

An Analysis of the Reliability of BEA's International Transactions Accounts

By Ryan Howley

THIS ARTICLE EXAMINES the reliability of the statistics composing the U.S. international transactions accounts (ITAs) produced by the Bureau of Economic Analysis (BEA). The ITA statistics are updated on a regular basis to include preliminary or “first” estimates for the most recent quarter and revised estimates for prior quarters. The revised estimates reflect newly available source data that are more complete, more detailed, and otherwise more reliable than those that were previously incorporated. The revised estimates may also include improvements in methodologies. To assess the reliability of the statistics, BEA analyzes revisions to early vintages, or the first published, account estimates. While these estimates are published before full or final information regarding an account is available, BEA endeavors to ensure that these estimates are sufficiently timely and reliable to be used confidently as the basis of economic policy and business decisions. The size and pattern of revisions—that is, the difference between early estimates and later estimates, which incorporate more up-to-date concepts and statistical methods and more complete and accurate source data—provide a measure of the reliability of the initial estimates. In this article, BEA's standard of reliability hinges on these revisions; the standard of reliability is met if the revisions do not substantively change BEA's measures of behavior and trends in key aggregates.

Among BEA's international economic accounts, the ITAs provide the broadest picture of interactions between the United States and the rest of the world. The importance of these interactions has been increasing in recent decades as the U.S. economy becomes increasingly “globalized.” The ITAs provide policymakers, scholars, and the public with the most complete and detailed information on the nature and scope of these interactions.

Major findings

Based on an analysis of revisions to the 1999–2015 quarterly ITA statistics, estimates from BEA provide a consistent and accurate picture of economic activity between U.S. residents and foreign residents. Early estimates, which are available approximately 75–80 days after the end of the quarter, closely track later estimates, particularly for key aggregates. Revisions are small relative to the estimates themselves or relative to quarter-to-quarter variability in the estimates. Revisions rarely change the direction of movement in the accounts and early estimates of key aggregates closely track turning points identified in later estimates.

Among the other specific findings of this study are the following:

- First estimates of the quarterly current-account balance show the same direction of change as the third estimates 94 percent of the time and identify a significant majority of the turning points identified in the latest estimates.
- The comprehensive restructuring of the ITAs in 2014 led to large revisions to the *levels* of several accounts, including the top-line current-account aggregates. However, quarterly changes are largely unaffected.
- Revisions to estimates of exports of goods and services and to imports of goods and services are particularly small, at less than 1 percent of the account value.
- Revisions to services accounts tend to be relatively larger than revisions to goods accounts.
- First estimates of the level of exports of goods and services and income receipts tend to undershoot third estimates because of revisions to services and primary income receipts components. First estimates of the quarterly change do not systematically undershoot or overshoot third estimates.

- First estimates of the current-account aggregates were early identifiers of trends during the 2001 and 2008 recessions.
- Seasonal factor revisions have a larger impact on revisions to quarterly changes than on revisions to levels.
- Later vintages of the statistical discrepancy are centered closer to zero than earlier vintages.

Approach of study

This article primarily examines the size and pattern of revisions to quarterly estimates of the ITAs from 1999 through 2015. It updates a 2012 revision study of the international economic accounts.¹ The two main measures examined are mean revisions, which indicate whether the revisions are generally upward or downward, and mean absolute revisions, which indicate the average size of the revisions regardless of sign. These means are based on revisions that have been scaled to enable comparisons over time and to enable comparison of revisions across accounts or between revisions and percent changes.

In addition to analyzing mean revisions and mean absolute revisions to the accounts, the study examines the consistency across estimate vintages of quarterly patterns of change (such as directional reliability and turning points), revisions due to seasonal adjustment, and the ITA statistical discrepancy.

Introduction

BEA aims to promote a better understanding of the U.S. economy by providing the most timely, relevant, and accurate economic accounts data. For most of its accounts, BEA produces several vintages of any given estimate. Early vintage estimates are necessarily more provisional and are based on less complete source data than updated, later vintage estimates. In spite of a largely unavoidable tradeoff between timeliness and reliability, BEA strives to present a consistent and accurate picture of economic patterns and trends even in its early estimates so that economic policy and business decisionmakers can be confident in the factual basis for their decisions. This article presents measures to assess BEA's success in this effort for its ITA estimates.

The ITAs provide a broad and detailed look at transactions between U.S. residents and foreign residents. These accounts contribute to, and provide important context for, BEA's national income and product accounts (NIPAs), including the statistics on gross domestic product (GDP). BEA regularly publishes articles in this journal analyzing its revisions to esti-

mates of GDP and other NIPAs and to other estimates, such as those in its regional economic accounts.² This article assesses the reliability of the ITAs primarily by comprehensively analyzing revisions to these accounts. The U.S. ITAs provide a quarterly and annual record of transactions between U.S. residents and the rest of the world, including trade in goods and services, income payments and receipts, and flows of financial and capital assets.³ They consist of 18 tables organized into 8 groups and an addendum table. Tables in the first group summarize the complete variety of transactions between U.S. residents and foreigners. ITA tables in groups 2–8 provide more detail for various subsets of transactions. This article places particular emphasis on assessing revisions to the seasonally adjusted aggregate estimates that BEA releases quarterly in table 1.2 of the ITAs (“U.S. International Transactions”); this table provides a detailed overview of all types of transactions covered by the ITAs.⁴ This analysis of the ITA estimates uses the seasonally adjusted quarterly data of 1999–2015 unless otherwise noted.

An assessment of reliability is somewhat different than an assessment of estimate accuracy. In a certain sense, an assessment of reliability is a next-best alternative to an assessment of accuracy. A standard approach to assessing accuracy is to analyze the errors associated with the estimation process. In general, however, the source data used to produce the ITA estimates are subject to a complex mix of sampling and nonsampling errors.

Typically, these source data are provisional, incomplete, or unavailable at the time of BEA's initial published estimates, that is, the “first” estimates. The reliance on source data with such limitations reflects the importance of providing estimates that are sufficiently timely to be useful to policymakers and economic and business analysts. In the current account, a substantial portion of estimates are based on contemporaneous source data while the rest are based on extrapolation of trends or on indicator series. In addition, although almost all of the remainder of the initial estimates are based on survey or administrative

2. For the most recent analysis of the revisions to GDP and related accounts, see Dennis J. Fixler, Ryan Greenaway-McGrevy, and Bruce T. Grimm, “Revisions to GDP, GDI, and Their Major Components,” *SURVEY* 94 (August 2014). This article contains references to several other articles and studies on GDP and associated revisions. For the analysis of revisions to BEA's regional accounts, see Matthew A. von Kerczek and B. Enrique Lopez, “An Examination of Revisions to the Quarterly Estimates of State Personal Income,” *SURVEY* 92 (August 2012).

3. The full set of U.S. international accounts includes other accounts that are not examined in this article, such as monthly estimates of trade in goods and services, a joint product of BEA and the U.S. Census Bureau international investment position accounts, and accounts covering direct investment and multinational enterprises.

4. As discussed later in this article, the ITA tables were restructured in 2014. Most of the accounts in table 1.2 examined in this article had counterparts in table 1 of the prestructured ITAs.

1. See Daniel R. Yorgason and Sarah P. Scott, “An Analysis of Revisions to BEA's International Economic Accounts,” *SURVEY OF CURRENT BUSINESS* 76 (November 2012).

data, these data are often provisional and subject to change as reporting response rates improve, survey data editing becomes more complete, and data from monthly or quarterly surveys are supplemented by, or replaced with, data from annual or benchmark surveys, which tend to collect data more extensively, include larger samples, and undergo more thorough editing.

After the first estimate is published, estimates are revised at set intervals to incorporate more current source data and to integrate other estimation changes. Revisions are made one quarter after the first estimate, as previously missing information becomes available and as previously incorporated source data are revised. By the annual update that occurs the following June,⁵ the vast majority of estimates for current-account components are based on revised source data or on newly available annual data; very few of the estimates are still based on trend projections.⁶ BEA also makes other changes to its later vintage estimates in the annual updates—including occasional changes in classifications, definitions, and methodologies—to reflect the changing nature of available economic data and the changing nature of the economy.

The combination of circumstances just described presents clear challenges in measuring the accuracy of the BEA's international economic accounts. The mix of source data errors, regular revisions, and occasional changes in definitions and methodologies means that the *accuracy* of BEA's estimates cannot be assessed by conventional statistical measures, such as standard errors.⁷ Nonetheless, information on the *reliability* of the estimates—in other words, how similar, repeated estimates of the same target are to each other—can be assessed by examining magnitudes and patterns of differences between different vintages of the same estimate. In general, the smaller the revisions to key aggregates, balances, and other accounts, the more the early estimates present an reliable picture of trends and levels in transactions as well as expansions or contractions of U.S. participation in the international economy. The reliability of estimates can also be assessed by an examination of the frequency with which early estimates capture turning points in the accounts—that is, quarters in which a previously increasing series turns downward or vice versa.

5. In the past, “annual updates” were referred to as “annual revisions.” In this article, the former term is used to refer generally to these events, and the latter term is used to refer to specific past events.

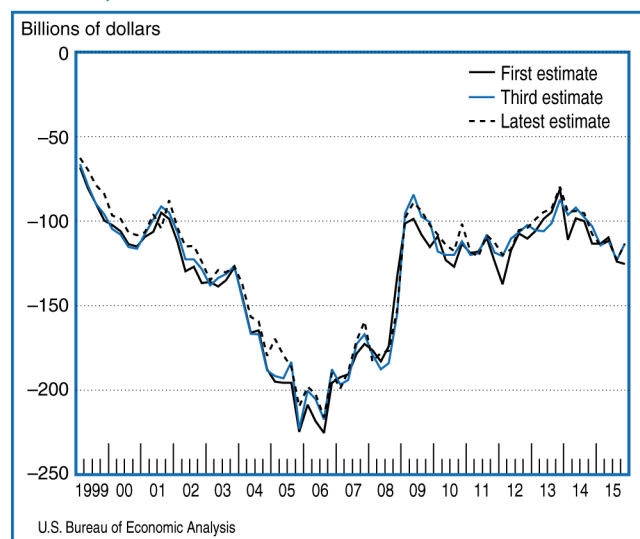
6. For more information, see [Yorgason and Scott, 78–79](#).

7. More fundamentally, the accuracy of BEA's estimates cannot be assessed at all, because a proper assessment of accuracy requires that “true” values are known. In reality, the true values that BEA's estimates attempt to approximate are never known. For more information on the difficulty of assessing accuracy and the relationship of accuracy and reliability, see [Fixel, Greenaway-McGrevy, and Grimm, 1–2](#).

While an analysis of revisions provides information on the reliability of early estimates, that information is not necessarily definitive. Estimates can be revised for a number of reasons, with different implications for the reliability and quality of the earlier estimates. Revisions that result from changes in definition may not have many implications for estimate quality. When the target changes, a change in the estimate does not necessarily mean that the earlier estimate, which had a different target, was flawed or that future estimates will be undependable.⁸ Implications for estimate quality are less clear with regard to revisions stemming from the introduction of new methodologies or new sources of (source) data. Revisions of these types may suggest some deficiencies in early vintage estimates released in the past but do not necessarily portend any problems for future early vintage estimates. Finally, small revisions resulting from ongoing updates to source data suggest that early vintage estimates may be considered reliable. As demonstrated throughout this article, the magnitudes of revisions and the behavior of the major components of the international accounts compiled by BEA indicate that early estimates present the same general picture of economic activity as later estimates. Chart 1—which presents the current-account balance, one of the most closely watched summary estimates in the ITAs—provides some initial evidence. This chart compares the first estimates to the third estimates, which are released in June of the year after the reference year, and to the “latest” available estimates published with the June 2016 annual revision.

8. This is especially true for the time frame studied in this article. The ITA accounts underwent a comprehensive restructuring in 2014 that shifted the level, but not necessarily the trend, of several accounts. See “[2014 Comprehensive Restructuring](#)” in this article.

Chart 1. Three Vintages of Estimates of Current-Account Balance, 1999–2015



U.S. Bureau of Economic Analysis

The chart shows that although the quarterly estimates for the current-account balance differ slightly in the three vintages, all three capture the key trends and patterns in the current-account balance. For example, each vintage shows a temporary bottoming out of the deficit in 2000, a slight rebound through the second half of 2001, followed by further off-and-on increases of the deficit through 2005. Each line shows a moderate reduction in the deficit through the middle of 2008 and a sharp reduction through the second quarter of 2009. From 2009 until 2015, each line shows a roughly stable current-account deficit, with various ups and downs resulting in deficits between \$80 billion and \$140 billion.

This chart also shows that revisions to the current-account balance are smaller than the quarterly variability of the estimates. Over the period, the average magnitude of revision between the first estimate and the third estimate is \$5.4 billion, or 55 percent of the average quarterly change of \$9.8 billion.⁹ The differences between the first estimates and the latest estimates are typically larger than those between the first and third estimates, partly reflecting the impact of changes in methodologies that have been introduced over the years as part of annual updates.

Chart 2 provides further evidence that early estimates present the same general picture of economic activity as later estimates. This chart provides directional reliability measures for some key ITA accounts.

9. Absolute dollar values of both revisions and quarterly changes are used in computing these averages.

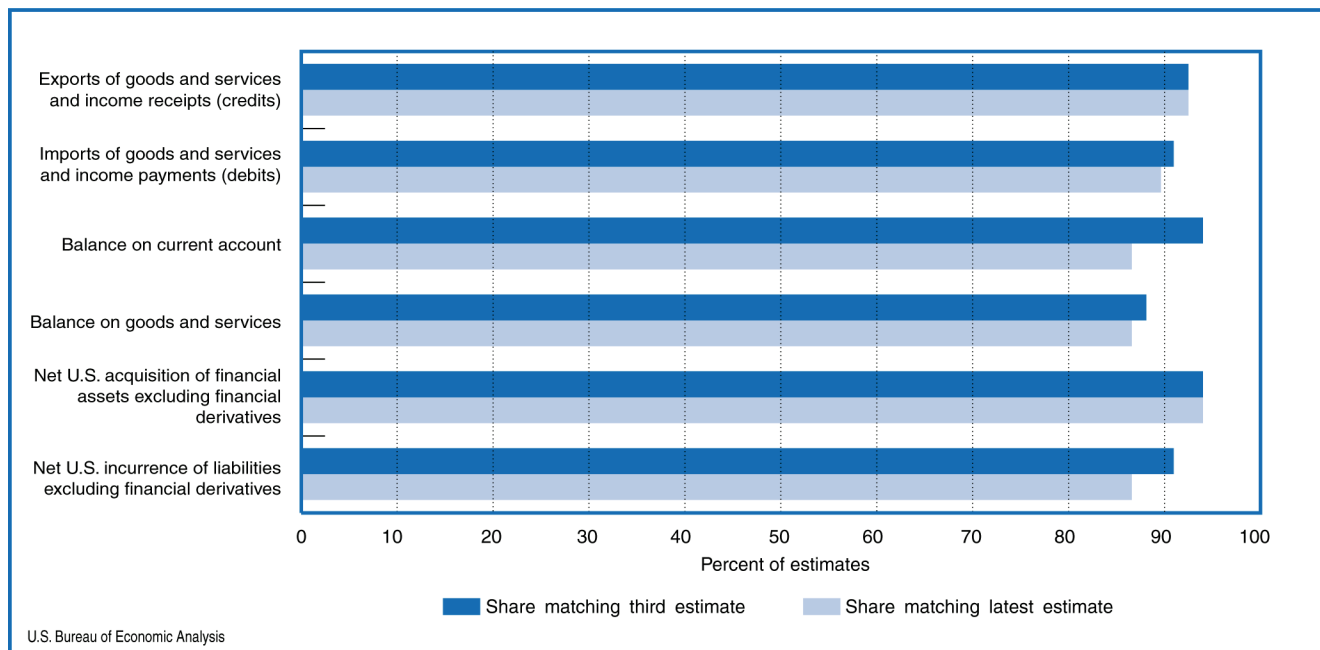
Specifically, it displays relative frequency measures of the fidelity of first estimates to later estimates in terms of the direction of movement in the estimates' time series. The bars in the chart indicate how frequently the first ITA estimates show the same direction of change as the third and latest estimates. If the first estimate and the later estimate both indicate a quarter-to-quarter increase in the account, or if both estimates indicate a quarter-to-quarter decrease, the two different vintages "match" directionally.¹⁰ If one estimate indicates a quarter-to-quarter increase while the other indicates a quarter-to-quarter decrease, the vintages do not match. For all but one of the aggregates shown in the chart, more than 90 percent of first estimates imply movement in the same direction implied by the third estimates.

The remainder of this article presents a variety of other statistical measures for gauging whether BEA's early vintage estimates accurately reflect its later vintage estimates, including mean revisions and mean absolute revisions. Three different scaling methods are used to standardize revisions used in calculations of mean and mean absolute revisions:

- Scaling by item value is the most intuitive of the scaling measures. It allows for an "apples-to-apples" comparison of the magnitude of revisions across time and accounts. It is used for revisions to current-account components.

10. It should be noted that the direction implied by the first estimate relies not only on the level of the first estimate for the current quarter but also on the second estimate of the previous quarter. Both of these estimates may be revised in the third and later estimates.

Chart 2. Share of First Estimates Matching Direction of Change of Later Estimates, 1999–2015



- Scaling by the sum of unsigned components is a variation on scaling by item value. For “simple” accounts—those that simply aggregate transactions—the two methods produce identical results. Scaling by the sum of unsigned components is well suited for scaling revisions to accounts formed as the difference, rather than the sum, of two other simple accounts. It is used in this study for current-account balances.
- Scaling by trend quarter-to-quarter changes compares revisions to typical account changes rather than to actual account levels. This serves to some extent to correct for the difficulty associated with estimating highly volatile accounts. It is used for accounts—such as those in the financial account—that are even more complex than those in the current account.

The rest of the article (1) provides information on the ITA estimates examined in this article, (2) presents the methodology used in this study, (3) describes the comprehensive restructuring of the ITAs that occurred with the June 2014 release, (4) discusses mean revisions and mean absolute revisions and directions of revisions, (5) considers revisions to ITA estimates from the perspective of quarterly changes rather than levels, (6) analyzes issues related to seasonal adjustment of ITA estimates, and (7) examines the statistical discrepancy in the ITAs. It concludes with a summary of the findings in this article.

Sources, Timing, and Vintages of the ITA Estimates

This section provides an overview of some key accounts in the ITAs. Topics include source data, estimate timing, and the estimate vintage nomenclature used in this article. The issues of source data and estimate vintages are interrelated; the source data used for an early estimate may differ from those used for later estimates. In addition, for certain estimates, little or no source data are available at the time the first estimate is produced.

The ITAs are a comprehensive record of U.S. international transactions—that is, transactions between U.S. residents and foreign residents. They are divided into three major categories: the current account, the capital account, and the financial account. Broadly, the current account measures international transactions that are most closely associated with current production, consumption, and income, including trade in goods and services. The capital account measures transactions that result in changes to the stock of non-produced, nonfinancial assets, such as the purchase or sale of rights to natural resources, or that are consid-

ered capital transfers, such as debt forgiveness. The financial account measures international transactions in financial assets and liabilities, such as transactions in U.S. and foreign stocks and bonds.¹¹ Current-account transactions and financial-account transactions are much larger in value than capital-account transactions.

BEA draws on data from a variety of sources to prepare estimates for the ITAs. Table 1 provides a list of several of the largest (by value) types of transactions in the ITAs and the sources used to produce estimates in these accounts.¹² By value, roughly a fifth to a fourth of later-vintage ITA estimates are based on surveys conducted by BEA. In particular, estimates of direct investment income and financial flows and estimates of various types of trade in services are based on BEA surveys. The remainder of the estimates are based on surveys conducted by other federal agencies and on a wide range of survey and nonsurvey data from other government and private sources. Among the non-BEA sources of data are administrative filings compiled by agencies, such as the U.S. Census Bureau (used for the goods trade accounts, for example) and the Federal Reserve Board (used for several types of financial-account transactions, for example), and mandatory surveys conducted by other government agencies, such as the U.S. Treasury Department (used for “other investment” income accounts and much of the financial account, for example). Certain data are also obtained from foreign sources including Statistics Canada and several foreign central banks.

The remaining columns in table 1 briefly characterize the extent to which source data are available (or not) and are revised for each of several estimate vintages. Chart 3 shows the evolution of ITA estimate vintages.¹³ BEA prepares an ongoing series of estimates for the transactions covered by the ITAs; each new estimate supersedes the most recent previous estimate. For every one of the accounts in the ITAs, an initial estimate—the “first” estimate—for a quarter is released approximately 75–80 days after the end of the reference quarter.

Source data may arrive too late to be included in a first estimate, and the data are commonly revised or updated. Therefore, a revised estimate—the “second” estimate—for that quarter’s transactions is released

11. A fourth ITA “category” is the statistical discrepancy. It is defined as the amount that balances the sum of recorded credits and debits across all of the accounts in the ITAs. It is discussed in more detail in the section “Analysis of the Statistical Discrepancy” of this article.

12. See *U.S. International Transactions Accounts: Concepts and Estimation Methods* for more information.

13. For a more thorough discussion of estimate vintages, see “Quarterly ITA estimates” in Yorgason and Scott.

3 months after the first estimate, based on the more complete and revised source data.

A further revised estimate—the “third” estimate—is released in June of the year after the reference year. If warranted, subsequent revised estimates are released in June of each subsequent year. The most recent vintage of these revised estimates is termed the “latest estimate.” Both the third estimate and the latest estimate are released in the June “annual” revisions.¹⁴ Note that

14. Each year, the results of the June revisions are published in the SURVEY; see C. Omar Kebbeh and Eric Bryda, “Annual Revision of the U.S. International Transactions Accounts,” SURVEY 96 (July 2016).

statistics of fourth-quarter transactions are first revised with the following “annual” revision; thus the “second” estimate for fourth-quarter transactions is skipped, moving directly to the “third” estimate.

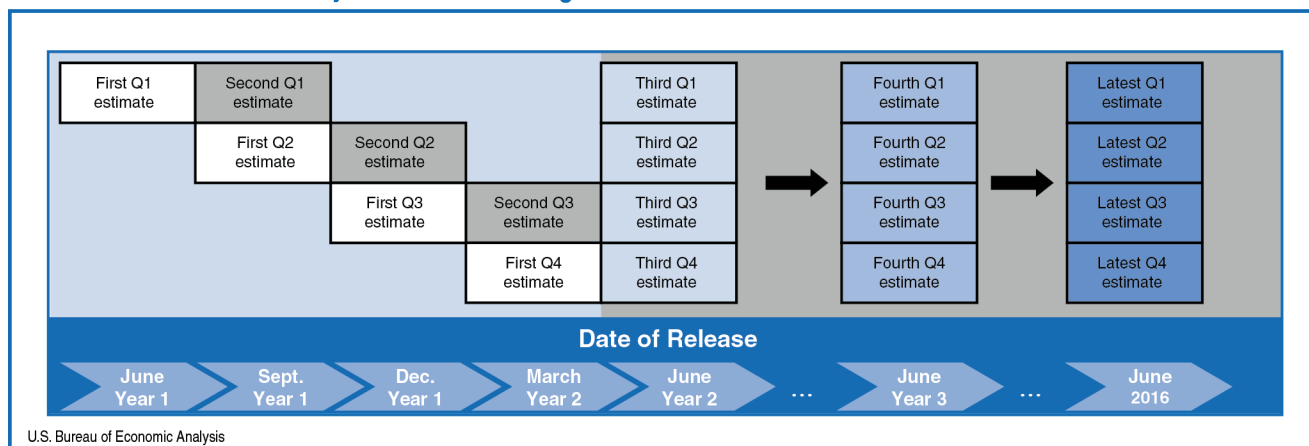
This framework of four estimate vintages—first, second, third, and latest—is used in this article to provide structure to the analysis of the revisions to the quarterly ITA estimates. Although this does not completely encompass all of the estimates and ignores some irregularly timed revisions, it captures most of the key features of BEA's estimate and revision release schedule.

Table 1. Availability of Primary Source Data for the Vintages of the Estimates for Selected Accounts

Primary data sources	Current account				
	First estimate	Second estimate	Third estimate	Fourth estimate	Later estimates
Trade in goods¹					
U.S. Census Bureau, compiling data mostly from Automated Exports System and Automated Commercial System	Primary source data fully available, some missing data on BOP adjustments	Some revised source data on BOP adjustments	Revised primary source data and source data on BOP adjustments	Revised source data on BOP adjustments	Revised source data on BOP adjustments
Travel (for all purposes including education)					
Traveler arrival, departure, and expenditure data, U.S. Customs and Border Protection and National Travel and Tourism Office; U.S. Department of State; Institute for International Education; National Center for Education Statistics; Statistics Canada and Bank of Mexico; foreign embassies	Source data available in some cases; trend-based projections otherwise	Additional and revised external source data; some trend-based projections	Additional and revised external source data	Revised external source data	Revised external source data if available
Transport					
Four BEA surveys; U.S. Census Bureau; U.S. Customs and Border Protection; Statistics Canada; Federal Aviation Administration; and U.S. Department of Transportation	Most source data available; trend-based projections otherwise	Additional and revised source data	Additional and revised source data	Revised source data if available	Revised source data if available
Charges for the use of intellectual properties; financial services; other business services; telecommunications, computer, and information services; maintenance and repair services					
BEA's quarterly and benchmark surveys of services	Trend-based projections	Most survey data available	Additional and revised survey data	Revised survey data	Revised survey data if available
Direct investment income					
BEA quarterly and benchmark surveys of direct investment	Some survey data available	Additional survey data	Additional survey data	Additional survey data	Survey data revised and reconciled with benchmark survey data
Portfolio investment income; other investment income					
Treasury Department surveys; representative yields; Federal Reserve; foreign central banks; International Monetary Fund; British Bankers Association	External source data fully available	Revised external source data	External source data revised and reconciled with annual or benchmark survey data	External source data revised and reconciled with annual or benchmark survey data	External source data revised and reconciled with benchmark survey data
Secondary income receipts and payments					
BEA quarterly and benchmark services surveys, and direct investment surveys; American Community Survey; U.S. Government Agencies	Some BEA survey data available; model-based projections otherwise	Additional BEA survey data; additional external source data	Additional BEA survey data; additional and revised external source data	Additional BEA survey data; additional and revised external source data if available	BEA survey data revised and reconciled with benchmark survey data; revised external source data if available
Primary data sources	Financial account				
	First estimate	Second estimate	Third estimate	Fourth estimate	Later estimates
Direct investment assets and liabilities					
BEA quarterly and benchmark surveys of direct investment	Some survey data available	Additional survey data	Additional survey data	Additional survey data	Survey data revised and reconciled with benchmark survey data
Portfolio investment assets and liabilities					
Treasury Department monthly, annual, and benchmark surveys; Federal Reserve; price indexes from MSCI, S&P, and Merrill Lynch; Depository Trust and Clearing Corporation	External source data fully available	Revised source data	Source data revised and reconciled with annual or benchmark survey data	Source data revised and reconciled with annual or benchmark survey data	
Other investment assets and liabilities					
BEA survey data; Treasury Department surveys; Federal Reserve; other government agencies and administrative data; IMF; DTCC; foreign central banks	Most source data available	New and revised source data	Revised source data	Revised source data if available	Source data reconciled with benchmark survey data

1. Balance of payments (BOP) adjustments are procedures used to bring the coverage and valuation of the Census Bureau basis goods trade data into conformity with balance of payments concepts.

Chart 3. Timeline of Quarterly ITA Estimate Vintages



U.S. Bureau of Economic Analysis

The terminology used for revisions is based on the vintage of the estimates. For example, the first estimate of second-quarter transactions is released in September. The second estimate is released in December. The “first-to-second” revision is defined as the difference between those two estimates—the December estimate minus the September estimate. Similarly, the “first-to-third” revision is defined as the difference between the third estimate and the first estimate.

This article primarily focuses on the first-to-third revision. As noted earlier, the third estimate is released anywhere from one to four quarters after the release of the first estimate. This article secondarily focuses on the first-to-latest revision. Although for many purposes, the first-to-latest revision provides the most useful information, the use of the first-to-third revision allows for an examination of the effects of changes to source data, abstracting in large part from potentially distortionary effects that arise when changes are made to definitions or major methodologies. To complement these two principal foci, this article includes a brief analysis of the more complete sequence of revisions.

Methodology

This section provides an overview of the definitions and formulas used in this article. The chief goals are to explain in more detail the calculations used in different article sections and to describe the various methods used to calculate the mean revisions and the mean absolute revisions. In calculating mean revisions and mean absolute revisions, scaled revisions are often used, but the suitability of the three scaling methods noted above differs by account type and the objective of the analysis.

Revisions and average revisions

A revision is the difference between a later vintage estimate and an earlier vintage estimate. Levels of published ITA estimates are expressed in current dollars. For an estimate expressed as a level rather than as a growth rate as would be common for GDP and the other NIPA accounts, an unscaled revision for period t , $r_t^{e,l}$, can be expressed as

$$r_t^{e,l} = E_t^l - E_t^e$$

where E denotes a current-dollar (level) estimate, the t subscript denotes the period (quarter) for the estimate, the e superscript denotes early vintage, and the l superscript denotes later vintage. The revision examined most frequently in this article is the first-to-third revision. This is given by

$$r_t^{1,3} = E_t^3 - E_t^1$$

Two simple measures—both averages—are used in this article to assess the size and direction of revisions. The first, the average of the revisions for some account over a given period, is called the mean revision. For a scaled revision, $R_t^{e,l}$, the mean revision ($MR^{e,l}$) is

$$MR^{e,l} = \frac{1}{T} \sum_{t=1}^T R_t^{e,l}$$

where t indexes quarters and T is the number of quarters over which the average is calculated. The mean revision indicates whether revisions are generally positive or negative. A positive mean revision indicates that the earlier estimates generally undershoot the later estimates; a negative mean revision indicates that the earlier estimates generally overshoot the later estimates. A near-zero mean revision suggests either

that early estimates are quite close to later estimates or that early estimate overshooting and undershooting largely offset one another.

Because revisions can be positive or negative, they may be offsetting. Therefore, it is also useful to look at the mean absolute revision ($MAR^{e,l}$), which is the average of the absolute value of the revisions over a given period:

$$MAR^{e,l} = \frac{1}{T} \sum_{t=1}^l |R_t^{e,l}|$$

Because positive and negative revisions are not offsetting in the mean absolute revision, a mean absolute revision is at least as large as the mean revision for the same period. Although a large positive or large negative mean revision necessarily implies a large mean absolute revision, a small mean revision has no implication for the mean absolute revision. Revisions may both center around zero and be highly variable; in that case, the mean absolute revision will be large and the mean revision will be small. In general, small mean absolute revisions, like small mean revisions, are indicators of reliability in early estimates.

Revision scaling methods

Most of the revisions considered in this article are scaled revisions.¹⁵ A scaled revision, R , is calculated simply by dividing the unscaled revision by a scaling term and multiplying it by 100 to express it as a percentage. For the first-to-third revision, R is

$$R_{m,t}^{1,3} = 100 \times \left(\frac{r_t^{1,3}}{S_{m,t}^{1,3}} \right) = 100 \times \frac{E_t^3 - E_t^1}{S_{m,t}^{1,3}}$$

where S denotes the scaling term and the m subscript denotes whatever scaling method is used.

The selection of a scaling method entails a tradeoff between simplicity and suitability. Some methods are more intuitive than others but are not adequate to deal with every type of account in the ITAs. In addition, no single scaling method gives a complete picture of the size of revisions. The use of multiple scaling methods has the benefit of allowing for consideration of the pattern of revisions from a variety of perspectives.

Scaling by item values

The first scaling method used in this study is scaling by the value of the estimate itself. Under this "item value" scaling method, the revision is expressed as a percent-

age of the earlier-vintage estimate. The scaling term for this scaling method (denoted by iv) is

$$S_{iv,t}^{e,l} = |E_t^e|$$

For example, if exports of goods are revised from \$100 billion to \$104 billion, the scaled revision is 4 percent. This scaling method stands out for its intuitiveness and simplicity. This method is most appropriate when account size and revision size are expected to be directly correlated.

Item value scaling is used in this article for most accounts in the current account. Its use would be misleading for two different types of accounts: (1) accounts with both positive and negative observations, and (2) accounts that are constructed as the sum of positive and negative components, or as the difference of positive components, even if the observations themselves all have a common sign.

Scaling by the sum of unsigned components

This scaling method is similar to the item value scaling method; the difference is that the early vintage estimate used as the scaling term is replaced by the sum of the unsigned components of the early vintage estimate. This scaling term (denoted by sc for sum of unsigned components) is

$$S_{sc,t}^{e,l} = \left(\sum_j |c_{t,j}^e| \right) = \sum_{j^+} c_{t,j^+}^e - \sum_{j^-} c_{t,j^-}^e$$

where the j^{th} component of the estimate is $c_{t,j}^e$. The components are divided into two groups: positively signed components, indexed by j^+ , and negatively signed components, indexed by j^- . Note that by construction, the estimate equals the sum of the signed components.

$$E_t^e = \sum_j c_{t,j}^e = \sum_{j^+} c_{t,j^+}^e + \sum_{j^-} c_{t,j^-}^e$$

This scaling method is used for current-account balances. For example, the balance on goods is calculated as exports of goods less imports of goods. The scaling factor in this method is exports of goods plus imports of goods. In general, its use is appropriate for accounts with both positively and negatively signed components as long as these components are known. If all components take the same sign, this scaling term is equivalent to the item value scaling term. Mean revisions and mean absolute revisions constructed using this method are quantitatively comparable with

15. For more information about the motivation for scaling revisions, see "Revision scaling methods" in Yorgason and Scott.

item-value-scaled mean revisions and mean absolute revisions. Thus, it is meaningful to compare numerically, for example, the item-value-scaled mean absolute revision of exports to the mean absolute revision of the trade balance scaled by the sum of its unsigned components.

Scaling by trend quarter-to-quarter absolute changes

Some accounts in the ITAs are net accounts in which the components are unmeasured (or are not fully measured). For these accounts, item value scaling is not appropriate, and scaling by the sum of unsigned components is unfeasible because these components are unmeasured. Chief among the accounts with these characteristics are financial accounts.¹⁶ Accordingly, another scaling method is needed.

The use of scaling by trend quarter-to-quarter absolute changes has the virtue of general applicability; that is, it could in principle be used for any account. However, it does not share with the other two scaling methods the same level of intuitive simplicity. Nor does it share with the other two methods a rough comparability with growth rate methods used in other BEA revisions studies. The method of scaling by trend quarter-to-quarter absolute changes is predicated on the size of revisions being related to the “typical” quarter-to-quarter change in account value in addition to the gross volume of transactions; that is, an account whose value varies greatly from one quarter to the next will tend to be more difficult to measure—and thus be subject to greater revision—than one whose value varies little.

Because quarter-to-quarter changes can be either positive or negative, this method uses absolute changes. For many series, the absolute changes vary considerably from quarter to quarter. In addition, any single quarter-to-quarter change can be arbitrarily close to zero. To provide a more stable scaling term and one that is not liable to become vanishingly small, some sort of measure of the typical change is required.

Most of the series examined in this article grow over time, so trend values of the absolute changes are used instead. This limits the extent to which early scaling terms are overweighted and later scaling terms are underweighted. Specifically, individual scaling terms for each observation (quarter) are generated using the Ho-

16. For example, net flows for some of the financial accounts are estimated by subtracting a beginning-of-period balance from an end-of-period balance. For these accounts, neither gross outflows nor gross inflows—the terms required to compute the sum of unsigned components—are observed.

drick-Prescott filter, with the smoothing parameter set to 1,600.¹⁷

Algebraically, the scaling term (using an *ac* subscript to denote absolute changes) is

$$S_{ac,t}^{e,l} = trend\{\Delta(E_t^L)\} = trend\{|E_t^L - E_{t-1}^L|\}$$

where $trend\{x\}$ denotes the trend extracted from the application of the Hodrick-Prescott filter to series x , and L denotes that the latest vintage estimates are used in extracting the trend.

This scaling method is used in this article primarily for the financial account. Because it scales by a function of changes rather than levels, mean revisions and mean absolute revisions obtained using this method are not quantitatively comparable to those obtained using the prior two methods.

The following table summarizes the three scaling methods and how they are used in this article.

Table A. Scaling Methods

Scaled by	Most suitable for	Accounts analyzed in this article
Item values	Accounts that measure aggregation of transactions or activities	Current-account components
Sum of unsigned components	Net accounts that measure differences in measured transactions	Current-account balances excluding balance on secondary income
Trend quarter-to-quarter absolute changes	Net accounts that measure differences in unmeasured transactions	Financial accounts; balance on secondary income

Revisions to quarterly percent changes

One *nonscaled* revision is used in the quarterly change behavior section of this article: mean and mean absolute percentage-point revision in quarterly percent changes. As the quarterly percent change is itself scaled by the previous quarter’s value, the revision to the quarterly percent change is not (further) scaled. This revision is the later vintage quarterly percent change less the earlier vintage quarterly percent change, expressed in percentage points. The quarterly percent revision calculation is given by

$$QR_t^{e,l} = 100 \times \left\{ \left(\frac{E_t^l}{E_{t-1}^l} - 1 \right) - \left(\frac{E_t^e}{E_{t-1}^e} - 1 \right) \right\}$$

where QR is the quarterly percent revision for quarter t from an early vintage, e , to a later vintage, l . Following

17. The Hodrick-Prescott filter is a procedure used to separate the quarter-to-quarter deviations from trend in a time series. The choice of 1,600 as the smoothing parameter for quarterly data was originally recommended by Hodrick and Prescott, and it is commonly used. See Robert J. Hodrick and Edward C. Prescott, “Postwar U.S. Business Cycles: An Empirical Investigation,” *Journal of Money, Credit and Banking* 29, no. 1 (February 1997): 1–16.

on this calculation, the mean percentage-point revision is given by

$$\frac{1}{T-1} \sum_{t=2}^T QR_t^{e,l}$$

and the mean absolute percentage-point revision is given by

$$\frac{1}{T-1} \sum_{t=2}^T |QR_t^{e,l}|$$

2014 Comprehensive Restructuring

For a robust revisions analysis, several years of estimates of individual accounts are needed. In 2014, as part of the June annual revision, BEA implemented a comprehensive restructuring of the ITAs to better align the statistics with recently updated international standards. That release contained two parallel versions of the statistics for the first quarter of 1999 to the first quarter of 2014, one consistent with the previously published statistics and a new restructured version based on standards set forth in the International Monetary Fund's *Balance of Payments and International Investment Position Manual, Sixth Edition (BPM6)*. While some account definitions were unchanged or little changed in the restructuring, others changed substantially, and still others were eliminated and replaced with new accounts organized on a different basis.

The two versions of the statistics represent a potential obstacle to revisions analysis; revisions to older and newer vintage estimates may not be fully comparable because of differences in account definitions. However, if definitions are similar enough across the two versions for some accounts, a revision analysis for those accounts may be appropriate.

This section examines the changes in individual accounts resulting from the comprehensive restructuring and compares the two versions of the statistics. This analysis identifies accounts that roughly span the pre-

and post-restructuring periods and thus can be considered suitable for use in a revision analysis covering 1999–2015, the period covered by ITA table 1.2.

Changes introduced with the *BPM6* standard included expanded gross recording, redefined series, and updated table presentations.¹⁸ For an analysis of revisions to the ITAs, the most important changes were the redefined series and the presentation of certain accounts on a gross basis rather than on a net basis.

The main aggregate series of the current account in the restructured ITAs and their most closely corresponding series in the previous version of the ITAs are presented in table 2. A key difference between the two sets of aggregates is the inclusion in the restructured aggregates of a second type of income: secondary income.¹⁹ Secondary income receipts and payments were newly published in the restructured ITAs (table 1.2, lines 30 and 58, respectively); previously, information on these transactions had been available only on a net basis—that is, receipts less payments—as unilateral current transfers (previous table 1, line 35).

Primarily as a consequence of including secondary income receipts in the restructured ITAs as a gross entry and treating them as a type of income receipt, exports of goods and services and income receipts were 4.5 percent higher under the new definitions than under the old definitions in the first quarter of 2014. Similarly, imports of goods and services and income payments were 7.7 percent higher under the new definitions. Recorded transactions in goods, in services, and in primary income (versus the previous income) were slightly higher as well under the new definitions,

18. For the details, see Maria Borga and Kristy L. Howell, "The Comprehensive Restructuring of the International Economic Accounts: Changes in Definitions, Classifications, and Presentations," *SURVEY* 94 (March 2014) and Jeffrey R. Bogen, Mai-Chi Hoang, Kristy L. Howell, and Erin M. Whitaker, "Comprehensive Restructuring and Annual Revision of the U.S. International Transactions Accounts," *SURVEY* 94 (July 2014).

19. The aggregate that had previously been called income was renamed primary income.

Table 2. Comparison of Current-Account Aggregates Before and After the 2014 Comprehensive Restructuring

Current table 1.2 line number	Current ITA name	Previous table 1 line number	Previous ITA name	2014:1 percent difference	Correlation of quarter-to-quarter percent change movements, 1999–2013
1	Exports of goods and services and income receipts (credits)	1	Exports of goods and services and income receipts	4.47	0.996
2	Exports of goods and services	2	Exports of goods and services	0.29	>0.999*
3	Goods	3	Goods, balance of payments basis	0.04	>0.999*
13	Services	4	Services	0.86	0.999
23	Primary income receipts	12	Income receipts	0.83	>0.999*
31	Imports of goods and services and income payments (debits)	18	Imports of goods and services and income payments	7.70	0.996
32	Imports of goods and services	19	Imports of goods and services	0.24	>0.999*
33	Goods	20	Goods, balance of payments basis	0.00	1.000
42	Services	21	Services	1.42	0.997
52	Primary income payments	29	Income payments	1.09	>0.999*

*Value would round to 1.000, but is not exactly 1. Values listed as 1.000 are exactly 1.

largely stemming from increased gross recording of transactions of certain subcomponents of these aggregates.²⁰

As with series levels, trends over time in the various aggregate series can be compared across the two versions of the accounts. As measured by correlation coefficients of the quarter-to-quarter changes of the two versions of each series, trends are quite similar for these aggregates. For example, the cross-definition correlation of quarter-to-quarter percent changes for exports of goods and services and income receipts from the first quarter of 1999 to the fourth quarter of 2013 is 0.996. For imports of goods and services and income payments, the cross-definition correlation is also 0.996. For many of the accounts, the definitional changes left quarterly trends essentially unaffected, with correlations between the old and new series approaching one.

Tables 3 and 4 compare levels and trends of the two largest aggregates in the financial accounts and the major ITA balances. For financial and balance accounts,

20. The percent difference between the old and new definitions in estimates for the first quarter of 2014 is closely representative of differences in estimates for the entire period of 1999 to the first quarter of 2014 for the current-account aggregates and balance accounts. For financial accounts, the percent difference for that single quarter is more loosely representative of the size of the differences over the longer period. Because the signs of financial accounts can vary from quarter to quarter, percentage differences are conceptually ambiguous and potentially volatile even when dollar differences are smooth.

quarterly dollar movements are used instead of percent change as these accounts can fluctuate around zero and produce extreme percent change movements.

The effects of the comprehensive restructuring on the primary financial-account aggregates were similar to the effects on the current-account aggregates: moderate differences in levels but little change in quarterly movements.²¹ For major ITA balances, the levels and quarterly dollar movements were both largely unaffected. For most of these major accounts, the only change associated with the restructuring was increased gross reporting. As balances net out the gross values, increasing gross reporting does not change balances. The only changes in balances were in balances on goods and balance on services and were due to reclassification of net exports of goods under merchandising to goods from services.²²

The analysis in this section shows that the major aggregates of the ITAs are largely comparable across the

21. The change in levels resulted from moving from a directional basis to an asset/liability basis in recording debt transactions in direct investment; see and [Bogen, Hoang, Howell, and Whitaker](#) for more information. This change resulted in *net acquisition of financial assets excluding financial derivatives* and *net incurrence of liabilities excluding financial derivatives* both exceeding their counterparts in the previous ITA tables by the same dollar amount. Definitional changes through much of the rest of the financial account were substantial but did not affect the two top-line aggregates.

22. This reclassification resulted in a decrease in the positive balance on services and an increase in the negative balance on goods. Since the balance on goods was negative (a deficit), the percentage difference in the balance on goods was negative (positive numerator, negative denominator).

Table 3. Comparison of Financial-Account Aggregates Before and After the 2014 Comprehensive Restructuring

Current table 1.2 line number	Current ITA name	Previous table 1 line number	Previous ITA name	2014:1 percent difference	Correlation of quarter-to-quarter dollar change movements, 1999–2013
61	Net U.S. acquisition of financial assets excluding financial derivatives	40	U.S.-owned assets abroad, excluding financial derivatives	3.39	0.995
84	Net U.S. incurrence of liabilities excluding financial derivatives	55	Foreign-owned assets in the United States, excluding financial derivatives	2.11	0.995

Table 4. Comparison of Account Balances Before and After the 2014 Comprehensive Restructuring

Current table 1.2 line number	Current ITA name	Previous table 1 line number	Previous ITA name	2014:1 percent difference	Correlation of quarter-to-quarter dollar change movements, 1999–2013
101	Balance on current account	77	Balance on current account	0.00	1.000
102	Balance on goods and services	74	Balance on goods and services	0.00	1.000
103	Balance on goods	72	Balance on goods	-0.09	>0.999*
104	Balance on services	73	Balance on services	-0.30	>0.999*
105	Balance on primary income	75	Balance on income	0.00	1.000
106	Balance on secondary income	35	Unilateral current transfers, net	0.00	1.000
107	Balance on capital account	39	Capital account transactions, net	0.00	1.000
108	Net lending (+) or net borrowing (-) from current- and capital-account transactions	N/A	Balance on current account + capital account transactions, net	0.00	1.000
109	Net lending (+) or net borrowing (-) from financial-account transactions	N/A	Net financial flows	0.00	1.000

*Value would round to 1.000, but is not exactly 1. Values listed as 1.000 are exactly 1.

2014 comprehensive restructuring. While some accounts experienced a one-time level shift during the restructuring release, the quarterly movements of these accounts remained essentially unaffected. As such, most of the analysis of the revisions in the following sections will make use of the entire 1999–2015 span.

With respect to revision analysis, the restructuring prompted BEA to publish two estimates for each series: one on the prerestructuring basis (“old”) and one on the post-restructuring basis (“new”). This overlap created two separate revisions for estimates covering certain periods (table 5). (Note that if the comprehensive restructuring left a series definition and methodology entirely unchanged, the two revisions will be identical for that series.) For example, consider the first-to-third

cifically noted below as “excluding the 2014 restructuring impact” where applicable.

For first-to-latest estimates, removing the impact of the comprehensive restructuring is more difficult. Statistics covering a greater number of periods are involved (all the quarters in 1999–2013), and only new basis—not old basis—estimates are available for the latest estimate.

Mean Revisions, Mean Absolute Revisions, and Direction of Revisions to the Quarterly ITAs

This section presents summary measures of revisions to the quarterly ITAs, with an appropriate scaling method used for each group of accounts. Revisions to current-account series are considered on an item-value-scaled basis, revisions to current-account balances are scaled by sum of components, and revisions to financial-account components are scaled by trend in quarterly change. Revisions are then compared across the ITAs more broadly. Finally, (unscaled) revisions to quarterly percent changes are considered.

Current-account components

For comparability across the current-account components, revisions are scaled by the early vintage estimate (item-value scaling) and expressed as percentages. The revisions in table 6 compare the first estimate published for a given quarter with the third estimate, which is the revised estimate for that quarter published in the annual update of June in the following year. The third estimates for 2013 quarterly values used to calculate revisions in “Including 2014 restructuring impact” use the estimates incorporating all of the changes associated with the comprehensive restructuring, including the changes in classification, definition, and presentation. Importantly, these changes include the compilation of secondary income on a gross basis, which

Table 5. Availability of Estimates Before and After the Comprehensive Restructuring

Estimate	Period covered by estimate				
	2011 (all quarters and earlier)	2012 (all quarters)	2013 (all quarters)	First quarter 2014	Second quarter 2014 and later
1 st	Old	Old	Old	Old and new	New
2 nd	Old	Old	Old	n.a.	New
3 rd	Old	Old	Old and new	New	New
4 th	Old	Old and new	New	New	New
.....	New	New	New	New
Latest	New	New	New	New	New

Old: pre-comprehensive restructuring basis; new: post-comprehensive restructuring basis

revision for estimates covering 2013. As the third estimate is the estimate released in June of the following year, estimates for 2013 have a third estimate on the “old” basis and a third estimate on the “new” basis. The “new” basis estimate is the official statistic, and by default it is used as the third estimate for quarterly first estimates in 2013. However, because the “old” basis is the same basis upon which first estimates for 2013 were published, to eliminate the restructuring-specific effects on these first-to-third revisions, values released in June 2014 on the “old” basis are used for third estimates in some calculations. These adjustments are spe-

Table 6. Mean Revisions and Mean Absolute Revisions of First Estimates of Quarterly Current-Account Components to Third Estimates, Item Value Scaling, 1999–2015

Table 1.2 line	Series	Including 2014 restructuring impact		Excluding 2014 restructuring impact	
		Mean percent revision	Mean absolute percent revision	Mean percent revision	Mean absolute percent revision
1	Exports of goods and services and income receipts (credits)	0.96*	1.29	0.71*	1.08
2	Exports of goods and services	0.23*	0.62	0.21*	0.61
3	Goods	-0.01	0.49	-0.01	0.48
13	Services	0.80*	1.80	0.75*	1.76
23	Primary income receipts	2.16*	3.12	2.11*	3.15
31	Imports of goods and services and income payments (debits)	0.54*	1.23	0.09	0.78
32	Imports of goods and services	0.12	0.50	0.10	0.50
33	Goods	0.07	0.41	0.07	0.41
42	Services	0.40	2.09	0.33	2.03
42	Primary income payments	-0.03	3.37	-0.10	3.30

*Indicates evidence at the 5 percent significance level that the first estimate undershoots the third estimate.

directly affects the two top-line accounts: (1) exports of goods and services and income receipts and (2) imports of goods and services and income payments.

The columns under “Excluding 2014 restructuring impact” remove the impact of many of the changes associated with the 2014 restructuring. The columns use third estimates of the four 2013 quarters that exclude changes in classification, definition, and presentation. In other words, they use estimates published in June 2014 on the prior basis. These estimates include any revisions due to revisions in source data, receipt of new data, or updating of seasonal adjustment factors but exclude any revisions due to other changes. (For estimates of the four quarters of 2014, all of the columns in the table use first and third estimates published on the basis of the restructured account categories.)

Mean absolute revisions—that is, revisions that do not account for the direction of the revision—are larger on a percentage basis for the primary income accounts than for the goods and services accounts.²³ Mean absolute revisions for the top-line aggregates are 1.08 percent for exports of goods and services and income receipts and 0.78 percent for imports of goods and services and income payments when revisions due to the 2014 restructuring are excluded.

The largest differences between first-to-third revisions including restructuring’s impact and first-to-third revisions excluding the impact are in the top-line accounts (lines 1 and 31), because only the top-line accounts were affected by the differing treatment of secondary income. For other accounts, differences in mean revisions are minimal.

One feature of these sets of calculations is that they suggest the first estimate tends to undershoot the third estimate in several aggregates. Estimates of exports of goods and services and income receipts (or current-account credits) are on average revised upwards 0.96 percent (0.71 percent excluding the effects of the 2014 restructuring) between the first and third estimates. Estimates of imports of goods and services and income payments (or current-account debits) are on average revised upwards 0.54 percent (0.09 percent excluding the effects of the 2014 restructuring) between the first and third estimates.

23. Secondary income was first published on a gross basis with the 2014 annual revisions, so not enough data points for a robust revision analysis are available yet. For 2014–2015, secondary income receipts had a mean revision of 4.41 percent and a mean absolute revision of 7.10 percent. Secondary income payments had a mean revision of 2.93 percent and a mean absolute revision of 2.93 percent.

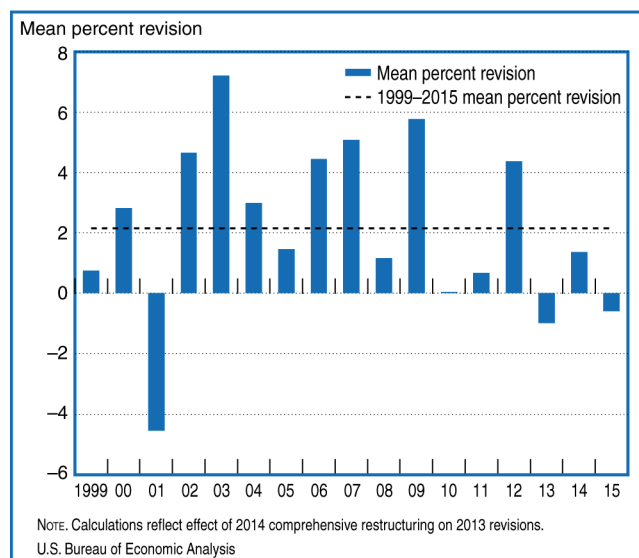
Both top-line accounts (lines 1 and 31) indicate at the 5 percent statistical significance level that the first estimate tends to undershoot the third estimate; that is, the mean revision calculated from the 1999–2015 sample of revisions is statistically greater than zero.²⁴ While this statistical significance disappears for imports of goods and services and income payments when the impact of the 2014 restructuring is removed, it remains for exports of goods and services and income receipts.

Of the components of exports of goods and services and income receipts that may contribute to this undershooting, primary income receipts shows the largest upward revisions to its first estimates, with a mean revision of 2.16 percent and mean absolute revision of 3.12 percent when including the 2014 restructuring impact (the restructuring had a minimal impact on primary income receipts). Looking at the mean first-to-third revision in primary income receipts by year, first estimates for reference years in the 2000s were consistently revised upward. For reference years after 2010, this account has exhibited a more random revision pattern (chart 4).

First-to-third revisions to exports of services also show an upward tendency, suggesting possible

24. More precisely, assuming that revisions from the first estimate to the third estimate are normally distributed with a fixed “true” mean of zero, the probability that a sample of revisions (of the same size as the observed sample) could be randomly drawn from the distribution with a mean revision as large as that calculated from the observed sample is less than 5 percent.

Chart 4. Mean Revision of Primary Income Receipts Between First and Third Estimates



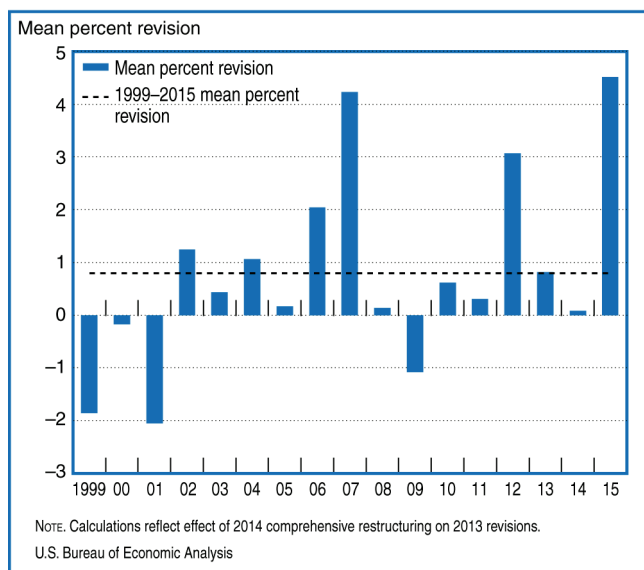
downward bias in the first estimate, but the revisions series is punctuated by several years of large upward revisions (chart 5). These revisions do not exhibit a strong trend over time. Some of the larger revisions are associated with major events in data collection or estimation procedures. For example, the large revisions to 2007 first estimates during the 2008 annual revision coincided with new results from a major benchmark survey for international services transactions covering 2006 that expanded the coverage of transactions and a new follow-on survey of services beginning in 2007.²⁵ The 2015 revisions coincided with the introduction of an improved methodology for travel services, new results from a benchmark financial services survey, and the incorporation of considerably revised source data for travel and transport services exports.²⁶

On the debits side of the current account, as previously noted, the top-line aggregate only gives statistical indication of undershooting by the first estimate when the third estimate includes all of the changes associated

25. See Christopher L. Bach, "Annual Revision of the U.S. International Accounts, 1974–2007" SURVEY 88 (July 2008).

26. See Kebbeh and Bryda.

Chart 5. Mean Revision of Exports of Services Between First and Third Estimates



with the comprehensive restructuring published in June 2014. When the comprehensive restructuring's changes in classification, definition, and presentation are not incorporated into these third estimates, the statistical significance disappears. Whether 2014 restructuring effects are included or excluded, none of its major components suggest bias at the 5 percent significance level.

The direction of first-to-third revisions to the current account follows a similar pattern to the mean revisions. The first estimate of exports of goods and services and income receipts (line 1) was revised upward 76.5 percent of the time (see table 7), which differs at the 5 percent significance level from an expected 50 percent if revision direction is completely random. Primary income receipts and exports of services were revised upward 75 percent and 61.8 percent of the time, respectively.

Table 7. Direction of Revisions from First Estimates of Quarterly Current-Account Components to Third Estimates, Excluding 2014 Restructuring, 1999–2015

Table 1.2 line	Series	Upward revisions	Downward revisions	Percent revised up
1	Exports of goods and services and income receipts (credits).....	52	16	76.5*
2	Exports of goods and services	43	25	63.2*
3	Goods.....	32	36	47.1
13	Services.....	42	26	61.8
23	Primary income receipts.....	51	17	75.0*
31	Imports of goods and services and income payments (debits).....	39	29	57.4
32	Imports of goods and services.....	37	31	54.4
33	Goods.....	34	34	50.0
42	Services.....	39	29	57.4
52	Primary income payments.....	38	30	55.9

*Indicates evidence at the 5 percent significance level that the relative frequency of upward revisions differs from 50 percent.

Imports of goods and services and income payments was revised upward 57.4 percent of the time, statistically indistinguishable from 50 percent at the 5 percent significance level. The components on the debit side of the current account all have a similar pattern, revised upward 50 percent of the time or slightly above 50 percent of the time.

Table 8 and table 9 look at mean revisions and mean absolute revisions in the current account across the various vintages. The averages in these tables include the impact from the 2014 restructuring. Note that

Table 8. Mean Percent Revisions of Estimates of Quarterly Current-Account Components, Item Value Scaling, Various Vintages, Including 2014 Restructuring, 1999–2015

Table 1.2 line	Series	First to second	First to third	Second to third	First to latest	Second to latest	Third to latest
1	Exports of goods and services and income receipts (credits).....	0.02	0.96*	0.94*	5.88*	5.83*	4.88*
2	Exports of goods and services	-0.04	0.23*	0.24*	0.97*	0.94*	0.74*
3	Goods.....	-0.01	-0.01	-0.02	1.19*	1.19*	1.21*
13	Services.....	-0.09	0.80*	0.85*	0.40	0.33	-0.39
23	Primary income receipts.....	0.17	2.16*	2.09*	7.8*	7.88*	5.49*
31	Imports of goods and services and income payments (debits).....	0.05	0.54*	0.50	6.82*	6.77*	6.28*
32	Imports of goods and services	0.01	0.12	0.08	0.58*	0.5*	0.46*
33	Goods.....	0.00	0.07	0.05	0.64*	0.58*	0.57*
42	Services.....	0.10	0.40	0.26	0.30	0.16	-0.10
52	Primary income payments.....	0.23	-0.03	0.03	1.69*	1.98*	1.72*

*Indicates evidence at the 5 percent significance level that the earlier estimate undershoots the later estimate.

estimates of fourth-quarter transactions do not have a “second” estimate, as the first revision is released with the subsequent annual update and is considered a third estimate. As such, each year includes only three first-to-second revisions, but four first-to-third revisions.

First-to-second mean revisions tend to be small and centered around zero (none are statistically different from zero at the 5 percent significance level). First-to-third mean revisions are larger than the first-to-second revisions and are comparable in magnitude with the second-to-third mean revisions for nearly all the accounts listed. This is not surprising in light of the discussion above, because the first estimate tends to undershoot the third estimate, particularly if the impact of the 2014 restructuring is included. The second estimate incorporates source data newly received or revised since the release of the first estimate. Effects from changes in definition, classification, or methodology are not incorporated until the third estimate, and impact both the first-to-third and second-to-third revisions similarly.

Some of the largest first-to-latest mean revisions are found in the top-line accounts (lines 1 and 31), even when compared with revisions to their components, because of the inclusion of secondary income on a gross basis with the 2014 restructuring. The inclusion affected every first-to-latest revision to estimates for 1999–2013 (60 quarters) for the top-line accounts (table 5). In contrast, the inclusion of secondary income affected only four of the first-to-third revisions: revisions to the estimates for the quarters of 2013.²⁷

27. To contextualize the impact that this gross inclusion had on the top-line aggregates, a mean revision and mean absolute revision can be calculated for first-to-latest revisions for 1999–2013 span on both a prerestructuring and postrestructuring basis, using first quarter 2014 releases as “latest” vintages. For exports of goods and services and income receipts, the prerestructuring first-to-2014 mean revision is 2.20 percent and mean absolute revision is 2.36 percent, compared with 6.40 percent and 6.40 percent, respectively, for postrestructuring first-to-2014 estimates. For imports of goods and services and income payments, the prerestructuring first-to-2014 mean revision is 0.38 percent and mean absolute revision is 1.16 percent, compared with 7.65 percent and 7.65 percent, respectively, for postrestructuring first-to-2014 estimates.

Table 9 shows the progression of mean absolute revisions across the vintages. The largest mean absolute revisions among the component accounts are in primary income receipts and payments. Exports and imports of services have higher mean absolute revisions across the vintages than exports and imports of goods. This is expected, as data for trade in goods are collected by the U.S. Customs and Border Protection and by U.S. Census Bureau at the time the goods leave or enter the United States and are compiled on a monthly basis by the Census Bureau. In contrast, much of the source data used in compiling the services trade statistics are collected on quarterly BEA surveys of services-trading companies. These data and many of the other source data for the services trade statistics are less timely than the data used for the goods trade statistics. Consequently, first estimates of services trade statistics are based on less actual source data than first estimates of goods trade statistics. Furthermore, over the years studied in this article, services trade statistics have undergone more methodology, definitional, and classification changes than goods trade statistics during annual or comprehensive revisions, such as the 2014 restructuring based on the *BPM6* standards.²⁸

Current-account balances

Current account balances are the differences between credits and debits of selected current account categories. In this section, revisions to current account balances are scaled by the sum of unsigned components that are used to calculate the balances. Weighting by the sum of unsigned components eliminates issues that arise with the item-value scaled approach when a net account switches signs or has values approaching zero. Like the item-valued scaled approach, however, and

28. Refer to table 2 as an example. First-quarter 2014 goods exports and imports differ little (just 0.04 percent and 0.00 percent, respectively) comparing data calculated according to definitions associated with the 2014 restructuring and data associated with the previous definitions. Differences in services exports and imports were 0.86 percent and 1.42 percent, respectively.

Table 9. Mean Absolute Percent Revisions of Estimates of Quarterly Current-Account Components, Item Value Scaling, Various Vintages, Including 2014 Restructuring, 1999–2015

Table 1.2 line	Series	First to second	First to third	Second to third	First to latest	Second to latest	Third to latest
1	Exports of goods and services and income receipts (credits)	0.39	1.29	1.21	5.88	5.83	4.88
2	Exports of goods and services	0.25	0.62	0.60	1.05	1.00	0.79
3	Goods	0.07	0.49	0.51	1.36	1.36	1.27
13	Services	0.83	1.80	1.57	2.93	2.66	2.32
23	Primary income receipts	1.03	3.12	2.72	8.09	8.05	5.64
31	Imports of goods and services and income payments (debits)	0.25	1.23	1.17	6.84	6.77	6.29
32	Imports of goods and services	0.14	0.50	0.49	0.80	0.76	0.55
33	Goods	0.06	0.41	0.41	0.80	0.77	0.63
42	Services	0.78	2.09	1.76	2.99	2.97	2.42
52	Primary income payments	1.24	3.37	2.83	4.71	4.33	3.38

unlike an unscaled approach, it does not unduly “penalize” larger component series.

The mean revision to the current-account balance is one-quarter of 1 percent of the sum of the components of the balance. However, the revisions indicate at the 5 percent significance level, that the first estimate may generally undershoot the third estimate.²⁹ This potential bias stems from revisions to primary income receipts, as discussed for the individual current-account components above and seen here where the mean percent revision to the balance on primary income is 1.19 percent. The mean absolute percent revision to the current-account balance is less than half of 1 percent of the sum of its components (0.46 percent).

The first-to-third mean absolute revision of the balance on services is larger than that of the balance on goods (table 10). This is consistent with the revisions seen for the components. Revisions to both balances give no statistically significant indication that their first estimates undershoot or overshoot the third estimates.

Table 10. Mean Revisions and Mean Absolute Revisions of First Estimates of Quarterly Current-Account Balances to Third Estimates, Sum-of-Unsigned-Components Scaling, 1999–2015

Table 1.2 line	Series	Mean percent revision	Mean absolute percent revision
101	Balance on current account.....	0.24*	0.46
102	Balance on goods and services.....	0.03	0.33
103	Balance on goods.....	-0.04	0.23
104	Balance on services.....	0.29	1.23
105	Balance on primary income.....	1.19*	1.89

*Indicates evidence at the 5 percent significance level that the first estimate undershoots the third estimate.

In terms of relative directional frequency, the current-account balance was revised upward 66.2 percent of the time, statistically different from 50 percent at the 5 percent significance level (table 11). This is consis-

29. Because the current account has been in deficit throughout 1999–2015, the first estimate’s undershooting of the third estimate means that the deficit (as opposed to the balance) is typically revised downward; that is, the balance is revised to be less negative.

Table 11. Direction of Revisions from First Estimates of Quarterly Current-Account Balances to Third Estimates, Excludes 2014 Restructuring, 1999–2015

Table 1.2 line	Series	Upward revisions	Downward revisions	Percent revised up
101	Balance on current account.....	45	23	66.2*
102	Balance on goods and services.....	38	30	55.9
103	Balance on goods.....	29	39	42.6
104	Balance on services.....	37	31	54.4
105	Balance on primary income.....	51	17	75.0*

*Indicates evidence at the 5 percent significance level that the relative frequency of upward revisions differs from 50 percent.

tent with the pattern seen in mean and mean absolute revisions to the balances. The balance on primary income was revised upward 75.0 percent of the time. The balances on goods, services, and goods and services were revised upward at frequencies indistinguishable at the 5 percent significance level from 50 percent.

Financial-account components

The financial accounts measure transactions on a net basis and not on a gross basis. As such, they cannot be analyzed like the balance accounts. Instead, their revisions and absolute revisions are scaled to their trend quarter-to-quarter absolute change. Included in this analysis for the purpose of comparison with revisions to the financial account are revisions to the top-line aggregates and balance for the current account (table 12, lines 1, 31, and 101). Also included as an addendum is the balance on secondary income. This balance was first published under this name with the 2014 restructuring; previously, the balance was published as *net unilateral transfers*. Although each side of the secondary income balance is currently published, this was not true for net unilateral transfers; only net estimates were published before the restructuring. Since a robust analysis of item-value-scaled revision cannot be performed with only 2 years of gross basis estimates, revisions to the balance for the full 1999–2015 span are scaled by trend in quarter-to-quarter absolute changes.

The mean revisions and mean absolute revisions to the financial accounts tend to be smaller than those of trend-quarter-to-quarter-change-scaled current-account credits, debits, and balance. However, this is mostly due to the large variation in quarter-to-quarter movements in the financial account rather than small

Table 12. Mean Revisions and Mean Absolute Revisions of First Estimates of Quarterly Financial-Account Components to Third Estimates, Trend-Quarter-to-Quarter-Absolute-Change Scaling, 1999–2015, Excludes 2014 Restructuring

Table 1.2 line	Series	Mean percent revision	Mean absolute percent revision
61	Net U.S. acquisition of financial assets excluding financial derivatives.....	6.9*	17.2
84	Net U.S. incurrence of liabilities excluding financial derivatives.....	9.1*	21.2
99	Financial derivatives other than reserves, net transactions	-3.8	4.5
Addenda:			
1	Exports of goods and services and income receipts.....	23.3*	35.2
31	Imports of goods and services and income payments.....	5.9	26.3
101	Balance on current account.....	28.0*	56.1
106	Balance on secondary income (unilateral current transfers).....	-11.1	51.1

*Indicates evidence at the 5 percent significance level that the first estimate undershoots the third estimate.

dollar revision values. One measure of volatility is the moving average of the quarterly absolute change of a series. Chart 6 shows the difference in this volatility between an aggregate financial account series and an aggregate current account series.

From the first estimate to the third estimate, net U.S. acquisition of financial assets excluding financial derivatives has been revised upward 69.1 percent of the time (table 13). Net U.S. incurrence of liabilities excluding financial derivatives has been revised upward 57.4 percent of the time. The third component of the financial accounts, “financial derivatives other than reserves, net transactions,” was not available during first estimates until the second quarter of 2012; it has fewer than four years of estimates available, and over this period, three of the first estimates were unrevised by the third estimate.

Chart 6. Absolute Quarterly Changes for Selected Components of Current Account and Financial Account

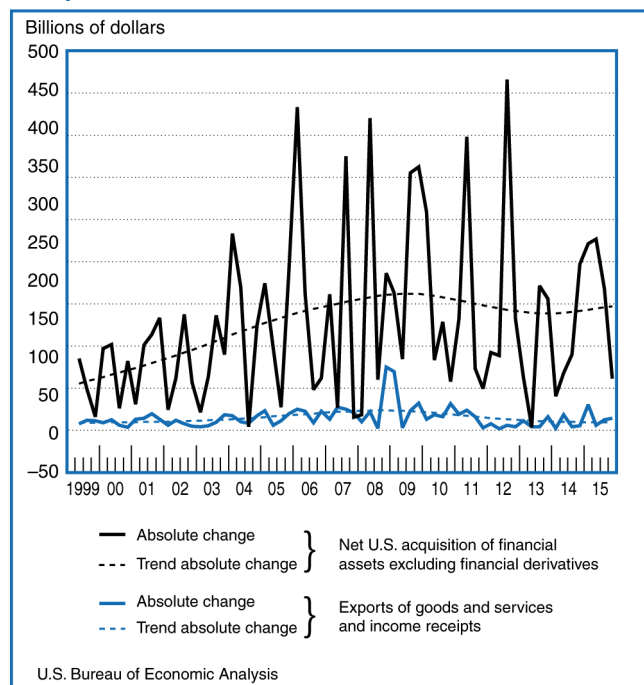


Table 13. Direction of Revisions from First Estimates of Quarterly Financial-Account Components to Third Estimates, Excludes 2014 Restructuring, 1999–2015

Table 1.2 line	Series	Upward revisions	Downward revisions	Percent revised up
61	Net U.S. acquisition of financial assets excluding financial derivatives	47	21	69.1*
84	Net U.S. incurrence of liabilities excluding financial derivatives	39	29	57.4
99	Financial derivatives other than reserves, net transactions ¹	4	8	26.7

*Indicates evidence at the 5 percent significance level that the relative frequency of upward revisions differs from 50 percent.

1. First estimates for this series began in the second quarter of 2012. There have also been three times the third estimate was equal to the first estimate.

Impact of Revisions: Quarterly Percent Change Revision, Directional Reliability, and Recession Periods

In the ITAs, estimates are presented as levels, not as percent changes. While other BEA estimates are presented both in terms of levels and percent changes, percent changes are deemphasized in the ITAs partly because the ITAs are expressed in nominal, not real, terms. Percent changes in nominal terms are affected by price and exchange rate changes and may give a distorted picture of actual changes of the activities being measured. Nonetheless, data users may compute percent changes themselves, and these calculations can be useful in comparing relative changes across accounts.

In this section, revisions from the first estimates to later estimates of quarterly percent change are analyzed. Quarterly change behavior was briefly discussed in the section on the 2014 restructuring to show that while the restructuring impacted series levels, it had minimal impact on trends. Analysis of revisions to quarterly percent changes provides additional perspective on the usefulness and reliability of the ITA statistics, complementing an analysis of revisions to levels.³⁰

Quarterly percent change revisions

In computing the revision in percentage change, the quarterly percent change from the first estimate vintage is subtracted from the quarterly percent change from the third or latest estimate vintage, and the result is expressed in percentage points (for example, a 1.0 percent first estimate quarterly change from the prior quarter’s second estimate revised to 1.2 percent quarterly change in a later vintage would be a revision of 0.2 percentage point). Analyzing the revisions to quarterly percent changes removes most of the impact from a general level shift revision and highlights revisions that change movements or trends.

Mean percentage point revisions to the quarterly percent change movements of the current account aggregates are generally small and centered around zero. In contrast to the mean revision analysis in the preceding section, using the threshold of a 5 percent significance level, there is no indication that the first quarterly percent change estimate of any account systematically overshoots or undershoots the corresponding quarterly percent change in the third or latest estimate.

30. Numerically, revisions to percent change can be roughly compared with revisions to item-value-scaled levels, because both consist of fractions with a level as the denominator. Neither of these revisions can be directly compared with revisions to levels using the other scaling methods discussed in this article.

Mean absolute revisions to quarterly percent changes follow a pattern similar to that seen in the item-value-scaled mean revision analysis discussed in the preceding section. The revision to primary income receipts and payments tend to be larger than revisions to the other main components, and the revision to exports and imports of services tend to be larger than revisions to exports and imports of goods. The mean absolute revisions of the top-line aggregates (table 14, ITA table 1.2, lines 1 and 31) are similar in value to those of their components; this is in contrast to revisions to levels, where revisions to top-line aggregates were among the largest. This is because revisions to quarterly percent changes were mostly unaffected by the level shifts applied to these series in the 2014 restructuring that accompanied the inclusion of secondary income on a gross basis.

Directional reliability

Whether the first estimate correctly predicts the direction of movement of later estimates also sheds light on the reliability of the first estimate in describing an account's trend. As can be seen in table 15, the first estimates of key aggregates in the ITAs are consistent predictors of the quarterly movements in the third estimates and latest estimates. The first estimates of exports of goods and services and income receipts and imports of goods and services and income payments show quarterly growth or decline in agreement with the third and latest estimates more than 90 percent of the time. First estimates of directional change in trade in goods tend to be more reliable than in trade in services or in primary income transactions. First estimates of current-account credit categories perform similarly to their current-account debit counterparts.

As balances are subject to revisions to both of their contributing series, one might expect that these series would show less consistency. However, the first estimate of balance on the current account accurately predicted the third estimate's directional movement 94 percent of the time and the latest estimate's movement

87 percent of the time. Again, the first estimate of the balance on goods is more reliable than either the balance on services or the balance on incomes.

Capturing turning points

A turning point is defined as a quarter that shows an increase (or decrease) in series level following a quarter that showed a decrease (or increase). Table 16 shows the identification and misidentification of turning points by the first estimate, compared with turning points identified in the latest estimate. For the first estimate to appropriately capture turning points, it should identify the same turning points as the latest estimate without falsely identifying other turning points (false positives).

Turning points are more common in net accounts, that is, the series in the financial-account and current-account balances. All that is required for a turning

Table 15. Directional Reliability of the Quarterly Change of the First Estimate Compared with Third and Latest Estimates

Table 1.2 line	Series	Same quarter-to-quarter direction [percentage of quarters]	
		With third estimate	With latest estimate
	Current account		
1	Exports of goods and services and income receipts	93	93
2	Exports of goods and services	97	96
3	Goods	97	96
13	Services	84	82
23	Primary income receipts	87	85
31	Imports of goods and services and income payments	91	90
32	Imports of goods and services	99	96
33	Goods	97	94
42	Services	85	84
52	Primary income payments	87	85
	Capital account		
107	Balance on capital account	69	74
	Financial account		
61	Net U.S. acquisition of financial assets excluding financial derivatives	94	94
84	Net U.S. incurrence of liabilities excluding financial derivatives	91	87
	Balances		
101	Balance on current account	94	87
102	Balance on goods and services	88	87
103	Balance on goods	97	96
104	Balance on services	72	69
105	Balance on primary income	78	73
106	Balance on secondary income	82	79

Table 14. Mean Revisions and Mean Absolute Revisions of Quarterly Percent Changes From First Estimate to Third Estimate and Latest Estimate of Current-Account Components, 1999–2015

Table 1.2 line	Series	First to third revision		First to latest revision	
		Mean percentage points revision	Mean absolute percentage points revision	Mean percentage points revision	Mean absolute percentage points revision
1	Exports of goods and services and income receipts (credits)	0.00	0.57	0.18	0.88
2	Exports of goods and services	-0.07	0.50	0.04	0.69
3	Goods	-0.03	0.48	-0.04	0.70
13	Services	-0.16	1.13	0.20	1.48
23	Primary income receipts	0.16	1.46	0.45	2.27
31	Imports of goods and services and income payments (debits)	0.03	0.57	0.06	0.95
32	Imports of goods and services	-0.01	0.46	0.04	0.70
33	Goods	-0.02	0.51	0.01	0.66
42	Services	0.02	1.06	0.14	1.93
52	Primary income payments	0.19	2.54	-0.03	3.03

No first estimates were found to overshoot or undershoot the later estimate at the 5 percent significance level.

Table 16. First Estimate Matching of Turning Points in Latest Estimates, Number of Quarters, 1999–2015

Table 1.2 line	Series	In latest estimate								
		Nonturning point		Upward turning point			Downward turning point			
		First estimate shows:								
		Match	False positive ¹	Match	False negative ²	Downward turning point	Match	False negative ²	Upward turning point	
	Current account									
1	Exports of goods and services and income receipts (credits)	46	9	4	1	0	5	1	0	0
2	Exports of goods and services	52	3	4	1	0	6	0	0	0
3	Goods	51	4	5	0	0	5	1	0	0
13	Services	45	4	4	4	0	2	6	1	1
23	Primary income receipts	38	11	4	4	0	6	2	1	1
31	Imports of goods and services and income payments (debits)	45	6	5	2	0	4	3	1	1
32	Imports of goods and services	50	1	5	2	0	6	1	1	1
33	Goods	51	2	4	2	0	5	1	1	1
42	Services	40	7	5	4	0	1	8	1	1
52	Primary income payments	35	10	7	2	1	7	3	1	1
	Financial account									
61	Net U.S. acquisition of financial assets excluding financial derivatives	18	3	19	3	0	22	1	0	0
84	Net U.S. incurrence of liabilities excluding financial derivatives	11	10	20	2	0	21	2	0	0
	Current account balances									
101	Balance on current account	30	5	12	3	1	11	2	2	2
102	Balance on goods and services	31	6	10	4	1	7	6	1	1
103	Balance on goods	36	3	12	2	0	12	1	0	0
104	Balance on services	22	14	7	8	0	5	8	2	2
105	Balance on primary income	11	11	12	8	2	12	8	2	2
106	Balance on secondary income	21	7	14	4	1	14	4	1	1

1. A turning point in the first estimate but not the latest estimate.

2. A turning point in the latest estimate but not the first estimate.

point to occur for these accounts is a switch in terms of which of the two underlying components grows faster than the other (on an absolute, not a relative, basis). For accounts that are not measured on a net basis, a turning point occurs when one quarter's growth in transactions switches to a contraction, or vice versa.

Overall, the first estimate identifies most of the turning points in the latest estimate, especially for higher -level current-account aggregates. It identifies turning points for trade in goods more reliably, and with fewer false positives, than trade in services or primary income receipts and payments.

Note that false positives and false negatives can be temporally paired; if the first estimate for a series identifies a turning point one quarter earlier or later than the latest estimate, it will show one false positive and one false negative. Furthermore, the identification of a first estimate as a turning point also depends on second or third estimates of previous quarters, as both the current quarter change and the previous quarter change (and thus levels for the current and the two preceding quarters) must be known. Therefore, it is possible for the first estimate to show consecutive upward (or downward) turning points. This is impossible for the latest estimate as determination of turning points are based on a single vintage. Overall, there does not appear to be a tendency towards more false positives or false negatives. Furthermore, there does not appear to be a tendency towards more false negatives for upward turning points compared with downward turning points.

Recessions

During times of economic change, it is important that GDP and its major components—to which the ITAs contribute—quickly and reliably capture the changing economic landscape. From 1960 to 2015, the top-line current-account aggregates were moderately correlated with current-dollar GDP.³¹ For this time span, the correlation coefficient of quarterly percent change in exports of goods and services and income receipts with the quarterly percent change in current-dollar GDP is 0.37; for imports of goods and services and income payments, it is 0.38. During recessions identified by the National Bureau of Economic Research (NBER), the correlations rise to 0.55 and 0.50, respectively, indicating a stronger correspondence between the main current-account aggregates and current-dollar GDP during recessions than in other periods.³²

Even when current-account aggregates don't move in line with nominal GDP, the accuracy of current-account estimates is arguably of more consequence during recessions than during nonrecessions. Since 1999, the U.S. economy has experienced two recessions as identified by NBER. The recession in 2001 was more United States-centric, and the second recession, beginning in 2007, was more global in scope. In these two

31. The current-account aggregates are current-dollar measures and are thus compared with current-dollar GDP. GDP is usually reported and discussed in real terms, that is, removing the impact of price movements. GDP does not include the income accounts of the current account; only net exports (exports less imports) is a component of GDP.

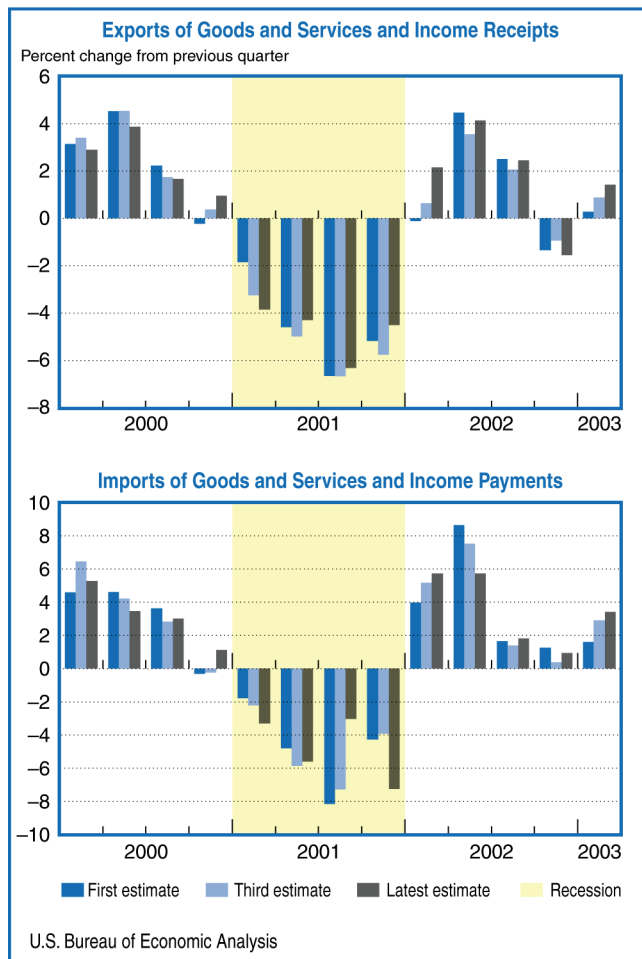
32. NBER identified 38 quarters in recessionary periods from 1960 to 2015.

recessions, both top-line aggregates in the current account (table 1.2, lines 1 and 31) declined in two or more successive quarters.³³ In both cases, the first estimate of exports of goods and services and income receipts and the first estimate of imports of goods and services and income payments were quick to identify turning points and reflected the general trend of the latest estimates.

For the 2001 recession, movement in the two primary current-account aggregates aligned with the movement of domestic economic activity; quarterly changes in (latest-vintage estimates of) both aggregates turned negative in the first quarter of the recession and changes in both turned positive in the quarter following the end of the recession. For current-account credits (that is, exports of goods and services and income receipts), the first, third, and latest estimates

33. Starting in the third quarter of 2014, the current-account aggregates also declined in several quarters. Although this has not been a recessionary period, the drops in the aggregates do appear to coincide with drops in the price of oil. During this period, first estimates generally matched those seen in the latest estimates.

Chart 7. Current-Account Aggregates, Quarterly Percent Change, 2001 Recession



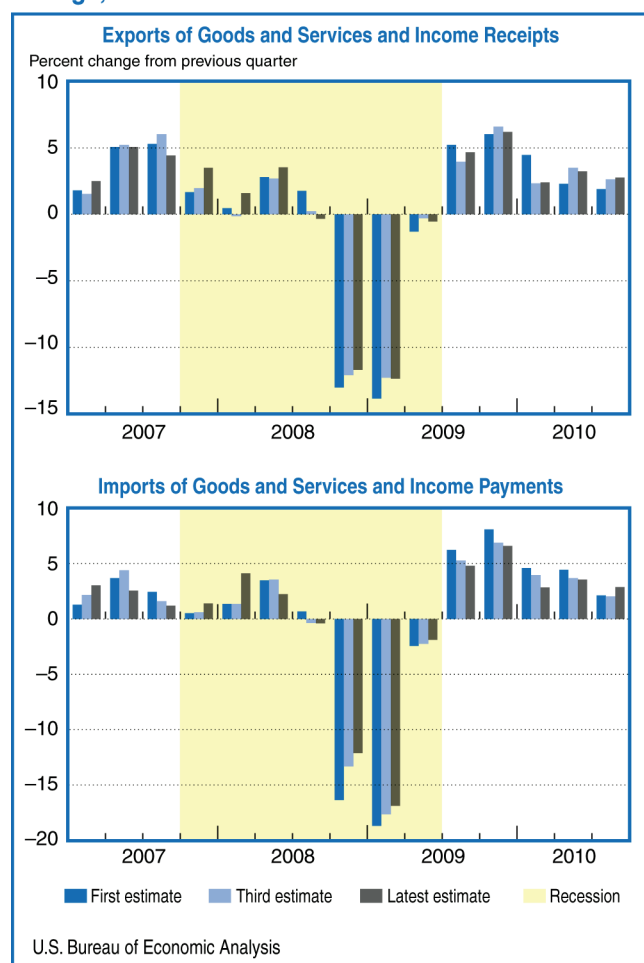
each peaked in growth rate during the second quarter of 2000 before slowing (chart 7, upper panel). The first estimate showed slightly negative growth one quarter earlier (fourth quarter of 2000) than the third and latest estimates (first quarter of 2001). The first, third, and latest estimates identify the same quarter (third quarter of 2001) as the period of steepest decline. The first estimate showed slightly negative growth in the first quarter of 2002, while the third and latest estimates identify this quarter as the period where positive growth resumes. The first, third, and latest estimates then identify peak growth occurring in the second quarter of 2002 before slowing and dipping into one quarter of negative growth (fourth quarter of 2002).

Similarly, first estimates of current-account debits (that is, imports of goods and services and income payments) identified similar trends as the third and latest estimates (chart 7, lower panel).³⁴ The first and third estimates showed a turn to slightly negative growth one quarter before the latest estimate (fourth quarter of 2000 rather than first quarter of 2001), and all three estimates identified the same quarter for the return to positive growth (first quarter of 2002). The first, third, and latest estimates all identify a sharp turnaround in the first quarter of 2002 and strong recovery in the second quarter of 2002 before showing growth rates slowing for the remainder of 2002. The first and third estimates identify the third quarter of 2001 as the period of steepest decline, while the latest estimate identifies the fourth quarter of 2001 as the period of steepest decline.

The first estimates also provided an early reflection of current-account changes during the 2008 global recession. The first estimate of both current-account credits and debits identified the same overall trend and similar magnitude of changes as the third and latest estimates (chart 8). For both series, the first estimate showed significant negative declines of over 10 percent in the same two quarters (fourth quarter of 2008 and first quarter of 2009) as the third and latest estimates and showed the same quarter as the return to recovery (third quarter of 2009). Notably, the first estimate not only identified the general direction of the trend, but it also reliably showed the extent of the deterioration in the current-account aggregates.

34. The story in this period is complicated by revisions to estimates after the third-estimate vintage that accompanied a methodological change in the 2003 annual revision. For detailed discussion, see Christopher L. Bach, "Annual Revision of the U.S. International Accounts, 1992-2002" SURVEY 83 (July 2003). The major source of revision was a methodological change to insurance services in which "normal" losses rather than actual losses were netted from premiums received. This change also affected the treatment of catastrophic losses, so quarterly changes for the third and fourth quarter of 2001 (reflecting the September 11 terrorist attacks) were sharply revised.

Chart 8. Current-Account Aggregates, Quarterly Percent Change, 2008 Recession



Seasonal Adjustment Revisions

Each June, as part of annual updates, seasonal factors—that is, factors that are applied to not seasonally adjusted quarterly estimates to generate seasonally adjusted estimates—are updated for the most recent years. Also, series that are not currently seasonally adjusted are examined to determine whether seasonal adjustment should be initiated. These updates and new adjustments are one source of the differences between the first and second estimates and the third estimates and between the third estimates and subsequent estimates. This section describes the extent to which revisions to seasonal factors affect revisions to the entire series.

In general, revisions to the seasonal factors have only a small impact on first-to-third revisions. Mean revisions of seasonal factors are essentially zero for all accounts,³⁵ and the mean absolute revisions of seasonal factors tend to be around one half of 1 percent (table 17). The seasonal factor revisions are at most on par with revisions to the not seasonally adjusted series, but are more often significantly smaller. Overall, the driving force of first-to-third revisions is not the revisions to the seasonal factors.

Seasonal factor updates can also be analyzed in the context of their impact on revisions to quarterly percent change. The importance of seasonal factor

35. As the seasonal adjustment process attempts to smooth seasonal movements within a year while holding the annual totals constant, it is expected that the mean revision to seasonal factors will always be close to zero.

Table 17. Contribution of Seasonal Adjustment Factors to Revisions of Quarterly Estimates, Item Value Scaling, 1999–2015

Table 1.2 line	Series	Mean percent revision			Mean absolute percent revision		
		Seasonally adjusted	Not seasonally adjusted	Seasonal factor	Seasonally adjusted	Not seasonally adjusted	Seasonal factor
First-to-third revision							
1	Exports of goods and services and income receipts (credits).....	0.71	0.74	-0.03	1.08	1.06	0.28
2	Exports of goods and services	0.21	0.23	-0.02	0.61	0.58	0.29
3	Goods	-0.01	0.03	-0.04	0.48	0.36	0.35
13	Services.....	0.75	0.73	0.02	1.76	1.82	0.45
23	Primary income receipts.....	2.11	2.16	-0.06	3.15	3.14	0.48
31	Imports of goods and services and income payments (debits).....	0.09	0.10	-0.01	0.78	0.73	0.28
32	Imports of goods and services	0.10	0.11	-0.01	0.50	0.37	0.31
33	Goods	0.07	0.08	-0.01	0.41	0.21	0.35
42	Services.....	0.33	0.32	0.01	2.03	2.04	0.46
52	Primary income payments.....	-0.10	-0.08	-0.01	3.30	3.32	0.41
First-to-latest revision							
1	Exports of goods and services and income receipts (credits).....	5.88	5.91	-0.03	5.88	5.91	0.38
2	Exports of goods and services	0.97	0.98	-0.02	1.05	1.03	0.35
3	Goods	1.19	1.23	-0.04	1.36	1.29	0.48
13	Services.....	0.40	0.37	0.02	2.93	3.06	0.70
23	Primary income receipts.....	7.80	7.85	-0.04	8.09	8.10	0.75
31	Imports of goods and services and income payments (debits).....	6.82	6.85	-0.02	6.84	6.86	0.35
32	Imports of goods and services	0.58	0.59	-0.01	0.80	0.70	0.39
33	Goods	0.64	0.66	-0.01	0.80	0.66	0.45
42	Services.....	0.30	0.27	0.04	2.99	3.02	0.52
52	Primary income payments.....	1.69	1.70	-0.01	4.71	4.75	0.51

NOTE. Excludes effect of 2014 comprehensive restructuring on first-to-third revisions.

Table 18. Contribution of Seasonal Adjustment Factors to Revisions of Quarterly Percent Change Estimates, 1999–2015

Table 1.2 line	Series	Mean absolute percentage points revision		
		Seasonally adjusted	Not seasonally adjusted	Seasonal factor
First-to-third revision				
1	Exports of goods and services and income receipts (credits)	0.57	0.46	0.39
2	Exports of goods and services	0.50	0.42	0.38
3	Goods	0.48	0.18	0.48
13	Services	1.13	1.34	0.63
23	Primary income receipts	1.46	1.30	0.77
31	Imports of goods and services and income payments (debits)	0.57	0.49	0.41
32	Imports of goods and services	0.46	0.24	0.44
33	Goods	0.51	0.16	0.51
42	Services	1.06	1.29	0.76
52	Primary income payments	2.54	2.59	0.68
First-to-latest revision				
1	Exports of goods and services and income receipts (credits)	0.88	0.61	0.54
2	Exports of goods and services	0.69	0.53	0.52
3	Goods	0.70	0.27	0.69
13	Services	1.48	1.80	1.21
23	Primary income receipts	2.27	1.93	1.10
31	Imports of goods and services and income payments (debits)	0.95	0.86	0.48
32	Imports of goods and services	0.70	0.35	0.57
33	Goods	0.66	0.17	0.66
42	Services	1.93	2.05	0.93
52	Primary income payments	3.03	2.90	0.77

NOTE: Excludes effect of 2014 comprehensive restructuring on first-to-third revisions.

revisions relative to the not seasonally adjusted series revisions increases when looking at revisions to the quarterly percent movements.³⁶ The mean absolute revision to quarterly percent change attributable to the seasonal factor varies less than proportionately with the mean absolute revision of the not seasonally adjusted series (table 18). In a series where mean absolute revisions to the not seasonally adjusted series are small, such as exports and imports of goods (0.18 percentage point and 0.16 percentage point, respectively), the seasonal factor revisions (0.48 percentage point and 0.51 percentage point, respectively) are larger than the revisions to the unadjusted series. Meanwhile, in a series where revisions to the unadjusted series are relatively large, such as primary income receipts and payments (1.30 percentage points and 2.59 percentage points, respectively), the mean absolute revisions due to seasonal factors are smaller (0.77 percentage point and 0.68 percentage point, respectively) than the revisions to the not seasonally adjusted series (though larger than the seasonal-factor revisions seen for trade in goods).

36. Unlike many revisions to not seasonally adjusted series, which often revise level estimates in adjacent periods by similar amounts, revisions to seasonal factors often revise level estimates in adjacent periods in different directions, thus magnifying the impact on percent changes.

In summary, revisions to the underlying not seasonally adjusted series are the more important factor for revisions to the level of the quarterly seasonally adjusted estimates. For quarterly percent changes, revisions to the seasonal factors are additionally important, especially for series that experience small revisions to the underlying not seasonally adjusted estimates. These findings reconcile previous, seemingly conflicting results on the importance of seasonal factor revisions to overall revisions to the seasonally adjusted series. Fixler, Grimm, and Lee found that “mean absolute revisions to seasonal factors are the principal determinants of the mean absolute revisions to seasonally adjusted estimates of exports and imports of goods and services” when studying revisions to growth rates.³⁷ Yorgason and Scott found “changes to seasonal factors are much less important than revisions to seasonally adjusted estimates for almost all [international transaction] accounts” when studying revisions to series levels.³⁸ Yorgason and Scott noted their different finding from that of Fixler, Grimm, and Lee and postulated that the differences were due to the type of revision studied (that is, quarterly percent changes versus series levels). The findings in this section confirm that seasonal factors play an important role in revisions to growth rates and are less influential on revisions to levels.

Analysis of the Statistical Discrepancy

At the conceptual level, any combined surplus or deficit from the current and capital accounts must be exactly accounted for in the financial account. If the U.S. residents import more goods and services than they export and the difference is not offset in capital transfers or other areas of the current account (primary and secondary income), the resulting deficit must be financed by borrowing (incurring liabilities) from foreign residents. In the current ITA table 1.2, net lending/borrowing from current- and capital-account transactions (line 108) should in principle, equal net lending/borrowing from financial account transactions (line 109). In practice, these two estimates are measured and calculated separately, differing in value by the statistical discrepancy.³⁹ In this table, the

37. Dennis J. Fixler, Bruce T. Grimm, and Anne E. Lee, “The Effects of Revisions to Seasonal Factors on Revisions to Seasonally Adjusted Estimates: The Case of Exports and Imports,” SURVEY 83 (December 2003), 43.

38. Yorgason and Scott, 96–97.

39. For more information, see *U.S. International Transactions Accounts: Concepts and Estimation Methods*.

statistical discrepancy (line 100) and the seasonal adjustment discrepancy (line 100a) are published.

This divergence between principle and practice is similar to one characterizing BEA’s featured aggregate measures of the domestic economy—GDP and gross domestic income (GDI). Like the two net borrowing measures, GDP and GDI are conceptually equivalent, but as a consequence of differences in surveying, measurement, and data availability, BEA’s estimates of these two measures differ.

Chart 9 plots the statistical discrepancy for BEA’s international transactions accounts from 1999 to 2015 after the 2016 annual revision. The statistical discrepancy is a nonseasonal series centered near zero that is more volatile than its seasonal adjustment discrepancy component. The seasonal adjustment discrepancy is calculated as the statistical discrepancy in the seasonally adjusted series less the statistical discrepancy in the not seasonally adjusted series. The seasonal adjustment discrepancy varies over a smaller range than the statistical discrepancy and has a highly seasonal pattern.⁴⁰

40. The series was tested with the U.S. Census Bureau’s X-13 software and found to be seasonal. It is not surprising to see a seasonal pattern in the seasonal adjustment discrepancy as the amount of seasonal adjustment differs between the two measures. The two major components in calculating net lending/borrowing in current- and capital-account transactions are mostly seasonally adjusted: 89 percent of the 2015 annual value of exports of goods and services and income receipts is seasonally adjusted, and 87 percent of imports of the value of goods and services and income payments is seasonally adjusted (the capital-account components are not seasonally adjusted but are very small compared with the current-account components). In the financial account, however, relatively few components are seasonally adjusted: in ITA table 1.2, only direct investment equity assets (line 63) and equity liabilities (line 86) are seasonally adjusted.

The mean quarterly statistical discrepancy from 1995 to 2015 is \$8.2 billion and the mean absolute statistical discrepancy is \$48.3 billion. For the seasonal adjustment discrepancy, the mean quarterly discrepancy is less than \$1 million and the mean absolute discrepancy is \$13.5 billion. Neither of the mean discrepancies is statistically different from zero at the 5 percent significance level.

The first estimate of the statistical discrepancy from 1999 to 2015 is presented in chart 10. The first estimate experiences extended periods where the statistical discrepancy is consistently positive, indicating that net lending calculated from financial-account transactions is greater (or less negative) than net lending calculated from current- and capital-account transactions. The mean of first estimates over the time span is \$23.4 billion and is statistically larger than zero at the 5 percent significance level. The mean absolute discrepancy is \$46.4 billion, slightly smaller than the mean absolute discrepancy in the latest estimate.

As discussed in the section on revisions to the current-account components, revisions to exports of goods and services and income receipts have tended to be positive and larger than revisions to imports of goods and services and income payments. As such, it is expected that net lending/borrowing calculated from capital- and current-account transactions would also be revised upward, thus leading to a reduction in the average statistical discrepancy. Indeed, the mean value of the third estimate of the statistical discrepancy declines to \$13.7 billion, and the mean value of the latest

Chart 9. Statistical Discrepancy, 1999–2015

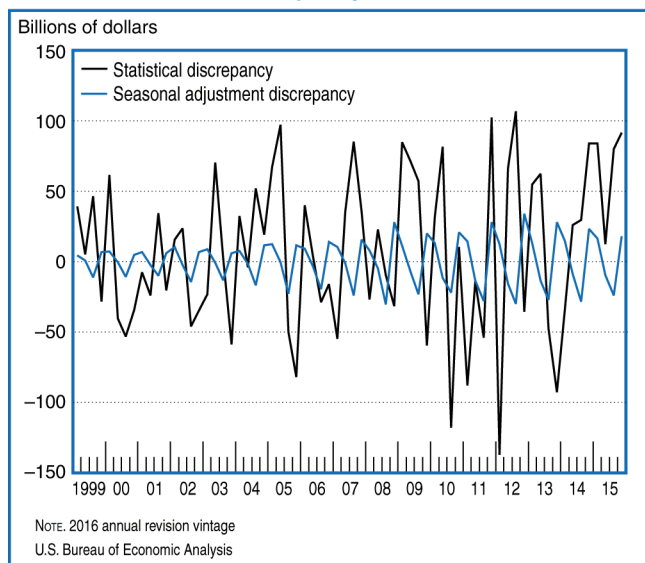
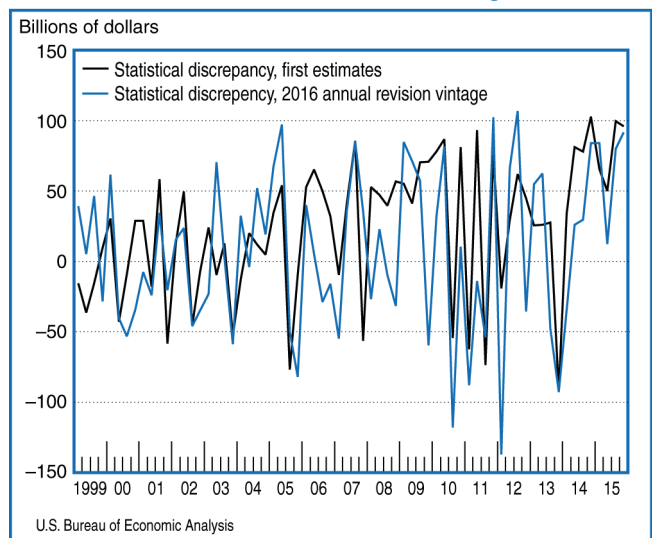


Chart 10. Statistical Discrepancy, 1999–2015, First Estimates and 2016 Annual Revision Vintage



estimate of the statistical discrepancy declines to \$8.2 billion (table 19). The mean value of the latest estimate is statistically smaller than the mean value of the first estimate at the 5 percent significance level, but differences between means of the first and third estimates and between those of the third and latest estimates are not statistically significant.

Table 19. Mean, Mean Absolute, Median, and Median Absolute Statistical Discrepancy of First, Third, and Latest Estimates, 1999–2015
[Billions of Dollars]

	First estimate	Third estimate	Latest estimate
Mean statistical discrepancy	23.4*	13.7*	8.2
Mean absolute statistical discrepancy.....	46.4	43.4	48.3
Median statistical discrepancy	29.6	18.4	11.2
Median absolute statistical discrepancy.....	46.3	42.4	40.1

*Statistically different from zero at the 5 percent significance level.

The mean absolute statistical discrepancy is more consistent across the vintages. While it declines slightly to \$43.4 billion from the first-to-third estimate, the mean absolute statistical discrepancy of the latest estimate is \$48.3 billion.

The median statistical discrepancy exhibits a similar pattern as the mean statistical discrepancy in that it declines from first-to-third and third-to-latest estimate. The median absolute statistical discrepancy also exhibits this declining pattern, but to a smaller degree than the mean discrepancy. The mean absolute discrepancy declines from \$46.3 billion to \$42.4 billion from first-to-third estimates and again to \$40.1 billion in the latest estimate.

Conclusion

This study presents an update to the ongoing examination of the revisions to BEA's international accounts es-

timates. Revisions tend to be small in magnitude, while early estimates for a few accounts indicate an undershooting of later estimates. In addition, first estimates normally show the correct direction of change. Revisions to key balances, such as the current-account balance and the trade balance, are broadly similar to those of their component accounts. The comprehensive restructuring in 2014 impacted the levels of several accounts but had little impact on quarterly changes. Most notably, the inclusion of secondary income on a gross basis with the restructuring had a large impact on the levels of the top-line current-account aggregates.

The size of revisions differs across accounts. Revisions to goods exports and goods imports are considerably smaller, for example, than revisions to services exports and services imports. Revisions to primary income receipts and payments tend to be the largest in the current account. Differences in the relative size of revisions across accounts can be largely explained by differences in the quality, timeliness, and variability of source data and by changes in the measurement of accounts over time.

BEA strives to ensure that its international accounts estimates are sufficiently timely to be relevant to policy and business decisions while presenting a comprehensive and accurate picture of interactions between the U.S. economy and the rest of the world. In large part, this involves efforts to improve source data coverage, both for the source data collected by BEA and in cooperation with partners such as the U.S. Census Bureau and Treasury International Capital system, for source data obtained externally. A primary focus of these efforts will continue to ensure that early estimates reflect the full range of relevant transactions.