



Real GDP in Annual Revisions to the U.S. National Accounts: 1966 - 2011*

Tom Stark

August 2011

Introduction

On July 29, 2011, the U.S. Bureau of Economic Analysis (BEA) released a flexible annual revision to the U.S. national income and product accounts. Real GDP growth was subject to large downward revisions. I use the Philadelphia Fed's real-time data set to compare the size of the recent revision with that of past annual revisions since 1966. I find:

- Large downward revisions are not uncommon in the annual revisions of recent years. In this regard, the 2011 annual revision does not stand out;
- Revisions are correlated with the state of the economy, as measured by real GDP growth itself and indicators of recession.¹

Methods

The BEA's annual revisions, released each summer, typically affect the observations over the past three years. The reason for the revision is that the BEA receives additional information on the national accounts from such sources as the annual economic surveys of the Census Bureau. The BEA's economists and statisticians use the additional information to improve the accuracy of their estimates for the variables in the national accounts. In the past, annual revisions would not involve changes to the methodology used to construct the data, just new and more comprehensive source data. In contrast, *flexible* annual revisions, such as the recent one, may affect more observations and incorporate changes to the BEA's methodology.

The analysis here focuses on the cumulative sum of the revisions to quarter-over-quarter growth in the 12 quarters of the three years prior to the year of each annual revision. For example, in the annual

* The views expressed here are those of the author and do not necessarily reflect those of the Federal Reserve Bank of Philadelphia or of the Federal Reserve System. Tom Stark is the assistant director and manager of the Philadelphia Fed's Real-Time Data Research Center and can be contacted at Tom.Stark@phil.frb.org.

revision of 2011, I examine the 12 quarters in 2008, 2009, and 2010. Over this 12-quarter period, the quarterly revisions can be positive in some quarters and negative in others, masking the overall effect of the annual revision. Figure 1 shows the results for revisions to quarterly quarter-over-quarter growth (not annualized, expressed in percent, not percentage points) in the BEA's past five annual revisions. In each annual revision, some quarters are characterized by positive revisions and others by negative ones. Thus, the 12-quarter sum of the revisions is a convenient metric for analyzing the overall effect. I examine the annual revisions that the BEA published from 1966 to 2011 and ask whether the revisions are related to the state of the economy. (The answer is yes.)

Empirical Findings

Figure 2 plots the 12-quarter sum of revisions to quarter-over-quarter growth in each annual revision from 1966 to 2011. The dates on the horizontal axis are those for the last year in the summation. The annual revision in 2011 (the last point plotted) was negative and large (-0.009) but not so negative as to stand out among the annual revisions of recent years. Large negative revisions also occurred in the annual revisions of 2010 (-0.010), 2009 (-0.008), and 2007 (-0.010).²

Notice that the last few annual revisions encompassed 12-quarter windows in which the underlying quarterly observation fell into periods of recession, as defined by the National Bureau of Economic Research (NBER). Figure 3 plots the observations according to whether the cumulative revisions occur over quarters that include at least one quarter that falls within the NBER's estimates of the dates for the peak and trough of the business cycle (see "Recession") or not (see "No Recession"). The figure shows that cumulative revisions are more likely negative when they involve quarters of recession. Moreover, a relationship exists between the cumulative revision and cumulative real GDP growth, measured over the same 12-quarter window as the revision (Figure 4). Large cumulative growth is often associated with large positive revisions. The relationship appears linear. Slow (and perhaps negative) growth is often associated with negative revisions. The revisions are also related to the number of quarters of recession in the 12-quarter window. Figure 5 plots the revisions against the number of quarters of recession in the window. (The number of quarters includes the quarters of the peak and the trough.)

Linear regression analysis confirms the impressions gleaned from the graphs (Table 1). I regressed the 12-quarter cumulative revision on, alternatively, the dummy variable for recessions (Figure 3), cumulative growth (Figure 4), and the number of recession quarters (Figure 5). Each equation includes a constant. I find statistically significant effects in each regression. The coefficient attached to the recession dummy variable (*RecDummy*) has a negative sign, indicating that revisions are smaller, on average, when the

¹ I thank John Chew for his assistance in assembling the data for this analysis.

² The annual observations for this paper are shown in the appendix. The analysis excludes observations when the BEA did not publish an annual revision.

quarters revised are those of a recession period. The coefficient attached to the number of quarters of recession (*RecQuarters*) also has a negative sign. By far, the results are most striking when the cumulative revision is regressed on cumulative growth: The equation's R-square statistic is 0.22 and cumulative growth carries a coefficient of 0.070, with a t-statistic of 3.170. This result suggests that revisions are related positively to growth.

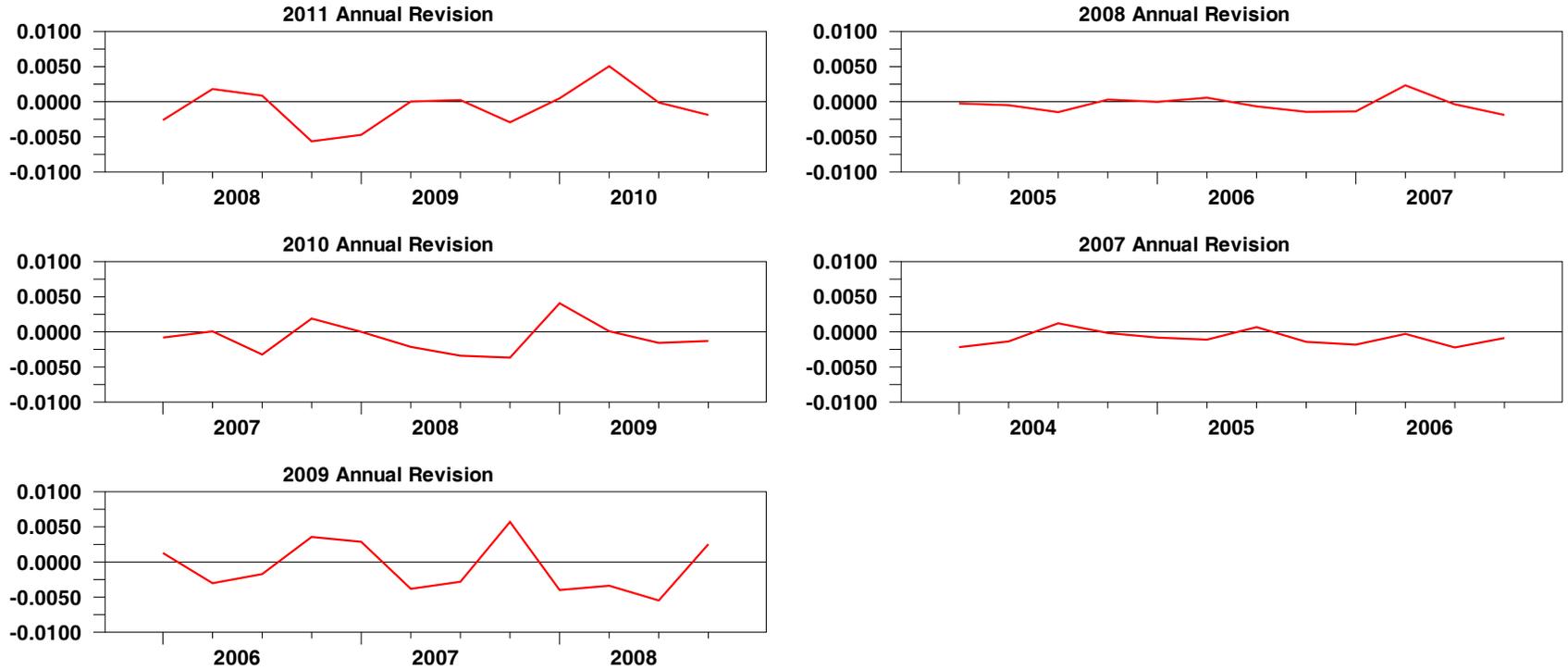
Table 1. Regressions of Cumulative Revisions on Indicators of the Business Cycle

	Dependent Variable: Cumulative Revision		
<i>Constant</i>	0.0023 (1.326)	-0.0062 (-2.753)	0.0016 (1.027)
<i>RecDummy</i>	-0.0042 (-1.786)		
<i>CumGrowth</i>		0.0699 (3.170)	
<i>RecQuarters</i>			-0.0007 (-1.555)
R-Square	0.081	0.22	0.063
N	38	38	38

Notes. The table shows the results of regressing the 12-quarter sum of revisions to quarter-over-quarter real GDP growth in the three years prior to the year of an annual revision on, alternatively, a zero-one dummy variable (*RecDummy*), 12-quarter cumulative growth in real GDP (*CumGrowth*), and the number of quarters of recession in the 12-quarter window (*RecQuarters*). Growth rates are not annualized and expressed in percent form (not percentage points). The dummy variable takes a value of unity when one or more quarters of the 12-quarter window are quarters of recession and zero otherwise. Cumulative growth is measured over the same 12-quarter window as the cumulative revision. The number of recession quarters is the number of quarters of recession in the 12-quarter window (inclusive of the peak quarter and the trough quarter). The numbers in parentheses are t-statistics, *uncorrected* for the presence of heteroscedasticity and serial correlation in the regression errors. (Slightly lower t-statistics result from a HAC estimator, using a truncation parameter of three lags.) The number of annual observations is 38. The sample covers the period of annual revisions from 1966 to 2011, excluding the observations lost in the years for which the BEA did not release an annual revision: 1975, 1980, 1981, 1985, 1991, 1995, 1999, and 2003. Note that the BEA tends to not release an annual revision when it is working on an upcoming benchmark revision or when it lacks the necessary source data to do so.

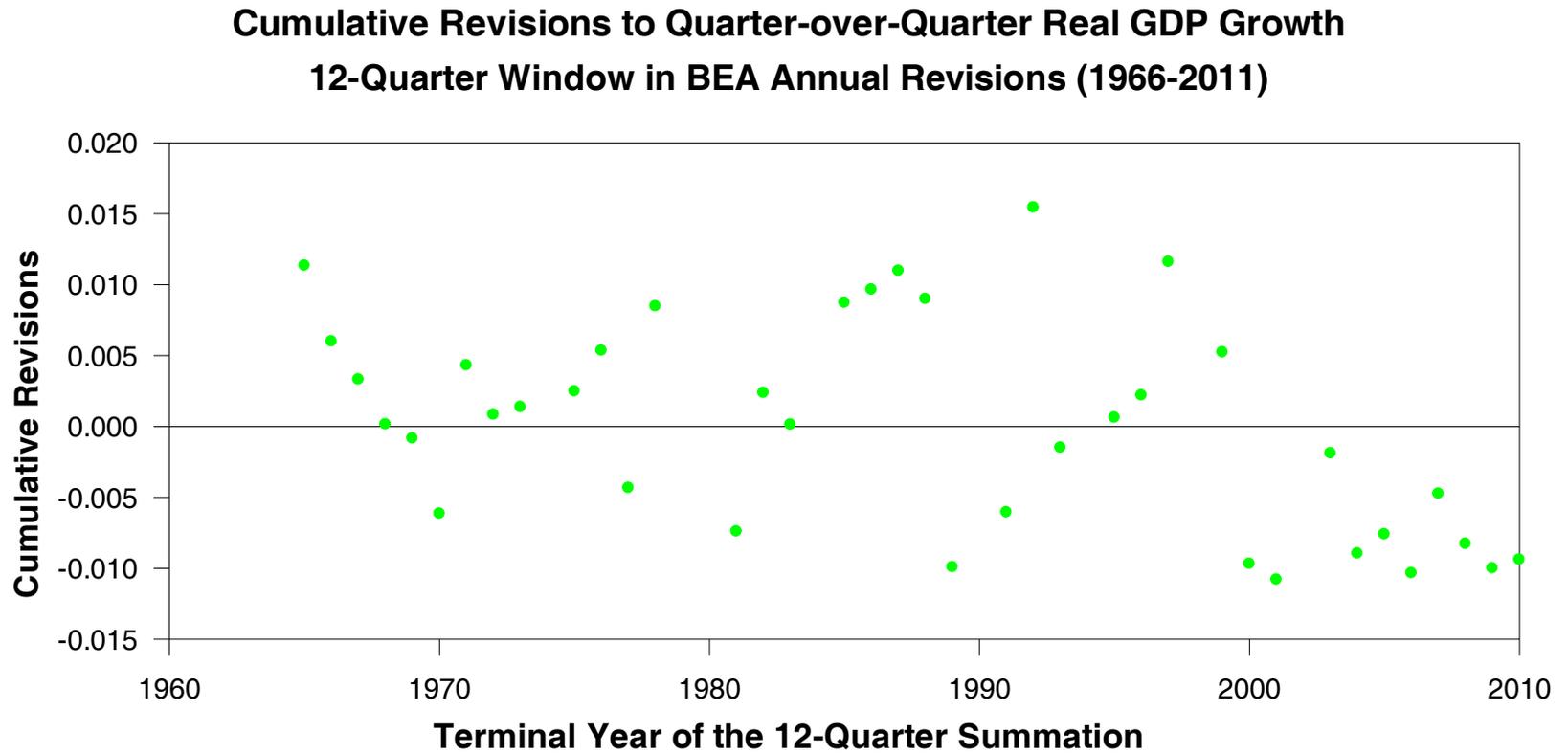
Figure 1.

The Five Most Recent Annual Revisions Quarterly Quarter-Over-Quarter Growth (Not Annualized, Percent)



Each chart shows the revisions to quarterly quarter-over-quarter growth (not annualized, percent) in the indicated annual revision.

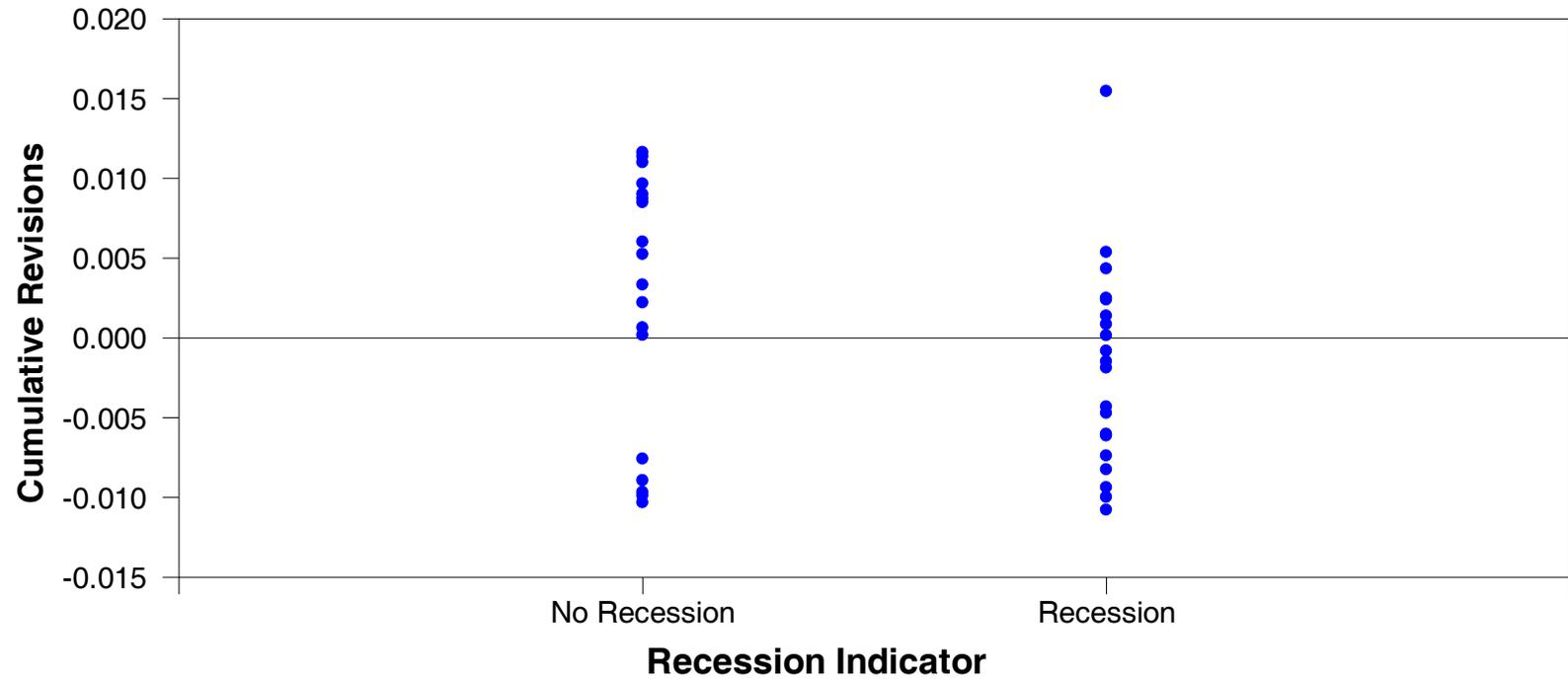
Figure 2.



Each point shows the 12-quarter sum of revisions to quarter-over-quarter growth (not annualized, percent) in the three-year period prior to the year of an annual revision.

Figure 3.

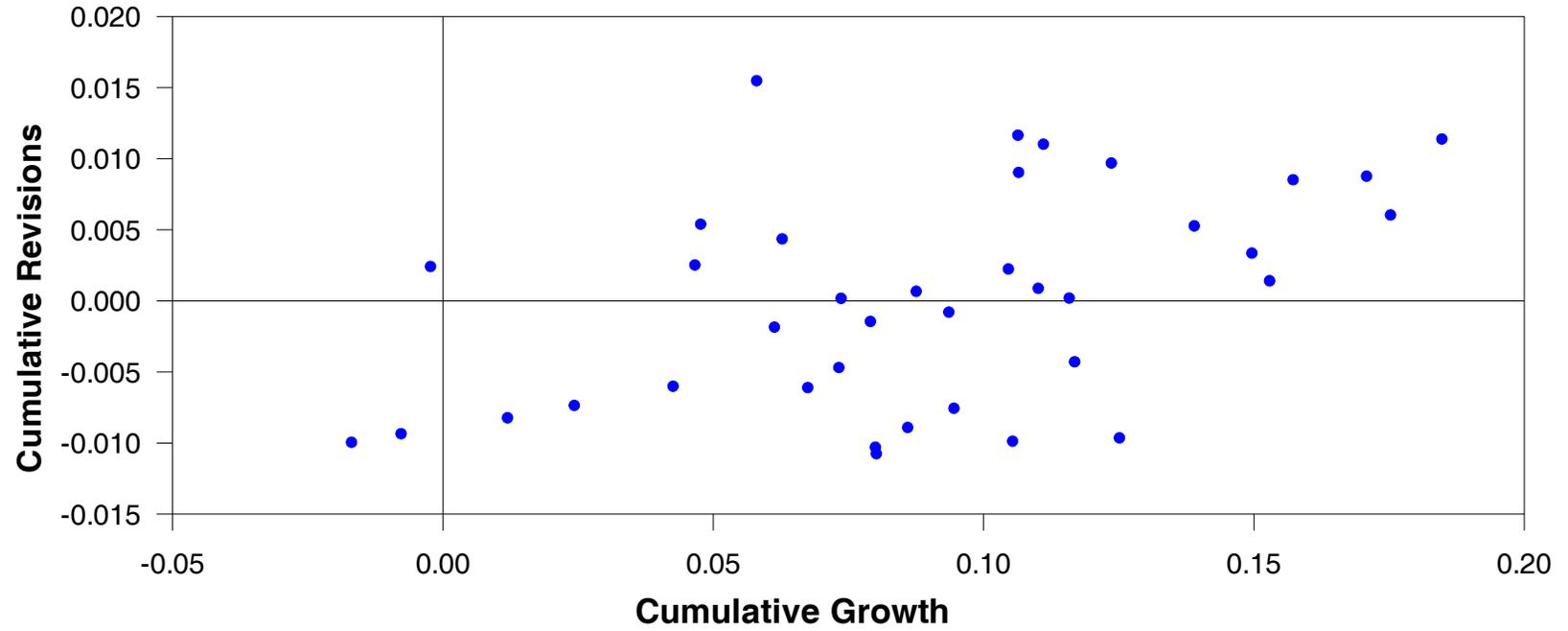
Cumulative Revisions in Nonrecession Periods and Recession Periods 12-Quarter Window in BEA Annual Revisions (1966-2011)



The points compare cumulative revisions in nonrecession periods with those in recession periods.

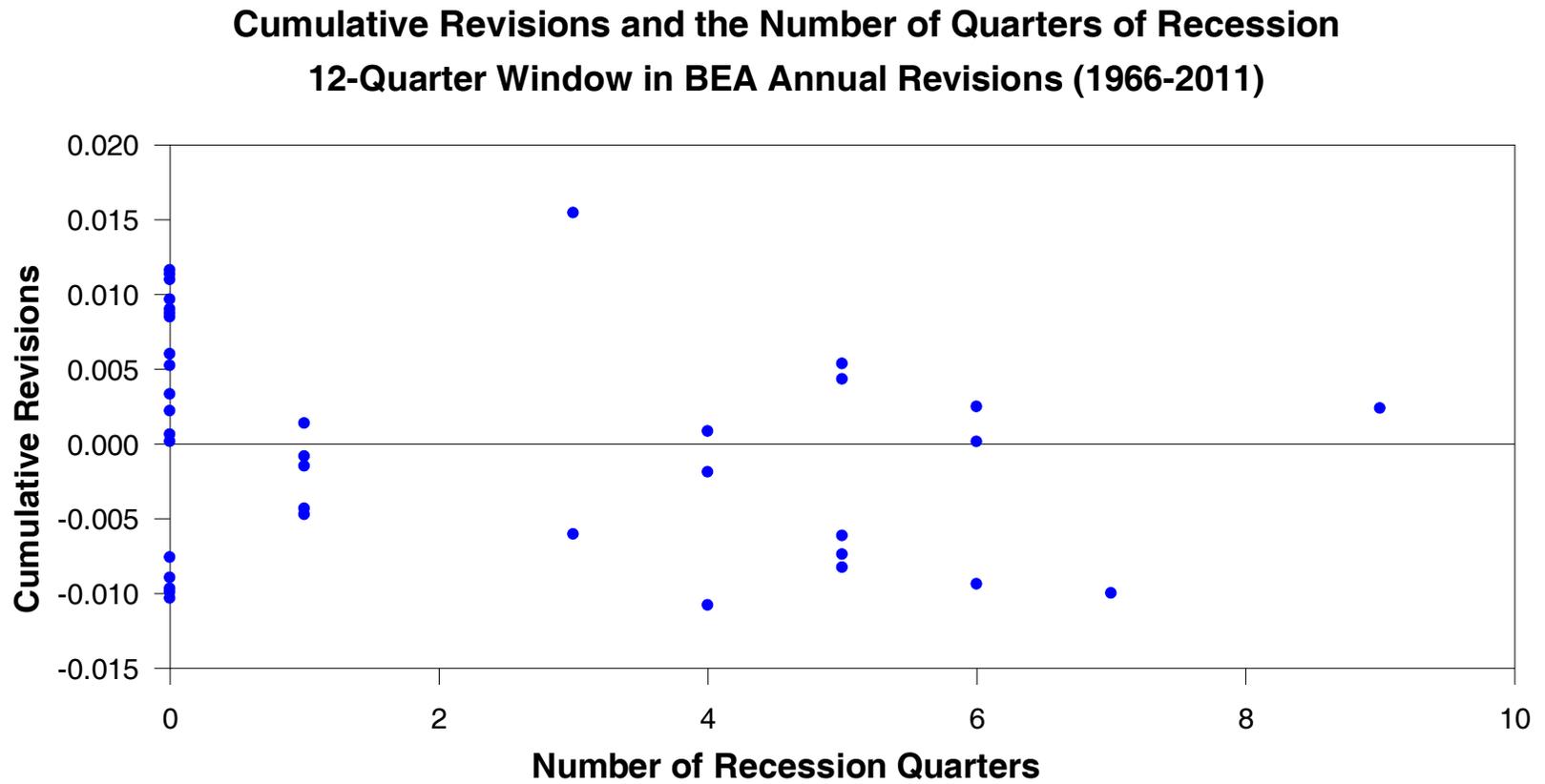
Figure 4.

Cumulative Revisions and Cumulative Growth 12-Quarter Window in BEA Annual Revisions (1966-2011)



The points show the relationship between cumulative revisions to real GDP growth (y-axis) and cumulative growth (x-axis). Growth rates are not annualized and in percent form.

Figure 5.



The graph shows the relationship between cumulative revisions (y-axis) and the number of recession quarters (x-axis).

Appendix. Annual Observations for Cumulative Revisions and Business Cycle Indicators

Annual Revision	Terminal Year	CumRev	RecDummy	RecQuarters	CumGrowth
1966	1965	0.011346	0.000000	0.000000	0.184867
1967	1966	0.006007	0.000000	0.000000	0.175385
1968	1967	0.003321	0.000000	0.000000	0.149744
1969	1968	0.000156	0.000000	0.000000	0.115944
1970	1969	-0.000831	1.000000	1.000000	0.093673
1971	1970	-0.006140	1.000000	5.000000	0.067588
1972	1971	0.004326	1.000000	5.000000	0.062857
1973	1972	0.000842	1.000000	4.000000	0.110213
1974	1973	0.001373	1.000000	1.000000	0.153008
1975	1974	NA	1.000000	5.000000	0.088964
1976	1975	0.002486	1.000000	6.000000	0.046709
1977	1976	0.005360	1.000000	5.000000	0.047778
1978	1977	-0.004327	1.000000	1.000000	0.116949
1979	1978	0.008485	0.000000	0.000000	0.157356
1980	1979	NA	0.000000	0.000000	0.127493
1981	1980	NA	1.000000	3.000000	0.077699
1982	1981	-0.007394	1.000000	5.000000	0.024403
1983	1982	0.002378	1.000000	9.000000	-0.002205
1984	1983	0.000138	1.000000	6.000000	0.073750
1985	1984	NA	1.000000	4.000000	0.115768
1986	1985	0.008732	0.000000	0.000000	0.170939
1987	1986	0.009659	0.000000	0.000000	0.123738
1988	1987	0.010983	0.000000	0.000000	0.111177
1989	1988	0.009002	0.000000	0.000000	0.106593
1990	1989	-0.009906	0.000000	0.000000	0.105470
1991	1990	NA	1.000000	2.000000	0.069149
1992	1991	-0.006043	1.000000	3.000000	0.042671
1993	1992	0.015448	1.000000	3.000000	0.058124
1994	1993	-0.001490	1.000000	1.000000	0.079194
1995	1994	NA	0.000000	0.000000	0.110106
1996	1995	0.000632	0.000000	0.000000	0.087646
1997	1996	0.002204	0.000000	0.000000	0.104695
1998	1997	0.011616	0.000000	0.000000	0.106469
1999	1998	NA	0.000000	0.000000	0.135439
2000	1999	0.005237	0.000000	0.000000	0.139079
2001	2000	-0.009679	0.000000	0.000000	0.125235
2002	2001	-0.010790	1.000000	4.000000	0.080291
2003	2002	NA	1.000000	4.000000	0.052172
2004	2003	-0.001886	1.000000	4.000000	0.061424
2005	2004	-0.008948	0.000000	0.000000	0.086071

Appendix (continued). Annual Observations for Cumulative Revisions and Business Cycle Indicators

Annual Revision	Terminal Year	CumRev	RecDummy	RecQuarters	CumGrowth
2006	2005	-0.007592	0.000000	0.000000	0.094636
2007	2006	-0.010331	0.000000	0.000000	0.080101
2008	2007	-0.004727	1.000000	1.000000	0.073347
2009	2008	-0.008263	1.000000	5.000000	0.012061
2010	2009	-0.009990	1.000000	7.000000	-0.016794
2011	2010	-0.009382	1.000000	6.000000	-0.007626

Notes. The table reports the annual observations used in this paper. The year of the BEA's annual revision is shown in the first column (labeled *Annual Revision*). The last year used in the 12-quarter summation of revisions to quarter-over-quarter growth is shown in the second column (labeled *Terminal Year*). The sum of the revisions to quarter-over-quarter growth is shown in the column labeled *CumRev*. The column labeled *RecDummy* shows the recession dummy variable, as defined previously. The column labeled *RecQuarters* shows the number of quarters in the 12-quarter window affected by recession, as defined previously. The column labeled *CumGrowth* shows the 12-quarter sum of quarter-over-quarter growth in real GDP over the same 12-quarter window used to cumulate the quarterly revisions. Additional information appears in the notes to Table 1. NA indicates an observation excluded from the analysis because the BEA did not produce an annual revision in the corresponding year.