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Commentary

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Ellen McGrattan and Ed Prescott's article is right in highlighting an important fact: "Intangible investment" is large and likely to vary over time. Unfortunately, standard methods for calculating national income and product accounts miss the bulk of this investment. Thus, conclusions about investment, productivity growth, and corporate sector performance can be severely distorted.

The authors go on to make a bold claim: They can measure intangible investment correctly with the help of a simple theory.

The result of their bold attempt is to change the "history" of the late 1990s—as, in their preferred version, productivity growth and other prosperity indicators look significantly better than those obtained with conventional national accounts data.

I like bold statements. They are a useful starting point and they invite reactions. My comments below start the latter. The current version of the paper incorporates my main suggestion during the conference, which was to provide a measure of the path of intangible investment that does not depend on verifiable assumptions that are rejected in the data. This is now their first approach. But they also chose to keep their previous method in the paper (now called the second approach) and much of the wording in the introduction and conclusion fits the second approach better than the first. Thus, I have decided to revisit the comments I made at the conference.

I had essentially two points: a minor one on the authors' characterization of the 1990s and a more substantive one on their measurement of intangible capital.

ON THE 1990S

In the abstract, the paper states that "ignoring intangible investments in the late 1990s leads one to conclude that productivity growth was modest, corporate profits were low, and corporate investment was at moderate levels."

This gloomy characterization of the (incorrectly measured) 1990s does not fit conventional wisdom and the (incorrect) facts. It may well be the case that correctly accounting for intangible investments makes things look better; but, even without this correction, the late 1990s are perceived as a time of massive investment, fast productivity growth, and corporate bonanza.

By 1995-2000, productivity growth had returned to levels not seen since the late 1960s, and in high-technology sectors, such as industrial machinery and electronic machinery, productivity growth reached astonishing numbers—well over 5 percent per year (see Table 1).

Similarly, investment as a share of gross domestic product reached record levels, especially when measured as a ratio of real quantities, as the rate of decline in the relative price of equipment accelerated during the late 1990s. Finally, while profits may not have accelerated in tandem with investment and productivity, capital owners did extremely well as the effective cost of capital declined and capital gains increased dramatically.

ON THE MODEL AND MEASUREMENT

Here one needs to differentiate between comments on the many steps to improve the

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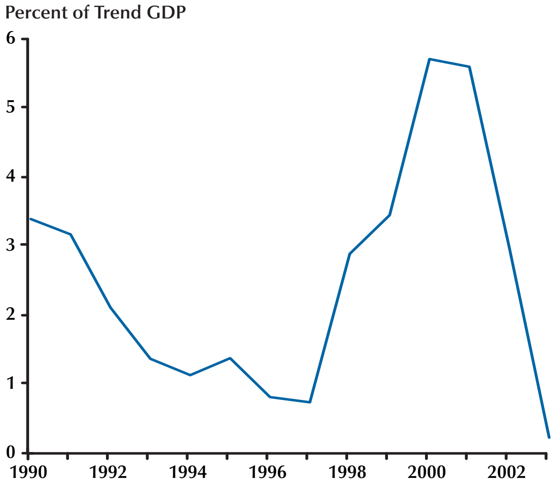
Table 1

Private Nonfarm Business Productivity Growth

	1948-73	1973-79	1979-90	1990-95	1995-2000
Labor productivity	2.9	1.2	1.4	1.6	**2.5**
Multifactor productivity	1.9	0.4	0.3	0.6	**1.1**
Manufacturing	1.5	–0.6	1.1	1.3	**2.1**
Industrial machinery	0.7	0.2	3.2	3.1	**5.8**
Electronic machinery	2.1	1	3	6	**7.4**

Figure 1

Intangible Investment



accounting of averages and comments on the dynamics. I have little to say about the former, except to express admiration for the many useful and careful steps taken in "amending" conventional national accounts procedures. My concerns are all about the discussion of dynamics.

On the investment side, the authors assume no adjustment costs and, hence, a marginal product of capital equal to the interest rate throughout. This is not a good model of short-run investment. Short-run frictions are of the essence in investment theory, and the corresponding capital gains can generate large wedges between marginal product and interest rates. Because several of the numbers computed in the paper are the result of ratios of numbers that are very close to zero, it is easy to generate variations of several hundred percent in the numbers reported in the paper, just by allowing for small wedges between marginal product and interest rates.

On the labor side, there are assumptions of perfect labor mobility across sectors, Cobb-Douglas production functions, and so on. Again, while these may be reasonable assumptions for the medium and long run, they are inadequate for the short run. This difficulty is particularly apparent in their main expression used in the conference to measure the path of intangible capital in the corporate sector:

$$(1) \qquad x_1 = \frac{(1-\alpha)}{(1-\theta)}\left(\frac{CCOMP}{NCOMP}\right)NVA - CVA,$$

where x is intangible investment; *CCOMP* and *NCOMP* are labor compensation in the corporate and noncorporate sectors, respectively; *NVA* and *CVA* are value added in the corporate and noncorporate sectors, respectively; and θ and α are the Cobb-Douglas share of labor in the corporate and noncorporate sectors, respectively. This leads to Figure 5 in the current version of their paper (my Figure 1).

This figure produces a dramatic rise in intangible investment at the end of the 1990s and is the figure that best matches the introduction and general message of the paper. But how did they obtain equation (1), and how important are the assumptions behind this derivation for the results? The answer to the second part of the question is "a lot." Let me follow a slightly different derivation from theirs, which facilitates understanding why this is so.

Figure 2

Intangible Estimates for Different "1" Operations

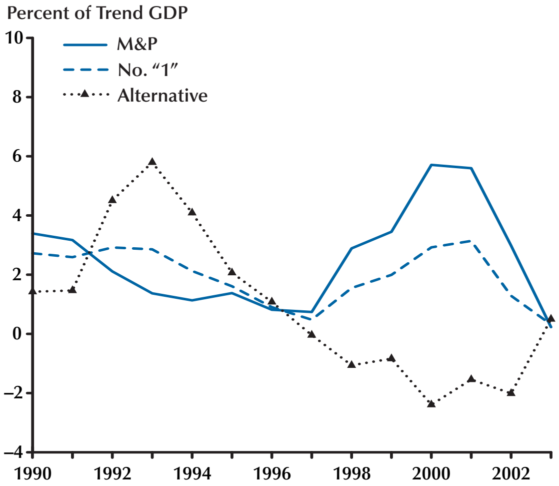
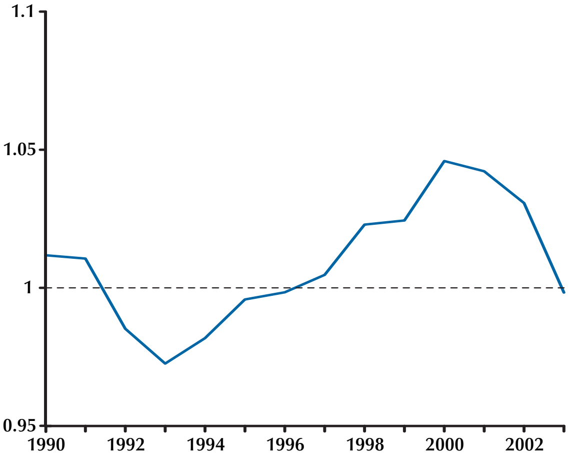


Figure 3

"1"



Following what they now refer to as "the first approach," one can obtain an expression for intangible capital from the first-order condition of the corporate sector, after assuming a Cobb-Douglas production function for actual (as opposed to measured) value added, and noticing that actual value added is equal to measured value added plus intangible capital (erroneously expensed). Then,

$$x_1 = CCOMP/(1-\theta) - CVA. \qquad (2)$$

But how do we go from equation (2) to (1)? Before answering this, note that under a Cobb-Douglas assumption in the noncorporate sector, the basic first-order condition for labor implies:

$$\text{“1”} = (1-\alpha)NVA/NCOMP. \qquad (3)$$

We are now ready to go from (2) to (1), as the latter is obtained by multiplying the first term on the right-hand side of (2) by the expression for "1."

However, the nice feature of 1 is that we can do many things with it without affecting the expression we are multiplying or dividing it by. In particular, we may chose not to multiply by "1," or we can chose to divide the first expression of the right-hand side of (2) and multiply the second expression. All of these formulas for intangible capital should yield the same result. My Figure 2 shows that they do not.

The dashed line corresponds to my suggestion at the conference and their current Figure 1; the solid line corresponds to their Figure 4; and the remaining line corresponds to the other transformation. It is apparent from this figure that their "1" is not really 1. This is confirmed in Figure 3.

In summary, I maintain my recommendation from the conference. Given that "1" is not really 1, I would suggest they focus on the measure of intangible investment that does not use this incorrect information. This is the dashed line in my Figure 2. Of course, in this case the story for the end of the 1990s is much less dramatic, and it looks more like a story about the dip of intangible investment during the mid-1990s rather than a surge at the end of the 1990s. Where would this dip come from? There is a good chance that the implicit "1" in the corporate sector (also Cobb-Douglas assumption, no frictions, etc.) is not correct either, in which case it may all be just "measurement" error.

Having said this, I believe the step taken by the authors was worth it. It was bold, most likely not right, but it opens a potentially important area of research. Somebody will get it right in the future. The authors will then get the credit they deserve.