BEA BRIEFING

Integrating the 2002 Benchmark Input-Output Accounts and the 2002 Annual Industry Accounts

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IN SEPTEMBER, the Bureau of Economic Analysis (BEA) released the 2002 benchmark input-output (I-O) accounts.[1] Benchmark I-O accounts are released every 5 years and provide a detailed picture of the economy, showing relationships among hundreds of industries and commodities. Estimates in the benchmark I-O accounts also serve as the statistical foundation for other BEA estimates, including gross domestic product (GDP). In addition, economists and government officials use the benchmark I-O accounts for a wide range of research.

One improvement in the 2002 benchmark I-O accounts was the enhanced integration with the 2002 annual industry accounts (chart 1).[2] These complementary accounts portray, for all industries, the

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1. For more information regarding the 2002 benchmark I-O accounts, see Stewart et al. (2007).

2. For more information regarding BEA's integration initiative, see Yuskavage (2000), Moyer et al. (2004a, 2004b), and Lawson et al. (2006). For this article, Baoline Chen, Karen Horowitz, Douglas S. Meade, Mark A. Planting, and George M. Smith provided early advice. Sumiye Okubo, Erich H. Strassner, Mary L. Streitwieser, and Robert E. Yuskavage also provided helpful comments.

This BEA Briefing *is the first in a new series of articles that aims to explain important aspects of BEA's economic accounts in less technical language.*

goods and services purchased, the incomes earned, and the distribution of sales.

However, there are notable differences between the two accounts, and the accounts are generally used for different purposes.

Because of their rich source data—mainly the every-5-year Economic Census—the benchmark I-O accounts paint a detailed picture of the economy at a point in time. The 2002 benchmark I-O accounts detail the flows of 428 commodities to 426 industries and to 13 categories of final uses. In contrast, the annual industry accounts, which are based primarily on data from the Internal Revenue Service (IRS), Census Bureau, and the Bureau of Labor Statistics, provide a time series of information about the flow of goods and services at a more aggregate level—65 industries and 65 commodities.
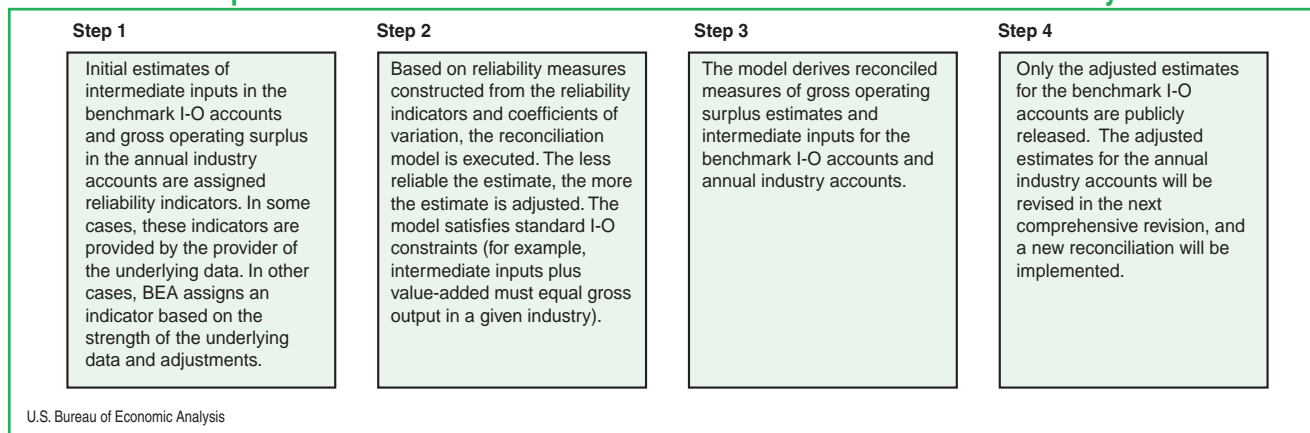
A long-standing goal of BEA has been to develop more consistency among its many accounts, including its benchmark I-O accounts and annual industry accounts, to provide a more useful view of the economy. For the 2002 benchmark I-O accounts, an improved model was used to "reconcile" the accounts with the 2002 annual industry accounts. The new model resulted in improved estimates of intermediate inputs and gross operating surplus for the 2002 benchmark

Chart 1. Basic Steps to Reconcile the 2002 Benchmark I-O Accounts and Annual Industry Accounts

Step 1	Step 2	Step 3	Step 4
Initial estimates of intermediate inputs in the benchmark I-O accounts and gross operating surplus in the annual industry accounts are assigned reliability indicators. In some cases, these indicators are provided by the provider of the underlying data. In other cases, BEA assigns an indicator based on the strength of the underlying data and adjustments.	Based on reliability measures constructed from the reliability indicators and coefficients of variation, the reconciliation model is executed. The less reliable the estimate, the more the estimate is adjusted. The model satisfies standard I-O constraints (for example, intermediate inputs plus value-added must equal gross output in a given industry).	The model derives reconciled measures of gross operating surplus estimates and intermediate inputs for the benchmark I-O accounts and annual industry accounts.	Only the adjusted estimates for the benchmark I-O accounts are publicly released. The adjusted estimates for the annual industry accounts will be revised in the next comprehensive revision, and a new reconciliation will be implemented.

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I-O accounts.

In theory, a reconciliation of the two accounts would adjust data in each account to make certain aggregates equal; for example, industry intermediate inputs in the 2002 benchmark I-O accounts would equal their counterparts in the 2002 annual industry accounts. In reality, only the published benchmark I-O accounts reflect adjusted data. The 2002 annual industry accounts, which were released in 2005, will not be adjusted until the next comprehensive revision of the annual industry accounts, scheduled for 2010. Thus, the published data from both accounts, which are available on BEA's Web site, will continue to differ.

However, there are several benefits from reconciling the two accounts, notably that the estimates in both are improved because the reconciliation takes into account the reliability of the underlying data. In addition, the reconciliation model provides a tool for balancing the benchmark use table, which means adjusting data so that all I-O identities are satisfied; for example, industry output equals commodity output.

More specifically, BEA's new reconciliation model—which is based on a generalized least squares framework—offers four advantages over past models. First, the model is transparent. The technique has been widely researched and is familiar to national economic accounting and statistical agencies. Second, the framework provides a firm statistical foundation. In particular, the technique uses information on the reliabilities of initial underlying data to make adjustments to initial estimates. Third, the framework guarantees that adjustments to initial estimates are as small as necessary to remove discrepancies between the estimates subject to the model's accounting constraints. In this way, the technique yields final estimates that are consistent with the economic concepts on which the accounts are built. Finally, the framework yields a model that is replicable. If no changes are made to the data that are introduced to the model, the model yields a duplicate set of results. Alternatively, updated data can be introduced to the model without requiring any substantial changes to the model or efforts to run the model.

The new reconciliation model builds on a long history of scholarly work, much of which was pioneered by Richard Stone (see the box "History of the Reconcil-

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History of the Reconciliation Model

In a series of papers that began in 1942, the economist Richard Stone advocated a framework to improve the accuracy of independent estimates of national income and expenditures based on the reliability of the data used to construct the statistics. The Bureau of Economic Analysis (BEA) has drawn upon this approach to reconcile its benchmark input-output (I-O) and annual industry accounts, culminating with the reconciliation of the 2002 accounts, which is presented in this article.

Researchers revised the Stone method to facilitate its implementation (Byron 1978; van der Ploeg 1982, 1984), but Federal agencies responsible for producing national economic accounts have generally not implemented the method. One reason for this has been a lack of technology that is typically required to solve the complex systems of equations faced by Federal agencies. Another reason has been a lack of information regarding the relative reliabilities of underlying data used to construct national accounting statistics.

While some agencies have resolved the latter challenge with subjective measures of relative reliabilities (Mantegazza and Pisani 2000; Moyer et al. 2004a, 2004b), a lack of adequate technology has until recently stymied implementation of the Stone method (Nicolardi 2000; Tuke and Aldin 2004). In a recent study, BEA economist Baoline Chen (2006) addressed both challenges by building an empirical model based on the Stone method and incorporating statistical measures of relative reliability in the model to reconcile and balance estimates.

BEA-assigned reliability indicators were first used to reconcile the 1997 accounts. For those accounts, value added in the benchmark I-O accounts was reconciled with value added in the annual industry accounts using a weighted average of the initial industry value-added estimates in each set of accounts. The weights were based partly on the reliability of the data from which value added was derived.

In particular, the weights in the benchmark I-O accounts were based on the percent of industry intermediate input estimates and industry gross output estimates that were derived from the 1997 Economic Census. The weights in the annual industry accounts were based on the reliability and size of the adjustments used to convert enterprise-based income data to an establishment basis and the percent of an industry's value added that is derived from proprietors' income. From these criteria, industry value-added reliability measures were calculated for each set of accounts, and these reliability measures were used to calculate the weights to adjust initial industry value-added estimates. Value-added estimates with smaller reliability measures had greater weights.

The reconciliation of the 2002 accounts built on the previous reconciliation. In particular, the new, more transparent reconciliation model relies on a generalized least squares framework that provides a solid statistical foundation for the adjusted estimates. The methodology to assign reliability weights has also been improved by drawing upon external data.

iation Model").[3] The model also builds on the work of BEA economist Baoline Chen (2006), who conducted a pilot study to build a reconciliation model for BEA's 1997 industry accounts.

The rest of this article includes a description of the benchmark I-O accounts and the annual industry accounts, focusing on the source data and adjustment methodologies that are relevant for the reconciliation. A nontechnical explanation of the reconciliation model follows, including a discussion of reliability measures, the technology used to solve the model, and the results. The article summarizes a more comprehensive paper by the authors that includes a mathematical description of the model. The paper is available at <www.bea.gov/papers/index.htm>.

Benchmark Input-Output Accounts

The benchmark I-O accounts are prepared every 5 years and provide a comprehensive picture of the flows of goods and services across all industries and the final use categories that make up gross domestic product. The accounts are presented in a series of tables, including a use table and a make table.

The structure of the use table is the same in the benchmark I-O accounts and the annual industry accounts (chart 2). The difference is that the benchmark use table includes much more industry detail than the annual use table.

The use table for both accounts provides gross output estimates for industries and commodities and intermediate input and value-added estimates by industry.

The upper left part of the table shows intermediate inputs, which are commodities purchased by industries for the production of goods and services. Below the intermediate inputs are the value-added components, which include compensation of employees, taxes on production and imports, and gross operating surplus. To the right of the intermediate inputs are final use categories. Finally, the bottom row and the far right column show the gross output for industries and commodities, respectively, which come from the balanced benchmark make table.

Intermediate inputs and gross operating surplus

The benchmark I-O accounts and annual industry accounts measure intermediate inputs and gross operat-

ing surplus differently. In the benchmark I-O accounts, gross operating surplus—a profits-like measure—is derived as a residual: Gross output less intermediate inputs, compensation of employees, and taxes on production and imports less subsidies.

Intermediate inputs for specific industries are derived mainly from Census Bureau expense data. Approximately 71 percent of the value of intermediate inputs comes from Census Bureau data, 22 percent from other data, and 7 percent from BEA adjustment methodologies. For the 2002 benchmark I-O accounts, Census Bureau data were more comprehensive than data available for previous benchmark I-O accounts. Within the manufacturing industries, 19 categories of expenses were available from the 2002 Economic Census. Within the service industries, 19 categories of expenses were available from the 2002 Business Expenses Survey. Given this depth of coverage, the gross operating surplus estimates in the benchmark I-O accounts were also improved in these industries before and after the reconciliation because gross operating surplus is calculated as a residual.

BEA adjusts the estimates in the benchmark I-O accounts to ensure they conform to established benchmark I-O concepts. In particular, adjustments are made for nonemployer expenses, misreporting and nonfiling, and auxiliary services.[4] The reconciliation model takes the reliabilities of these adjustments into account.

Nonemployer expenses. The Economic Census only covers establishments with employees and payroll. To capture the inputs and outputs of nonemployers, BEA makes an adjustment using information derived from administrative data calculated by the Census Bureau.[5] In part because these data are considered reliable, the nonemployer adjustments are considered more reliable than other adjustments in the benchmark I-O accounts but less reliable than estimates based on Economic Census data.

Misreporting and nonfiling. Unlike nonemployer establishments, small employers are included in estimates published for the Economic Census. The estimates for small employers are derived from administrative data gathered mainly by the IRS. Such data for nonemployers typically include individual

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3. In a series of papers beginning with Stone et al. (1942), Stone (1961, 1968, 1970, 1975, 1976, and 1984) advocates a GLS framework to improve the economic and statistical accuracy of independent estimates of national income and expenditures based on the reliabilities of underlying data used to construct the estimates.

4. While other types of adjustments are made to source data for intermediate inputs, these three types of adjustments capture the majority of the dollar value of adjustments made in the benchmark I-O accounts.

5. The Census Bureau provides receipts for nonemployers at a more aggregate level than receipts for employer establishments. To distribute receipts for nonemployers to the appropriate industry level, BEA uses a ratio of receipts for small-employer establishments by industry to total receipts for all small employers from the Economic Census. However, these adjustments do not affect the data for the reconciliation because gross output is fixed in the reconciliation model.

Chart 2. Structure of Use Table

		INDUSTRIES																	FINAL USES (GDP)						TOTAL COMMODITY OUTPUT
		Agriculture, forestry, fishing and hunting	Mining	Utilities	Construction	Manufacturing	Wholesale trade	Retail trade	Transportation and warehousing	Information	Finance, insurance, real estate, rental, and leasing	Professional and business services	Educational services, health care, and social assistance	Arts, entertainment, recreation, accommodation, and food services	Other services, except government	Government	Total intermediate use	Personal consumption expenditures	Private fixed investment	Change in private inventories	Exports of goods and services	Imports of goods and services	Government consumption expenditures and gross investment	Total final uses (GDP)	
COMMODITIES	Agriculture, forestry, fishing and hunting																								
	Mining																								
	Utilities																								
	Construction																								
	Manufacturing																								
	Wholesale trade																								
	Retail trade																								
	Transportation and warehousing																								
	Information																								
	Finance, insurance, real estate, rental, and leasing																								
	Professional and business services																								
	Educational services, health care, and social assistance																								
	Arts, entertainment, recreation, accommodation, and food services																								
	Other services, except government																								
	Government																								
	Other inputs																								
	Scrap, used and secondhand goods																								
	Total intermediate use																								
VALUE ADDED	Compensation of employees																								
	Taxes on production and imports, less subsidies																								
	Gross operating surplus																								
	Total																								
TOTAL INDUSTRY OUTPUT																										

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income tax returns; administrative data for small employers typically include individual, partnership, and corporate income tax returns. Based on these administrative data, BEA adjusts estimates for nonemployers and small employers for misreporting and nonfiling.[6] A misreport results when a tax return is filed with incomplete or incorrect information. Nonfiling results when a business or individual who earns income fails entirely to file a return. An adjustment for misreporting is based on data from two IRS programs: the Taxpayer Compliance Measurement Program (TCMP) and the TCMP-Information Return Program (TCMP-IRP).[7] An adjustment for nonfilers is based on data from an exact-match study conducted by Census.[8] These adjustments are considered less reliable than other adjustments because of the infrequency with which the TCMP, TCMP-IRP, and exact-match studies are conducted and the need to approximate the industry distributions.

Auxiliary services. An auxiliary is an establishment that provides services that may not be part of a company's main industry. BEA adjusts the data to allocate the auxiliary's expenses into the proper industry. For example, in the benchmark I-O accounts, a management services establishment within a pharmaceutical company would be broken out of the pharmaceutical industry and added to management services. For a given auxiliary, the Census Bureau provides expense data tabulated for the sector of the auxiliary. For each industry, the ratio of industry-level payroll to sector-level payroll is assumed to be the same as industry-level expense to sector-level expense. Additions to intermediate inputs in a given industry served are offset by reductions to gross operating surplus in that industry. The adjustment for auxiliary services is considered more reliable than the misreporting and nonfiling adjustment but less reliable than the adjustment for non-employer expenses because of the source data and the assumption regarding payroll and other expenses.

Annual Industry Accounts

The annual industry accounts provide a time series of estimates for gross output, intermediate inputs, and value added by industry. Like the benchmark I-O accounts, they also include make and use tables. Unlike the benchmark I-O accounts, intermediate inputs in the annual industry accounts are derived as a residual: Gross output less compensation of employees, taxes on production and imports less subsidies, and gross operating surplus.[9] Gross operating surplus in the annual industry accounts is derived from gross operating surplus estimates in the most recent benchmark I-O accounts, extrapolated forward using annual measures of gross operating surplus based on gross domestic income (GDI). These GDI-based estimates of gross operating surplus are also used as inputs for the new reconciliation model. Thus, estimates of 2002 gross operating surplus used in the reconciliation model are different from estimates of gross operating surplus published in the 2002 annual industry accounts.

GDI-based estimates of gross operating surplus for private, nonfarm industries are derived using data from the IRS, other data sources, and BEA adjustment methodologies.[10] Approximately 47 percent of private, nonfarm industries' gross operating surplus comes from IRS data, 14 percent from misreporting and nonfiling adjustments, 22 percent from concept and coverage adjustments, and 17 percent from other data and related adjustments.

Misreporting and nonfiling. Similar to the benchmark I-O accounts, BEA makes a misreporting and nonfiling adjustment for noncorporate business income-tax based source data in the annual industry accounts based on data from the TCMP, TCMP-IRP, and exact-match studies. Thus, the misreporting and nonfiling adjustment is considered less reliable than other types of adjustments. These adjustments are given the same reliability indicator as they are in the benchmark I-O accounts.

Concepts and coverage. Concept adjustments are designed to convert tax accounting-based concepts from IRS data to economic accounting-based concepts consistent with national accounts. Concept adjustments include the removal of capital gains and dividends from business income. Coverage adjustments are designed to include the activities of entities that contribute to gross domestic product but are not required to file a return with the IRS. Coverage adjustments include adding income earned by Federal Reserve banks and imputing net income for owner-

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6. According to IRS compliance studies, three components contribute to a tax gap between the amount taxpayers should pay and the amount taxpayers actually pay in a timely manner: Nonfiled returns, underreported income, and underpaid taxes (Brown and Mazur 2003).

7. Discontinued in the early 1990s, the TCMP was an audit program designed to study compliance patterns and levels of misreporting among sole proprietors. The TCMP-IRP was designed to compare the results of the TCMP audits to information returns filed with the IRS in order to capture misreporting that TCMP auditors failed to find.

8. An exact-match study compares records from the Current Population Survey (CPS) to records from the IRS in order to identify and estimate non-filed income for individuals who report income in the CPS but do not file a return with the IRS.

9. Gross output in the annual industry accounts is calculated using annual survey data to extrapolate gross output from the make table in the most recent benchmark I-O accounts. Estimates of the compensation and tax components of value added in the annual industry accounts are derived from the GDI components of the NIPAs.

10. Gross operating surplus estimates for farm and general government industries and the owner-occupied housing portion of gross operating surplus estimates in the real estate industry are not reconciled using the current model. Thus, a discussion of the data and methodologies used to prepare estimates for these industries is outside the scope of this article.

occupied housing. While concept and coverage adjustments are considered more reliable overall than the misreporting and nonfiling adjustment, reliability varies by specific adjustment. Adjustments based on administrative data are considered more reliable than other adjustments, except those based on Economic Census data. Adjustments based on survey data are considered less reliable than those based on administrative data.

Company-establishment. Because the tax data used to make some estimates are classified on a company basis, BEA makes an adjustment to convert these data to an establishment basis. A company may consist of several establishments, each of which operates in a different industry. This adjustment shifts gross operating surplus from one industry to another with no impact on total gross operating surplus.

The company-establishment adjustment is limited to three of the income components of gross operating surplus derived from corporate income tax data: profits before tax, the capital consumption allowance, and net interest. The adjustment is based on employment data from the Census Bureau that relates employment by industry on a company basis and an establishment basis. The adjustment assumes that profits before tax, capital consumption allowance, and net interest are the same per employee for all establishments performing the same activity, regardless of the company to which that establishment belongs. The company-establishment adjustment is considered less reliable than most concept and coverage adjustments but more reliable than misreporting and nonfiling adjustments.

Reconciling Gross Operating Surplus in a Balanced Input-Output Framework

The objective of the reconciliation model is to adjust intermediate inputs in the benchmark I-O accounts and gross operating surplus in the annual industry accounts so that the industry gross operating surplus estimates of each are equal, subject to the accounting constraints of the I-O framework (chart 1, table 1). For the benchmark I-O accounts, the adjusted estimates

are published. For the annual industry accounts, recall the caveat that the adjusted estimates are not published. However, both accounts will be adjusted as part of the next comprehensive revision.

Initial estimates and reliability measures

An essential feature of BEA's new model is that it adjusts estimates in a way that takes the reliability of each initial estimate into account, subject to the accounting constraints of the I-O framework.[11] A more detailed, mathematical description of the model is available in the BEA paper that was mentioned at the end of the introduction to this article. In particular, the reconciliation model makes adjustments to initial estimates based on the strengths and weaknesses of the data that underlie those estimates. Initial estimates that are considered relatively weak are adjusted more than initial estimates that are considered relatively reliable.

Specific adjustments are made to the following:

- **Intermediate inputs in the benchmark I-O accounts.** The improved estimates of intermediate inputs also improve the estimates of gross operating surplus because the gross operating surplus is derived as a residual: Gross output less intermediate inputs, compensation and taxes on production and imports less subsidies.
- **Gross operating surplus in the annual industry accounts.** The improved estimates of gross operating surplus will likewise improve the residual estimates of intermediate inputs.

In both cases, final intermediate input estimates and gross operating surplus estimates are informed by the reliability of the underlying data used to produce the initial estimates. In this way, the data from each account is used to improve estimates in the other.

To take reliability of the underlying data into account, the model requires reliability indicators for each initial estimate. These indicators gauge the strength of

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11. While Chen's (2006) model adjusts gross output, intermediate inputs, and all components of value added in the benchmark I-O accounts, the current model only adjusts intermediate inputs and the gross operating surplus component of value added.

Table 1. Effects of the Reconciliation Model on Benchmark I-O and Annual Industry Accounts

	Gross output	Intermediate inputs	Compensation	Taxes	Gross operating surplus
Benchmark I-O accounts	No change	Each estimate is adjusted based on the reliability of the underlying data	No change	No change	Each estimate is derived as a residual, so each estimate is adjusted because intermediate inputs are adjusted
Annual industry accounts	No change	Each estimate is derived as a residual, so each is adjusted because gross operating surplus estimates were adjusted	No change	No change	Each estimate is adjusted based on the reliability of the underlying data

the underlying data and are used in part to weight the adjustment. Initial estimates are assigned a reliability indicator from two sources:

- **Source data providers.** Coefficients of variation, which measure sampling errors, are available for some source data provided by the Census Bureau and the IRS.[12] These coefficients range from 0 to 1, with 0 denoting the highest reliability and 1 denoting the lowest reliability. About 23 percent of the total value of benchmark intermediate inputs and about 47 percent of the total value of annual gross operating surplus estimates had coefficients of variation from the source data provider.
- **BEA.** For estimates that do not have coefficients of variation, BEA assigns reliability indicators (table 2). These reliability indicators also range from 0 to 1 according to a rubric developed by BEA economists. The rubric considers the data on which initial estimates are based and the adjustments to those estimates. The adjustments are designed to correct nonsampling errors in the underlying data (for example, misreporting). However, the adjustments are themselves subject to nonsampling errors, and the reliability of adjustments, as determined by BEA economists, vary widely.

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12. Coefficients of variation are available for all IRS estimates. Because sampling errors apply to surveys and not censuses, coefficients of variation are available from the Census Bureau for the expense data from the Business Expenses Survey and purchased services from the Annual Survey of Manufactures portion of the Census of Manufactures. Purchased services include the following expense categories: Accounting, auditing, and bookkeeping; advertising; communications; computer services; legal services; management, consulting, and administrative services; other expenses; refuse removal; repairs and maintenance of buildings and machinery; and taxes and license fees.

Chart 3 shows the distributions of BEA-assigned reliability indicators and coefficients of variation for all industries. According to the rubric, estimates based on Economic Census data with no adjustments are assigned a zero, which means they are considered the most reliable. Approximately 13 percent of the total value of intermediate input estimates receives this indicator. No gross operating surplus estimates are assigned a reliability indicator of zero because none were based on Economic Census data without adjustments. Estimates based on Economic Census data with adjustments are assigned an indicator of 0.10, the second most reliable ranking.

Of all estimates with BEA-assigned reliability indicators, almost 45 percent of the intermediate input value and 40 percent of the gross operating surplus value are assigned reliability indicators of 0.10 or 0.35. Reliability indicators of 1 are assigned to a higher percent of the gross operating surplus value because the misreporting adjustment plays a larger role in the annual industry accounts.

Constraints

The reconciliation model does not allow all estimates to adjust. Estimates of final uses, gross output, and the compensation and tax components of value added

Table 2. Rubric for Assigning Reliability Indicators to Initial Estimates

Reliability indicator	Source of estimate
0	Economic Census data with no adjustments
0.10	Economic Census data with adjustments Survey data with no adjustments Concept and coverage adjustments based solely on administrative data Nonemployer adjustments
0.35	Survey data with adjustments Trade association data Concept and coverage adjustments based on survey data Auxiliary service adjustments
0.65	Company-establishment conversion adjustment Adjustments based on a combination of analyst judgment and external source data
1	Misreporting adjustments Adjustments based solely on analyst judgment

Chart 3. Distributions of Coefficients of Variation and BEA-Assigned Reliability Indicators

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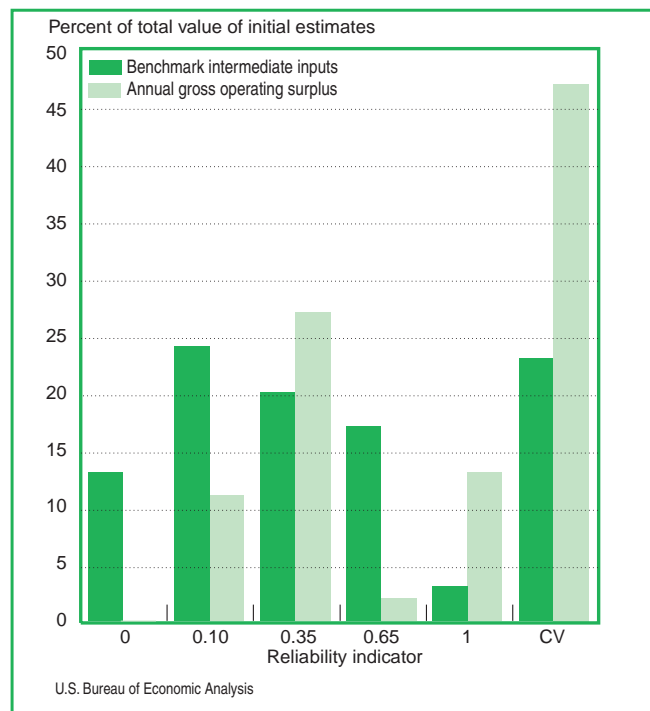
from the benchmark I-O accounts are fixed.[13] The system of constraints also incorporates the accounting identities upon which the table is built. Thus, the system of constraints ensures that intermediate and final uses of each commodity equals the commodity's supply, the sum of each industry's intermediate inputs and value added equals the industry's gross output, and that total value added equals total GDP. In this way, the model provides a tool for balancing the benchmark use table.

Technology

In previous years, attempts to develop robust reconciliation models have been stymied partly because of a lack of adequate software. For the 2002 benchmark I-O accounts, the reconciliation model was executed using the CPLEX solver in the Generalized Algebraic Modeling System (GAMS). GAMS is a flexible optimization software package designed to handle large mathematical programming problems. CPLEX is a GAMS solver with solution algorithms for linear, quadratically constrained, and mixed-integer problems. The CPLEX solver automatically chooses the optimal combination of algorithms to efficiently solve the particular model specified. Alternatively, GAMS also allows users to adjust tuning parameters in order to set algorithmic options. The reconciliation model is solved with the combination of algorithms chosen by GAMS.

The scale of the model is suggested by the number of variables involved. At the most disaggregated industry level (987 industries and 8,910 items), the model in theory contains 8,795,157 variables to be solved and 9,963 constraints to be satisfied. However, in practice, the intermediate input portion of the benchmark use table is not fully populated, resulting in fewer variables to be solved.

Results

More than 50 percent of intermediate input estimates in the benchmark I-O accounts and gross operating surplus estimates in the annual industry accounts were adjusted less than 5 percent from their initial values (chart 4). As expected, the majority of these small adjustments were made to estimates derived from Economic Census data, survey data, and administrative data. Approximately 13 percent of intermediate input

estimates in the benchmark I-O accounts and approximately 6 percent of gross operating surplus estimates in the annual industry accounts were adjusted more than 50 percent from their initial values. As expected, the majority of these adjustments were made to estimates derived from adjustments based on analyst judgment and misreporting and nonfiling adjustments. In addition, the majority of these large adjustments were for small initial values.
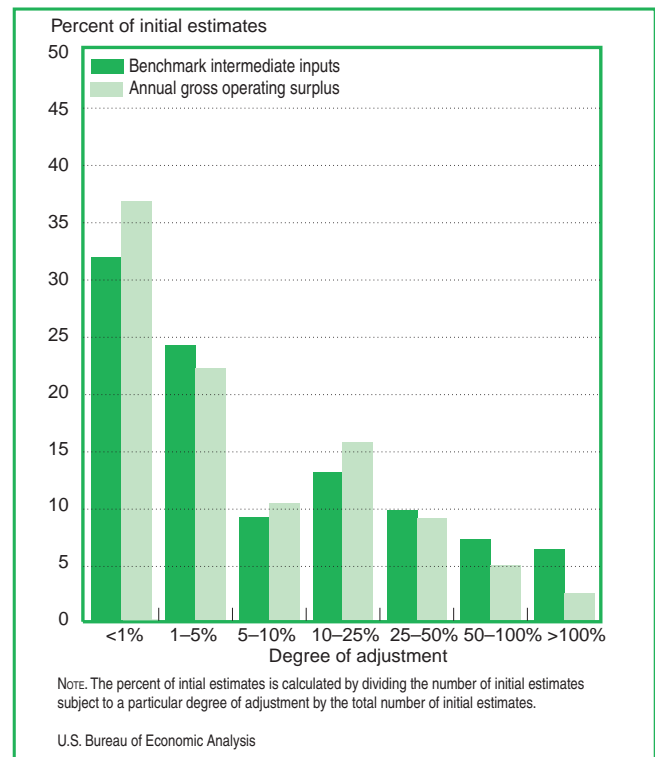
To assess results at a more aggregate level, an aggregate industry reliability measure was calculated for initial intermediate input estimates in the benchmark I-O accounts and for initial gross operating surplus estimates in the annual industry accounts. The results of the reconciliation results in a given industry are expected to favor the initial value with the smaller aggregate reliability measure, and indeed, this pattern generally holds for all industries.

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Chart 4. Distribution of Adjustments to Initial Estimates

Percent of initial estimates

Legend: Benchmark intermediate inputs; Annual gross operating surplus

Degree of adjustment: <1%, 1–5%, 5–10%, 10–25%, 25–50%, 50–100%, >100%

NOTE. The percent of intial estimates is calculated by dividing the number of initial estimates subject to a particular degree of adjustment by the total number of initial estimates.

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13. Estimates of the commodity distribution of final use categories are reconciled through a negotiation process with the NIPAs. Industry and commodity estimates of gross output are determined in the make table of the benchmark I-O accounts, which was published in September 2005 (Stanley-Allen et al. 2005). Industry estimates of the compensation and tax components of value added are derived from Census Bureau data and scaled to match the NIPA totals.

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