Forecasting With NIPA Income Data:

Estimation Procedures and Revision Evidence

Background Paper

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Introduction

Granger and Newbold (1986) make the following statement in connection with forecasting: "A good deal of macroeconomic data is subject to continual revision, even several years after the event. This problem could be worthy of a separate book..." (p. 203). Specifically, what they refer to is the "errors in observation" problem (p. 203), which haunts all forecasters of economic data. Whether forecasters use autoregressive, integrated, moving average (ARIMA) or simultaneous equations system models to produce conditional or unconditional forecasts, revisions to published data can have significant impacts on the quality and reliability of forecasts.

This background paper is in the spirit of others that attempt to address one part of the "errors in observation" problem by discussing the reasons for revisions to key National Income component series and commenting on possible improvements to these series that can contribute to mitigating the problem.

Table 1 below shows that revisions to the National Income aggregate are relatively small over the period under consideration. However, because of the recent large revisions to the detailed components of National Income (wage and salary accruals, profits before tax (PBT), and net interest), forecasters may have produced less accurate and less reliable forecasts. We highlight the three cited National Income component series in this responses because they constitute nearly 78 percent of National Income for 2000. Also, wage and salary disbursements and personal interest income constitute over 70 percent of Personal Income for 2000.

Because there have been only two annual revisions since the last comprehensive revision of the National Income and Product Accounts (NIPA's), we are unable to reflect the full three-year cycle of annual revisions that are discussed for the component estimates below.

Table 1.--Revisions Since the 1999 Comprehensive NIPA Revision
(In billions of current dollars)

Estimate	1997	1998	1999	2000
National Income				
a. 2000 Annual Revision	-17.1	-.7	-26.6	
b. 2001 Annual Revision		3.3	-7.6	-21.1
Wages and salaries				
a. 2000 Annual Revision	1.3	3.3	2.8	
b. 2001 Annual Revision		-0.7	2.3	67.8
Profits before tax				
a. 2000 Annual Revision	-3.5	-23.7	-25.5	
b. 2001 Annual Revision		-37.1	-46.7	-80.2
Net interest				
a. 2000 Annual Revision	11.4	47.0	39.6	
b. 2001 Annual Revision		29.2	-0.6	-34.5

Wages and salaries

For current estimates, wage and salary estimates are extrapolations using Current Employment Statistics (CES, 790) data as the indicator series. For annual revision estimates, wages and salaries are based on data collected through the Unemployment Insurance system (UI, ES-202). UI data are not available for incorporation into current quarterly NIPA estimates; UI data are available five months after the reference quarter. BEA closes current estimates for a quarter three months after the end of the quarter.

Replacing CES data with UI wage and salary data at annual revisions produces revisions for the following reasons:

1. Industry coverage differences: CES excludes agriculture, private households, and the self employed; UI excludes statutory employees, excluded nonprofit employees, and only has partial coverage of some industries including farm, agricultural services, railroads, and private households.
2. Worker coverage differences: CES includes nonsupervisory and supervisory workers in manufacturing industries and nonsupervisory workers in nonmanufacturing industries; UI includes all UI-covered employees.
3. Wage and salary coverage differences: CES covers "regular earnings," excluding bonuses and other non-wage payments; UI covers total wages, including bonuses and irregular payments.
4. Data collection differences: CES is a sample survey while the UI provides significantly broader coverage.

It is worth noting that the CES data provide about 55 percent of the coverage of wages and salaries that is reflected in the UI data.

Recently, there have been sizeable annual revisions to the wage and salaries estimates (see table 2 for a history of revisions). BEA believes that a major contributor to these recent revisions is the inability of the CES to capture irregular payments adequately, particularly those associated with the exercise of stock options. Although these recent revisions may have been, in great part, due to irregular payments, we do not discount the importance of covering wages and salaries for all workers--certainly in terms of trend growth. To account for the CES' exclusion of the wages and salaries of many higher earning workers and for irregular payments, BEA employs a "revision or 'bias' adjustment," which was first used in the early 1990's.

Possible improvements to the wage and salaries estimates:

1. Expansion of the CES to reflect more comprehensive coverage; a major CES coverage expansion is scheduled to be implemented in 2005.
2. Conduct research and collaborate with other agencies, such as the Financial Accounting Standards Board, to prepare timely estimates of stock option exercises.
3. Open up a period t-1 quarter for revision when a period t quarter is being estimated. A

related problem is that UI data are very volatile and are difficult to seasonally adjust. This improvement is being researched currently; a decision on its implementation is expected in 2003.

Profits before tax (PBT)

Current estimates of PBT are extrapolations using Quarterly Financial Report (QFR) data, Regulatory Information, and COMPUSTAT (shareholder report) data as the indicator series. Although the first annual revision estimates are based on essentially the same data sources, there are coverage and estimation detail differences between the current quarterly estimates and the first annual revision estimates. For the second annual revision the previously cited data sources are replaced with advance Internal Revenue Service (IRS) Statistics of Income Division (SOI) data. Sizeable revisions in level can occur for the first and second annual revisions; however, large revisions in change are often associated with the second annual revision. For the third annual revision, advance SOI data are replaced with final SOI data–the major difference being a more inclusive sample. Recently, and contrary to previous history, revisions between the second and third annual revision were large. (See table 3 for a revision history.)

For recent periods, the large revisions for the first and second annual revision may have been caused primarily by coverage and accounting problems. Many of the private dot.com companies that experienced losses were not covered by the QFR or COMPUSTAT data (these data sources primarily cover publically held companies). COMPUSTAT data may have reflected accelerated earnings that may be reported for financial accounting purposes, but that are not reportable for tax accounting purposes. The QFR and COMPUSTAT data do not facilitate identification of stock option exercises. Also, recent revisions could be partly attributable to the conversion of SOI data to the North American Industrial Classification System (NAICS) from the Standard Industrial Classification System (SIC)

BEA's efforts to ensure the quality of PBT estimates include, but are not limited to:

1. BEA and the SOI agreed on a critical case list, which is a list of large impact companies that should be included in unbiased tabulations. Therefore, the SOI ensures that the most important companies (by asset size) are reflected in advance SOI tabulations.
2. BEA performs internal consistency checks by separately estimating liability year taxes based on monthly tax collections data, and uses those tax estimates in conjunction with the PBT estimates to prepare implicit tax ratios. The implicit tax ratios can signal inconsistencies with the PBT estimates.

Possible improvements to PBT estimates:

1. Seek greater coverage of QFR data.
2. As with wages and salaries, conduct research and collaborate with other agencies, such as the Financial Accounting Standards Board, to prepare timely estimates of stock option exercises.

3. Open up a period t-1 quarter for revision when a period t quarter is being estimated. This improvement is being researched currently; a decision on its implementation is expected in 2003.

Net Interest

Current quarterly estimates of net interest are derived residually from extrapolations of household and government interest flows that are based, in part, on Federal Reserve Board (FRB) Flow-of-Funds (household) data. For the first annual revision, estimates of net interest are derived directly and the FOF household data are replaced with FOF nonfinancial business data and with financial business interest flow data from regulatory agencies. For the second annual revision, these sources are replaced with advance SOI interest flow data. For the third annual revision, the advance SOI data are replaced with final SOI data. Sizeable revisions may occur for any of the three revision vintages. (See table 4 for a revision history.)

BEA believes that the FOF household sector data, which are derived residually within the FOF accounts, contribute significantly to first annual revisions.

BEA plans to assess whether net interest revisions between the first and second annual revisions have been generally smaller for financial companies, on a relative basis, than for nonfinancial companies. This is a reasonable conjecture because first annual revision interest estimates for financial companies are based on regulatory agency data, which should be consistent with interest estimates that are derived from SOI tabulations. If the conjecture proves true, then BEA can isolate efforts to improve first annual revision estimates to net interest for nonfinancial business.

To improve the current quarterly net interest estimates, last annual revision, BEA began to incorporate interest paid by persons estimates that were based, in part, on improved rate of return estimates from the FRB. This was in response to a long-standing BEA belief that a substantial portion of the first annual revisions to net interest are caused by weak estimates of rates of returns on household financial liabilities. Also, as for PBT, BEA believes that recent large revisions to net interest may be the result of the SOI conversion to NAICS from an SIC system.

Possible improvements to net interest estimates:

1. Conduct research based on tabulations from the IRS' Information Return Master File to improve personal interest and net interest estimates.
2. Develop a PBT-type estimating methodology; i.e., use QFR and COMPUSTAT company-based source data to directly measure net interest.
3. Open up a period t-1 quarter for revision when a period t quarter is being estimated. This improvement is being researched currently; a decision on its implementation is expected in 2003.

Table 2.–First and Second Annual Revisions to Wage and Salary Accruals Estimates
(In billions of current dollars)

Reference Periods	First annual revisions		Second annual revisions	
	Published estimates	Revisions	Published estimates	Revisions
1992	2,953.1	36.5	2,954.8	1.7
1993	3,100.8	0.3	3,095.2	-5.6
1994*	3,255.9	-23.1	3,257.3	1.4
1995	3,433.2	13.5	3,442.6	9.4
1996	3,633.6	3.5	3,640.4	6.8
1997	3,893.6	15.0	3,884.7	-8.9
1998*	4,189.5	35.6	4,192.8	3.3
1999	4,475.1	-2.8	4,472.2	-2.9
2000	4,837.2	67.8		

*–Comprehensive revision estimates.

Table 3.–First and Second Annual Revisions to Profits Before Tax Estimates
(In billions of current dollars)

Reference Periods	First annual revisions		Second annual revisions	
	Published estimates	Revisions	Published estimates	Revisions
1992	395.4	23.8	395.9	0.5
1993	462.4	13.0	464.3	1.9
1994*	528.2	3.7	531.2	3.0
1995	598.9	-1.9	622.6	23.8
1996	676.6	36.7	680.2	3.6
1997	734.4	4.6	795.9	61.5
1998*	781.9	64.1	758.2	-23.7
1999	823.0	-25.5	776.3	-46.7
2000	845.4	-80.2		

*–Comprehensive revision estimates.

Table 4.–First and Second Annual Revisions to Net Interest Estimates
(In billions of current dollars)

Reference Periods	First annual revisions		Second annual revisions	
	Published estimates	Revisions	Published estimates	Revisions
1992	442.0	26.8	420.0	-22.0
1993	399.5	-46.1	398.1	-1.4
1994*	392.8	-16.9	394.9	2.1
1995	403.6	2.6	425.1	21.5
1996	425.1	21.8	418.6	-6.5
1997	432.0	-16.7	412.5	-19.5
1998*	435.7	-13.6	482.7	47.0
1999	507.1	39.6	506.5	-0.6
2000	532.7	-34.5		

*–Comprehensive revision estimates.

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