9	-0.5	16.8	17.3	0.5	16.6	17.1	0.5	16.4	16.4	0.0	NA	15.8	NA
Durable goods	9.9	9.5	-0.3	9.6	9.8	0.2	9.6	9.7	0.1	9.6	9.5	-0.1	NA	9.3	NA
Nondurable goods	7.6	7.4	-0.2	7.3	7.6	0.3	7.0	7.4	0.4	6.7	6.9	0.1	NA	6.5	NA
Transportation and public utilities	8.7	8.9	0.2	8.5	8.4	-0.1	8.6	8.2	-0.4	8.7	8.2	-0.4	NA	8.6	NA
Transportation	3.2	3.3	0.1	3.1	3.1	-0.0	3.2	3.1	-0.1	3.2	3.1	-0.1	NA	3.2	NA
Communications	2.7	2.8	0.1	2.7	2.7	-0.1	2.9	2.5	-0.4	3.0	2.7	-0.3	NA	3.0	NA
Electric, gas, and sanitary services	2.8	2.8	-0.0	2.7	2.6	-0.0	2.5	2.6	0.1	2.5	2.5	0.0	NA	2.5	NA
Wholesale trade	6.8	6.6	-0.2	6.8	6.7	-0.0	6.9	6.9	0.0	7.0	7.0	0.0	NA	7.0	NA
Retail trade	8.7	8.9	0.1	8.8	8.7	-0.1	8.8	8.7	-0.1	8.9	8.9	-0.0	NA	9.0	NA
Finance, insurance, and real estate	18.2	18.5	0.3	18.4	18.4	0.0	18.8	19.2	0.4	19.1	19.7	0.5	NA	19.6	NA
Services	19.8	19.9	0.1	20.0	20.1	0.1	20.4	20.2	-0.2	21.0	20.8	-0.2	NA	21.5	NA
Statistical discrepancy	0.4	0.4	0.0	0.4	0.4	0.0	-0.0	-0.0	-0.0	-0.5	-0.6	-0.0	NA	-0.8	NA
Government	13.4	13.2	-0.2	13.1	12.8	-0.2	12.8	12.6	-0.2	12.6	12.4	-0.1	NA	12.4	NA
GDI	99.6	99.6	-0.0	99.6	99.6	-0.0	100.0	100.0	0.0	100.5	100.6	0.0	NA	100.8	NA
Mean Absolute Error			0.13			0.11			0.18			0.14			NA

Source: Bureau of Economic Analysis

lower part presents values and differences as shares of nominal GDP.[19] Since GDI is available as a control total, the initial estimates would be scaled to match the GDI and GDP estimates. The mean absolute error is also shown for the differences in industry shares of GDP. These preliminary results indicate that the largest dollar errors (in percentage terms) would be expected in Agriculture, forestry, and fishing and in Mining. Industry shares of GDP, however, would be fairly reliable.[20] A comparison of the mean absolute errors in industry group shares of GDP between table 6a and table 6b indicates that the errors are similar, except for 1997. More sophisticated extrapolation procedures are possible, but they would require more extensive testing and evaluation.

VI. Summary and Recommendations

The U.S. economy appears to be undergoing major structural changes due to investment in information technology and other factors related to the new economy. Economists and policymakers are increasingly interested in studying and understanding these changes from an industry perspective. BEA's industry accounts have the potential for providing much of the data needed to address these issues, particularly industry and sectoral output measures, but further enhancements and improvements are needed. BEA would like to consider further improvements, but resource constraints require that priorities be established and hard choices made.

BEA is at a critical juncture with respect to the future of the industry accounts. A major

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[19] These extrapolations assume that the statistical discrepancy for the prior year is available directly from the NIPA's. As a result, all of the error in the extrapolations is assumed to be in gross domestic income.

[20] The reliability of these results varies by year due to differences in the vintages of available data. The results for 1997 are the most reliable because the data come closest to matching the hypothesized projection scenario. In that scenario, the published GPO estimates for years t-1 and t-2 are obtained from the two most recent GPO annual revisions, and the national income estimates are from the most recent NIPA annual revision for year t-2 and from the four quarters of year t-1. The results for 1998 are the least reliable because the GPO estimates are from the June 2000 comprehensive revision, while the national income estimates are from the Spring of 1999 and therefore do not incorporate the comprehensive NIPA revision. The results for 1999 are preliminary because the "actual" GPO estimates have not been released. The results for 1995 and 1996 are not as reliable as the results for 1997 due to the absence of an annual GPO revision in Fall 1996.

change in industrial classification that will be implemented over the next few years starting with the 1997 benchmark I-O accounts will loom large in any strategy for improving the industry accounts. The requirements for conversion to NAICS must be taken into account when designing new programs. For example, if BEA were to benchmark its industry accounts programs to the 1997 I-O accounts, time series comparability would be reduced. Considerable resources that BEA cannot afford at this time would be required to convert prior I-O accounts, gross output series, and price indexes to the NAICS basis.

The issues of time series comparability and consistency of estimates also loom large for the key issue of integrating the GPO and I-O accounts. On the surface, the notion of using GPO by industry as a control total for value added in the benchmark and annual I-O accounts is very appealing, especially when one considers the difficulties with measuring intermediate inputs by industry in the I-O accounts. On closer inspection, however, this approach has serious limitations. The problems stem from at least three sources: (1) inconsistency between the estimates of nominal GPO and gross output with the resulting implications for nominal I-O ratios and the measurement of real value added by industry; (2) limited industry detail in the GPO estimates compared to the benchmark I-O accounts and even the annual I-O accounts; and (3) the need for conversion of GPO by industry estimates to a NAICS basis, further straining the source data and estimating procedures for computing estimates of property-type income by industry.

Listed below are several options packages. (These options packages are summarized in table 7.) Each of the options packages incorporates elements of the actions described in Part V that BEA could take to address existing limitations in the industry accounts.

Status Quo: No changes to the current industry accounts programs other than NAICS conversion; convert the GPO program to NAICS in 2004 following completion of the 1997 benchmark I-O accounts and the comprehensive NIPA revision; convert the GSP program to NAICS shortly afterwards; NAICS conversions are not made prior to 1997; the annual I-O accounts maintain their focus on final uses for the third annual NIPA revision; the benchmark I-O accounts are prepared with full industry detail.

--Advantages: No new resources required; familiarity among users; changes in IT systems required only for NAICS conversion; maximizes the amount of industry data available for

Table 7.--Summary of Features of Proposed Options Packages

Feature	*Status Quo* [21] *(Baseline)*	*Options Packages*			
		Status Quo Accelerated (short run)	*Full Integration (long run)*	*Partial Integration*	*Limited Integration Accelerated*
Timeliness[22] (in months)	GPO: 11 GSP: 18	GPO: 5 GSP: 12	GPO: 11 GSP: 18	GPO: 11 GSP: 18	GPO: 5 GSP: 12
Industry detail	I-O: 1141 GPO: 68-99	I-O: 1141 GPO: 68-99	I-O: 303 GPO: 68-303	I-O: 1141 GPO: 68-99	I-O: 303 GPO: 68-99
Accuracy of nominal GPO by industry	Affected by incomplete and inconsistent establishment-based industry source data	Same as status quo plus error introduced by advance extrapolation procedures	Improved by a benchmark to I-O with improved intermediate inputs by industry	Affected by incomplete and inconsistent establishment-based industry source data	Improved by a benchmark to I-O with improved intermediate inputs by industry
Accuracy of real GPO by industry	Affected by nominal GPO and inconsistent source data for gross output and GPO (I-O ratios)	Affected by nominal GPO and inconsistent source data for gross output and GPO (I-O ratios)	Improved by nominal GPO and more consistent source data for gross output & GPO (I-O ratios)	Affected by nominal GPO and inconsistent source data for gross output and GPO (I-O ratios)	Improved by increased consistency due to benchmarking to I-O accounts
Consistency with NIPA income estimates	Matches NIPA income components by detailed type and by industry	Matches NIPA income components by detailed type and by industry	Matches NIPA income components by major type but not by industry	Matches NIPA income components by detailed type and by industry	Matches NIPA income components by major type but not by industry
Consistency with I-O accounts	Gross output levels and industry input weights are consistent	Gross output levels and industry input weights are consistent	Value-added and GPO are the same for each estimate cycle (single series)	GPO used as control totals for annual I-O in t-3 annual revision only	GPO by major component extrapolated from bench-mark I-O
Primary role of annual I-O accounts	Sets final use "best levels" for t-3 annual NIPA revision	Sets final use "best levels" for t-3 annual NIPA revision	Provides a time-series of consistent I-O accounts	Sets final use "best levels" for t-3 annual NIPA revision	Sets final use "best levels" for t-3 NIPA revision

[21] After conversion to NAICS in 2004-05.

[22] Number of months after reference year for the initial year t-1 estimate.

users by maintaining separate industry accounts programs.

--Disadvantages: Does not respond to the need for more consistent, more reliable, and/or more timely industry estimates for analysis of structural change and the new economy.

Status Quo Accelerated: Maintains the status quo, but provides more timely GPO advance estimates for year t-1 in the Spring, and GSP estimates several months later. The advantages are the same as in the status quo, but also include more timely estimates. The disadvantages are the same as in the status quo (excluding timeliness), plus the need for additional resources for the earlier release. This resource requirement could be reduced if savings are realized as part of the research into more timely estimates. Another advantage is that resources could be allocated to improving source data and methods.

Full Integration: Reduces the industry detail in the 2002 benchmark I-O accounts and makes high-quality estimates of intermediate inputs and value-added by industry a priority; incorporates improved source data for intermediate inputs; refocuses the annual I-O program with a greater emphasis on a time series of industry output, including regular annual and benchmark revisions; VA by industry estimates for t-3, t-2, and t-1 are prepared from the production account approach; real GPO by industry estimates are computed using the double-deflation method.

--Advantages: Provides a consistent time series of industry output in an I-O framework, at least from 1997 forward, for both gross output and value added for each estimation cycle; improves benchmark I-O estimates of intermediate inputs and value added by industry, providing the benchmark staff more time for research and the opportunity to specialize and develop industry expertise; improves reliability of real GPO estimates.

--Disadvantages: Annual income by industry no longer tied to the NIPA's; does not provide more timely estimates; requires a change in orientation and new programming for the benchmark I-O accounts and additional resources; loss of information from no longer maintaining separate programs;

Partial Integration: Maintains the existing GPO and GSP programs with conversion to NAICS in 2004-05; uses the GPO by industry estimates at the BEA published NAICS level (possibly 100 industries) as control totals for value added by industry for the annual I-O accounts, which are also published at the BEA NAICS level; the annual I-O accounts are produced with a lag of 3 years, are not subject to revision, and retain their focus on final uses for the NIPA's;

benchmark I-O accounts are prepared in full NAICS industry detail.

--Advantages: One set of industry gross output and value added estimates for the year t-3 estimate; relatively small changes to the data processing techniques for the annual I-O and GPO accounts; no loss of industry detail in the benchmark I-O accounts.

--Disadvantages: Does not eliminate the inconsistencies between gross output and VA that currently generate volatile and questionable I-O ratios, which could be even greater at more detailed industry levels; does not improve the intermediate inputs in the benchmark I-O accounts; does not provide more timely annual estimates.

Limited Integration Accelerated Accelerates the GPO and GSP by industry estimates with a Spring release for the year t-1 GPO estimate using extrapolation techniques based on NIPA data; after conversion to NAICS, computes nominal GPO by industry by major component benchmarked to the I-O accounts using income components as extrapolators on a NAICS basis, with intermediate inputs computed as a residual; does not change the focus of the annual I-O program but insures that GPO gross output and I-O gross output are consistent.

--Advantages: Provides more timely GPO and GSP estimates; improves consistency between nominal GPO and gross output; improves consistency between GPO and annual I-O gross output estimates;

--Disadvantages: Does not provide a consistent time series of annual I-O accounts; does not provide a single series for industry value-added; requires some new programming.

BEA recommends the Status Quo Accelerated option package in the short run, the Partial Integration option package in the mid-term, and consideration of the Full Integration option package in the long run. Realistic implementation of full integration must await improvements in source data consistency and quality that most likely cannot be realized until the next I-O benchmark at the earliest. Resources saved by the short-run option can be redirected towards research into the partial integration solution, improvements in source data, and better methods for estimating real output. The Limited Integration Accelerated option package does not achieve the same degree of integration, but provides more timely estimates. Given resource constraints and the requirements of the conversion to NAICS, it is very unlikely that BEA could achieve all possible improvements for the industry accounts.

Appendix: Descriptions of Industry Accounts Programs

A. Input-Output Accounts[23]

1. Benchmark I-O Accounts. I-O accounts show the production of commodities (goods and services) by each industry, the use of commodities by each industry, the commodity composition of GDP, and the industry distribution of value added. The benchmark I-O accounts are based on detailed source data from the economic censuses that are conducted every five years by the Bureau of the Census. Economic census source data are supplemented by data from government regulatory agencies, tabulations of business tax returns, trade associations, and other sources. BEA has prepared benchmark I-O accounts for 1958, 1963, 1967, 1972, 1977, 1987, and 1992. Benchmark I-O accounts for 1997 are scheduled for release in late 2002.

These accounts are presented in five tables–a make table, use table, direct requirements table, and two total requirements tables. The make table shows the commodities (detailed goods and services) that are produced by each industry, including both primary and secondary products. The use table shows the commodity inputs to industry production and the commodities consumed by final users. The 1992 benchmark I-O accounts provide published data showing how 498 industries provide input to, and use output from, each other to generate GDP. At the unpublished workfile level, more detailed information is available for nearly 800 industries and 5,000 products. Industries in the 1992 use table follow the 1987 Standard Industrial Classification (SIC) system.[24]

Figure 1 in Part II illustrates the relationships between the make and use tables. The make table is the starting point for building the I-O accounts because it provides "control totals" for both industry and commodity output, which are the row and column controls in the use table. The use table provides benchmark informati1on for the "best level" estimates of final uses for the NIPA's and also for the product composition of an industry's intermediate inputs. The latter are used as weights for computing price and quantity indexes for intermediate inputs by industry in the GPO accounts. Value-added by industry is obtained from the use table as the difference between industry gross output and industry intermediate inputs.

The three requirements tables are derived from the make and use tables. The direct

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[23] This section borrows heavily from Lawson (August 2000).

[24] For more information about the 1992 benchmark I-O accounts, see Lawson (November 1997).

requirements table shows the amount of a commodity that is required by an industry to produce a dollar of the industry's output. All valuations are in terms of the prices received by producers (producers' prices). The two total requirements tables show the production that is required, directly and indirectly, to deliver a dollar of a commodity to final users; one is in a commodity-by-commodity format and other is in a commodity-by-industry format. BEA's requirements tables are used extensively in the application of I-O modeling techniques to determine the impact of changes in final demand on industries and regions. BEA's Regional Economic Analysis Division uses the national data to develop its RIMS II multipliers.

Production of benchmark I-O accounts is a complex process that requires collection, evaluation, and reconciliation of various sources of data for nearly a thousand industries and more than 5,000 products that are often inconsistent with one another. The major reason that the benchmark I-O accounts are used to establish the "best level" for the NIPA final expenditures is that, in addition to being based on the most complete, comprehensive, and consistent source data, the estimates are refined and synthesized by the discipline of the I-O accounting framework that requires a balance between supply and uses of detailed commodities. This process exposes weaknesses and remaining inconsistencies in source data and estimating methods, and provides a framework for correcting the estimates.

Several major improvements were introduced for the 1992 benchmark I-O accounts, and more are planned for the 1997 benchmark I-O accounts. The 1992 benchmark I-O accounts were released with a lag of five years from the reference year, which was a significant improvement over the nine-year lag for the 1982 benchmark I-O accounts. The 1992 benchmark I-O accounts are scheduled for release in Fall 2002. In addition, beginning with the 1992 benchmark, an alternative set of make and use tables was prepared that defines industries more closely along the lines of the Standard Industrial Classification (SIC) system used to collect the source data.[25] The alternative tables allow users to more easily combine industry outputs and inputs with industry data from other sources, such as receipts data from Census Bureau annual surveys and employment data from the Bureau of Labor Statistics (BLS).

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[25] The traditional I-O industries reflect adjustments to source data for redefinitions for stability of input coefficients, which is a key assumption for I-O requirements analysis.

The 1997 benchmark I-O accounts will be based on NAICS, which attempts to consistently classify producing units (establishments) with similar production processes in the same industry. In addition, the new NAICS system will allow the 1997 benchmark I-O accounts to identify a larger number of services-producing industries compared to goods-producing industries. The Census Bureau used the 1997 version of NAICS to collect data for the 1997 economic census. Compared to the old SIC system, the new NAICS better reflects today's economy. For example, NAICS added 358 new industries, with 250 in the services-producing sector. In addition, more industry detail is available for high-tech manufacturing industries that are making large contributions to economic growth, such as computers and semiconductors.

2. Annual I-O Accounts. The "annual" I-O accounts represent an update of the most recent benchmark I-O accounts using source data that are generally less detailed and less complete than that available for the benchmark accounts. The annual I-O accounts incorporate industry and commodity output data based on source data for the reference year and the most recent estimates of GDP from the NIPA's, but initially hold constant important relationships about industry production technology and the use of commodities from the most recent benchmark. The presentation of the annual I-O accounts is very similar to the benchmark accounts, but the information is less detailed. Summary estimates are published for 97 industries compared to 498 industries in the benchmark accounts. (More detailed industry data are available upon request.)

In December 1999, BEA released the 1996 annual I-O accounts for the U.S. economy, which are based on an update of the 1992 benchmark I-O accounts.[26] This release marked the resumption of the regular preparation of annual I-O accounts for "non-benchmark" years and the refocusing of resources that had been used to speed up the preparation of the 1992 benchmark I-O accounts. The annual I-O accounts for 1997 are scheduled for release before the end of this year. Prior to the 1996 accounts, the last set of annual accounts--which presented estimates for 1987--was published in April 1992.

The annual I-O accounts have several important analytical and statistical uses. Analytical uses include more up-to-date studies of interindustry relationships within the economy and a framework for developing satellite accounts for particular aspects of the economy. Another

[26] See Okubo, Lawson, and Planting (January 2000).

important analytical use is tracing changes over time in the supply and use of commodities at fairly detailed levels. The statistical uses are similar to those described for the benchmark I-O accounts. For example, in the 1996 comprehensive NIPA revision, estimates from the 1996 annual I-O accounts were used to estimate the 1996 commodity distribution for most of the components of personal consumption expenditures (PCE) for goods. For the recent comprehensive revision of GPO by industry, the product composition of industry intermediate inputs from the 1996 annual I-O accounts was used to update the weights from the 1992 benchmark.

The potential time series dimension of the annual I-O accounts is important. By their nature, the benchmark I-O accounts incorporate definitional, methodological, and statistical changes that are introduced independently or as part of a NIPA comprehensive revision. These changes are typically not carried back to earlier benchmark tables, which limits their value for long-term analysis. The annual I-O accounts offer the potential for a consistent time series, but currently they are conceptually and statistically consistent with the most recent NIPA comprehensive revision and not with prior benchmark I-O tables. The current focus of the annual I-O program emphasizes the development of independent estimates for the NIPA's. As a consequence, annual I-O tables are now prepared only once for a reference year, and only after the "best level" data become available, which is generally three years after the reference year.

BLS Annual I-O Accounts--A consistent time series of I-O tables and related industry production accounts is available for 1983-99 from the Office of Employment Projections at BLS for use in its employment projections program. Sources and methods for the BLS I-O tables are similar to those used for the BEA annual I-O accounts, and they are controlled to the various BEA benchmark I-O tables through interpolation and extrapolation procedures.[27] A key difference, however, concerns assumptions about the commodity composition of final uses. BLS assumes that the commodity composition of NIPA final expenditure categories has not changed from the most recent benchmark, whereas BEA devotes considerable resources to establishing independent "best levels" and thereby indirectly changing the commodity composition of final uses.

The BLS accounts are used for long-term industry analysis, such as industry productivity analysis, because of the industry detail, their consistency over time, and their incorporation of NIPA

[27] Sources and methods are described in U.S. Department of Labor (1995).

definitional revisions on a time series basis. These accounts are also timely. Estimates for 1999 were released in November 2000. A recent comparison of the BLS accounts with BEA's annual I-O accounts for 1996, however, revealed differences in industry and commodity output measures that could not be readily explained. BLS has expressed interest in BEA assuming responsibility for the production of annual or updated I-O accounts so that BLS can focus its resources on others aspects of the employment projections program.

B. Gross Product Originating

BEA provides annual estimates of gross product originating (GPO) by industry, starting in 1947 for nominal estimates and in 1977 for real estimates. GPO, which is a value-added concept, represents the contribution of each private industry and of government to the Nation's GDP. It is defined as an industry's gross output less its consumption of intermediate inputs such as energy, materials, and purchased services. The June 2000 GPO comprehensive revision provided GPO estimates for 62 industries and for four government classifications.[28] Estimates for 1987-98 are classified according to the 1987 SIC, while estimates prior to 1987 are classified according to the 1972 SIC. The standard release and revision cycle for the GPO accounts closely follows the annual NIPA revision cycle. Before the end of this year, new GPO estimates for 1999 and revised estimates for 1997 and 1998 will be released that incorporate the annual NIPA revision and revised source data for gross output and prices.

The current-dollar GPO estimates are prepared as the sum of the distributions by industry of the components of gross domestic income (GDI) from the NIPA's. The statistical discrepancy (which is defined as GDP less GDI) is included in the GPO total for private industries and is shown as a separate item, but it is not allocated among industries or income components. Most of the income components are based on source data that provide distributions by industry on an establishment basis (e.g., wages and salaries). Some of the components are based on source data distributed by industry on a company basis, such as corporate profits before tax. These estimates are converted from a company basis to an establishment basis using company-establishment employment matrices. Current-dollar gross output estimates are controlled to the benchmark I-O accounts and are extrapolated with data from annual surveys and other sources. Current-dollar

[28] See Lum, Moyer, and Yuskavage (June 2000).

intermediate inputs are obtained as the difference between gross output and GPO. Price indexes are from BLS, the NIPA's, and other sources. Real GPO is a quantity index computed using the double-deflation method.

Data from the GPO accounts can be used to assess the relative performance of particular industries or industry groups by examining their real GPO growth rates, their contributions to real GDP growth and to aggregate price change, their shares of nominal GDP, and the composition of their nominal GPO (labor vs. capital). The integrated set of estimates also includes nominal GPO by detailed income component; nominal and real gross output and intermediate inputs for industries; and price change measures for GPO, gross output, and intermediate inputs. Additional detail is available for gross output by industry and for indirect business tax and nontax liability by industry.

A major element of the June 2000 GPO comprehensive revision was the development of an integrated set of estimates of gross output, intermediate inputs, and GPO for all industries, beginning with 1987. As a result, the GPO estimates are now a consistent set of industry production accounts that are more closely integrated with the NIPA's and the I-O accounts, thus opening new analytical possibilities at the industry level. Gross output, intermediate inputs, and GPO are now generally derived from a consistent framework based on an industry production account that depicts how an industry uses both intermediate inputs and value-added inputs (capital and labor) to produce its gross output. The industry production account is a key component in international guidelines for the development of integrated economic accounts.

In addition, the development of the new estimates of gross output allowed the extension of the double-deflation method for computing real GPO to all industries, thus improving the reliability of the real GPO estimates and their consistency with the estimates of real GDP. Using the double-deflation method improves the real GPO estimates in two ways. First, the GPO estimates now incorporate more complete information on industry output, inputs, and prices, so fewer assumptions are required about the relationships among industry outputs and inputs. Second, the source data on prices used to compute real GPO are now more consistent with the source data on prices used to compute real GDP.

C. Gross State Product

BEA provides annual estimates of gross state product (GSP) for each of the 50 States and the District of Columbia, starting in 1977. GSP for each State is derived as the sum of the gross

product originating in each industry in the State, and is often considered the State counterpart of the Nation's GDP. The September 2000 comprehensive GSP revision provided revised nominal and real GSP estimates for 1977-98 for 63 industries.[29] For each industry, GSP is presented in three components: Compensation of employees, indirect business tax and nontax liability, and property-type income. The GSP release and revision cycle closely follows the national GPO cycle. For example, new GSP estimates for 1999 and revised GSP estimates for 1997-98 are scheduled to be released in June 2001.

Comparisons of GSP growth rates and shares of GSP across industries or States provide indications of the relative performance of industries or States. These estimates can be used to determine the distribution of economic growth among the States, and the industry contributions to each State's growth. Industry shares of a State's GSP can be used to determine changes in the industrial composition of a State's economy, or how it compares to other States. Nominal and real GSP estimates are widely used in studies of State economic growth, and are used in economic models by State governments to forecast State tax receipts.

Estimates of GSP are prepared as the sum of the State distributions of each industry's national GPO estimates, using State-specific industry source data. State estimates of GSP and its components are "controlled" to national totals of GPO and its components for all industries. Like GPO, GSP excludes the statistical discrepancy but does not show it as a separate item. GSP differs from GPO because GSP excludes the compensation of Federal civilian and military personnel stationed abroad, government consumption of fixed capital for military structures located abroad, and most military equipment. Real GSP is an inflation-adjusted measure of each State's gross product that is based on national prices for the goods and services produced within that State. It is computed using national GPO chain-type price indexes for the 63 detailed industries within each State.

D. NIPA Industry Estimates

The NIPA's provide industry distributions for most of the components of gross domestic income (GDI), manufacturing and trade inventories and sales, employment, and net capital stock. The published level of industry detail for these series varies widely. Compensation of employees,

[29] See Downey and Woodruff (October 2000).

corporate profits before tax (PBT), corporate capital consumption allowances (CCA), employment, and net capital stock are published at approximately the same level of industry detail as the GPO and GSP estimates. Corporate PBT and corporate CCA, however, are published at the 1-digit SIC level for the two most recent years. Industry distributions are generally less detailed for manufacturing and trade inventories and sales and for the other components of GDI, and in some cases are provided only at the one-digit SIC level. The NIPA's also publish annual and quarterly estimates of current-dollar national income without capital consumption adjustment (table 6.1C) at the 1-digit SIC level.

As described above, the nominal GPO estimates are derived as the sum of the industry distributions of the components of GDI. The NIPA industry estimates are either used directly (e.g, wages and salaries) or after adjustments to obtain additional industry detail or for conversion from a company basis to an establishment basis. For most of the components that are not published at the GPO industry level, additional unpublished industry detail is provided for preparing the GPO estimates. The NIPA income by industry and employment estimates are normally released in August as part of the annual NIPA revision, approximately three months before the GPO estimates are released. Inventories and sales are normally released in October, followed by the net capital stock estimates later in the year or early in the following year.

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