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Recently Asked Questions

NIPA Revisions and Total Factor Productivity

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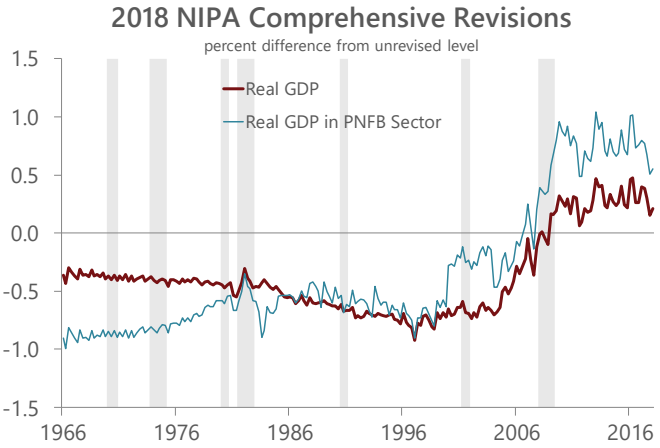
Do the 2018 Comprehensive Revisions (CR) to the National Income & Product Accounts (NIPAs), just published by the Bureau of Economic Analysis (BEA), have implications for total factor productivity (TFP) growth, and hence your estimate of trend GDP growth?

In the CR, the recent growth of real GDP was essentially unrevised, but a substantial upward revision in the recent level of nonresidential fixed investment implies a faster-growing capital stock. That, in turn, implies a notable downward revision to recent growth of TFP. This shift in the sources of growth may have implications for the future growth of potential GDP, which we currently put at 2% per year through 2028, but for now we've assumed it doesn't.[1]

Revisions in Output

The CR show a recent upward revision in the level of real GDP of about 0.25%.[2] However, because the value added by households, nonprofits, and state & local governments were all revised down,[3] the level of output produced by the private nonfarm business (PNFB) sector—the measure of output that will used by the Bureau of Labor Statistics (BLS) to compute revisions in labor productivity—was revised up by almost twice as much as GDP. Those revisions are compared in the nearby



Source: BEA; Macroecomic Advisers by IHS Markit

chart. Note that upward revisions to the levels of output occurred between 1996 and the end of the Great Recession.[4] Hence, there were essentially no revisions to growth of output during the ensuing recovery and expansion.

Revisions in Investment

Nonresidential fixed investment was revised up more substantially, mainly for two reasons. First, BEA introduced new deflators for software, medical equipment, and communications equipment that, because they better reflect rapid improvements in quality, rise more slowly (or, in some instances, decline faster) than the unrevised deflators. For a given path of nominal investment spending, slower growing (or faster declining) prices imply faster-growing real investment. Second, BEA assigned an imputed return to own-account investment.[5] On the expenditure side of the NIPAs, this raised the levels of both nominal and real gross investment. On the income side of the accounts, there were corresponding upward revisions in the consumption of fixed

[1] Thanks to Bob Gordon for discussion.

[2] The CR advanced the reference year in the NIPAs from 2009 to 2012. Here, we've restated the revised estimates of "real" magnitudes in 2009 dollars to facilitate direct comparison to the unrevised data.

[3] The downward revision in state & local output partly reflected a downward revision in compensation of state & local employees consistent with a new treatment of state & local defined-benefit pension plans. That new treatment also resulted in a substantial upward revision in state & local (imputed) interest payments that are part of personal income and that contributed importantly to a significant upward revision in the personal saving rate.

[4] Indeed, the data imply that output per hour grew 1% more over the decade 1997-2007 than previously estimated.

[5] Own-account investment is investment undertaken by businesses that is not explicitly reflected in a market transaction. For example: software developed in house.

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capital, corporate profits, and proprietors' income.[6] The upper-right chart compares the revised and unrevised histories of real nonresidential fixed investment. For 2017, the upward revision reached almost 9%.

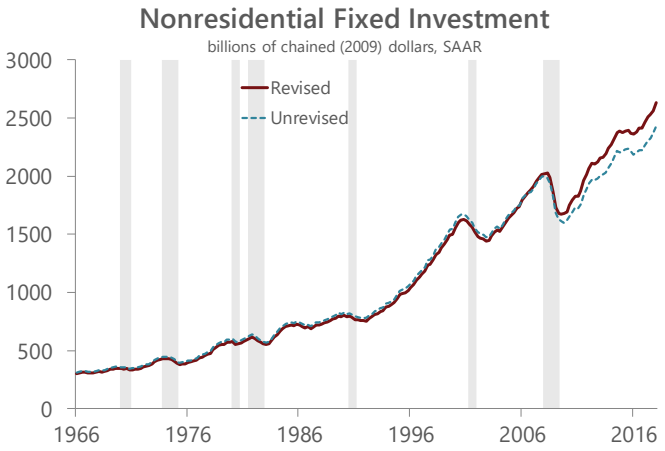
Revisions in Capital Stocks and Capital Services

A higher level of investment implies faster growth of capital stocks. BEA will not, until this fall, publish revised estimates of capital stocks that correspond to the revised paths of investment. However, by combining our pre-revision estimates of effective depreciation rates on capital with the revised estimates of gross investment, we computed our own revisions to the business capital stocks tracked in the Macro Advisers macro model of the US economy,[7] and used those revised capital stocks to construct a revised estimate of aggregate capital services used in our computation of full-employment GDP for the PNFB sector.[8] The middle-right chart compares the revised and unrevised levels of capital services; by the first quarter of 2018, the upward revision reached nearly 8%. The lower-right compares the revised and unrevised 4-quarter growth rates of capital services; by the first quarter of 2018, the upward revision reached 0.6 percentage point.

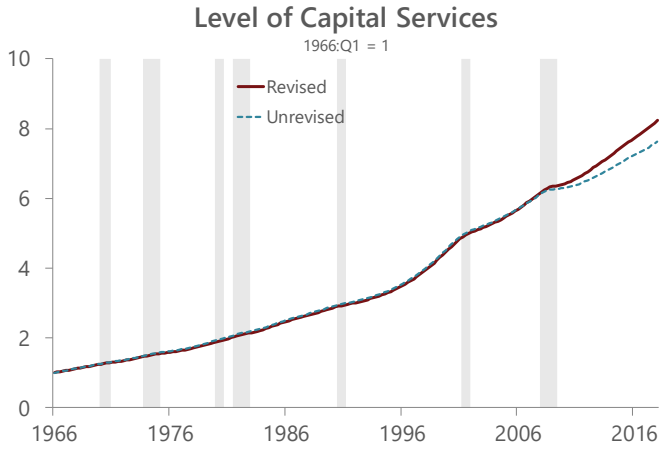
Implications for Growth Accounting

In traditional growth accounting, the growth in output of the PNFB sector is decomposed into the contribution from the growth of capital services, the contribution from growth of labor inputs, and the growth of the residual, TFP:[9]

$$\overbrace{\%\Delta Q}^{\substack{growth\\ in\ output}} = \overbrace{\%\Delta TFP}^{\substack{growth\\ in\ TFP}} + \overbrace{\alpha\%\Delta K}^{\substack{contr\ from\ growth\\ in\ capital\ services}} + \overbrace{(1-\alpha)\%\Delta L}^{\substack{contr\ from\ growth\\ in\ labor\ inputs}}$$



Source: BEA; Macroecomic Advisers by IHS Markit



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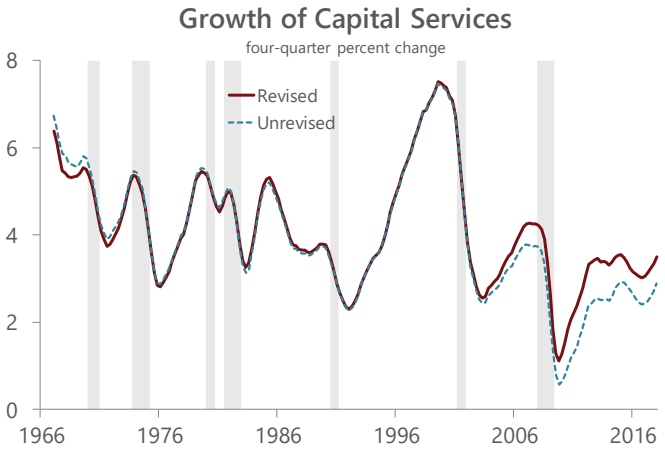


Source: Macroecomic Advisers by IHS Markit

[6] While this upward revision in proprietors' income did contribute to the upward revision in the personal saving rate, recent proprietors' income was also revised up to reflect new Treasury estimates of unreported income.

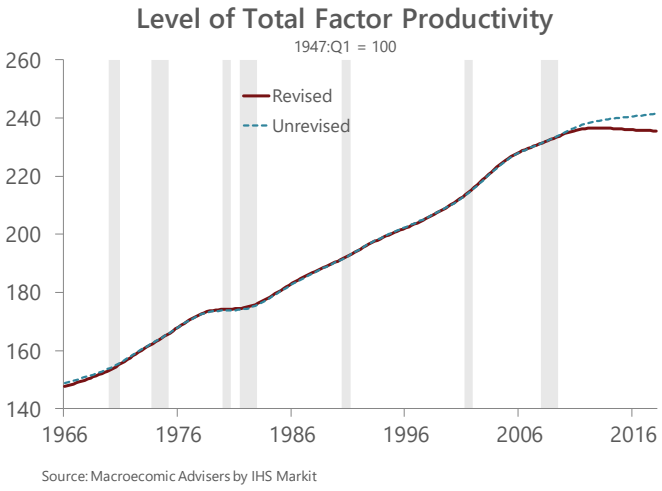
[7] Computer equipment; all other equipment; nonresidential structures; and intellectual property products.

[8] Capital services is an index that reflects the weighted-average growth of capital stocks. The weights reflect the "user costs" of capital, which serve as proxies for the marginal productivities of capital.

where α is capital's "share" of output.[10] The CR did not alter historical estimates of labor inputs, which are based on hours worked by all persons in the nonfarm business sector.[11] Nor, as described above, did the revisions alter (much) the recent growth of PNFB output. Hence, the recent upward revision in the contribution to growth from capital services necessarily implies a downward revision to recent TFP growth. The upper-right chart compares the revised and unrevised levels of TFP. The unrevised index was barely advancing of late; the revised level is now flat-to-declining for most of the current recovery. The middle-right chart compares the revised and unrevised 4-quarter growth rates of TFP. In late 2013 the revised estimate of TFP growth turns slightly negative; in the first quarter of 2018, the downward revision is 0.27 percentage point.

Implications

Prior to the CR, students of productivity trends identified and puzzled over an apparent recent shortfall of capital relative to labor. Indeed, since the Great Recession, it appeared that the capital-labor ratio, which shows a long secular rise, had stalled (see lower-right chart), suggesting a period of underinvestment that might portend an eventual, perhaps even rapid, catch-up in capital expenditures. In our revised estimates, the capital-labor ratio continues its long secular rise after the last recession, significantly mitigating concerns of a capital shortfall and undercutting the case for a large cyclical rebound in business fixed investment. Indeed, given the upward revision in the capital-labor ratio and the downward revision in TFP growth, the recent disappointing growth of labor productivity now seems to be less about



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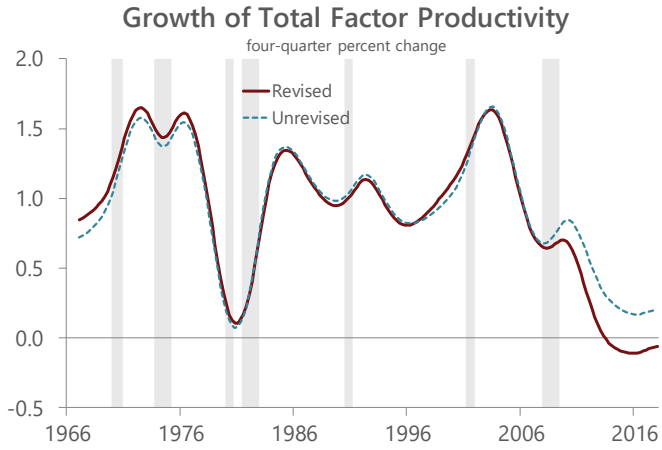

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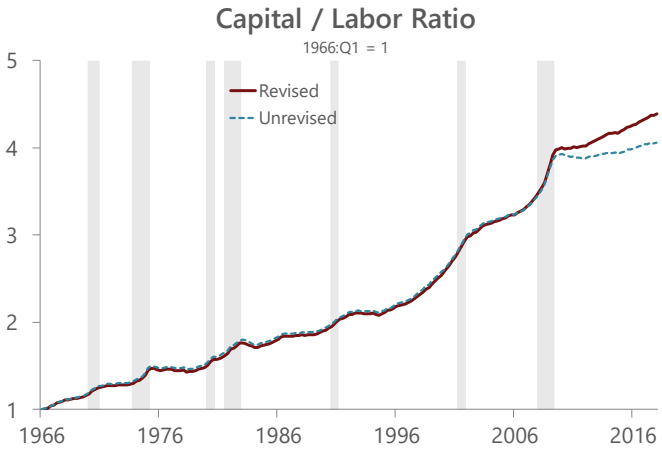

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[9] TFP reported here differs in two regards from the measure reported by BLS. First, we do not show changes in the educational attainment of the labor force as a separate factor contributing to growth; it is subsumed in our estimate of TFP. Second, BLS estimates are based on a much finer disaggregation of capital stocks than carried in our model. BLS will revise its estimates of TFP next year. We expect those revisions to be the same as ours directionally.

[10] We currently estimate this as 44% in the private nonfarm business sector.

[11] Employment and hours will be revised in early 2019 to reflect the usual annual benchmarking of the establishment survey to the most recent QCEW data. These revisions could mitigate or magnify revisions to TFP.

the recent lack of investment and more about the lethargic pace of advances in organizational efficiencies, in educational attainment of the labor force, or in technology.

Finally, it is a straightforward calculation to show that in a Solow-type growth model, steady-state growth in labor productivity depends positively on TFP growth and inversely on the rate of change in the relative price of investment goods.[12] Perhaps, given continuing improvements in measured quality, this price can keep falling fast enough to offset a propagation of our downward revision in recent TFP growth.[13] Otherwise, TFP growth must rebound to prevent an eventual slowing of potential GDP growth.

While constructing our just-completed forecast, we struggled with this dilemma, but in the end, while awaiting more detailed revisions of capital stocks (from BEA this fall) and TFP (from BLS next year), we assumed that the adverse impact on potential growth of a gradual acceleration in the real price of investment goods is offset by a return of TFP growth to our assumed, pre-revision path, a path which itself gradually returns towards the historical average. This maintains our estimate of potential GDP growth at 2% per year through 2028.

[12] See Macroeconomic Advisers *Macro Focus*, "Accounting for Productivity Growth" (July 19, 2016) and Macroeconomic Advisers *Recently Asked Questions*, "Capital Deepening and Productivity Growth" (July 19, 2016).

[13] As cited above, we estimate annualized TFP growth in early 2018 was revised down by 0.27 percentage point. To offset the impact on the growth of labor productivity requires that the relative price of investment goods declines $0.27 / \alpha$ = 0.61 percentage point faster per year.