

“THEY CAN MAKE EVERYTHING FOR LESS”: WOODY BROCK ON WHY PRODUCTIVITY IS MISMEASURED AND UNDERSTATED

Laurence B. Siegel
September 2017¹

Has productivity growth slowed in the U.S. and around the world, as conventional measurements suggest? Or is that just an illusion, caused by the difficulty of measuring the quality improvements (instead of quantity improvements) that now constitute the bulk of productivity growth? In a provocative interview, Horace (“Woody”) Brock, an economist, strategist and consultant to many of the world’s leading institutional investors, puts his unique spin on questions like these.

Woody and I discussed issues that he raised in an article, “Rampant Confusion: Monetary policy, yield curve, bond yields,” disseminated by Portfolio Construction Forum (Sydney, Australia), August 10, 2017, (password-protected; free to join).² In it, he introduces the topic by recalling,

A client recently called me to ask: “Does any central banker or economist you know of understand what is really going on with respect to inflation, growth, and in turn monetary policy? Those of us who must make decisions about developments in real-world markets feel we are living in a Tower of Babel in which no one seems to know what they are talking about.”

I spoke with Woody on August 30, 2017.

SLOW OR ROBUST GROWTH?

Larry: What is the source of the “rampant confusion” to which your article refers? As best I understand it, we are in what appears to be a very extended period of slow growth in the real economy, at least in the developed world, but stock prices are high and, thus, do not agree with the verdict of slow growth. To reconcile these two observations, you are looking at factors that suggest maybe growth has been faster than measured, with the discrepancy due to mismeasurement of inflation in a period rapid technological change. Is this an accurate characterization?

Woody: Explaining the fact that the stock market has done very well, with that being a problem because the economy has done less well, is not my motivation at all. The stock market to me is a totally different subject. The stock market, to be rid of this issue, has gone from 775 [on the Dow] in 1982 to 22,000 today, without a huge bubble over the long run, for two reasons that have never happened before: interest rates

¹ Laurence B. Siegel is the Gary P. Brinson director of research at the CFA Institute Research Foundation in Charlottesville, VA, and an independent consultant. He lives in Wilmette, IL and Del Mar, CA and can be reached at lbsiegel@uchicago.edu.

² <https://portfolioconstructionforum.edu.au/perspectives/rampant-confusion-monetary-policy-yield-curve-bond-yields/>

went from 15% to a little more than 1%, and corporate profits as a share of GDP doubled from 5.2% to 10.3%.

Obviously, these two developments would mean a fantastic market over that period. Moreover, at 22,000 the price/earnings (PE) ratio is 22 or 23, not the 36 we saw back in 2000. So, the stock market has good reasons to do what it has done.

Larry: What, then is your principal concern?

Woody: I'm concerned that, for unemployment to fall as fast as it did since the end of the global financial crisis, real GDP has not been growing at the stated rate, but much faster. I am not alone in this view, as I am sure you know. I believe that, for many reasons, the mismeasurement of inflation — where true inflation is lower than the measured rate — has been getting worse. Improvement in the quality of products and services is the best-known source of measurement error, but that is not the only error.

Larry: What is the consequence of mismeasuring inflation?

Woody: The only measure of macroeconomic performance that we know with any accuracy is nominal GDP growth: price times quantity of shovels, blankets, lamps, sofas. We understand the nature of that growth. We then take nominal GDP growth, we subtract the computed inflation rate from it to get *real* GDP growth, and that latter number is effectively the same as productivity growth. (The difference between real GDP growth and productivity growth is due to changes in the number of hours worked, usually a small number.)

Obviously, if real growth is officially now at 1.3%, and productivity growth is at 1%, those numbers are way down from their historical averages. So the newspapers say productivity and real GDP growth have fallen.

Larry: What is wrong with them saying that?

Woody: If Martin Feldstein and many others are right, the bias is now a solid 2%; that is, true inflation is 2% per year lower than inflation as measured by the Consumer Price Index (CPI). If you subtract a 2% lower inflation rate from the only number we know, which is nominal GDP, then you'll find that, other than in the recession, neither productivity nor real growth has slowed down at all.

Larry: I've read Feldstein's remarks at a Brookings Institution conference,³ wherein he says that the bias is 2%. Feldstein, who was the chairman of President Reagan's Council of Economic Advisors as well as past president of the National Bureau of Economic Research, is very persuasive. I have always admired his work. Can you expand on what he said?

Woody: Sure, but let me start by noting the inconsistency in the data that I am trying to explain. The high level of corporate profits simply cannot be explained if productivity

³ Feldstein, Martin. 2016. "Remarks at the Brookings Institution conference on productivity," (September 8), <https://www.brookings.edu/wp-content/uploads/2016/08/feldstein-remarks.pdf>

growth has fallen in half. It just doesn't add up, and there are models to show that. In other words, if you are saying innovation is over and that productivity growth is half of what used to be, or even less as some people are saying, then how have profits not just kept even but *doubled*— something that has never happened before?

The answer appears to be that productivity growth has not fallen in half, and that we are mismeasuring it because we are overestimating the inflation number that we subtract from nominal GDP growth to get real GDP growth. But that is not the only source of bias in the numbers. Nominal GDP is itself biased because it does not include new goods; and it also handles existing goods in an unsatisfactory way.

CREATIVE DESTRUCTION

Larry: What is the problem with measuring the production of existing goods?

Woody: Producing more is no longer a matter of putting more food in your mouth, or more TVs in your house — but *ever better* food or TVs. Our national income and product accounting system cannot deal with that at all, except by artificial and essentially unsatisfactory adjustments for quality. But economists have satisfactory ways of making those “hedonic” adjustments, which I will get around to discussing.

But quality mismeasurement is not the only source of the bias in the productivity data. The process of creative destruction creates price mismeasurements of a very interesting kind having nothing to do with quality improvement.

Larry: What do you mean by that? I am, of course, aware that the great Austrian economist Joseph Schumpeter said progress involves a process of creative destruction, but I don't know how you are applying that statement. Do you mean that, for example, I used to spend \$20 a week on music CDs, and now I can get the music at a marginal cost of zero (once I've paid for my streaming music service, such as Spotify) over the Internet?

Woody: Yes; everybody has an old wives' tale that captures this effect. I have two clients, John Deere and 3M — which are two of the best managed companies in the world according to most lists — and, when you ask the process engineers in those companies, they will say that, using CAD-CAM, and this and that other technology, we can now make spare parts, not for 5% less, but suddenly for 50% less. It is absolutely incredible.

Larry: What does it mean, in the bigger picture, for spare parts to fall in cost by 50%?

Woody: Put it this way: the engineers are in a state of shock at how cheap everything has suddenly gotten. You and I do not necessarily experience that directly — college tuition is not cheaper. Government services and education, have, if anything, suffered negative productivity growth. In high school, you learn less math than ever before. I'm just talking about the productive part of the economy.

Their story is that — although people never see this directly — you can now use a technique to make screws having a curvature that will make them last, not a little longer, but four times longer. There are thousands of little stories like this, and basic

economics tells you that every time you can make a widget for less, then no matter what the price of the widget is in the market, you will maximize profits by producing more at that price than you used to, so the whole supply curve moves outward.

The result of that is disinflation. In particular, if the supply curve for widgets isn't moving out faster than the demand curve — which is the only thing government looks at — then, as the Harvard professor Benjamin Friedman said, it's axiomatically true that the inflation rate will fall. Inflation doesn't have to go negative, into outright deflation, but it has been falling for a long time, all due to the supply curve's movement.

Larry: Really? Milton Friedman said that "inflation is always and everywhere a monetary phenomenon." Now you are saying that the sources of inflation and deflation are in the real economy. How do you reconcile these observations?

Woody: Proving all this, which I have done, is not easy. But you get the idea if you just draw the supply and demand curves on a piece of paper. Move the supply curve out more than the demand curve moves out, and the price goes down. And, nominal GDP goes down, given normal slopes of these curves.

Larry: I think this analysis is correct for relative prices, not absolute prices, and that Milton Friedman would agree — an expansive monetary policy could cause nominal prices to increase even in the face of the effects that you describe. As I see it, in an inflationary monetary regime, the prices of some goods would increase faster than others, depending on the cost curves or supply curves for producing them, which in turn depend on relative rates of productivity growth. How do you respond?

Woody: That is correct. I'm assuming you have a neutral monetary policy. By assuming that, I am able to focus on the question at hand, which is the effect on prices of a change in supply.

THE GREAT ENRICHMENT: TRANSITIONING FROM LOW TO HIGH PRODUCTIVITY GROWTH

Larry: But the supply curves didn't move dramatically for 5,000 years — we didn't have high rates of productivity growth from the beginning of civilization and economic activity until around 1750, or 1800.

Woody: It was in the 1800s, coming out of the Industrial Revolution. Since then, high rates of productivity growth have been rare, but the two great periods were from the 1870s to 1900, and during the Digital Revolution.

Larry: What happened between the 1870s and 1900?

Woody: Until 1870 productivity relied on mobility: shipping goods and delivering them. It was risky and it took forever. Then, suddenly, rather than shipping goods on a horse-drawn cart that went four miles an hour, the whole world could ship things at 50 miles an hour by railroad. (While railroads had been around for decades, the nationwide rail links that made efficient shipping possible were not established until after the Civil War; in England it was a little earlier.) It was a huge revolution; it was cheap, it was fast, and it was safe.

But the digital revolution, in my view, is an even more staggering development in industrial history. There has never been anything like it. I just read this book on Claude Shannon...

A MIND AT PLAY: CLAUDE SHANNON AND THE INFORMATION AGE

Larry: Wait a minute. I have the book, *A Mind at Play* by Jimmy Soni and Rob Goodman, and I started reading it last night. I was just astonished. I'm a bit of a tech fan — I know about John Von Neumann, Alan Turing, Norbert Wiener, even Lady Ada Lovelace, the 19th century programmer — yet until I started reading this book, I had never heard of Claude Shannon.⁴ Who was he?

Woody: He was an engineer, a country boy from Michigan who wanted to be an electrical engineer like his distant cousin Thomas Edison. He taught at MIT and worked for Bell Laboratories. He was the genius of the computer age, America's Alan Turing, but he is not known.

Yet Walter Isaacson, the great biographer of Einstein and Steve Jobs among others, said that Shannon wrote "the Magna Carta of the Information Age," the age we live in.

Larry: Can you elaborate on what his greatest innovation was?

Woody: In Shannon's master's thesis, he took something you and I know and think is simple, but until he discovered it, it wasn't. He established the isomorphism between Boolean algebra, with its use of 0s and 1s to express any quantity or concept you might want to express, and the on-off properties of embedded electronic circuits. Therefore, anything you can do mathematically with 0s and 1s, you can do with on-off switches in a circuit.

But that is not all. He developed the theory of circuits, which is very important in its own right, because he was also an engineer. So unlike Einstein, who was a thinker, this guy actually delivered the products he was thinking about. He figured out the basics of information theory, the technique for making error-free transmission of messages possible, and the calculations for determining the size of the channel you need in order to do so. No one had ever thought of a formula for measuring the amount of information in a message before, so he did that as well. So, you could say that he almost single-handedly invented the information age and the digital computer.

Larry: How does Claude Shannon's story fit into the stories of the other pioneers I mentioned, Von Neumann, Wiener, and so forth?

Von Neumann conceived of a program that could modify itself, a very important concept; his paper on self-replicating machines covers that. But no, the real work of

⁴ Lady Ada Lovelace (1815-1852), the daughter of Lord Byron, was the first to realize that Charles Babbage's Analytical Engine, a mechanical computer, could be used to execute algorithms and not just for pure calculation. She wrote algorithms for the engine and is thus widely regarded as the first computer programmer.

genius was the digital revolution. It was not Von Neumann; it was all Shannon. That's why you have to read the book.

Shannon is known as the only genius greater than Norbert Wiener from that time and place. Norbert Wiener was the competitor of Von Neumann; he was the more practical one. Von Neumann was, I think, the most abstract mathematical thinker that we've had in a long time. Shannon was also capable of very abstract thinking, as you will find out when you read this book. But he also put it right into action. He was an engineer as well as a conceptual thinker.

All I'll say to you is: the logic that he stumbled upon, which became domesticated in the 1970s with airline reservation systems, has taken off. It exfoliates. It expands. It is hitting everybody everywhere.

THE INDUSTRIAL REVOLUTION(S) VERSUS THE DIGITAL REVOLUTION

Larry: That is a lot of drama for a set of innovations that Robert Gordon at Northwestern, and Robert Solow at MIT, among others, don't think had all that much of an impact on productivity. Gordon wrote a book entitled *The Rise and Fall of American Growth*, which I reviewed in this publication,⁵ arguing that 1870-1970 constituted a "special century" in which effectively all the tools of modern life were invented, with subsequent technological progress having little impact. (Although the computer was invented before 1970, Gordon didn't include it in the list of special-century innovations, which were from the Second Industrial Revolution of 1870-1920 although some of them took a while to be used.) And Robert Solow said in 1987 that the computer age was visible everywhere but in the productivity statistics.⁶

Woody: I don't think Bob Gordon understands the modern age at all.

Larry: That was my conclusion too.

Woody: But he's absolutely right about the importance of the Second Industrial Revolution from the 1870s to 1900, or, as Gordon has it, 1920 or even 1970.

My point comes from comparing that revolution to the digital revolution. In the Industrial Revolution, the cart, which for 5,000 years had gone 4 miles an hour, suddenly could go 50. That was a huge thing.

But it still goes 50 miles an hour 100 years later. If Moore's Law applied to it, the cart would now be going 100 billion miles a minute. That's what makes the digital revolution so amazing. There has never been anything like it. You pay one-hundredth as much for a phone call as you use to. I pay a millionth as much to write a letter, mail it, and have it delivered.

⁵ <https://www.advisorperspectives.com/articles/2015/12/22/robert-gordon-the-special-century-and-the-prospects-for-economic-growth>

⁶ Solow, Robert. 1987. "We'd better watch out." *New York Times Book Review* (July 12), page 36, <http://www.standupeconomist.com/pdf/misc/solow-computer-productivity.pdf>

Larry: I don't pay anything for either one. The marginal cost is so low that Internet providers don't bother charging it. They just charge a fixed cost that covers anything I might do.

Woody: That's right, and your children don't even think about it. This does not mean everything is perfect. Our health care system is a disaster. Ivy League schools have gotten away with murder in what they charge. So there is another side to the modern age, one where high costs and inefficiency rule in some spheres.

But, as the Nobel Prize-winning economist Kenneth Arrow pointed out, all these revolutions, including the existence of Walmart, brought down the cost of living for the bottom half. The cost of living for rich people has not gone down nearly as much. Try going to Ivy League schools or buying a ticket to the Metropolitan Opera; they're unaffordable.

THE HIGH COST OF THINGS THAT ARE DONE THE OLD-FASHIONED WAY

Larry: They really are. And William Baumol, who deserved a Nobel Prize but did not get one before he died a few months ago, explained why. He wrote about the "cost disease of the performing arts." If you have to do something the old-fashioned way, for example, playing the violin, it's going to get expensive because technology makes other activities more efficient while not improving the efficiency of violin-playing one bit. So the relative price of hearing a violin concerto performed in person becomes high relative to everything else.

That is what the Ivy League schools are using as an excuse: "we give individual instruction by famous professors." But I got plenty of individual instruction from famous professors at the University of Chicago in the 1970s for a fraction of the real price, because they didn't have an army of administrators making three times a professor's salary.

Woody: A good point. Everybody these days is talking about the subject of my book-in-progress, inequity and the distribution of income and wealth. Something that Ken Arrow said is extremely interesting. And he's what you'd call left-wing.

Larry: What is that?

Woody: This is the kind of integrity he had. He said, despite the inequality of the distribution of income and wealth, morally what matters most is the distribution of consumption. When he was a boy in Brooklyn, he said, people who were poor looked undernourished because they didn't have much to eat; now, they are all obese. He said that everyone has the same iPhone as the Rockefellers do. Everyone goes to the same concerts. Everyone wears Nikes.

Where the rich really are different is that when a rich man goes into his apartment on Fifth Avenue, there will be a \$40 million Monet over the fireplace. The rich have assets.

Larry: But the \$40 Monet over my fireplace looks exactly like the rich man's Monet — mine is a picture of his.

Woody: That is the joke. I tell people that all you need to have a great art collection today is \$5,000 for each picture to make a very good frame. That is the only difference between the poor man's collection of art prints and the rich man's collection of originals.

Larry: I can tell the difference, but on a price-adjusted basis, I prefer the inexpensive prints.

Woody: That's right. The consumption distribution has never been more equal.

HEDONIC ADJUSTMENTS

Larry: That is my sense too, but what phenomena are you looking at in particular?

Woody: We don't know how to value the consumer surplus that comes from things like free apps and Google. If they're free, they can be consumed by people with relatively little money (but enough to buy the device that the app runs on). There's a study that said a lot of people would pay \$2,000 a month not to lose their 10 favorite apps.

Larry: I would probably pay that if I had to. Without the Internet I would only be able to do my job by moving near an academic library, paying library tuition, and hiring two or three research assistants. With the Internet, I do it all myself with almost no cash costs.

Woody: That is exactly my point. Your living standard has improved even if your income has not improved.

LIVING STANDARDS

Larry: Let's talk some more about living standards. You've argued that living standards are rising faster than the *per capita* GDP or income data suggest. While you have already touched on some of those issues, could you please elaborate? My reason for asking is that so many people today believe living standards are falling, not rising, except for the top 1% of the population, or more realistically the top 15% or 20%.

Woody: At one time, productivity growth effectively meant that if the same number of people could produce 3% more pizzas than they used to, that meant 3% more food per mouth. We live better because we are less hungry. But there is only so much food you can eat, and we have past that point. Productivity growth is now about *better*.

In the old framework, it was okay to say that productivity growth measured by more output was a pretty good proxy for living better and having a little more pizza per mouth. So, in that sense, the classical idea, that living standards follow productivity growth, made sense.

The problem today is that productivity growth isn't about "more pizza" any more. So if you follow the old paradigm, established by Simon Kuznets, who established the national income and product account conventions back in the 1930s, and you simply measure how much more stuff there is per person, you'd find that productivity growth has fallen in half.

Larry: What paradigm should we be following instead?

Woody: The old story would have been that, if the rate of growth in the amount of stuff per person has fallen in half, then the gain in living standards has also fallen in half. But that is not the right way to look at the question.

People were used to 4% annual raises, and now their wages are stagnant. You heard about this in the election. It was said that real wages have stagnated for 30 years. It's not true, but suppose that it is true. Do you have the same living standard as 30 years ago?

Conceptually, living standards are measured by your preference or consumption level. Given the same amount of real money, if you far prefer today's bundle of consumption goods that include Viagra, Thai food, living four years longer, and less pain, to the bundle back when telephones had party lines and cars didn't come with seat belts, you are living much better today on the same income. So, having the same income is a red herring. If you love your consumption basket today, you would not go back to the one from 40 years ago that you could purchase with the same income.

Larry: You've suggested in your writing that there is a way to measure the difference in satisfaction or utility provided by the two consumption baskets, today and 40 years ago. What is it?

Woody: This question was answered by Kenneth Arrow and Paul Samuelson. You just ask someone, subjectively, how much of your income today would you give up, meaning next year you will have less Thai food, less Viagra, and so forth, so that you are indifferent between the new modern consumption basket and the one 40 years ago? The answers you get are that people would give up a very large fraction of their current income to avoid going back to the old consumption basket.

Larry: How large?

Woody: A typical answer is that 40% less income tomorrow will establish indifference.

Hence, via Arrow's calculus of indifference and Samuelson's concept of revealed preference, his living standard is up 67% (that is, $100/[100-40]$). Yet the official productivity statistics said he has had only a 10% improvement in living standards, the smaller number reflecting the quality adjustments that are in the official numbers. (Remember that all these examples are for someone whose real wage has not changed.)

Larry: The way I've expressed the same concept is: I have a pill that keeps you alive for three years longer. How much would you pay me to get this pill? It turns out that is what statins do, and they cost almost nothing, so your standard of living has risen by the amount you would pay, without getting a raise.

Woody: Marty Feldstein's Brookings piece also talks about statins. It's a perfect example. They don't appear in the data. As Bob Gordon pointed out, the Model T Ford didn't appear in the GDP calculations for 35 years; by that time it was not only a

cheaper car in real terms, that is, in terms of the number of hours of effort you had to work to get one, but a much better car. These changes are just not captured by GDP.

CONCLUSION

Larry: To wrap up, where can readers find more of your work?

Woody: <http://www.sedinc.com/good-reads.html>. That is the free part of my company's web site.

I'm also writing a book.

Larry: What is the book about?

Woody: The mathematical foundations of the theory of justice. And it's very serious. Half of it is going to be in simple English, but it's the only serious thing I've ever done.

Larry: Good luck with that, Woody. I'll be looking out for it. Thank you for your time.

