

An Analysis of Revisions to BEA's International Economic Accounts

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Executive Summary

This article examines the accuracy of the international accounts estimates of the Bureau of Economic Analysis (BEA), primarily through an analysis of revisions to early vintage, 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 accurate 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 accuracy of the initial estimates. In this article, BEA's standard of accuracy hinges on these revisions; the standard of accuracy is met if the revisions do not substantively change BEA's measures of behavior and trends in key aggregates.

BEA's quarterly international transactions accounts (ITAs) are the primary focus of this study. 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 and the other international economic accounts provide policymakers, scholars, and the public with the most complete and detailed information on the nature and scope of these interactions. If BEA's standard of accuracy is met, policymakers and other users of these accounts will be able to rely on BEA's early estimates as accurate indicators of the state of the economy; policies will not necessarily need to be reconsidered in light of revisions to the accounts.

Major findings

Based on the analysis of revisions to the 1999–2011 quarterly ITA estimates, BEA's estimates do provide a

consistent and accurate picture of economic activity between U.S. residents and foreigners. Early estimates, which are available approximately 75 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.

Notwithstanding the strong overall performance of the ITA estimates, revisions of some accounts are larger than those of others. Among accounts with the largest revisions are income receipts and payments, particularly those related to direct investment. Among the other specific findings of this study are the following:

- More than 95 percent of first estimates of the current-account balance show the same direction of change as third estimates. First estimates also correctly identify 95 percent of third-estimate turning points.
- The component account making the largest contribution to quarter-to-quarter changes of major aggregates is the same for both first and third estimates in at least 75 percent of the estimates for each major aggregate.
- Revisions in the current account to quarterly estimates of exports of goods and services and to imports of goods and services are particularly small, at less than 1 percent of account value.
- The average revision to the current-account balance, relative to the sum of the credits and debits contributing to the balance, is less than one-half of 1 percent. For goods trade, whose sum of credits and debits constitutes approximately 60 percent of all credits and debits in the current account, the average revision of the balance is smaller still.
- The average revision to the current-account balance is less than 50 percent of the quarterly variability of the current-account balance.
- Revisions in the financial account are larger in dollar terms than those in the current account but are of similar magnitude relative to the quarterly variability of both of these accounts and of smaller magnitude relative to comparably scaled revisions in GDP.

Alexis N. Chaves contributed some calculations used in the preparation of this article.

- The range of revisions for international accounts outside the ITAs (the international investment position accounts and items from surveys of the operations of multinational companies) is similar, on a relative basis, to the range of current-account revisions in the ITAs. These accounts are annual accounts and, depending on account, are published approximately 6 months to 23 months after the end of the reference year.

Approach of study

The article primarily examines the size and pattern of revisions to quarterly estimates of the ITAs from 1999 onward. 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. Both means are based on revisions that have been scaled to enable comparisons over time, given that the ITA estimates are reported in current dollars and to enable comparison of revisions across accounts. Four scaling methods are used:

- Scaling by item value is the most intuitive scaling measure because it expresses revisions as percentages; it is used for revisions of current-account components.
- Scaling by the sum of unsigned components is a variation on scaling by item value that is well suited for revisions of net accounts, such as balances in the current account. Under this method, the trade balance, for example, is scaled by the sum of exports and imports.
- Scaling by trend quarter-to-quarter changes compares revisions to account changes rather than to account levels. This method is applied to more complex accounts—namely, net accounts for which available component detail is incomplete—such as those in the financial account.
- Scaling by trend gross domestic product, which allows for comparisons of dollar revisions across accounts while adjusting for economic growth and inflation.

In addition to analyzing mean revisions and mean absolute revisions of the accounts, the study examines the consistency across estimate vintages of qualitative patterns of change (turning points, acceleration/deceleration, and component account contributions to changes in an aggregate), trends in revisions, the impact of revisions to seasonal adjustment factors, and the correlation of same date revisions of different reference quarters' estimates.

The article secondarily examines mean revisions and mean absolute revisions for annual estimates from

1989 onward of two other types of international economic accounts: the international investment position accounts and the activities of multinational companies.

I. Introduction

The mission of the Bureau of Economic Analysis (BEA) is, in part, to promote “a better understanding of the U.S. economy by providing the most timely, relevant, and accurate economic accounts data.”¹ For most of its accounts, BEA produces several vintages of any given estimate. Early vintage estimates are necessarily more provisional and based on less complete source data than later vintage estimates. In spite of a largely unavoidable tradeoff between timeliness and accuracy, 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 international economic accounts estimates.

The international economic accounts published by BEA provide a broad and detailed look at transactions between U.S. residents and foreign residents and at other economic links between the United States and the rest of the world. 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 estimates of GDP and other NIPAs, and it recently published an article analyzing revisions to its estimates of state personal income, one of its regional economic accounts.² This article assesses the accuracy of the international economic accounts primarily by comprehensively analyzing revisions to these accounts.³

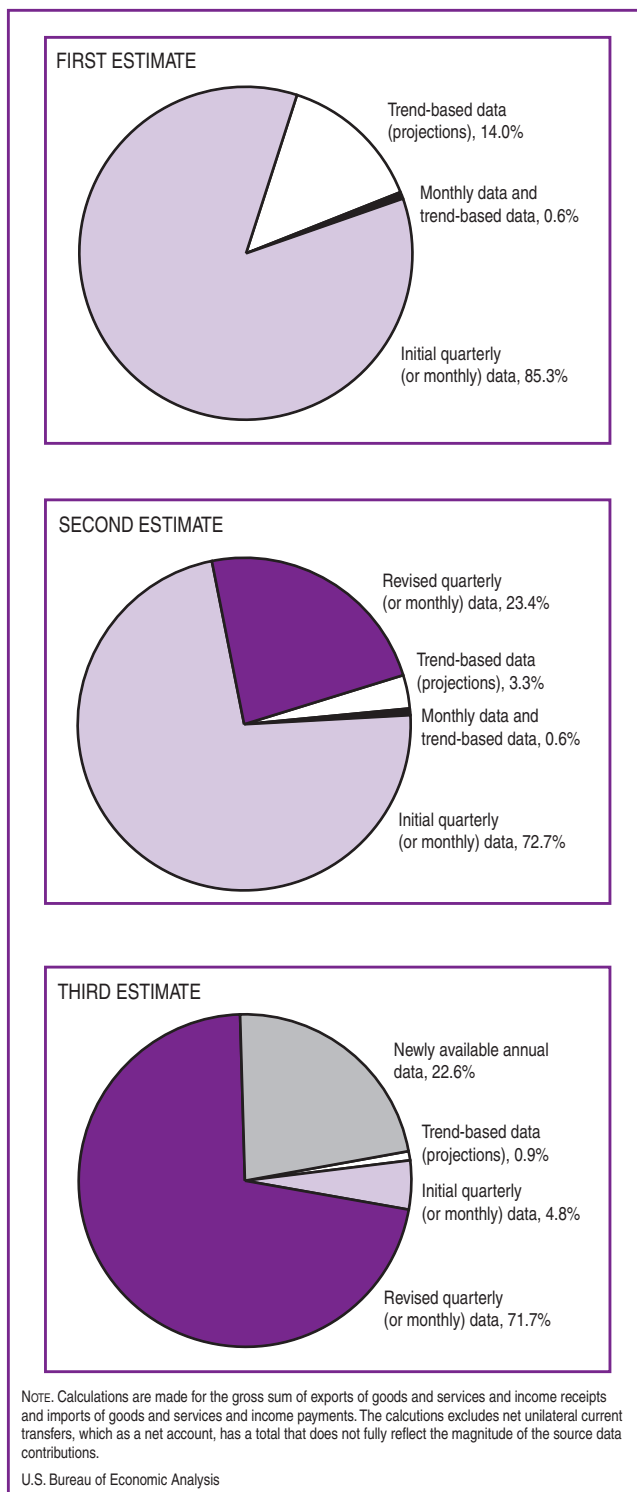
The U.S. international transactions accounts (ITAs) are an important and highly visible subset of BEA's international economic accounts.⁴ The ITAs are a quarterly and annual record of transactions between U.S. residents and the rest of the world, including trade in goods and services, income payments and receipts, and

1. See BEA's mission statement at www.bea.gov/about/mission.htm.

2. For the most recent analysis of the revisions of GDP and related accounts, see Dennis J. Fixler, Ryan Greenaway-McGrevy, and Bruce T. Grimm, “Revisions to GDP, GDI, and Their Major Components,” *SURVEY OF CURRENT BUSINESS* 91 (July 2011): 9–31. That 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): 243–266.

3. BEA periodically reports to the Office of Management and Budget on revisions to a limited set of international accounts statistics. This article extends those reports in several directions.

4. Another term by which the ITAs are known is the “balance of payments.”

Chart 1. Shares of Source Data for the Current Account

flows of financial and capital assets. They consist of 12 tables. Table 1 of the ITAs is entitled “U.S. International Transactions.” It provides an overview of all transactions in the ITAs. ITA tables 2–12 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 of the ITAs. The data periods primarily analyzed in examining the ITA estimates are the quarters of 1999–2011.⁵

In addition to the ITAs, the article examines revisions to the estimates of the international investment position (IIP) accounts—accounts that record end-of-year positions for U.S.-owned assets abroad and for foreign-owned assets in the United States. The article also examines revisions to estimates of the activities of U.S. multinational companies (MNCs) and U.S. affiliates of foreign MNCs with operations in the United States.⁶

In this article, revisions are analyzed in order to evaluate the accuracy of the international economic accounts estimates. A standard approach to assessing estimate accuracy is to analyze the errors associated with the estimation process. In general, however, the source data used to produce the international economic accounts 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” estimate. 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, approximately 15 percent of initial estimates are based on extrapolation of trends or on indicator series rather than on actual, contemporaneous source data (chart 1). In addition, although almost all of the remainder of the initial estimates are based on survey or administrative data, those data are often provisional and subject to change as reporting response rates improve, data editing becomes more complete, and data from monthly or quarterly surveys are supplemented by, or replaced with, data from annual surveys, which tend to collect data more extensively as well as have larger samples and 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 to the source data as previously missing information becomes available and as previously incorporated source data are revised. By the “annual revision” that occurs the following June, only about 1 percent of estimates are trend based; 94 percent are

5. The availability of ITA table 1 data in electronic form is the reason for focusing on the 1999–2011 time period.

6. The full set of U.S. international accounts includes other accounts whose revisions 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.

based on revised source data or on newly available annual data. BEA also makes other changes to its later vintage estimates, including occasional changes in classifications, definitions, and methodologies, to reflect the changing nature of available economic data and the changing nature of the economy itself.

The combination of circumstances just described makes measuring the accuracy of the BEA's international economic accounts estimates a challenge. 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. Information on the accuracy of early vintage estimates can, however, be garnered by examining magnitudes and patterns of differences between different vintages of the same estimate. This article assesses the accuracy of BEA's early estimates primarily by assessing the size and direction of revisions. In general, the smaller the revisions to key aggregates, balances, and other accounts, the more the early estimates present an accurate picture of trends and levels in transactions as well as expansions or contractions of U.S. participation in the international economy. Another way the accuracy of estimates is assessed is by 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.

While an analysis of revisions provides information on early estimate accuracy, that information is not necessarily definitive. Estimates can be revised for a number of different reasons, with different implications for the accuracy 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. 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 accurate. As demonstrated throughout this article, the magnitudes of revisions and 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. Charts 2 and 3, which look at the current-account balance, one of the most closely watched summary estimates in the ITAs, provide some initial evidence. These charts compare 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.⁷

The charts show that although the quarterly estimates for the current-account balance differ slightly in

7. Of the three estimate vintages shown in the charts, only one—the latest vintage—constitutes a data series published by BEA. The published data series includes the first estimate for the most recent quarter, second estimates for earlier quarters in the same year, third estimates for quarters of the prior year, and fourth and later estimates for earlier years. (This sequencing is discussed at greater length later on page 81.) The first estimate “series” in the charts is an amalgam that extracts a single quarter's estimate from every data release over the period at issue.

Chart 2. Three Vintages of Estimates of Current-Account Balance, 1989–1999

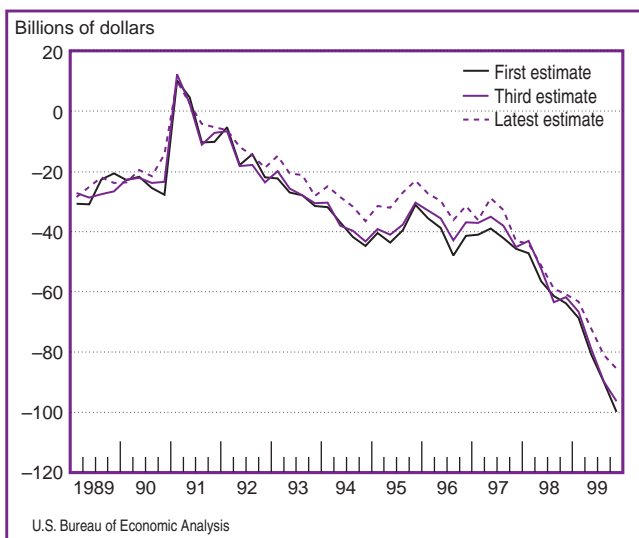


Chart 3. Three Vintages of Estimates of Current-Account Balance, 2000–2010

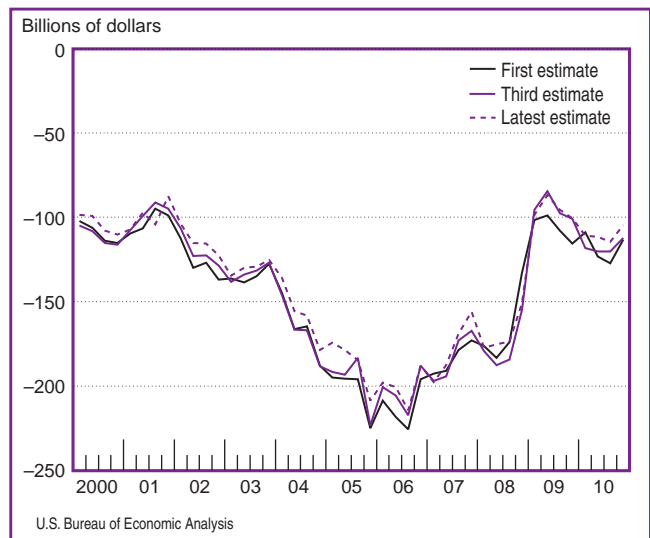
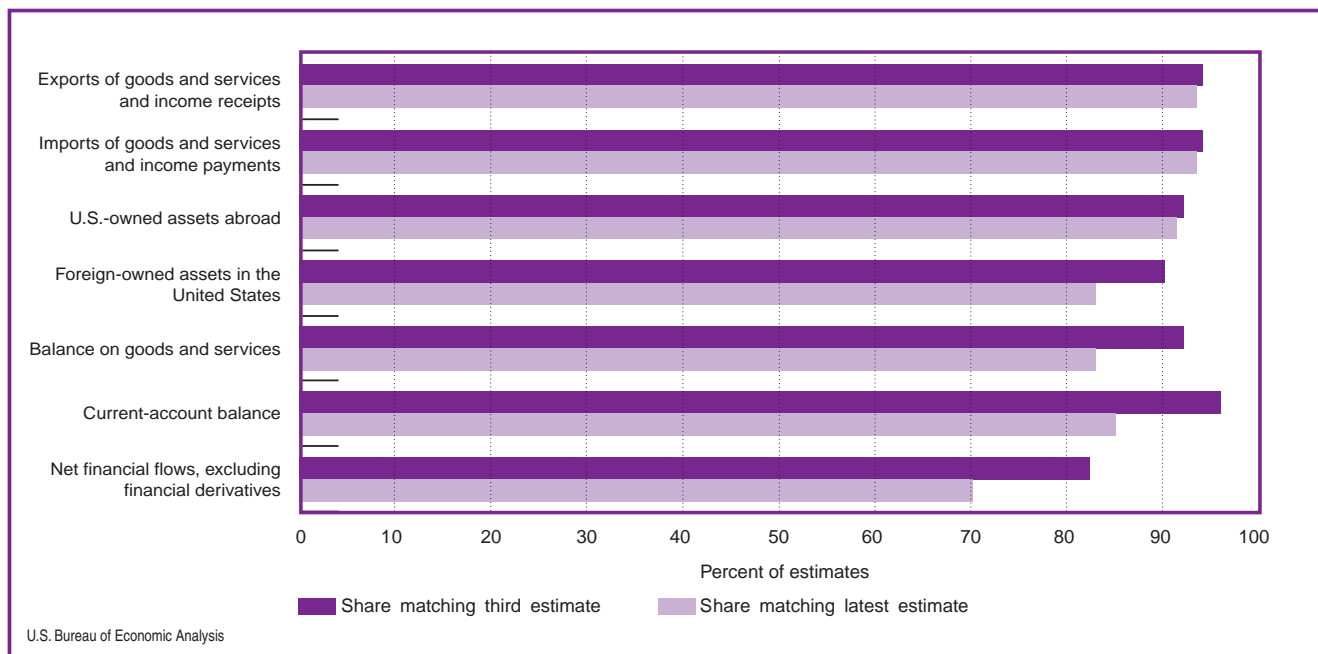


Chart 4. Share of First Estimates Matching Direction of Change of Later Estimates, 1999–2011

the three estimate vintages, all three capture the key trends and patterns in the current-account balance. For example, each vintage shows that in the first and second quarter of 1991, the balance briefly moved into surplus after being in deficit for the 2 previous years, only to fall back into deficit in the third quarter. Each vintage also shows the deficit increasing sharply starting in the first quarter of 1998 and again in the second quarter of 1999. Similarly, 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 shows a moderate reduction in the deficit through the middle of 2008 and a sharp reduction through the second quarter of 2009.

These charts also show that revisions in the current-account balance are also 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 \$5.3 billion, 61 percent of the average quarterly change of \$8.8 billion.⁸ The differences between the first estimates and the latest estimates are typically larger than those between the first and third estimates, reflecting in part the impact of changes in definition and methodologies that have been introduced over the years.

8. Absolute values of both revisions and quarterly changes are used in computing these averages. A later section of the article develops an alternative method for comparing revisions to quarterly changes. The alternative method is preferred because it accounts for economic growth and inflation. With the alternative method, current-account revisions average less than 50 percent of quarterly changes.

Chart 4 provides further evidence that early estimates present the same general picture of economic activity as later estimates. This chart provides directional accuracy measures for some key ITA accounts. 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 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. 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 as implied by the third estimates.

The remainder of the article presents a variety of other measures for gauging whether BEA's early vintage estimates accurately reflect its later vintage estimates. This issue is evaluated using a variety of statistical measures, including mean revisions and mean absolute revisions. Four versions of mean (scaled) revisions and mean absolute (scaled) revisions are used:

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

- 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 of 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 account changes rather than to 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.
- Scaling by trend gross domestic product is a method that does not provide an “apples-to-apples” comparison of accuracy in terms of item levels or changes across accounts. Rather, it allows for the dollar value of revisions to be compared across accounts while adjusting for economic growth and inflation.

Section II of the article provides information on the international accounts estimates examined in this article, focusing on data sources and the timing of the various estimate vintages. Section III presents the methodology used in the study, including revision definitions and the construction of different scaling methods. This section also discusses why the different scaling methods are used for different types of accounts. Section IV revisits the issue of directional matching at greater depth and examines which component account is the largest contributor to a quarterly increase or decrease in an aggregate estimate. Section V considers mean revisions and mean absolute revisions of the ITA estimates. Section VI analyzes other issues related to ITA revisions. Section VII examines revisions of non-ITA estimates. Finally, section VIII summarizes the findings of the article.

II. Sources, Timing, and Vintages of International Economic Accounts Estimates

This section provides an overview of some key international economic accounts. While the primary focus is on the ITAs, the international investment position accounts and estimates of activities of multinational companies are also briefly discussed. Topics include source data, estimate timing, and the estimate vintage nomenclature used later in the 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.

Quarterly ITA estimates

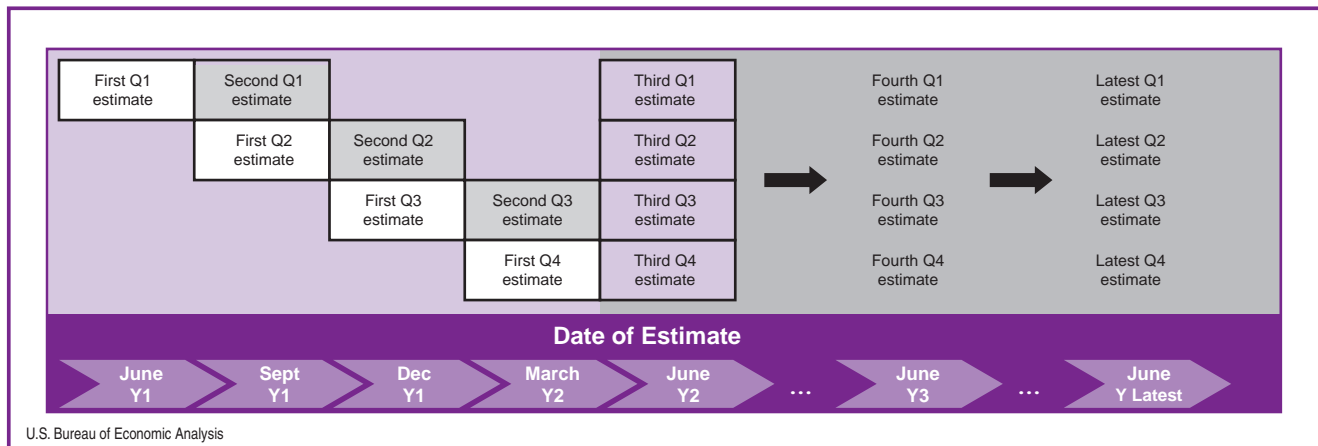
The ITAs are a comprehensive record of U.S. international transactions—that is, transactions between U.S. residents and foreign residents. They are divided into three major categories: the current account, the capital account, and the financial account. Broadly, the current account measures those international transactions 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 nonproduced nonfinancial assets, such as the purchase or sale of rights to natural resources, or that are considered 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.⁹ Of the three, current-account transactions and financial-account transactions are much larger in value than capital-account transactions.

BEA draws upon data from a variety of sources to produce estimates for the ITAs. Table 1 provides a list of several of the largest types of accounts in the ITAs and the sources used to produce estimates in those accounts.¹⁰ By value, roughly one-fifth to one-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 several types of trade in services are based on BEA surveys.¹¹ 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 example, for

9. 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 can be computed as the reversed-sign sum of net financial flows and the combined balance of the current and capital accounts. For a more complete description of the current account, capital account, financial account, and statistical discrepancy, see Christopher L. Bach, “A Guide to the U.S. International Transactions Accounts and the U.S. International Investment Position Accounts,” SURVEY 90 (February 2010): 33–51 and *U.S. International Transactions Accounts: Concepts and Estimation Methods* (Washington, DC: Bureau of Economic Analysis, June 2011).

10. See Christopher L. Bach, *U.S. International Transactions Accounts: Concepts and Estimation Methods* (Washington, DC: Bureau of Economic Analysis, June 2011) for more information on source data.

11. These surveys are mandatory for respondents. BEA also conducts a relatively small voluntary survey on institutional remittances. These data are used in producing estimates of net unilateral current transfers, an account not shown in table 1.

Chart 5. Timeline of Quarterly ITA Estimate Vintages

the goods trade accounts) and the Federal Reserve Board (used, for example, for the financial-account transactions reported by nonbanks), and mandatory surveys conducted by other government agencies, such as the U.S. Treasury Department (used, for example, for “other” private investment income accounts and much of the financial account). 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 revised for each of several estimate vintages. The evolution of ITA estimate vintages is shown in chart 5. BEA prepares an ongoing series of estimates for the transactions covered by the ITAs; each supersedes the most recent previous estimate. For every one of the accounts in the ITAs, an initial estimate—the “first” estimate—is released approximately 75 days after the end of the reference quarter. First estimates include projections for accounts for which source data are not yet available. For instance, first estimates of royalties and license fees received and paid are based on projections, as data from BEA’s quarterly survey of services are not yet available. Even for cases in which complete or near complete source data are available, the extent to which BEA relies on these source data in the first estimates varies. For most of the goods trade data, for instance, BEA’s estimates closely mirror the source data from the Census Bureau. For transactions in securities, on the other hand, experience has shown that exclusive reliance on source data can lead to large revisions. Therefore, some judgmental and other adjustments are made to produce a first estimate that better anticipates the later estimates.

Source data may arrive too late to be included in a first estimate and are commonly revised or updated. Therefore, a revised estimate—the “second” esti-

mate—for that quarter’s transactions is released 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.”¹² Both the third estimate and the latest estimate are released in the June “annual” revisions.¹³ BEA incorporates updated quarterly source data and new annual surveys, as well as data from new sources in preparing revisions. Frequently, annual revisions incorporate results from benchmark surveys. Benchmark surveys, which are normally conducted very 5 years, are more comprehensive and complete than quarterly or annual surveys and allow for more robust evaluation of the internal consistency of individual reports. Previous results from higher frequency surveys are reconciled with the benchmark results or revised as needed.

In addition, BEA may introduce new methodologies, definitions, classifications, or tabular presentations in the yearly annual revisions of the ITAs. The results of any such improvements are incorporated into estimates for earlier time periods to maintain series consistency. The time periods covered by annual

12. Because past publications had little need to distinguish estimate vintages in the manner done here, this terminology—first, second, third, latest—is not used by BEA in other articles discussing the ITAs. To the extent that it is useful in other articles to discuss vintages, the terms “preliminary,” “previously published,” and “revised” are used descriptively, as in “estimates are preliminary” (referring—mostly—to the first estimates) or “previously published estimates have been revised” (referring to any estimate past the first).

13. Each year, an article in the July *SURVEY* discusses the results of the June revisions. For the most recent article, see Jeffrey R. Bogen and Jessica M. Hanson, “Annual Revision of the U.S. International Transactions Accounts,” *SURVEY* 92 (July 2012), 35–46.

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 Export 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 services					
Traveler arrival and departure data, U.S. Customs and Border Protection; Statistics Canada and Bank of Mexico	Most source data available; trend-based projections otherwise	Additional and revised source data	Revised source data	Revised source data	Revised source data if available
Other transportation services					
Four BEA surveys; U.S. Census Bureau; U.S. Army Corps of Engineers	Most source data available; trend-based projections otherwise	Revised source data	Nearly all source data available; some revised data	Revised source data if available	Revised source data if available
Royalties and license fees; "other" private services					
BEA's quarterly and benchmark surveys of services	Trend-based projections	Some survey data available	Additional and revised survey data	Revised survey data	Revised survey data
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
Other private investment income					
Treasury Department monthly, annual, and benchmark surveys; representative yields; Federal Reserve; foreign central banks	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	Source data reconciled with benchmark survey data
Primary data sources	Financial account				
	First estimate	Second estimate	Third estimate	Fourth estimate	Later estimates
Direct investment					
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
Transactions in U.S. Treasury securities					
Treasury International Capital S and BL-2 forms	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	
Transactions in long-term securities other than U.S. Treasury securities					
Treasury International Capital S form (monthly) and related annual and benchmark surveys	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	
Transactions reported by U.S. nonbanks					
Treasury and BEA surveys; Depository Trust Corporation records; Federal Reserve; Bank of International Settlements; 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
Transactions reported by U.S. banks and securities brokers					
Treasury International Capital BC, BL, and BQ forms	Source data fully available	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.

revisions depend, in part, on the nature of the revisions and the availability of source data.

There are differences in source data availability and timing. For some accounts, source data are quickly finalized; for others, source data continue to be revised and improved over several years. For exports and imports of goods, BEA's first estimates are based primarily on revised monthly data received from the U.S. Census Bureau. These data are, in turn, compiled from legally mandated, nonsurvey documents submitted to the Census Bureau or the U.S. Customs authorities with almost every shipment of merchandise, except those of very low values.¹⁴ BEA makes some minor adjustments to these primary source data to put the data on a "balance of payments" basis.¹⁵ Revisions to data from the Census Bureau are not available until BEA's third estimate (the annual revision); any revisions incorporated in the second estimate are due to revisions to BEA's adjustments. After the third estimate, there are generally no further revisions to the source data from the Census Bureau.

For exports and imports of services, source data availability at the time of the first estimate is much less complete even though data availability for services has improved in recent years. Following its 2006 benchmark survey of international services, BEA implemented a quarterly follow-on survey for transactions in all types of services covered by the benchmark survey. Previously, annual surveys had been the primary source for some of the estimates of quarterly services trade. The quarterly surveys allow for a better representation of the quarter-to-quarter changes in services trade, but these data do not begin to become available for estimation purposes until the second or third estimate. Thus, the first estimate must be prepared using projections. Past the third estimate, source data do become more complete over time in some accounts, so revisions continue to be made.

Outside of data for trade in services, the other main type of data collected directly by BEA is data on direct investment income and financial flows. In contrast to

data from BEA's services trade surveys, source data on direct investment are available for, and used in, the first ITA estimate. However, by the time of the first estimates, survey reports received by BEA often represent less than half of the population of direct investment (in terms of account totals). BEA's second estimates of direct investment income and financial flows are based on an increase of approximately 20 percent in the availability of reported survey data, and the third estimates are based on another increase of approximately 10 percent in data availability. Smaller increments of source data availability are incorporated in later vintages. Results of benchmark surveys of direct investment, conducted every 5 years, are utilized when available. These surveys have lower reporting thresholds, higher response rates, and more complete data on income, balance sheets, and other aspects of direct investment.

BEA's first estimates of direct investment income and financial flows are constructed in large part by calculating growth rates for companies that have provided prompt survey responses and applying those rates to nonresponders. In doing so, BEA endeavors to apply growth rates conservatively; entry of new companies into the universe is not assumed, and outliers are dropped when applying growth rates to nonresponders.

For a large portion of the source data received from the Treasury International Capital (TIC) system for use in BEA's financial-accounts estimates and in its estimates of "other" private investment income, revisions can be considerable and can occur for several years. For instance, BEA's first estimates of securities transactions are based on monthly surveys of transactions conducted by the Treasury Department's TIC system. The surveys have a relatively small number of respondents, high reporting thresholds, and allow for the consolidation of transactions from a number of different transactors on a single report. These source data are revised for BEA's second estimate. For BEA's third estimate, data on securities positions are available from a separate TIC survey. These positions data are reconciled with revised transactions data, a process that can generate substantial revisions to BEA's accounts.

As noted, for several accounts, the earliest available source data are ultimately reconciled with, or replaced by, results from benchmark surveys. These benchmark surveys are conducted approximately every 5 years but occur in different years for different accounts. The lack of synchronicity means that the incorporation of results from benchmarks does not necessarily have a strong impact for the most aggregate accounts. At more

14. In other words, the source data are based on reports covering nearly the entire "universe" of trade in goods.

15. These adjustments are procedures used to bring the coverage and valuation of the Census Bureau goods trade data into conformity with the concepts and definitions used to prepare the international and national economic accounts. Broadly, these adjustments are necessary (1) to supplement coverage of the Census basis data, (2) to eliminate duplication of transactions recorded elsewhere in the international accounts, (3) to value transactions according to standard definitions, and (4) to include certain changes in ownership that occur without goods crossing the customs boundary of the United States.

disaggregated levels, however, the incorporation of benchmark results can have a significant impact on later vintage estimates and even on vintages as early as the third estimate, as the results of the benchmark survey are spread forward in time.

A framework of four estimate vintages—first, second, third, and latest—is used in this article to provide structure to the analysis of the revisions of the quarterly ITA estimates.¹⁶ Although this does not completely consider all of the estimates and ignores some irregularly timed revisions, it captures most of the key features of BEA's estimate/revision release schedule.¹⁷

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 of those transactions 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.

Because there are several vintages of each estimate, there is a large number of implicitly defined revisions. For instance, the first estimate could be compared to the second estimate, the third estimate, or the latest estimate to define three different revisions. Similarly, the second estimate could be compared to the third estimate or the latest estimate to define two more revisions. This article focuses primarily on the first-to-third revision—that is, the difference between the third estimate and the first estimate. As noted earlier, the third estimate is released anywhere from one to four quarters after the release of the first estimate. The 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 foci, the article includes a brief analysis of the more complete roster of revisions.

International investment position (IIP) estimates

Unlike the ITAs, which measure transaction *flows* between the United States and foreign countries, the IIP accounts measure *stocks*. In particular, they measure the value of U.S.-owned assets abroad and the value of foreign-owned assets in the United States.

Much of the source data for the IIP accounts are the same as the source data used to construct the financial account of the ITAs. In fact, nearly every *stock* (or “position”) line in table 2 of the IIP accounts has a counterpart *flow* line in the financial account in table 1 of the ITAs.¹⁸ However, the IIP accounts also rely on data on prices and exchange rates that are not used for the ITAs.

Historically, the IIP accounts have been released once a year, in June.¹⁹ The first estimate of outstanding positions of claims and liabilities as of December 31 of the reference year is made in June of the following year. The second estimate is made in the June that falls 2 years after the reference year. Each year another estimate is (potentially) released.²⁰ In this article, the focus is only on the first-to-second revision—that is, on the difference between the second estimate released in June 2 years after the reference year and the first estimate released 1 year prior.²¹

16. Three technical issues deserve mention. First, there may be fourth, fifth, sixth, and so on estimates made prior to the latest estimate. For the most part, these intervening estimates are unexamined in this article. This article also ignores the rare and irregular estimates that can be made between the second estimate (the quarter after the first estimate) and the third estimate (June following the reference year), or between third and fourth estimates, between fourth and fifth estimates, and so on. Finally, the article ignores the fact that estimates for some accounts change slightly in the March release following the reference year to force quarterly seasonally adjusted estimates to add to annual totals.

17. To avoid internal inconsistency, one slight modification to the identification of vintages is made. In the approach described, the second estimate of fourth-quarter transactions occurs at the same time as the third estimate of those transactions (in June following the reference year). To avoid one in four second estimates exactly matching the associated third estimates, the third estimate is given precedence. For this case, there is a “second” estimate for first-, second-, and third-quarter transactions, but the “second” estimate is undefined for fourth-quarter transactions. The preference given the third estimate is not arbitrary, as this means that all third estimates, but no second estimates, are associated with the June annual ITA revisions. The June revisions generally incorporate more complete and accurate source data than the second estimates, incorporate updates to seasonal adjustment factors, and reflect changes that are not applied in second estimates for other quarters.

18. One ITA flow account—“financial derivatives, net”—is related to the financial derivatives asset position, the financial derivatives liability position, and the net financial derivatives position in the IIP accounts. In addition, for direct investment positions, there are two different valuations (each for both inward investment and outward investment) shown in the IIPs, but only one of these valuations corresponds to the flows shown in the ITAs.

19. This will change in March 2013. At that time, BEA will introduce quarterly IIP estimates. For additional information, see Kristy L. Howell, “Modernizing and Enhancing BEA's International Economic Accounts: A Progress Report,” *SURVEY* 92 (May 2012): 37–50.

20. As with the ITAs, most June releases present revised estimates only for those years for which revisions are relevant.

21. Researchers at the Board of Governors of the Federal Reserve System have investigated some of the implications of longer-horizon revisions on the net international investment position. The contrast between long-horizon revisions to this position and long-horizon revisions to annual net financial flows in the ITAs is emphasized in Stephanie E. Curcuru, Tomas Dvorak, and Francis E. Warnock, “Cross-Border Returns Differentials,” *The Quarterly Journal of Economics* 123, No. 4 (2008): 1495–1530. Specifically, the former revisions have historically been much larger than the latter. This contrast is also discussed in Stephanie E. Curcuru, Charles P. Thomas, Francis E. Warnock, “Current Account Sustainability and Relative Reliability,” *International Finance Papers* 947 (September 2008), along with the reliability (in a broad sense) of investment income estimates in the ITAs relative to that of IIP estimates.

Estimates of activities of multinational companies (MNCs)

As already noted, BEA directly collects data on direct investment income and financial flows that are used in the ITAs and the IIP accounts. Associated with this survey program, BEA also collects data on the activities of those entities involved in direct investment relationships: MNCs.²² Unlike the surveys on direct investment income and financial flows, the scope of these surveys is not confined to transactions between parent company and affiliates. Rather, it ranges across a broad selection of activities and financial indicators such as employment, sales, profits, international trade, research and development, and balance sheet items.

Surveys on the activities of MNCs are conducted on an annual basis, and preliminary estimates are generally released 19–23 months after the end of the reference year. Except in rare circumstances, the estimates are only revised once; revised estimates are released 1 year after the preliminary estimates. Estimates are published for three types of entities associated with direct investment to or from the United States: U.S. parent companies, foreign affiliates of U.S. parent companies, and U.S. affiliates of foreign parent companies.

III. Methodology

This section provides an overview of the definitions and formulas used in the article. The chief goal is to describe various methods used to calculate the mean revisions (MRs) and mean absolute revisions (MARs). In calculating these measures, scaled revisions are used, but the suitability of the scaling methods differs by account type and the objective of the analysis. In all, four different scaling methods are presented: scaling by item values, scaling by the sum of unsigned components, scaling by trend quarter-to-quarter absolute changes, and scaling by trend GDP.²³ An algebraic representation

22. A 10 percent ownership stake by an entity in one country of an entity in another is the threshold used to distinguish a direct investor from a portfolio investor. In surveys of activities of MNCs, special attention is given to situations where the ownership stake exceeds 50 percent, that is, majority ownership.

23. The European Central Bank (ECB) regularly publishes reliability analyses of the balance of payments accounts and IIP accounts estimates for the euro area; for the most recent analysis, see European Central Bank, "Euro Area Balance of Payments and International Investment Position Statistics: 2011 Quality Report," (March 2012). Although much of the approach taken in those analyses is similar to the one taken here, different terminologies are used. For instance, the term MAR is not used at all. Instead, MARs associated with each different scaling method are given unique names. MARs for revisions scaled by item values are called mean absolute percentage errors and MARs for revisions similar to ones scaled by trend quarter-to-quarter absolute changes are called mean absolute relative errors. The ECB also use one measure with no counterpart here—the "mean absolute comparative error". That measure scales revisions for the financial accounts in the balance of payments by the corresponding positions in the IIP.

of an unscaled revision is presented first, followed by a discussion of scaling in general terms, definitions of MRs and MARs, and finally, a presentation of the scaling methods.

Revisions and average revisions

A revision is the difference between a later vintage estimate and an earlier-vintage estimate. Published ITA estimates are expressed in current-dollar levels. For an estimate expressed as a level, as opposed to one expressed as a growth rate as would be common for GDP and the other NIPA accounts,²⁴ 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 which the estimate applies, 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 overall size and direction of revisions. The first, the average of the revisions for some account over a given period, is called the mean revision (MR). For a scaled revision, $R_t^{e,l}$, the MR 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.²⁵ The MR indicates whether revisions are generally positive or negative. A positive MR means that the earlier estimates generally understate the later estimates; a negative MR means that the earlier estimates generally overstate the later estimates. A near-zero MR suggests either that early estimates are quite close to later estimates or that early-estimate overstatements and understatements largely offset one another.

Because revisions can be positive or negative, they may be offsetting. Therefore, it is also useful to look at

24. BEA's previous revision studies have focused primarily on revisions to growth rates. Growth rate revisions are not examined in this article, both because ITA estimates are not generally presented in terms of growth rates and because growth rates are not meaningful when levels are close to zero or switch signs, as is the case, either in potential or practice, for several of the ITAs.

25. The next subsection will cover scaling methods.

the mean absolute revision (MAR), which is the average of the absolute value of the revisions over a given period:

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

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

Revision scaling methods

Analyzing revisions to current-dollar estimates raises two related difficulties. First, current-dollar estimates tend to increase over time due to economic growth and inflation. This gives undue weight to revisions for later periods if they are compared with revisions for earlier periods—as would occur if the earlier- and later-period current-dollar revisions were to be averaged. Second, it would be misleading to compare current-dollar revisions from one account with those of another account because one of the accounts may be much larger than another. A current-dollar revision that is relatively small for a larger account may be quite large for a smaller account. For example, in the current account of the ITAs, imports of goods are about three times as large as income payments. A \$1 billion revision to income payments would be proportionately larger and more significant than a \$1 billion revision to imports of goods.

Scaling resolves both of these difficulties. The appropriate scaling method can remove the effects of growth and inflation, and it can make revisions from two different accounts comparable. All of the revisions considered in this article are scaled revisions. 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.

The purpose of scaling is twofold: to create a consistent standard over time and to aid in comparing revisions across accounts. In large part, the usefulness of a scaling term can be judged by the following criteria:

- (1) Does the scaling term grow over time with the account transactions?
- (2) How well known and understood is the scaling term?
- (3) Is the time series of the scaling term relatively smooth?

If the answer to 1) is yes, the use of the scaling term will counteract the effects of economic growth and inflation that would otherwise cause later observations to be weighted more heavily in the calculation of means. For 2), the better known and understood the scaling term, the easier it will be to interpret MRs and MARs. For 3), smoothness in the series of scaling terms helps to ensure that pattern of change in the time series of scaled revisions primarily reflects the pattern of change in the time series of unscaled revisions.²⁶

In many cases, there is a tradeoff among these criteria. A scaling method may do well on one criterion but not so well on another.

A fourth criterion relates to whether:

- 4a) differences in the size of scaled revisions across accounts indicate differences in accuracy, or whether
- 4b) differences in the size of scaled revisions across accounts reflect differences in the size of dollar revisions.

Scaling by item values

Of the four different scaling methods used in this article, one stands out for its intuitiveness and simplicity: scaling by the value of the estimate itself. This is the first scaling method used in this study. Under this “item value” scaling method, the revision is expressed as a percentage of the earlier-vintage estimate. The scaling term for this scaling method (denoted by iv) is

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

26. In addition, smoothness in the scaling term can be viewed as a judicious precaution. To the extent that the ideal scaling term is unknown, smoothness at least serves to prevent the choice of a suboptimal scaling term from generating substantial idiosyncrasies in the series of scaled revisions.

For example, if exports of goods are revised from \$100 billion to \$104 billion, the scaled revision is 4 percent.

The use of this scaling method is most appropriate when account size and revision size are expected to be directly correlated. For accounts with such properties, item value scaling does very well on criteria (1), (2), and (4a) but, depending on the volatility of the series, may not do so well on criterion (3).

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, except 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. 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. MRs and MARs constructed using this method are quantitatively comparable to item value scaled MRs and MARs. Thus it is meaningful to compare numerically, for instance, the item-value-scaled MAR of exports to the MAR of the trade balance scaled by the sum of its unsigned components. Like item value scaling, scaling by the sum of unsigned components does very well on criteria (1), (2), and (4a) but may or may not do well on criterion (3), depending on the volatility of the unsigned sum.

Scaling by trend quarter-to-quarter absolute changes

Because some accounts in the ITAs are net accounts whose components are unmeasured (or not fully measured), item value scaling is not appropriate. Moreover, because components are unmeasured, scaling by the sum of unsigned components is infeasible. Chief among the accounts with these characteristics are financial accounts, though net unilateral current transfers in the current account and the capital account also share these characteristics.²⁷ 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 already discussed 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.²⁸

Because quarter-to-quarter changes can be either positive or negative, the 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 (criterion 3), and one that is not liable to become vanishingly small, some sort of measure of the typical change is required.

27. For instance, net flows for some of the financial accounts are estimated by subtracting a beginning-of-period balance from an end-of-period balance; an example is “U.S. claims on unaffiliated foreigners reported by U.S. non-banking concerns”—ITA table 1, line 54. For such accounts, neither gross outflows nor gross inflows—the terms required to compute the sum of unsigned components—are observed. Similarly, gross transaction detail is lacking at the ITA table 1 level of detail for most accounts in the financial account. (Two relatively small accounts—line 47, “U.S. credits and other long-term assets” and line 48, “Repayments on U.S. credits and other long-term assets”—are exceptions.) There may be some accounts for which the requisite gross transactions detail is available in other ITA tables or in the underlying source data, but, for uniformity, these data are not utilized in this article.

28. A simpler alternative to using typical quarter-to-quarter changes as the scaling term would be to use actual quarter-to-quarter changes in account values. However, this approach suffers from the same limitation as item-value scaling: the changes change signs and can be arbitrarily close to zero. This approach could be modified by taking absolute values to resolve the problem of switching signs and by taking the average to resolve the problem of any individual change being near zero. Small revisions relative to the resulting average period-to-period changes would provide evidence that the initial estimate of period-to-period changes reflects actual economic activity rather than estimation error. However, scaling each revision by a whole-period average of absolute changes ignores the impact of inflation and general economic growth.

If a series does not tend to grow over time, a simple average of these absolute changes would suffice. However, most of the series examined in this article grow over time, so trend values of the absolute changes are used instead.²⁹ Specifically, individual scaling terms for each observation (quarter) are generated using the Hodrick-Prescott filter, with the smoothing parameter set to 1,600.³⁰

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, MRs and MARs obtained using this method are not quantitatively comparable to those obtained using the prior two methods.

Scaling by trend GDP

To meet criterion (4b), this scaling method uses a common scaling term for every account rather than an account-specific term. The scaling term is the trend value of current-dollar GDP. GDP is used here to satisfy criterion (2); it is widely known and understood and it facilitates easy interpretation. Using the trend value rather than GDP itself helps to satisfy criterion (3), as the trend is smoother than the actual values. As with the previous method, the trend is extracted by an application of the Hodrick-Prescott filter, with smoothing parameter set to 1,600, to the latest vintage of estimates:

$$S_{gdp,t}^{e,l} = trend\{Y_t^L\}$$

where Y_t^L is a representative member of the current-dollar GDP series.

Like scaling by trend quarter-to-quarter absolute changes, scaling by trend GDP can be applied to any

account. However, unlike that method, and unlike the other two methods used in this article, comparing MRs and MARs of one account to those of another does not indicate whether one account's early estimates are more accurate than the other. Rather, it indicates which account's dollar revisions tend to be larger than the other criterion (4b).

The following summarizes the 4 scaling methods and how they are used in this article.

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; international investment position accounts; multinational company activities
Sum of unsigned components	Net accounts that measure differences in measured transactions	Most current-account balances
Trend quarter-to-quarter absolute changes	Net accounts that measure differences in unmeasured transactions	Financial account; net unilateral current transfers; capital account; and key current-account aggregates for comparison
Trend gross domestic product	All accounts	All accounts

IV. Directional Measures and Contributions to Growth

Chart 4 showed that in most cases, first estimates of key accounts in the ITAs match later estimates in terms of the quarter-to-quarter direction of change. In this section, matching of directional changes is examined at greater length. Table 2 expands in three ways on the frequency shares shown in the chart for comparisons of the first estimate with the third estimate. First, it presents several more accounts than shown in the chart. Second, it decomposes the matches and non-matches. Third, it examines a related phenomenon: acceleration/deceleration.

The first column of table 2 presents the frequency with which the first ITA estimates show the same direction of change as the third estimates.³¹ In the vast majority of cases, these two estimates show a common direction of growth, indicating that in most cases first

29. This limits the extent to which early scaling terms are overweighted and later scaling terms are underweighted.

30. The Hodrick-Prescott filter is a procedure used to separate out the quarter-to-quarter deviations from trend in a time series. The procedure uses the time series values as inputs and yields the deviations and the trend values as outputs. The procedure is not unique; different parameter settings can yield somewhat different results. In this case, the trend is extracted from a time series of absolute values of quarter-to-quarter changes with the filter's smoothing parameter set to 1,600. (The choice of 1,600 for quarterly data was originally recommended by Hodrick and Prescott, and it is commonly used in practice; 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 (Feb., 1997): 1-16; and Morten O. Ravn and Harald Uhlig "On Adjusting the Hodrick-Prescott Filter for the Frequency of Observations," *Review of Economics and Statistics* 84, No. 2 (May 2002): 371-376).

31. Algebraically, the first column gives the frequency of agreement between the first and third estimates on $\text{sgn}(\Delta x_t) = \text{sgn}(x_t - x_{t-1})$, where x_t is the value of some estimate x for quarter t . The second column gives the frequency with which the third estimate indicates $\text{sgn}(\Delta x_t) \neq \text{sgn}(\Delta x_{t-1})$. The third column gives the frequency with which the first estimate indicates $\text{sgn}(\Delta x_t) \neq \text{sgn}(\Delta x_{t-1})$ given that the third estimate indicates $\text{sgn}(\Delta x_t) = \text{sgn}(\Delta x_{t-1})$. The fourth column gives the frequency with which the first estimate indicates $\text{sgn}(\Delta x_t) = \text{sgn}(\Delta x_{t-1})$ given that the third estimate indicates $\text{sgn}(\Delta x_t) \neq \text{sgn}(\Delta x_{t-1})$. The fifth column gives the frequency of agreement between the first and third estimates on $\text{sgn}(\Delta(\Delta x_t))$.

Table 2. Directional Matching of First and Third Quarterly Estimates, 1999–2011

[Share of estimates, percent]

Account	Direction of change				Direction of change in increase or decrease (acceleration/deceleration)	
	Correct ¹	Turning points				Correct ⁵
		In third estimate ²	False positive ³	False negative ⁴		
Current account						
Exports of goods and services and income receipts.....	94.1	17.6	3.9	2.0	90.0	
Exports of goods and services.....	100.0	13.7	0.0	0.0	86.0	
Exports of goods.....	98.0	11.8	0.0	2.0	94.0	
Exports of services.....	88.2	21.6	9.8	2.0	80.0	
Income receipts.....	88.2	25.5	7.8	3.9	78.0	
Direct investment income receipts.....	94.1	29.4	2.0	3.9	76.0	
Other private income receipts.....	100.0	21.6	0.0	0.0	92.0	
Imports of goods and services and income payments.....	94.1	15.7	3.9	2.0	92.0	
Imports of goods and services.....	98.0	15.7	2.0	0.0	84.0	
Imports of goods.....	96.1	15.7	2.0	2.0	84.0	
Imports of services.....	92.2	21.6	5.9	2.0	74.0	
Income payments.....	86.3	29.4	5.9	7.8	86.0	
Direct investment income payments.....	82.4	56.9	9.8	7.8	86.0	
Other private income payments.....	100.0	21.6	0.0	0.0	94.0	
Unilateral current transfers.....	84.3	62.7	13.7	2.0	86.0	
Capital account						
Capital account, net.....	66.7	47.1	7.8	25.5	76.0	
Financial account						
U.S.-owned assets abroad.....	92.2	68.6	3.9	3.9	94.0	
U.S.-owned private assets.....	92.2	64.7	2.0	5.9	92.0	
Direct investment abroad.....	76.5	68.6	15.7	7.8	76.0	
Foreign-owned assets in the United States	90.2	68.6	2.0	7.8	98.0	
Foreign official assets in the United States.....	96.1	62.7	0.0	3.9	90.0	
Other foreign assets in the United States.....	88.2	64.7	0.0	11.8	92.0	
Direct investment in the United States.....	88.2	62.7	9.8	2.0	78.0	
Balances						
Balance on goods.....	98.0	31.4	2.0	0.0	86.0	
Balance on services.....	74.5	52.9	15.7	9.8	76.0	
Balance on goods and services.....	92.2	31.4	5.9	2.0	84.0	
Balance on income.....	76.5	56.9	9.8	13.7	82.0	
Current-account balance.....	96.1	39.2	2.0	2.0	86.0	
Net financial flows, excluding financial derivatives.....	82.4	64.7	5.9	11.8	82.0	
Addendum						
Gross domestic product ⁶	98.0	3.9	0.0	2.0	72.0	

1. Percent of quarters in which the direction of change indicated in the first estimate matches that indicated in the third estimate.

2. Percent of quarters that are turning points—an increase (decrease) in the reference quarter follows a decrease (increase) in the prior quarter—in the third estimate.

3. Percent of quarters indicated as turning points in the first estimate but not in the third estimate.

4. Percent of quarters indicated as turning points in the third estimate but not in the first estimate.

5. Percent of quarters in which the acceleration or deceleration pattern indicated in the first estimate matches that indicated in the third estimate.

6. The "advance" and the "first annual" current-dollar level estimates are used.

estimates accurately capture the direction of changes in economic activity. For current-account items, this directional matching is mostly above 90 percent. For financial-account items, the matching is a bit lower, but mostly above 85 percent. The difference reflects a greater inherent ease in predicting the direction of change in the current account: as the second column of table 2 shows, turning points occur less frequently in the current account than in the financial account.

A handful of accounts show weaker directional matching, including the net capital account, the balance on services, the balance on income, and net financial flows. For the net capital account, the relatively poor matching is not surprising. Among other reasons, source data are difficult to obtain, a small number of individual transactions can generate relatively large changes, and turning points are relatively common.

However, difficulties in measuring directional change in the capital account do not imply difficulties in measuring directional change in broader aggregates as the volume of capital-account transactions is dwarfed by those in the current and the financial accounts.

Turning points are more common for "difference" accounts, particularly for the balances on services and income and for net financial flows. All that is required for a turning point to occur for these accounts is that there be 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 difference or net basis, growth of transactions has to actually switch to contraction for a turning point to occur.

The third and fourth columns decompose the directional mismatches implied by the first column into false positives and false negatives. There is no obvious tendency towards one type of mismatch or the other.

The fifth column shows the frequency with which first estimates identify whether account values are accelerating or decelerating, using third estimates as the standard. For instance, if values increased both last quarter and this quarter, was this quarter's increase larger or smaller than last quarter's increase? In general, acceleration and deceleration matching is nearly as strong as matching of turning points. However, early estimates of both exports and imports of services match the later estimate acceleration/deceleration pattern less frequently than do estimates of some of the other accounts. This is likely a consequence of the fact that first estimates of trade in services draw on relatively little source data; for the early estimate, projections predominate.

Table 3 provides another qualitative measure of the performance of the first estimates. It gives the share of estimates for which the three largest component accounts-contributors to growth—whether positive or negative—in the first estimate of an aggregate retain their position as a contributor to growth in the third estimate. The first row of the table shows that for the aggregate "exports of goods and services and income receipts," the largest contributor to growth in the first estimate remains the largest contributor in 74.5 percent of third estimates. The largest contributor in the first estimate is the second-largest contributor in 19.6 percent, and is the smallest contributor in 5.9 percent, of third estimates.

For other aggregates, the stability of the ranking of contributions to growth is even greater. The current-account balance is of particular interest. For this balance, the largest contribution to growth is made by the same component in both first and third estimates 84

Table 3. Stability of Component Rank in Contributions to Quarterly Growth of Aggregate from First Estimate to Third Estimate, 1999–2011

[Share of estimates, percent]

Accounts — aggregate: components	Component rank in contributions to first estimate's quarterly change	Change in contribution-to-growth rank of component, third estimate relative to first estimate		
		No change in rank	Up or down one spot	Up or down two spots
Exports of goods and services and income receipts: exports of goods; exports of services; income receipts	1st	74.5	19.6	5.9
	2nd	68.6	31.4	0.0
	3rd	76.5	11.8	11.8
Imports of goods and services and income payments: imports of goods; imports of services; income payments	1st	90.2	3.9	5.9
	2nd	68.6	31.4	0.0
	3rd	70.6	27.5	2.0
Current-account balance: balance on goods; balance on services; balance on income; net unilateral current transfers	1st	84.3	7.8	3.9
	2nd	54.9	35.3	9.8
	3rd	54.9	41.2	3.9
U.S. private assets: direct investment; foreign securities; U.S. claims on unaffiliated foreigners reported by U.S. nonbanking concerns; U.S. claims reported by U.S. banks and securities brokers	1st	86.3	9.8	0.0
	2nd	66.7	27.5	5.9
	3rd	58.8	41.2	0.0
Other foreign assets in the United States: direct investment; U.S. Treasury securities; U.S. securities other than U.S. Treasury securities; U.S. currency; U.S. liabilities to unaffiliated foreigners reported by U.S. nonbanking concerns; U.S. liabilities reported by U.S. banks and securities brokers	1st	76.5	11.8	0.0
	2nd	56.9	21.6	11.8
	3rd	52.9	33.3	11.8

NOTE: For aggregates with more than three components, row totals will not necessarily add up to 100 percent, as some rankings can change by more than two spots.

Table 4. Mean Revisions and Mean Absolute Revisions of First Quarterly Estimates of Current-Account Components, Item-Value Scaling, 1999–2011

[Percent of account value]

Account	Mean revision	Mean absolute revision
Current account		
Exports of goods and services and income receipts.....	0.72	1.16
Exports of goods and services.....	0.11	0.60
Exports of goods.....	0.01	0.54
Exports of services.....	0.39	1.65
Income receipts.....	2.50	3.48
Direct investment income receipts.....	3.14	5.16
Other private income receipts.....	1.85	4.45
Imports of goods and services and income payments.....	0.01	0.85
Imports of goods and services.....	0.10	0.55
Imports of goods.....	0.06	0.44
Imports of services.....	0.38	2.35
Income payments.....	-0.37	3.53
Direct investment income payments.....	-0.16	15.20
Other private income payments.....	0.32	2.37
Addendum		
Gross domestic product ¹	-0.12	0.79

1. The "advance" and the "first annual" current-dollar level estimates are used. Notes. Revisions are computed as the ratio of the difference between third estimate and first estimate to the first estimate and are expressed in percent terms. Natural signs used for revisions and estimates. See footnote 32 in the text.

percent of the time. Not surprisingly, the stability of the second-largest and third-largest contributions is not as great as that of the largest contribution for this balance and for the other aggregates shown in the table. Both the second-largest and third-largest contributions are made by the same component in both the first and third estimates only 55 percent of the time.

V. Mean and Mean Absolute Revisions to the Quarterly ITAs

In this section, revisions to three groups of accounts are considered using the most appropriate scaling measures for each group. Revisions to current-account components are distinguished from revisions to current-account balances. Financial-account revisions are examined together with capital-account revisions and revisions of net unilateral current transfers. After the analysis by group, sizes of revisions are compared across the ITAs more broadly.

Current-account components

For the components, but not balances, of the current account, dollar revisions are scaled by item values—that is, by the early-vintage estimates themselves—and are expressed as percentages. The MRs and MARs resulting from comparing first estimates of key accounts in the current account with the corresponding third estimates are shown in table 4.³² For the two broadest aggregates—"exports of goods and services and income receipts" and "imports of goods and services and income payments"—revisions are generally small. MRs are less than 1 percent for these two accounts.³³ MARs are about 1 percent. Although estimates of exports of goods and services and income receipts tend to be revised up slightly more than down, revisions for both accounts are broadly comparable to those of GDP.³⁴

The picture is more varied for more disaggregated accounts. Revisions to goods exports and goods imports are even smaller than revisions to the two aggregates:

32. Note that the estimates and revisions used for table 4 and throughout this article use "natural" signs, not the sign conventions imposed by the ITA framework. For instance, imports of goods enter the ITAs with a negative sign, that is, as a debit, as these transactions reflect an outflow of payments (dollars). In table 4, however, imports of goods are measured as a positive number so that the revision measures are more easily interpreted.

33. All but two of the ITA MRs in table 4 are positive. This does not appear to reflect a systematic pattern over the current account of upward revisions. None of the MRs in that table are statistically different from zero at the 5 percent level using a standard t-test.

34. Several tables in this article include current-dollar GDP—which is not part of the international accounts—as an addenda account. This is done only to provide an additional frame of reference against which the reported MRs and MARs can be judged, as the average revisions of GDP estimates have been examined at length in other BEA articles on revisions. No direct connection between the ITA MRs and MARs and those of GDP should be inferred even though one of the components used to construct GDP under the expenditure approach is the trade balance. Although there are some slight differences in definition between the ITA trade balance and that used in GDP, the revisions to both should be quite similar. Note that the averages reported for GDP here will not match those shown in earlier articles because different scaling methods are used. In addition, the time periods examined differ.

MARs are about one-half of 1 percent.³⁵ However, MARs for services trade and for income transactions are substantially higher: about 2 percent for services trade, a bit lower for exports than for imports, and 3.5 percent for income receipts and income payments. Differences noted earlier in the availability of source data contribute to the differences in revisions. Specifically, the Customs Bureau data on goods trade are available in a much timelier manner than much of the source data used in the services trade estimates and are available more completely for the first estimate than the source data used for estimates of income receipts and payments.

Another explanation for the difference in MARs between goods and services relates to the periodicity of data collection for goods and services trade. Although the source data underlying the quarterly estimates of services trade have improved in recent years, these improvements will not necessarily be reflected in lower MARs. The relatively new quarterly surveys of trade in services allows for a better representation of the quarter-to-quarter changes, but this benefit accrues primarily to later estimates—that is, to third and later

35. Scaled MARs may increase with further disaggregation, as revisions to one component that are offset in the aggregate by revisions to another component are exposed in the disaggregated measures. This increase need not always occur, however, for the component with smaller revisions; a disaggregation-related increase is less likely to occur for the component with smaller revisions the larger the disparity between the component MARs. In this case, the disparity between the goods exports MAR and the services-exports MAR is sufficiently large that the goods exports MAR is lower than the MARs for the aggregates that include both goods and services exports. The same holds for imports.

Table 5. Mean and Mean Absolute Revisions of Quarterly Estimates of Current-Account Components, Item-Value Scaling, Various Vintages, 1999–2011
[Percent of account value]

Measure and account	First to second	First to third	Second to third	First to latest	Second to latest	Third to latest
Mean revision						
Exports of goods and services and income receipts.....	0.04	0.72	0.68	2.82	2.78	2.04
Exports of goods and services	-0.01	0.11	0.09	0.86	0.81	0.74
Exports of goods.....	-0.01	0.01	0.00	1.61	1.61	1.60
Exports of services.....	0.00	0.39	0.37	-0.93	-1.13	-1.32
Income receipts.....	0.18	2.50	2.40	8.80	8.87	5.97
Imports of goods and services and income payments.....	0.06	0.01	-0.06	0.33	0.29	0.32
Imports of goods and services.....	0.02	0.10	0.05	0.51	0.42	0.39
Imports of goods.....	-0.02	0.06	0.04	0.66	0.60	0.58
Imports of services.....	0.27	0.38	0.11	-0.18	-0.39	-0.54
Income payments.....	0.26	-0.37	-0.43	-0.30	-0.06	0.12
Mean absolute revision						
Exports of goods and services and income receipts.....	0.38	1.16	1.03	2.93	2.87	2.04
Exports of goods and services	0.26	0.60	0.55	0.94	0.88	0.78
Exports of goods.....	0.07	0.54	0.56	1.68	1.69	1.64
Exports of services.....	0.86	1.65	1.29	2.16	1.88	1.70
Income receipts.....	1.04	3.48	3.02	9.20	9.13	6.08
Imports of goods and services and income payments.....	0.26	0.85	0.79	1.18	1.02	0.80
Imports of goods and services.....	0.13	0.55	0.53	0.79	0.72	0.52
Imports of goods.....	0.05	0.44	0.45	0.82	0.79	0.69
Imports of services.....	0.69	2.35	1.99	3.14	3.19	2.81
Income payments.....	1.23	3.53	2.86	5.04	4.21	3.62

Notes: Revisions are computed as the ratio of the difference between later estimate and earlier estimate to the earlier estimate and are expressed in percent terms.
Natural signs used for revisions and estimates. See footnote 32 in the text.

vintages. Even if earlier estimates were also to improve in a similar manner, they may be less consistent with later estimates—which is what MARs measure—than when both vintages were based on annual surveys.

For income receipts, the MAR of 3.5 percent is accompanied by a MR of 2.5 percent. Although not statistically significant at conventional levels, the MR is relatively large, suggesting some imbalance in the direction of revisions. Of the two components of income receipts, the MR of direct investment income receipts, at 3.1 percent, is particularly large. The size of these revisions may be related to BEA's "conservative" approach to estimation of these flows. As noted earlier, entry of new companies into the universe is not assumed, so early estimates may not fully reflect the entire population of MNCs. Consequently, when the previously unreported data are ultimately received, revisions are often upward in direction.³⁶

Another reason that MARs for income receipts and payments are higher than those for goods exports and imports is that income flows show greater relative quarter-to-quarter variability than goods flows. More quarterly variability in account values generally produces a greater estimation challenge. Relative to account values, the average absolute quarterly change—that is, the average absolute growth rate—from 1999–2011 is 5.2 percent and 6.3 percent, respectively, for income receipts and payments, compared with 2.7 percent and 4.0 percent, respectively for goods exports and imports.

The first-to-third results analyzed thus far consider how closely the first estimates in the current account match the third estimates that are released from 3 to 12 months after the first release. Different results may emerge, however, if different revision horizons are considered. MRs and MARs are shown in table 5 for 10 key accounts for all revision horizons. The first column shows that the initial revisions to the quarterly estimates—first-to-second MARs of 0.4 percent and 0.3 percent for the two top-level items (exports of goods and services and income receipts; imports of goods and services and income payments)—are generally much smaller than the first-to-third revisions shown in the second column (and in table 4). Second-to-third

36. This argument should also apply to estimates of direct investment income payments. However, the MR for payments is small. The difference in outcomes may stem in part from the lower underlying growth rates for income payments. Comparing direct investment income flows for 2011 with those for 1999, receipts rose 203 percent, while payments rose only 148 percent. When the underlying growth rate is lower, revisions arising from the effects of a conservative estimation approach should be smaller. The difference may also stem from the use during much of the period being examined of a separate survey on U.S. businesses established or acquired by foreign direct investors. This survey, which was discontinued after 2008, had no counterpart for outward direct investment. It may have provided more complete and timely information on entry into the inward direct investment universe than was available for outward direct investment.

revisions (third column), in contrast, are generally similar to the first-to-third revisions.

Of particular interest is the fourth column, which presents information on MRs and MARs between the first estimate and the latest estimate. For exports of goods and services and income receipts, the first-to-latest MAR is much larger, at 2.9 percent, than the corresponding 1.0-percent first-to-third MAR. Most of these large revisions are upward; the MR is 2.8 percent.³⁷ Of the next level components of this account, large MRs and MARs for income receipts, at about 9 percent, are prominent.^{38, 39} There are similar, if less pronounced, differences in the magnitude of revisions (first-to-latest versus first-to-third) for several accounts.

That there are measurable differences in revisions across horizons is not surprising. Over time, new data sources are identified and utilized, definitions and methodologies are changed, and other changes are incorporated. Often these changes have a cumulative effect on the level of an estimate, but a smaller impact on estimates of quarter-to-quarter changes or growth rates. Nonetheless, the largest differences suggest that imprecision in early estimates for certain accounts—income receipts and payments, in particular—is not fully resolved by the time of the first subsequent June annual revision. This, in large part, is because the incorporation into estimates of income receipts and payments of data from benchmark surveys does not typically occur until several years after the reference year.

Current-account balances

Current-account balances are the differences between credits and debits for selected current-account categories. Table 6 shows MRs and MARs scaled by the sum of the unsigned components of the balance. In the case of the trade balance, revisions are scaled by the sum of exports and imports. This scaling method retains a key aspect of item-value scaling: as transactions volumes increase, dollar revisions get larger. The use of this method produces a measure of revisions to the trade balance that can be compared with, and will often be similar in magnitude to, revisions to the *sum of exports and imports*, a sum that is not actually an account but

37. This MR is statistically significant at the 5-percent level. The third-to-latest MR is also statistically significant for this account. The three “to-latest” MRs for exports of goods are also statistically significant at the 5-percent level.

38. The three “to-latest” MRs for income receipts are statistically significant at the 10-percent level, but not at the 5-percent level.

39. A further decomposition of income receipts (not shown in the table) indicates that both direct investment income receipts and other private income receipts make substantial contributions towards the large MR and MAR.

is a value of interest that may be derived directly from the ITAs.⁴⁰

Table 6 indicates that relative to the size of the component flows, initial estimates of balances in the current account are generally quite representative of later estimates: MRs are close to zero and MARs are small. Revisions to balances display a similar pattern to those of their component accounts. The MAR of the balance on goods is smallest at 0.24 percent. Those of the balance on services and the balance on income are somewhat larger. Overall, the MAR of the current-account balance is 0.47 percent, roughly half the MARs of its components—1.16 percent for credits and 0.85 percent for debits—indicating that revisions of the two components are often offsetting.

MRs are very close to zero for the balance on goods and the balance on services. For the current-account balance, the MR is also near zero. For the balance on income, the MR is 1.51 percent; estimates of the surplus on income tend to be higher in later estimate vintages because, as previously discussed, estimates of income receipts are generally revised upward.⁴¹

Financial account

Like current-account balances, the accounts in the financial account provide a net measure of transactions. However, unlike current-account balances, gross transactions value associated with the financial accounts’ net value is typically not measured. Hence, MRs and MARs are calculated for financial accounts using scaling by trend values of the quarter-to-quarter absolute

40. The sum of exports and imports as a percentage of GDP is often used as a measure of openness to trade. For example, see Organisation of Economic Co-operation and Development (OECD), *Measuring Globalisation: OECD Economic Globalisation Indicators 2010* (Paris: OECD Publishing): 58–59.

41. However, neither this MR nor any of the others in table 6 is statistically significant.

Table 6. Mean Revisions and Mean Absolute Revisions of First Quarterly Estimates of Current-Account Balances, Sum-of-Unsigned-Components Scaling, 1999–2011
[Percent of sum of unsigned components of account]

Account	Mean revision	Mean absolute revision
Balance		
Balance on goods	−0.03	0.24
Balance on services	0.05	1.21
Balance on goods and services	−0.01	0.34
Balance on income	1.51	1.95
Current-account balance	0.25	0.47
Addenda		
Exports of goods and services and income receipts	0.72	1.16
Imports of goods and services and income payments	0.01	0.85

NOTES. Revisions are computed as the ratio of the difference between later estimate and earlier estimate to sum of unsigned components of the earlier estimate and are expressed in percent terms. Natural signs used for revisions and estimates. See footnote 32 in the text.

changes. Table 7 displays MRs and MARs for key accounts in the financial account as well as for net unilateral transfers in the current account and net capital-account transactions.

On average, first-to-third revisions of net financial flows are 37.4 percent as large as the trend quarter-to-quarter changes in this account. Because of differences in scaling methods, this MAR cannot be directly compared with those presented in earlier tables. To provide a sense of whether the financial account MARs in table 7 are relatively large or small, the table also shows trend-quarter-to-quarter-absolute-change-scaled MARs for key accounts in the current account and for GDP. The MAR for the current-account balance is 47.0 percent, which, like the MAR for net financial flows, is smaller than that for GDP.⁴² When scaling by trend quarterly changes, MARs that are well below 100 percent indicate that early estimates typically identify the correct quarterly direction of change and that subsequent estimates tend not to alter greatly the magnitude of that quarterly change.

For the two largest components of net financial flows, revisions are 19.7 percent (U.S.-owned assets abroad) and 23.1 percent (foreign-owned assets in the United States) of the trend of their respective quarterly changes. MARs for major components in the financial account are of a similar magnitude to those for major

42. A calculation was presented in the introduction of this article showing that for this balance the average unscaled revision is 61 percent as large as the average quarter-to-quarter absolute change. These two percentages roughly measure similar things. In large part, the difference between the 47 percent shown in table 7 and the 61 percent from the introduction can be attributed to the fact that the calculation in table 7 corrects for inflation and economic growth while the calculation in the introduction does not.

Table 7. Mean Revisions and Mean Absolute Revisions of First Quarterly Estimates, Trend-Quarter-to-Quarter-Absolute-Change Scaling, 1999–2011

[Percent of trend quarter-to-quarter absolute change in account values]

Account	Mean revision	Mean absolute revision
Current account		
Unilateral current transfers	-25.1	48.2
Capital account		
Capital account, net.....	-6.6	33.3
Financial account		
U.S.-owned assets abroad	8.7	19.9
U.S.-owned private assets.....	9.0	19.7
Direct investment abroad	8.4	33.2
Foreign-owned assets in the United States	9.2	23.1
Foreign official assets in the United States	17.1	26.9
Other foreign assets in the United States.....	4.3	26.1
Direct investment in the United States	-0.5	36.1
Net financial flows, excluding financial derivatives	3.6	37.4
Addenda		
Exports of goods and services and income receipts.....	17.8	30.1
Imports of goods and services and income payments	0.7	21.5
Current-account balance.....	22.8	47.0
Gross domestic product ¹	-19.6	66.1

1. The "advance" and the "first annual" current-dollar level estimates are used. Notes: Revisions are computed as the ratio of the difference between third estimate and first estimate to trend quarter-to-quarter changes in the latest estimate and are expressed in percent terms. Natural signs used for revisions and estimates. See footnote 32 in the text.

components of the current account. Most of the MRs in the financial account are also fairly close to zero.⁴³

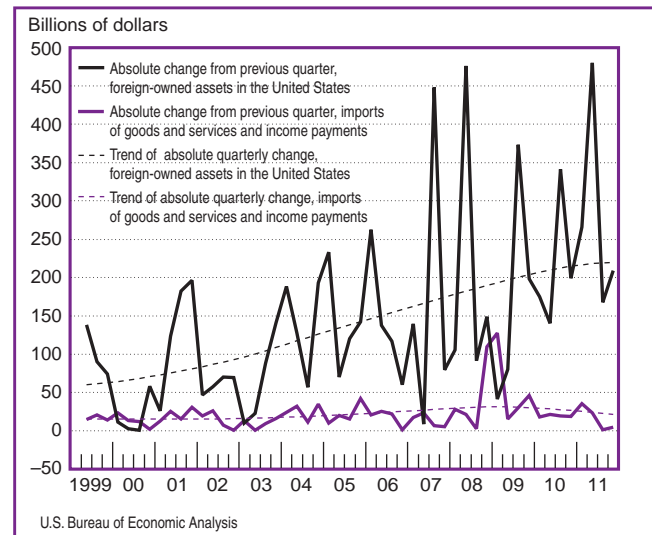
The similarity of the financial-account MRs and MARs in table 7 with those in the current account is more a result of large quarter-to-quarter absolute changes than of small dollar-value revisions. In general, quarter-to-quarter absolute changes tend to be much larger in the financial account than in the current account; that is, financial-account volatility exceeds current-account volatility. This difference in volatility is also shown in chart 6, which compares quarter-to-quarter absolute changes for a key component of the current-account balance with those of a key component of net financial flows. Absolute changes are shown as solid lines, and trend values of these changes are shown as dashed lines. For 2011, the trend quarterly change of net flows of foreign-owned assets in the United States was about \$219 billion compared with about \$24 billion for imports of goods and services and income payments, despite the latter account showing larger net flows.⁴⁴

The relatively large quarterly changes in financial-account values make estimation of quarterly values challenging. Producing estimates that are close to the true value requires a substantial amount of information. The scaling method used for financial-account revisions brings a "degree-of-difficulty" adjustment to comparisons of MRs and MARs across the various

43. Foreign official assets in the United States has the largest MR in the financial account. However, neither that MR, nor any of the others in table 7 are statistically significant.

44. The \$219 billion difference and the 23 percent MAR shown in table 7 suggests that for each quarter in 2011, the expected absolute revision to foreign-owned assets in the United States would be just over \$50 billion.

Chart 6. Absolute Quarterly Changes for Selected Components of Current Account and Financial Account, 1999–2011



U.S. Bureau of Economic Analysis

ITAs, one that suggests that early financial account estimates, despite the relative lack of complete source data coverage, are reasonably accurate.

Comparing the size of revision across accounts

To assess the contributions that revisions to two or more component accounts make to the total revisions of an aggregate account, it is useful to compare dollar revisions of one account to those of another. Comparing dollar revisions also indicates which of two or more unrelated accounts tends to have the largest revisions.

As described in the section on scaling methods, scaling by the trend of current-dollar GDP facilitates the comparison of dollar revisions while still accounting for the history of economic growth and inflation.⁴⁵ However, as previously noted, the GDP-scaled MRs and MARs do not allow for a direct comparison of estimate accuracy across accounts. Table 8 and chart 7 show that, on average, first-to-third revisions of the current-account balance, with a MAR of 0.16 percent of (trend) GDP, are less than a fourth as large in dollar terms as revisions of net financial flows, with a MAR of 0.73 percent of GDP.

Financial accounts in general display very large dollar revisions. The GDP-scaled MARs of two financial accounts—“other foreign assets in the United States” and

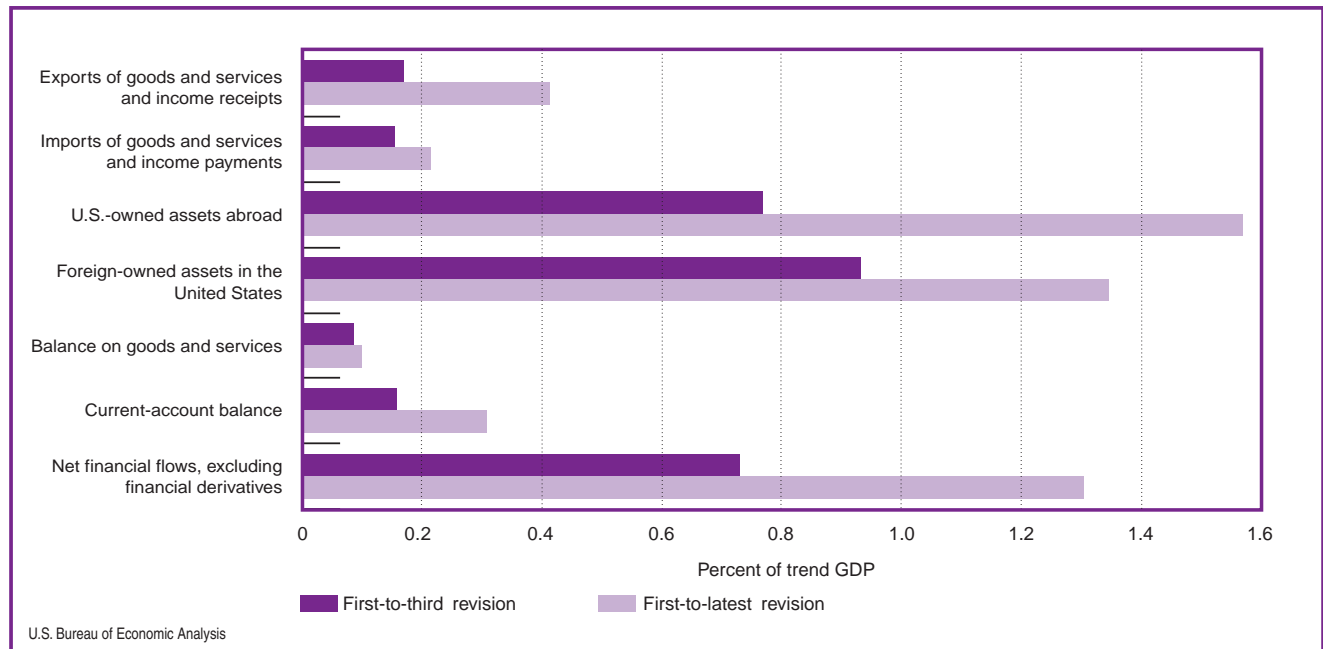
45. To the extent that the ITAs have become larger over time relative to the total U.S. economy, recent quarters still carry some disproportionate weight in the averages.

Table 8. Mean Revisions and Mean Absolute Revisions of First Quarterly Estimates, GDP Scaling, 1999–2011
[Percent of trend GDP]

Account	First to third		First to latest	
	Mean revision	Mean absolute revision	Mean revision	Mean absolute revision
Current account				
Exports of goods and services and income receipts	0.106	0.168	0.398	0.413
Exports of goods and services	0.012	0.067	0.090	0.101
Exports of goods	-0.002	0.042	0.116	0.122
Exports of services	0.013	0.054	-0.025	0.067
Income receipts	0.094	0.126	0.308	0.321
Direct investment income receipts	0.059	0.096	0.171	0.190
Other private income receipts	0.033	0.072	0.119	0.148
Imports of goods and services and income payments	0.010	0.155	0.072	0.215
Imports of goods and services	0.016	0.080	0.076	0.116
Imports of goods	0.007	0.055	0.085	0.104
Imports of services	0.009	0.055	-0.009	0.071
Income payments	-0.006	0.121	-0.004	0.165
Direct investment income payments	-0.006	0.072	-0.016	0.102
Other private income payments	0.011	0.042	0.032	0.056
Unilateral current transfers	-0.021	0.036	-0.065	0.078
Capital account				
Capital account, net	-0.001	0.011	0.030	0.042
Financial account				
U.S.-owned assets abroad	0.287	0.767	0.617	1.570
U.S.-owned private assets	0.289	0.768	0.620	1.574
Direct investment abroad	0.065	0.234	0.252	0.470
Foreign-owned assets in the United States	0.355	0.932	0.602	1.345
Foreign official assets in the United States	0.201	0.335	0.465	0.497
Other foreign assets in the United States	0.153	0.981	0.136	1.260
Direct investment in the United States	0.037	0.312	0.202	0.467
Balances				
Balance on goods	-0.009	0.051	0.031	0.073
Balance on services	0.005	0.065	-0.016	0.093
Balance on goods and services	-0.004	0.087	0.015	0.099
Balance on income	0.100	0.136	0.312	0.327
Current-account balance	0.075	0.158	0.262	0.308
Net financial flows, excluding financial derivatives	0.067	0.730	-0.015	1.304
Addenda				
Gross domestic product ¹	-0.123	0.787	0.657	1.318

1. The “advance” and the “first annual” current-dollar level estimates are used.
 NOTES: Revisions are computed as the ratio of the difference between third estimate and first estimate to the trend value of the latest GDP estimate and are expressed in percent terms.
 The sum of component MRs may not add to the MR of the higher-level aggregate due to rounding.
 Natural signs used for revisions and estimates. See footnote 32 in the text.

Chart 7. GDP-Scaled Mean Absolute Revisions, 1999–2011



its aggregate “foreign-owned assets in the United States”—are even larger than that of GDP. These large dollar revisions have multiple causes, two of which have already been discussed. First, the financial accounts are quite volatile and, thus, estimation is intrinsically difficult. Second, their source data differ in nature and availability compared to some other accounts. In particular, for estimates of transactions in securities, first estimates are based on a less than fully comprehensive report of transactions. Third estimates are based on revised data on transactions that have been reconciled with a separate, more comprehensive survey on positions.

Although the item-value-scaled MARs for services trade are larger than those for goods trade, goods trade is much larger in total value. These two effects work in opposite directions with respect to the magnitude of dollar revisions. Table 8 shows that services trade revisions contribute at least as much as goods trade revisions to first-to-third revisions to combined goods and services trade flows. For exports, the GDP-scaled services MAR of 0.054 percent exceeds the goods MAR of 0.042 percent; for imports, the 0.055 percent services MAR equals the 0.055 percent goods MAR.

Table 8 also shows that revisions to income receipts exceed in magnitude revisions of exports and imports of goods and services. The ratio of the GDP-scaled MAR for income receipts to the MAR for exports of goods and services is 1.9 ($= 0.126 \div 0.067$). Similarly, the ratio of the MAR for income payments to the MAR for imports of goods and services is 1.5. In both cases, revisions to direct investment income flows account for more of the revisions to income flows than do revisions to other private income flows. For receipts, direct investment income revisions are 1.3 times as large, and for payments, direct investment income revisions are 1.7 times as large as revisions to other private income flows.

VI. Other Considerations for ITA Revisions

This section examines issues related to the ITA revisions including (1) the extent to which revisions to the seasonally adjusted estimates are driven by revisions to seasonal adjustment factors, as opposed to revisions to the seasonally unadjusted data, (2) whether MARs have systematically changed—that is, become larger or smaller—over time, and (3) the extent to which revisions made on the same date tend to be correlated and/or of a common sign.

Revisions of seasonal adjustment factors

BEA publishes both seasonally adjusted and unadjusted ITA estimates. For trade in goods, the Census Bureau and BEA calculate seasonal factors; other accounts in the ITAs are seasonally adjusted by BEA. For seasonally ad-

justed ITA estimates, one source of revision is the revision to the seasonal adjustment factors. Each revision to a seasonally adjusted estimate can be decomposed into the revision to the corresponding seasonally unadjusted estimate and the revision to its seasonal adjustment factor. Given BEA's publication and revision schedule, the seasonal adjustment factors applied to the first estimates are based on seasonality detected in seasonally unadjusted estimates for years prior to the reference year. In the third estimates, the reference year's seasonally unadjusted quarterly data themselves become inputs into the seasonal adjustment procedure. For later revisions, adjustment factors account for seasonality in seasonally unadjusted estimates for years before, during, and after the year of the reference quarter. The relative impact on revisions to seasonal factors are likely greatest for the first-to-third revision. At the first-to-second horizon, seasonal factors are usually unrevised or minimally revised; at horizons past the third estimate, cumulative revisions resulting from new methods, new data sources, or definitions tend to be increasingly important.

Revisions to seasonal adjustment factors are important potential contributors to the overall magnitude of revisions. A 2003 study by BEA researchers using quarterly data covering 1990–2000 found “revisions to seasonal factors [to be] the principal determinants of the mean absolute revisions to the seasonally adjusted estimates of exports and imports of goods and services.”⁴⁶ However, the results of the 2003 study are not fully comparable with those of this study because the 2003 study examined growth rate revisions rather than item-value-scaled revisions.⁴⁷

Table 9 examines the impact of revisions to seasonal factors with item-value scaling. For item-value-scaled estimates, revisions to seasonal factors are relatively unimportant in explaining the overall MRs and MARs.⁴⁸ For first-to-third MARs, changes to seasonal factors are

46. 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), 43–50; see page 43.

47. A key characteristic of revisions due to changes in seasonal factors is that these revisions do not change the overall annual estimate; they simply reallocate transactions from one quarter to another. These changes often cause one quarter's dollar estimate to rise and that of an adjacent quarter to fall. Consequently, revisions to seasonal factors tend to exhibit negative autocorrelation. For instance, 9 of the 10 series shown in table 9 exhibit negative autocorrelation; the average correlation coefficient over these series is -0.18 . For growth rate revisions, the effect is magnified, as growth rates are calculated by dividing the current quarter's dollar estimate by the prior quarter's dollar estimate and subtracting one. Any change to a dollar estimate affects growth rates in two adjacent quarters, but in different directions, as the dollar estimate is the numerator in the calculation of one quarter growth rate and the denominator in that of the prior quarter, exacerbating the negative correlation between revisions.

48. By construction, the MR for seasonal factors will be very close to zero, as seasonal factors are constrained to leave the sum of four quarters of estimates for any given year unchanged.

much less important than revisions to seasonally unadjusted estimates for almost all accounts. Only for exports of goods (0.38 percent versus 0.41 percent for revisions to seasonally unadjusted estimates) and imports of goods (0.38 percent versus 0.23 percent) do seasonal factors play a relatively large role. For both of these accounts, the magnitudes of revisions to seasonally unadjusted estimates are very small. For both accounts, the revisions to the seasonally unadjusted estimates become larger in the first-to-latest revisions and the relative role of revisions to seasonal factors becomes smaller.

Trends in revisions

Chart 8 examines trends in the moving averages of revisions for six key accounts: three from the current account and three from the financial account, including the overall balances in both accounts. As the 1999–2011 period is relatively short, chart 8 includes an additional 10 years of revisions, so estimates from 1989–2011 are included in the analysis.⁴⁹ Because this analysis is applied to accounts in both the current account and the financial account, trend quarter-to-quarter absolute changes is used for scaling. The MRs and MARs are computed as 21-quarter weighted moving averages. Using moving averages rather than simple averages smooths the curves shown in the chart and mitigates the impact of the somewhat arbitrary choice of the number of quarters included in each average.⁵⁰ Each quarter's weighted average includes the revision associated with the quarter itself, along with revisions from the 10 preceding and the 10 succeeding quarters.⁵¹

Included in each panel is a 90 percent confidence interval. This is the interval bounded by the 5th and 95th percentile of a distribution of 21-observation-sample weighted means for both revisions (MRs) and absolute revisions (MARs) for a simulated baseline distribution.

49. As noted in footnote 5, early vintage estimates extending this far back in time are not generally available electronically. These estimates were obtained from printed sources for the six accounts examined in this section.

50. Using a weighted average with weights declining away from the central quarter means that an outlier on the edge of the averaged sample has only a small impact on the average. In contrast, the same outlier would have a much larger impact when a simple average is used. As a result, the simple average can vary much more strongly from quarter to quarter than the weighted average. A corollary is that changing the number of quarters used in the averages can be much more consequential for simple averages than for weighted averages.

51. Because the weighting is somewhat arbitrary, using different weighting schemes may generate slightly different results. The weights are as follows for quarters at the indicated number of quarters remove from the reference quarter: 0, 9 percent; 1, 9 percent; 2, 8 percent; 3, 7 percent; 4, 6 percent; 5, 5 percent; 6, 4 percent; 7, 3 percent; 8, 3 percent; 9, 1 percent; 10, 0.5 percent. To add two more quarters in at the edge of this sample, the weighted average uses revisions from 19 quarters when revisions for the 10th preceding/succeeding quarter are not available, and uses revisions from 17 quarters when revisions for the 9th and 10th preceding/succeeding quarters are not available. The averages for these cases use the same relative weights as for the full 21-quarter cases, but absolute weights are scaled to equal 100 percent.

The baseline distribution is constructed under the assumption that each revision is an independent random draw from a normal distribution with mean and standard deviation equal to those observed in the 92-quarter empirical distribution.⁵² Therefore, comparing the plotted data points to the confidence intervals can be interpreted as a test of whether any given 21-quarter subperiod has a different MR or MAR than the overall MR or MAR. Data points outside the confidence interval provide statistical evidence that the given subperiod's average is different from the overall average.

If there has been no change in the distribution of revisions from 1989 to 2011, approximately 10 percent of the points on each panel should lie outside the confidence interval bounds. In actuality, 23 percent of the MRs and 40 percent of the MARs are outside the

52. The 5th and 95th percentiles of the subperiod sample means were calculated by using the corresponding empirical percentiles from 100,000 simulated 21-observation samples. For the MR, direct algebraic calculation of these percentiles is feasible as the distribution of means is known. However, for the MAR, algebraic calculation is not straightforward, particularly as the average is a weighted, not a simple, average. For larger samples, a central-limit-theorem argument could be used to algebraically approximate these percentiles, but tests indicate that 21 observations is too few for the central limit theorem to apply in this case; the distribution of weighted MARs is right-skewed.

Table 9. Contribution of Seasonal Adjustment Factors to Revisions of Quarterly Estimates of Current-Account Components, Item-Value Scaling, 1999–2011
[Percent of account value]

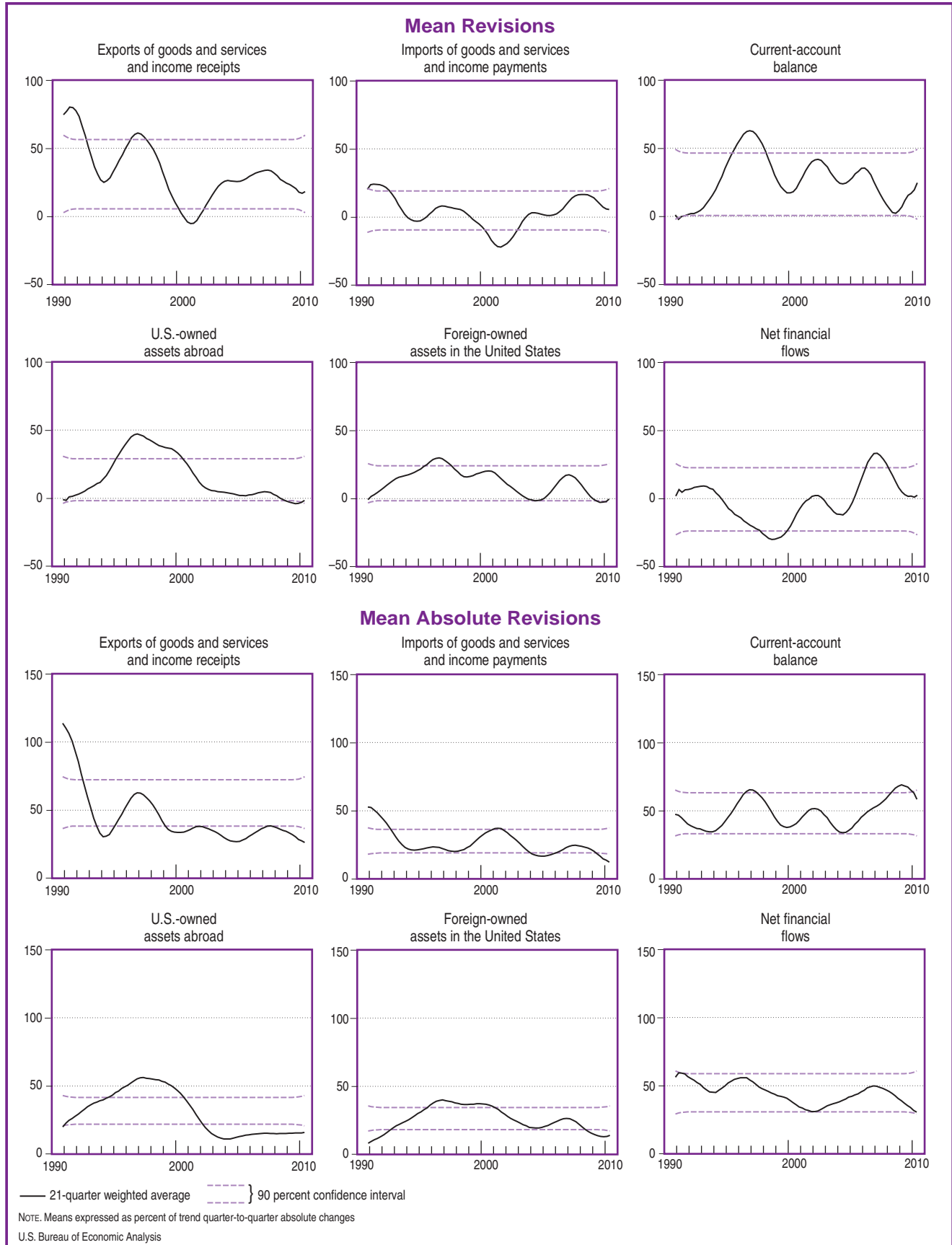
Measure and account	First to third			First to latest		
	Seasonally adjusted	Seasonally unadjusted	Seasonal factor ¹	Seasonally adjusted	Seasonally unadjusted	Seasonal factor ¹
Mean revision						
Exports of goods and services and income receipts	0.72	0.76	-0.04	2.82	2.86	-0.04
Exports of goods and services	0.11	0.15	-0.03	0.86	0.89	-0.04
Exports of goods	0.01	0.07	-0.06	1.61	1.67	-0.06
Exports of services	0.39	0.36	0.03	-0.93	-0.96	0.03
Income receipts	2.50	2.56	-0.06	8.80	8.85	-0.06
Imports of goods and services and income payments	0.01	0.02	-0.01	0.33	0.34	0.00
Imports of goods and services	0.10	0.11	-0.01	0.51	0.51	0.00
Imports of goods	0.06	0.07	-0.01	0.66	0.66	0.00
Imports of services	0.38	0.38	-0.01	-0.18	-0.16	-0.01
Income payments	-0.37	-0.36	-0.01	-0.30	-0.30	0.00
Mean absolute revision						
Exports of goods and services and income receipts	1.16	1.14	0.30	2.93	2.92	0.37
Exports of goods and services	0.60	0.57	0.33	0.94	0.94	0.38
Exports of goods	0.54	0.41	0.38	1.68	1.67	0.50
Exports of services	1.65	1.74	0.49	2.16	2.24	0.53
Income receipts	3.48	3.46	0.43	9.20	9.19	0.72
Imports of goods and services and income payments	0.85	0.79	0.29	1.18	1.11	0.37
Imports of goods and services	0.55	0.42	0.33	0.79	0.65	0.40
Imports of goods	0.44	0.23	0.38	0.82	0.68	0.48
Imports of services	2.35	2.35	0.44	3.14	3.13	0.44
Income payments	3.53	3.54	0.43	5.04	5.10	0.46

1. Calculated as the percentage point difference between the seasonally adjusted and seasonally unadjusted revisions.

NOTES: Revisions are computed as the ratio of the difference between later estimate and earlier estimate to the earlier estimate and are expressed in percent terms.

Natural signs used for revisions and estimates. See footnote 32 in the text.

Chart 8. Revision Moving Averages



bounds. For exports of goods and services and income receipts and for U.S.-owned assets abroad, over 70 percent of the MARs are outside the bounds. For both of these accounts, the MAR and MR appear to have decreased, with that of exports of goods and services and income receipts decreasing early on and that of U.S.-owned assets abroad decreasing near the middle of the period. For three of the other accounts, evidence of systematic change is weaker. There is some indication of decreases in the MARs of imports of goods and services and income payments early in the period as well as for foreign-owned assets in the United States, and of an increase in the MAR of the current-account balance recently.

Overall, the MRs and MARs of ITA estimates seem to fluctuate considerably. Neither peaks nor valleys are particularly long lived, and there is no common trend in MRs and MARs across accounts, although more seem to trend downward than upward. To the extent that there is any evidence of change in the distribution of revisions over time, this may reflect a number of factors including a change in source data quality for early estimates or changes in methodologies or definitions. Given that the evidence for change is weak and given that estimation-related changes have been numerous and complex over this period, it is not possible to isolate any specific event as being responsible for the observed trends.

Impact of annual ITA revisions

As noted earlier, the annual revisions of the ITAs occur each June. Although the first estimate of the first quarter of the contemporaneous reference year is also released at that time, the rest of the estimates released in June, and the only ones to which the term “revision” applies, are for earlier years. In almost every case, any estimate beyond the second estimate is released as part of the June annual revision. Thus, an “annual revision” is essentially synonymous with later estimates. This subsection identifies patterns that may be present in the annual revisions.

In principle, the first-to-third revisions to the four quarterly estimates for a given reference year, which are contained in the estimates released in the next year’s annual revision, could be positively correlated, negatively correlated, or uncorrelated. For instance, if revisions to seasonal adjustment factors are the primary driver of the total revisions, there should be a negative relationship, as revising one quarter’s factor up necessarily means that some other quarter’s factor will be revised down. On the other hand, if revisions come primarily from newly available annual data that are distributed relatively evenly to each of the four quarters,

there would be a positive relationship among revisions.

Correlation coefficients for revisions to each quarter’s estimates with revisions for other same-year quarters are shown in table 10. Like table 7, table 10 examines accounts from both the current account and financial account, so revisions are scaled by the trend value of absolute quarter-to-quarter changes. In large part, correlations are positive, but the strength of the correlation varies across quarters and accounts. For instance, there is stronger correlation in the current account in revisions than in the financial account.

A related, but broader, question is whether the “annual” revisions made on a given date for quarters from one reference year are correlated with the annual revisions made on the same date for quarters from another reference year. For instance, it might be that the June 2008 annual revision for some accounts results in higher estimates for all of the 16 quarters from 2004–2007, but the June 2009 annual revision results in lower estimates for all of these quarters. The 2008 and 2009 revisions may largely offset each other in the MR calculation, but the effect of each is correlated across multiple years of estimates.

Revisions made on a given date that apply new definitions or methods to an account’s estimates will often move estimates in a common direction. Compared with a focus on revision vintages, a focus on revision dates highlights patterns from different types of revisions. For example, suppose that for some item, the largest influx of new source data is normally received too late for the second estimate but in time for the third estimate. The primary pattern observed would be by revision vintage: the second-to-third revision MAR

Table 10. Correlation of Revisions with Other Revisions to Quarters in Same Year, 1999–2011

[Correlation coefficient]

Account and revision	Estimate			
	Q1	Q2	Q3	Q4
Exports of goods and services and income receipts				
First-to-third revision	*0.695	*0.773	*0.657	*0.789
First-to-latest revision	*0.770	*0.795	*0.736	*0.748
Imports of goods and services and income payments				
First-to-third revision	*0.730	*0.765	*0.709	*0.515
First-to-latest revision	*0.636	*0.666	0.178	*0.580
U.S.-owned assets abroad				
First-to-third revision	0.152	*0.323	*0.253	*0.261
First-to-latest revision	*0.380	*0.397	*0.373	*0.472
Foreign-owned assets in the United States				
First-to-third revision	0.157	0.115	0.222	*0.345
First-to-latest revision	0.029	0.200	0.154	0.106
Current-account balance				
First-to-third revision	*0.547	*0.638	*0.590	*0.621
First-to-latest revision	*0.403	*0.475	*0.260	*0.338
Net financial flows, excluding financial derivatives				
First-to-third revision	0.139	-0.147	*0.278	0.202
First-to-latest revision	0.047	0.080	*0.320	-0.022

* Significant at p-values ≤ 0.05 .

NOTE: Revisions are computed as the ratio of the difference between later estimate and earlier estimate to trend quarter-to-quarter changes in the latest estimate.

would be larger than the first-to-second MAR. On the other hand, if a new definition is adopted, it will be imposed all at once in a given June when annual revisions are published. The primary pattern in this case would be by revision date: all (or most) revisions made that June would be in a common direction (either up or down). More generally, changes in methodologies and definitions should generate more distinct patterns in an analysis of revision dates, while the normal acquisition of updated source data may generate more distinct patterns in an analysis of revision vintages.

Table 11 presents information on directional patterns for June revisions for five key accounts. Several (25 of the 60) of the annual revisions change estimates for a given account in a common direction, as indicated by p-values less than 0.05. For example, the June 2011 annual revision increased estimates of exports of goods and services and income receipts in 47 out of the 48 quarters that were revised. If each of these 48 revisions were independent and just as likely to be upward as downward, there would be almost no chance of such a lopsided pattern, as indicated by the low p-value in

Table 11. Directional Patterns in June Revisions

Account and year of revision	Range of estimates revised	Number of quarters		P-value of ratio of up to down revisions ¹	Mean revisions as percent of trend quarter-to-quarter absolute changes
		Revised up	Revised down		
Exports of goods and services and income receipts					
2001.....	Q1 1999 – Q4 2000	7	1	<i>0.070</i>	17.1
2002.....	Q1 1999 – Q4 2001	6	6	1.000	-11.8
2003.....	Q1 1999 – Q4 2002	13	3	0.021	13.9
2004.....	Q1 1999 – Q4 2003	20	0	0.000	23.2
2005.....	Q1 1999 – Q4 2004	24	0	0.000	13.9
2006.....	Q1 1999 – Q4 2005	4	24	0.000	-5.2
2007.....	Q3 2001 – Q4 2006	22	0	0.000	39.7
2008.....	Q1 2002 – Q4 2007	17	7	<i>0.064</i>	29.1
2009.....	Q3 2001 – Q4 2008	13	16	0.000	-0.7
2010.....	Q1 2000 – Q4 2009	22	10	<i>0.050</i>	12.4
2011.....	Q1 1999 – Q4 2010	47	1	0.000	11.2
2012.....	Q1 2009 – Q4 2011	10	2	0.039	10.5
Imports of goods and services and income payments					
2001.....	Q1 1999 – Q4 2000	7	1	<i>0.070</i>	10.8
2002.....	Q1 1999 – Q4 2001	0	12	0.000	-53.7
2003.....	Q1 1999 – Q4 2002	8	8	1.000	-0.4
2004.....	Q1 1999 – Q4 2003	16	4	<i>0.012</i>	9.2
2005.....	Q1 1999 – Q4 2004	22	2	0.000	3.5
2006.....	Q1 1999 – Q4 2005	1	27	0.000	-5.6
2007.....	Q1 1999 – Q4 2006	18	14	0.597	1.1
2008.....	Q1 2004 – Q4 2007	13	3	0.021	14.4
2009.....	Q1 2001 – Q4 2008	29	3	0.000	3.0
2010.....	Q1 1999 – Q4 2009	10	34	0.000	1.2
2011.....	Q1 1999 – Q4 2010	45	3	0.000	7.6
2012.....	Q1 2009 – Q4 2011	7	5	0.774	1.0
U.S.-owned assets abroad					
2001.....	Q1 1999 – Q4 2000	4	4	1.000	2.3
2002.....	Q1 1999 – Q4 2001	7	5	0.774	-2.2
2003.....	Q1 1999 – Q4 2002	9	7	0.804	-1.9
2004.....	Q1 2001 – Q4 2003	8	4	0.388	3.7
2005.....	Q1 1999 – Q4 2004	18	6	0.023	7.6
2006.....	Q1 2002 – Q4 2005	8	8	1.000	-2.3
2007.....	Q1 2003 – Q4 2006	8	8	1.000	2.2
2008.....	Q1 2004 – Q4 2007	14	2	0.004	21.2
2009.....	Q1 2006 – Q4 2008	7	5	0.774	8.6
2010.....	Q1 2007 – Q4 2009	5	7	0.774	-12.0
2011.....	Q1 2007 – Q4 2010	5	11	0.210	-7.9
2012.....	Q1 2009 – Q4 2011	7	5	0.774	0.2
Foreign-owned assets in the United States					
2001.....	Q1 1999 – Q4 2000	7	1	<i>0.070</i>	22.2
2002.....	Q1 1999 – Q4 2001	1	11	0.006	-25.4
2003.....	Q1 1999 – Q4 2002	10	6	0.454	7.8
2004.....	Q1 2000 – Q4 2003	12	4	<i>0.077</i>	5.9
2005.....	Q1 2002 – Q4 2004	8	4	0.388	7.6
2006.....	Q1 2002 – Q4 2005	8	8	1.000	-4.3
2007.....	Q1 2003 – Q4 2006	7	9	0.804	3.9
2008.....	Q1 1999 – Q4 2007	17	19	0.868	9.1
2009.....	Q1 2006 – Q4 2008	7	5	0.774	0.8
2010.....	Q1 2007 – Q4 2009	2	10	0.039	-10.0
2011.....	Q1 2007 – Q4 2010	4	12	<i>0.077</i>	-1.3
2012.....	Q1 2009 – Q4 2011	5	7	0.774	9.8
Current-account balance					
2001.....	Q1 1999 – Q4 2000	4	4	1.000	-4.1
2002.....	Q1 1999 – Q4 2001	12	0	0.000	103.0
2003.....	Q1 1999 – Q4 2002	11	5	0.210	18.1
2004.....	Q1 1999 – Q4 2003	11	9	0.824	12.3
2005.....	Q1 1999 – Q4 2004	7	17	<i>0.064</i>	-1.3
2006.....	Q1 1999 – Q4 2005	21	7	0.013	4.3
2007.....	Q1 1999 – Q4 2006	24	8	0.007	37.3
2008.....	Q1 2002 – Q4 2007	15	9	0.307	24.5
2009.....	Q1 2001 – Q4 2008	11	21	0.110	-21.7
2010.....	Q1 1999 – Q4 2009	41	3	0.000	17.5
2011.....	Q1 1999 – Q4 2010	36	12	0.001	1.8
2012.....	Q1 2009 – Q4 2011	7	5	0.774	23.4

1. Given the null hypothesis that the estimates are equally likely to be revised up as revised down, the p-value represents the probability of seeing a) a ratio at least as high as the observed ratio, or b) a ratio with a reciprocal that is at least as high as the observed ratio. P-values below 0.05 in **bold**; between 0.05 and 0.1 in *italics*.
NOTE: Natural signs used for revisions and estimates. See footnote 32 in the text.

the fifth column of the table.⁵³ However, common direction changes are not spread equally throughout the accounts. More than half of the current-account p-values are less than 0.05, but only 4 of 24 of the financial-account p-values are below that threshold.

The adoption of new data and methods plays an important role in some common-direction revisions. For example, in June of 2007, 22 quarterly estimates of exports of goods and services and income receipts were revised upward. A substantial contribution to these revisions stemmed from instituting a new method for calculating bond interest; BEA changed to a current-yield method (reflecting only coupon interest flows) from a yield-to-maturity method (reflecting both coupon interest flows and future gains and losses on the security). As part of this change, BEA was able to use more detailed and precise survey data to replace the use of broad market indexes. This change resulted in higher yield estimates, which in turn led to higher estimates of income receipts extending back to the second half of 2001.

As a second example, in June of 2008, estimates of flows of U.S.-owned assets abroad were revised upward for 14 of the 16 quarters from 2004 to 2007. The revisions stemmed from two main sources. First, adjustments were made as a result of the 2006 Treasury Department benchmark survey to account for underreported source data on net U.S. purchases of foreign securities. The adjustments increased estimates of net purchases of foreign bonds. Second, methods for estimating missing source data on flows of short-term funds raised in U.S. markets by special purpose vehicles were improved. This increased “U.S. claims on unaffiliated foreigners reported by U.S. nonbanking concerns” from 2005 to 2007.

As noted earlier, ITA revisions are made for a number of reasons, including updated source data, new data sources, methodological improvements, and changes in definition. At the level of aggregation considered in this study, it is not possible quantitatively to assess the relative importance of each source of revision. For some accounts and for some time periods, source data updates are a major factor underlying observed MRs and MARs. For others, changes in definitions and methodologies are more important. The revisions summarized throughout this article reflect BEA’s continuing efforts to improve its estimates to re-

flect new types of economic activities or new sources of data. In addition, revisions reflect BEA’s efforts to ensure that its account categories reflect logical and useful classification frameworks.

VII. Revisions to Other International Accounts Estimates

This section briefly examines MRs and MARs of key estimates outside, but related to, the ITAs. These measures are presented for annual estimates of international investment position (IIP) accounts and the activities of multinational companies (MNCs).

IIP accounts

As stock measures, IIP estimates have a certain inertia not displayed by the corresponding flow estimates in the financial account of the ITAs, insofar as much of the stock from one year carries over to become part of the stock of the next year. Thus, the period-to-period variability of the IIP estimates, relative to the estimates themselves, is not as great as in the corresponding ITA financial-account transactions, suggesting that item-value-scaled MRs and MARs may not be large relative to other accounts.

Table 12 shows averages for the first-to-second revisions of six key components of the IIP accounts. Average absolute revisions of the estimates for 1989 to 2010 range in magnitude from 1.4 percent to 4.4 percent. MARs are larger on the U.S.-owned assets abroad side of the position and are associated with positive, although not statistically significant, MRs of similar size.⁵⁴ This finding raises a concern about possible persistent underestimation in the initial published estimates for U.S. holdings of assets in other countries. The MR for U.S. private assets varied over the sample period. Over the first half of the period, the MR was 5.1 percent; over the second half of the period, it was 2.1 percent. The difference in MRs between the first and second half of the period largely reflects the introduction into the estimates in 1997 of results from the Treasury Department survey of U.S. portfolio investment abroad as of March 1994, the first such benchmark survey in 50 years. The survey resulted in substantial revisions (nearly 13 percent) to the 1995 estimate. Since then, BEA’s estimates of U.S. private assets have been reconciled with, and calibrated to, the Treasury Department’s reinstated benchmark survey and its more recently instituted annual survey on securities holdings.⁵⁵ As a result of this ongoing process, BEA’s estimation methods and assumptions have improved.

53. The p-values are based on a binomial distribution, where each revision can be considered a Bernoulli trial—an estimate is either revised upward or revised downward, with “success” probability of 0.5. The number of successes is the maximum of the number of upward revisions and the number of downward revisions. The number of Bernoulli trials is the sum of the two types of revisions. This statistical test does not allow for either an *a priori* imbalance of up and down revisions or any within-year clustering of the direction of revisions.

54. None of the MRs shown in table 12 are statistically significant.

55. BEA’s estimates of foreign-owned assets in the United States show much smaller MRs. One reason is that Treasury Department surveys on liabilities in securities were in place throughout the period.

MNC activities

Table 12 also shows average revisions for estimates of selected MNC activities—employment, value added, and capital expenditures—for three types of entities: U.S. parent companies, their foreign affiliates, and U.S. affiliates of foreign companies. These data are collected by BEA on benchmark and annual surveys. Due to data collection and analysis requirements, published estimates of MNC activities are necessarily less timely than ITA or IIP estimates, so the MRs and MARs cover years only through 2008. MARs range from less than 1 percent to nearly 3 percent. In general, revisions are largest for capital expenditures, an activity that is “lumpy” with large swings from one year to the next and therefore difficult to impute with precision (at the company level) before complete data are available.

Overall, the revisions of the estimates for both IIP accounts and the activities of MNCs are generally comparable with those of estimates in the current account. Revision magnitudes are generally low or moderate, and evidence of systematic underestimation may be

explained by changes in data collection and verification procedures.

VIII. Conclusion

This study has presented the first indepth examination of the revisions of BEA's international accounts estimates. Revisions for most accounts center around zero and are small in magnitude. In addition, first estimates normally show the correct direction of change. For several of the main ITA aggregates, revisions are similar in magnitude to those of GDP, an estimate that has been the subject of multiple prior studies. Revisions to key balances, such as the current-account balance and the trade balance, are broadly similar to those of their component accounts.

The size of revisions differs across accounts. Revisions to goods exports and goods imports are considerably smaller, for instance, than revisions to income receipts and income payments. The method used to scale revisions influences the apparent size of the revisions. Whereas revisions in the financial account are quite large in dollar terms, when scaled by quarter-to-quarter variability in the estimates, revisions in the financial account are relatively modest. 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 Treasury International Capital system, for source data obtained externally.⁵⁶ A primary focus of these efforts will continue to be ensuring that early estimates reflect the full range of relevant transactions.

56. Several recent developments from the Treasury International Capital system should help to improve BEA's estimates, including more timely production of statistics on cross-border derivatives contracts (see www.federalregister.gov/articles/2011/09/14/2011-23586/proposed-collections-comment-requests) and a new reporting form for cross-border securities position data (see Erika Brandner, Fang Cai, and Ruth Judson, “Improving the Measurement of Cross-Border Securities Holdings: The Treasury International Capital SLT,” *Federal Reserve Bulletin* 98 (May 2012): 1–28.)

Table 12. Mean Revisions and Mean Absolute Revisions of First Annual Estimates in Selected Other International Accounts, Item-Value Scaling
[Percent of account value]

Account	Mean revision	Mean absolute revision
International investment position (1989–2010)		
U.S.-owned assets abroad	3.28	3.40
U.S. private assets	3.57	3.70
Direct investment at current cost.....	1.31	2.37
Foreign-owned assets in the United States.....	0.43	1.38
Other foreign assets.....	0.21	1.65
Direct investment at current cost.....	-0.12	2.38
Foreign direct investment in the United States: U.S. affiliates (1989–2009)		
Employment ¹	0.55	0.82
Value added ²	-0.04	1.67
Capital expenditures ³	1.76	2.28
U.S. direct investment abroad: U.S. parent companies (1989–2008)⁴		
Employment	-0.34	1.45
Value added (1994–2008)	0.16	1.44
Capital expenditures.....	0.77	2.34
U.S. direct investment abroad: foreign affiliates (1989–2008)⁵		
Employment	0.29	1.21
Value added (1991–2008).....	0.95	1.70
Capital expenditures.....	0.19	2.79

1. All nonbank, majority-owned affiliates for 1989–2006; all majority-owned affiliates for 2007–2009.
2. All nonbank affiliates for 1991; nonbank, majority-owned affiliates for all other years before 2007; all majority-owned affiliates for 2007–2009.
3. All nonbank affiliates for 1989–1991 and 2000–2001; nonbank, majority-owned affiliates for all other years before 2007; all majority-owned affiliates for 2007–2009.
4. Nonbank parent companies.
5. Nonbank, majority-owned affiliates.
NOTE: Revisions are computed as the ratio of the difference between second annual estimate and first annual estimate to the first annual estimate and are expressed in percent terms.