

ECONOMIC COMMENTARY

The Discrepancy between Expenditure- and Income-Side Estimates of US Output

Kurt G. Lunsford

The United States has two measures of economic output: gross domestic product (GDP) and gross domestic income (GDI). While these are conceptually equivalent, their initial estimates differ because these initial estimates are computed from different and incomplete data sources. I study the difference, or “statistical discrepancy,” between GDP and GDI in percent and document three features. First, its size does not materially shrink on average as more data become available. Second, the size of the initial discrepancy in absolute value does not predict the size of the discrepancy in absolute value after revisions. Third, the initial discrepancy has some predictive information about revisions to lagged GDP growth but no predictive information about revisions to lagged GDI growth.

The Bureau of Economic Analysis (BEA) computes US gross domestic product (GDP), which is measured as total expenditure on all of a country’s finished goods and services. The BEA also computes US gross domestic income (GDI), which is measured as all incomes earned from the production of a country’s finished goods and services. Because one person’s expenditure is another person’s income, GDP and GDI are conceptually equivalent measures of economic output. Despite the conceptual equivalence of these two measures, however, the BEA’s estimates of GDP and GDI differ because the BEA uses different data sources to compute GDP and GDI. Further compounding these differences is that real-time estimates of GDP and GDI rely on incomplete data and are subject to revisions as new data become available.¹

In this *Commentary*, I study the difference, or “statistical discrepancy,” between GDP and GDI measured in percent.² I begin by discussing GDP and GDI for 2022:Q1. Initially, GDI in this time period was measured to be 3.4 percent larger than GDP. As discussed by assistant secretaries at the US Department of the Treasury, this large discrepancy between GDP and GDI could change perceptions about economic productivity and the burden of public debt.³

However, Federal Reserve governor Christopher Waller speculated that differences between GDP and GDI growth could shrink as GDP and GDI are revised.⁴ Indeed, the BEA has since revised down the discrepancy between GDP and GDI to 1.1 percent. This sizable reduction in the statistical discrepancy is a result of a downward revision to GDI growth, particularly in 2021, and an upward revision in GDP growth, particularly in 2020. That is, the large statistical discrepancy in 2022:Q1 was revised down in part because of revisions to growth in earlier time periods.

Next, I study if these recent GDP and GDI revisions have similar characteristics to previous revisions. Using data vintages from 1995:Q3 through 2022:Q2, I document three features of revisions to GDP and GDI.⁵ First, the size of the statistical discrepancy between GDP and GDI does not materially shrink on average, implying that the large reduction in the discrepancy in 2022:Q1 does not represent the typical historical revision. Second, a large discrepancy between GDP and GDI in absolute value does not predict that the discrepancy will stay large in absolute value (or shrink) after revisions.⁶ Hence, while the big reduction in the 2022:Q1 discrepancy was not typical, the large initial discrepancy was not informative regarding the size of the discrepancy after revisions.

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Third, GDI larger than GDP has some predictive information for revisions to GDP in earlier time periods; however, it has no predictive information for revisions to GDI in earlier time periods. Hence, the upward revision to 2020 GDP growth is consistent with previous revisions, but the downward revision to 2021 GDI growth is not.

Discrepancies between GDP and GDI, such as in 2022:Q1, can be problematic for policymakers and business economists because they may rely on initial estimates of economic output to make policy and business decisions. While revised data shrank the 2022:Q1 discrepancy, my finding that historical discrepancies do not shrink on average indicates that revisions do not usually move GDP and GDI into agreement about the level of economic output. However, while GDP and GDI might persistently disagree, recent research has provided methods for combining GDP and GDI into reconciled measures of economic output. For example, the BEA began reporting the average of GDP and GDI in 2015 (McCulla and Smith, 2015),⁷ and the Federal Reserve Bank of Philadelphia has been publishing “GDPplus” growth rates based on Aruoba et al. (2016).⁸ Research in this direction has been ongoing, using different statistical models to provide different estimates of output growth, provide monthly estimates of output growth, or incorporate earlier data vintages into estimates of output and of output growth.⁹

The Revision to the Discrepancy between GDP and GDI in 2022:Q1

Figure 1 shows the initial and revised levels of GDP and GDI in chained 2012 dollars from 2017:Q1 to 2022:Q1.¹⁰ The left panel of Figure 1 shows the BEA’s measures of GDP and GDI as of June 2022. With these measures, GDI was 3.4 percent larger than GDP in 2022:Q1.

The solid lines in the right panel of Figure 1 show the BEA’s estimates of GDP and GDI as of September 2022. The dashed lines in the same panel show the June 2022 estimates for comparison purposes. With the September 2022 estimates, GDI is 1.1 percent larger than GDP in 2022:Q1. That is, from the June 2022 estimates to the September 2022 estimates, the discrepancy between GDI and GDP fell by 2.3 percentage points.

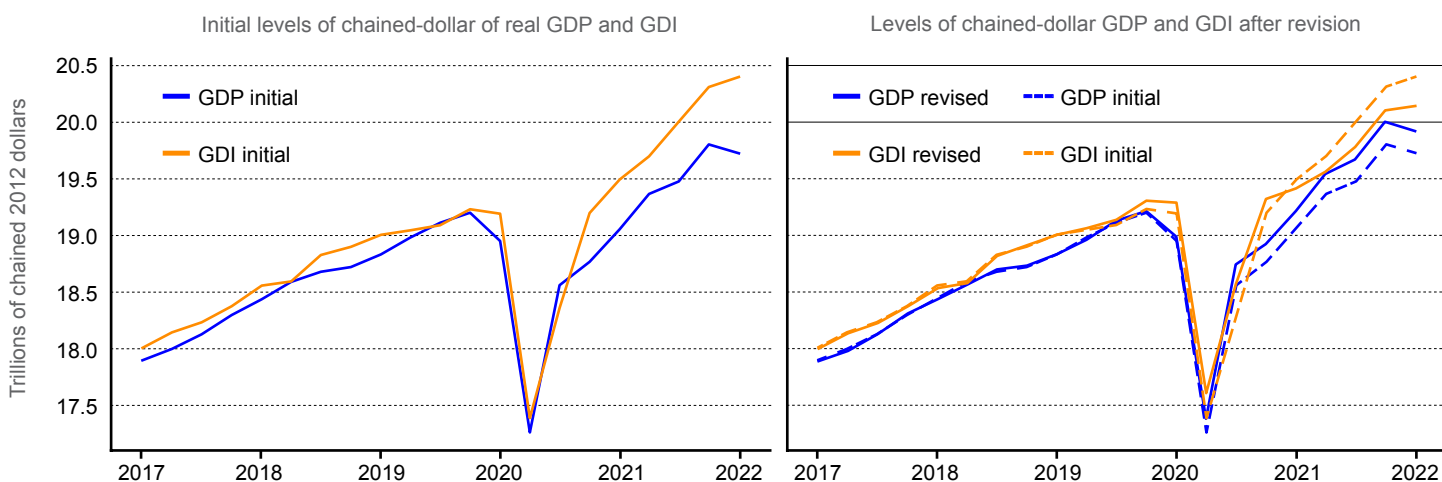
The right panel of Figure 1 shows that the BEA’s revision in September 2022 was not just to 2022:Q1. Both GDP and GDI were revised back to 2017:Q1, with the largest revisions occurring in 2020 and 2021.¹¹ In 2020 and 2021, average annualized quarterly GDP growth was revised up by 0.7 percentage points and 0.2 percentage points, respectively. In 2020 and 2021, average annualized quarterly GDI growth was revised down by 0.1 percentage points and 1.7 percentage points, respectively. Together, the upward GDP revisions and the downward GDI revisions in the years before 2022:Q1 account for most of the reduction in the statistical discrepancy.

The remainder of this *Commentary* studies historical revisions to GDP and GDI to assess if these recent revisions have similar characteristics to previous revisions. In my analysis, I ask the following three questions:

1. Does the size of a discrepancy typically go down when revisions occur?
2. Is the initial size of a discrepancy informative for what the size will be after revisions occur?
3. Does the initial discrepancy have predictive information about revisions to previous periods’ GDP growth or GDI growth?

The answer to the first two questions is no. The answer to the third question is yes for GDP growth but no for GDI growth.

Figure 1: Initial and Revised Levels of Chained-Dollar GDP and GDI



Sources: Bureau of Economic Analysis gross domestic product (GDP), chained-dollar gross domestic product (GDPC1), and gross domestic income (GDI), retrieved from ALFRED, Federal Reserve Bank of St. Louis, and the Bureau of Economic Analysis; author’s calculations.

Notes: Initial GDP and GDI use data as of June 2022. They have the same values in both panels. Revised GDP and GDI in the right panel use data as of September 2022.

Do Revisions Typically Reduce the Size of the Discrepancy between GDP and GDI?

The left panel of Figure 2 shows the initial and revised discrepancies between GDI and GDP from 1995:Q3 through 2022:Q2. I measure the discrepancy as how much larger GDI is compared to GDP in percent.¹² A value above zero indicates that GDI is larger than GDP; correspondingly, a value below zero indicates that GDI is smaller than GDP. In Figure 2 and throughout this *Commentary*, the initial discrepancies are based on the BEA's estimates of GDP and GDI three months after the end of the respective quarter.¹³ The revised discrepancies are based on the estimates of GDP and GDI as of September 2022.

The left panel of Figure 2 shows that the initial and revised discrepancies generally move together, with a correlation equal to 0.47. However, the revised discrepancies can sometimes be quite different than the initial discrepancies. In the right panel of Figure 2, I show the absolute values of the initial and revised discrepancies. I'll refer to these absolute values as the "size" of the discrepancies. In some instances, such as in 2021 and 2022:Q1, the size of the initial discrepancy is large and gets revised down. In other instances, such as in 2006, the size of the initial discrepancy is small and gets revised up.

To assess whether the sizes of the discrepancies generally decline with revisions, I compute the average of the absolute values of both the initial and revised discrepancies that are shown in the right panel of Figure 2. I show these averages in Table 1 using two different sample periods. The first sample uses all available data from 1995:Q3 through 2022:Q2. The second sample uses data from 1995:Q3 through 2020:Q4. I include this second sample for two reasons. First, it allows me to compare the large revisions in 2021 and 2022:Q1 to revisions in previous time periods. Second, it removes more recent time periods that have had fewer revisions and for which the source data are likely incomplete.

Table 1: Averages of Absolute Values of Discrepancies between GDP and GDI

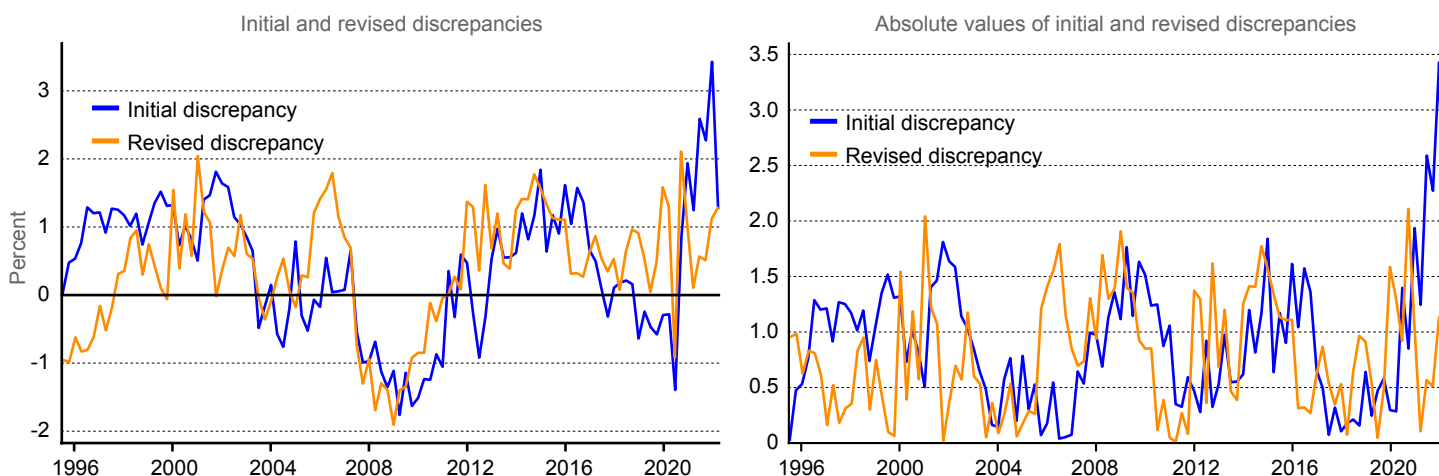
	1995:Q3 to 2022:Q2	1995:Q3 to 2020:Q4
Initial discrepancy	0.90	0.82
Revised discrepancy	0.79	0.79
Difference (standard error)	-0.10 (0.13)	-0.03 (0.13)

Sources: Bureau of Economic Analysis gross domestic product (GDP), chained-dollar gross domestic product (GDPC1), and gross domestic income (GDI), retrieved from ALFRED, Federal Reserve Bank of St. Louis, and the Bureau of Economic Analysis; author's calculations.

Notes: Values are expressed in percentage points. The difference row may not match the difference of the initial and revised discrepancy rows because of rounding.

Table 1 shows that the average size of the revised discrepancies is smaller than the average size of the initial discrepancies. However, the difference between the initial and revised discrepancies is small and is not statistically different from zero.¹⁴ Using the whole sample, the average difference is 0.10 percentage points. This is much smaller than the -2.30 percentage points observed for the revision of the statistical discrepancy in 2022:Q1. Using the 1995:Q3 to 2020:Q4 sample, the average difference is 0.0 after rounding to one decimal point. Essentially, there is no evidence that revisions cause a reduction in the average sizes of the discrepancies between GDP and GDI prior to 2021, and in view of that historical pattern, the big discrepancy reduction in 2022:Q1 should not have been expected.¹⁵

Figure 2: Initial and Revised Discrepancies between GDP and GDI and Absolute Values of the Discrepancies



Sources: Bureau of Economic Analysis gross domestic product (GDP), chained-dollar gross domestic product (GDPC1), and gross domestic income (GDI), retrieved from ALFRED, Federal Reserve Bank of St. Louis, and the Bureau of Economic Analysis; author's calculations.

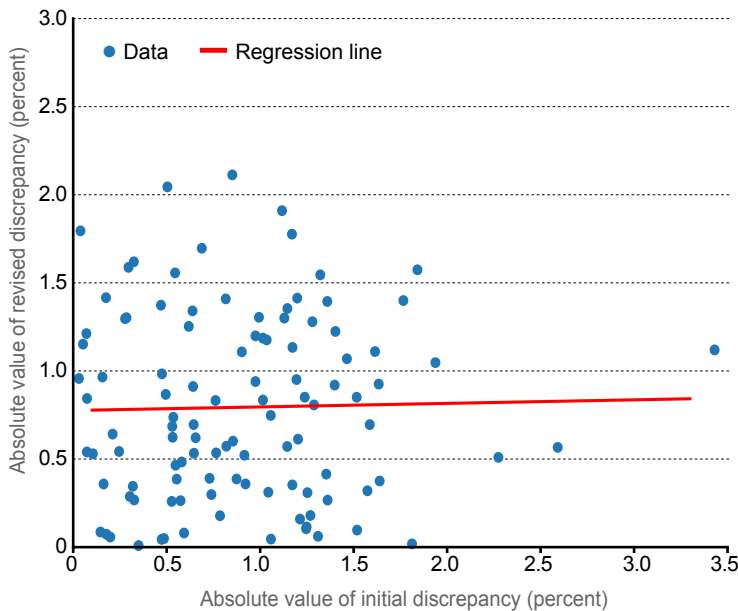
Notes: In the left panel, the discrepancy is measured as how much larger GDI is than GDP in percent. A value above zero indicates that GDI is larger than GDP. A value below zero indicates that GDI is smaller than GDP. The right panel shows the absolute values of the discrepancies from the left panel.

Does the Initial Size of the Discrepancy between GDP and GDI Help Predict the Revised Size?

In the previous section, I showed that revisions do not cause a material reduction in size of the discrepancy between GDP and GDI on average. In this section, I study a natural follow-up question: if the size of the initial discrepancy is large (or small), does it stay large (or small) after revisions?

Figure 3 shows a scatter plot of the absolute values of the initial discrepancies and the absolute values of the revised discrepancies. Figure 3 also shows a regression line that I estimate with ordinary least squares. If large initial discrepancies were associated with large revised discrepancies, then the data in Figure 3 should have a positive relationship, that is, the data and the regression line would have an upward slope. However, Figure 3 shows no apparent relationship between the sizes of the initial discrepancies and the sizes of the revised discrepancies.¹⁶ In short, the initial size of the discrepancy has no predictive information about the revised size of the discrepancy. This result implies that the large initial discrepancy in 2022:Q1 was not informative about the eventual size of the discrepancy after revisions.

Figure 3: Scatter Plot of Absolute Values of Initial Discrepancies and Absolute Values of Revised Discrepancies



Sources: Bureau of Economic Analysis gross domestic product (GDP), chained-dollar gross domestic product (GDPC1), and gross domestic income (GDI), retrieved from retrieved from ALFRED, Federal Reserve Bank of St. Louis, and the Bureau of Economic Analysis; author's calculations.

Notes: The data for the scatter plot are the same as in the right panel of Figure 2. The regression line is estimated with ordinary least squares. The estimated intercept is 0.77 with a standard error of 0.12. The estimated slope is 0.02 with a standard error of 0.08.

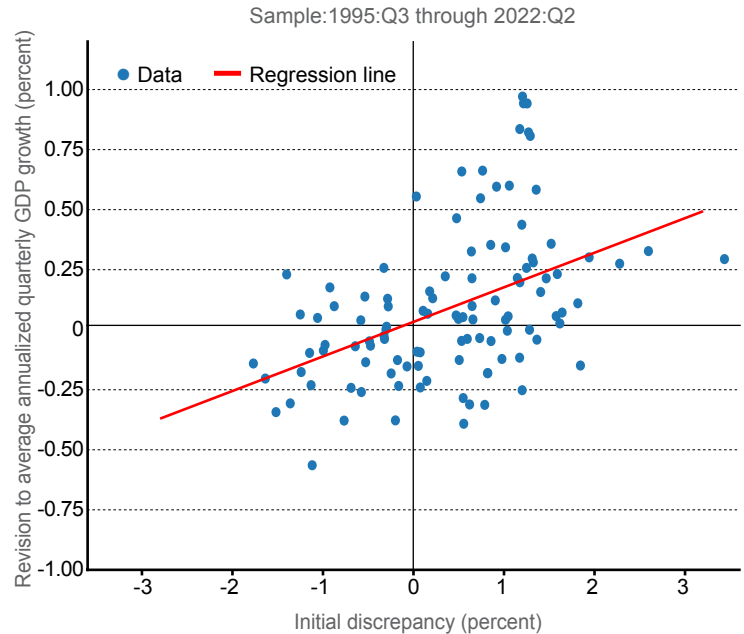
Does the Initial Discrepancy between GDP and GDI Help Predict Revisions to Previous Periods' GDP or GDI Growth?

In this section, I address the third question of this *Commentary*: does the initial discrepancy between GDP and GDI help predict revisions to previous periods' GDP or GDI growth? To answer this question, I compare the initial discrepancy in a quarter to the difference between the initial and the revised quarterly annualized growth rates of GDP and GDI averaged over the previous 12 quarters.

Figure 4 shows these comparisons as a scatter plot for all quarters from 1995:Q3 through 2022:Q2 for GDP growth. Figure 4 also shows a regression line, estimated with ordinary least squares.

Figure 4 shows a positive relationship between initial discrepancies and the revisions to previous periods' GDP growth. That is, when GDI is initially measured to be larger than GDP, subsequent revisions increase GDP growth in previous periods.¹⁷ As described above, this was the case for GDP growth in 2020 and 2021 when the initial discrepancy in 2022:Q1 was positive. Shortening the sample to exclude data from 2021 and 2022 does not materially change this result.¹⁸

Figure 4: Scatter Plot of Initial Discrepancies and Revisions to Average Annualized Quarterly GDP Growth Rates over the Previous 12 Quarters



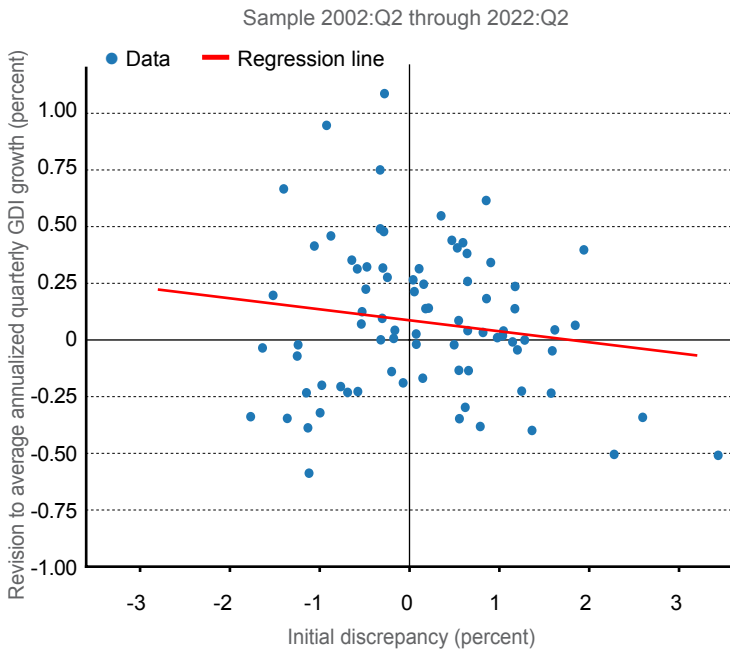
Sources: Bureau of Economic Analysis gross domestic product (GDP), chained-dollar gross domestic product (GDPC1), and gross domestic income (GDI), retrieved from retrieved from ALFRED, Federal Reserve Bank of St. Louis, and the Bureau of Economic Analysis; author's calculations.

Notes: The discrepancy is measured as how much larger GDI is than GDP in percent. A value above zero indicates that GDI is larger than GDP. A value below zero indicates that GDI is smaller than GDP. The regression line is estimated with ordinary least squares. The estimated slope is 0.15 with a standard error of 0.07.

Figure 5 shows the comparisons of initial discrepancies to revisions to GDI growth as a scatter plot. The sample is shorter in Figure 5 than in Figure 4. Figure 5 shows data from 2002:Q2 through 2022:Q2.¹⁹ It also shows a regression line estimated with ordinary least squares.

Figure 5 shows a negative relationship in the data, indicating that when GDI is initially measured to be larger than GDP, then subsequent revisions decrease GDI growth in previous periods. However, based on the estimation of the regression line, this negative relationship is not statistically significant.²⁰ Further, shortening the sample to exclude data from 2021 or 2022 changes the slope of the regression line to essentially 0. That is, while GDI was initially larger than GDP in 2022:Q1 and GDI growth was revised down in 2021, this type of negative relationship does not appear in the data prior to 2021.²¹

Figure 5: Scatter Plot of Initial Discrepancies and Revisions to Average Annualized Quarterly GDI Growth Rates over the Previous 12 Quarters



Sources: Bureau of Economic Analysis gross domestic product (GDP), chained-dollar gross domestic product (GDPC1), and gross domestic income (GDI), retrieved from ALFRED, Federal Reserve Bank of St. Louis, and the Bureau of Economic Analysis; author's calculations.

Notes: The discrepancy is measured as how much larger GDI is than GDP in percent. A value above zero indicates that GDI is larger than GDP. A value below zero indicates that GDI is smaller than GDP. The regression line is estimated with ordinary least squares. The estimated slope is -0.05 with a standard error of 0.10.

Summary and Discussion

In June 2022, the BEA estimated that GDI was 3.4 percent higher than GDP in 2022:Q1. A revision in September 2022 brought this discrepancy between GDI and GDP in 2022:Q1 down to 1.1 percent. This reduction in the discrepancy is largely accounted for by an upward revision to GDP growth in 2020 and 2021 and downward revision to GDI growth in 2020 and 2021. That is, the size of the discrepancy fell because of revisions to growth in previous periods.

In this *Commentary*, I study the discrepancy between GDI and GDP and its revisions. I provide three results. First, the size of the discrepancy does not materially shrink on average as revisions occur, indicating that the big reduction in 2022:Q1 does not represent the typical historical revision. Second, the size of the initial discrepancy does not predict the size of the discrepancy after revisions. That is, while the big reduction in 2022:Q1 was not typical, the large initial discrepancy was not informative about the size of the discrepancy after revisions. Third, the initial discrepancy has some predictive information about revisions to lagged GDP growth but no predictive information about revisions to lagged GDI growth. In other words, the upward revision to GDP growth in 2020 and 2021 is consistent with previous revisions, but the downward revision to GDI growth in 2021 is not.

The discrepancy between GDP and GDI can pose problems for understanding the current state of the economy. Further, my finding that the size of the discrepancy does not shrink with revisions indicates that GDP and GDI are not expected to eventually agree about the level of economic output. Given this feature of the data, combined estimates of GDP and GDI that are publicly available could be especially useful. Such estimates include the BEA's average of GDP and GDI, available in the addenda to National Income and Product Account Table 1.7.5; the Federal Reserve Bank of Philadelphia's "GDPplus," available at <https://www.philadelphiafed.org/surveys-and-data/real-time-data-research/gdpplus>; or Koop et al.'s (2022) monthly estimates of output growth, available at https://drive.google.com/file/d/10f7N8BI9Fs68cgZVp3_cwhTq8XkhkhK/view?usp=sharing.

Endnotes

1. See Holdren (2014) for a discussion of revisions and source data for GDP and GDI.
2. This *Commentary* follows in the spirit of Nalewaik (2010). However, I study the percent difference of GDP and GDI in levels. Conversely, Nalewaik (2010) studies the difference between the growth rates of GDP and GDI.
3. See Harris and Mehrotra (2022).
4. See Waller (2022).
5. The initial vintage in my analysis is determined by data availability of GDI in levels. For GDI vintages from 2012:Q3 through 2022:Q2, I collect data from the Federal Reserve Bank of St. Louis's ALFRED database, series code GDI. For GDI vintages from 2002:Q2 through 2012:Q2, I collect data from BEA's data archive at <https://apps.bea.gov/histdata/histChildLevels.cfm?HMI=7>. For GDI vintages from 1995:Q3 to 2002:Q1, I collect data from the BEA's archives of its *Survey of Current Business* at <https://apps.bea.gov/scb/issues.htm>. I also collect real-time vintages of nominal GDP and chained-dollar real GDP. I collect data for both variables from the Federal Reserve Bank of St. Louis's ALFRED database, series codes GDP and GDPC1. I am also grateful to Martín Almuzara of the Federal Reserve Bank of New York for sharing his data with me.
6. The revisions in earlier time periods usually occur with the BEA's annual revisions, which can revise GDP and GDI estimates several years in the past. The BEA occasionally makes comprehensive revisions, which can update the concepts underlying GDP and GDI and revise GDP and GDI estimates back for decades.
7. This average can found in the addenda to National Income and Product Account Table 1.7.5.
8. See <https://www.philadelphiafed.org/surveys-and-data/real-time-data-research/gdpplus>.
9. See Almuzara et al. (2021), Almuzara et al. (2022), Jacobs et al. (2022), and Koop et al. (2022).
10. Throughout this *Commentary*, I use real GDP and GDI measured in chained dollars. I refer to these measures as "chained-dollar" GDP and GDI but could equivalently refer to these measures as "real" GDP and GDI. The BEA produces chained-dollar GDP measures but does not produce chained-dollar GDI measures. To compute chained-dollar GDI measures, I first compute GDP deflators by dividing nominal GDP by chained-dollar GDP. Then, I divide nominal GDI by the GDP deflators.
11. The revision in September 2022 was the BEA's annual revision to the national economic accounts. For details, see <https://apps.bea.gov/scb/2022/05-may/0522-gdp-economy.htm#annual-update>.
12. The percent discrepancy is $100 \times (\text{GDI}/\text{GDP} - 1)$.
13. This value may be called the "final" or "third" estimate of GDP. For the first, second, and third quarters of the year, this value is the second estimate of GDI. For the fourth quarter of the year, this value is the first estimate of GDI.
14. Throughout this *Commentary*, standard errors for sample averages and for ordinary least squares estimates are adjusted for potential autocorrelation with the Bartlett kernel (Newey and West, 1987). To select the number of lags for the Bartlett kernel, I use 1.3 times the square root of the sample size (Lazarus et al., 2018).
15. Another approach to answering this question is to compute the fraction of observations in which the revised discrepancy is smaller than the initial discrepancy in absolute value. From 1995:Q3 through 2020:Q4, the revised discrepancy is smaller in 57 of the 102 observations, about 56 percent of observations. However, this value of 56 percent is not statistically different from 50 percent, a value indicating equal probability that the revised discrepancy is larger or smaller than the initial probability.
16. The slope of the regression line is 0.02 compared to a standard error of 0.09.
17. Using revised quarterly annualized growth rates over the previous eight quarters gives similar results. This positive relationship becomes weaker when using only four previous quarters.
18. Using data from 1995:Q3 through 2020:Q4 yields an estimated slope of 0.16 for the regression line with a standard error of 0.09. Another approach to studying this topic is to compute the fraction of observations where the initial discrepancy is positive and the revision to GDP growth over the previous 12 quarters is positive. From 1995:Q3 through 2020:Q4, both are positive in 68 of the 102 observations, about 67 percent of observations. The difference between this value of 67 percent and 50 percent is 17 percentage points with a standard error of 10 percentage points.
19. Prior to 2002:Q2, I collect GDI data from the BEA's archives of their Survey of Current Business. These archives typically only show the five or six most recent quarters of GDI estimates, preventing me from computing 12-quarter averages of quarterly growth rates.
20. Using revised quarterly annualized growth rates over the previous four or eight quarters also yields regression lines with slopes that are not statistically different from zero.
21. I emphasize here that my results in Table 1 and Figure 3 are about the absolute values of initial and revised discrepancies. In contrast, Figures 4 and 5 do not take absolute values of initial discrepancies or revisions to GDP or GDI. Hence, my finding that a positive initial discrepancy predicts an upward revision to GDP growth but no change to GDI growth does not necessarily contradict my finding that absolute values of revised discrepancies are not materially smaller than absolute values of initial discrepancies. These results can both exist because while the signs of revisions to GDP growth have a predictable component that can shrink the absolute value of the discrepancy, revisions to GDP and GDI growth also have unpredictable components that can push the absolute value back up.

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