

Does the Conventional Wisdom About Productivity Need To Be Reconsidered?

Conventional wisdom holds that U.S. productivity growth, the weakest it has been in more than a quarter-century, is the reason for today's subpar GDP growth and low wages. Because of coming demographic and technological headwinds, some think this disappointing economic scenario will be baked in the cake for decades.

But is the conventional wisdom correct? Is productivity being mismeasured, and is technology-driven innovation already having a more powerful effect than realized? Is the problem that the diffusion process of spreading the positive effects of innovation takes time? Is productivity growth therefore on the launching pad ready to rebound? Would better policies lead to sufficient investment in capital equipment and software? Or is the slowdown in productivity growth a result of a decline in demand and a weak labor market that has kept wage growth soft? Would companies invest more in productivity-enhancing innovation if the economy were experiencing more robust wage growth and tighter labor markets? In that case, weak productivity growth may be slowing GDP growth, not the other way around.

Or is productivity the great paradox wrapped in a riddle, impossible to truly understand or predict?

Over two dozen noted analysts offer their views.





*Look closely at
the decade from
1997 to 2007.*

MARTIN FELDSTEIN

*George F. Baker Professor of Economics,
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The conventional wisdom is that labor productivity (that is, nonfarm business output per hour worked by employees in the nonfarm business sector) has grown only very slowly over the long term and that the rate of productivity growth has recently experienced a surprisingly sharp decline. Both aspects need to be reconsidered.

The official measure of the growth rate of productivity over the past sixty years (ending in the second quarter of 2017) has been just 2.0 percent. I believe this is an underestimate and may be a substantial underestimate.

As I have explained elsewhere (*Journal of Economic Perspectives*, Spring 2017), the growth rate of real output is underestimated because the official statistics do not accurately reflect the contribution to real output of quality improvements and of new products. The underestimate of real output growth translates directly into an underestimate of the growth of productivity.

While it is impossible to know by how much the true growth rate of real output has been underestimated, I believe it could be as much as 2 percent a year. If that is true, it would double the long-term growth of productivity.

The official productivity growth rate has declined to just 1.2 percent in the most recent decade (to the second quarter of 2017) from 2.8 percent in the previous decade. But this just brings the average productivity growth over the past twenty years back to the exact 2.0 percent average of the previous forty years.

The anomaly worth studying may therefore be the sharp rise in productivity growth from 1997 to 2007. Researchers who are concerned about the low productivity growth in the past decade should instead be asking why the decade from 1997 to 2007 was an outlier with the productivity growth rate rising sharply from the rate during the previous forty years.



*The productivity
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in sight.*

ROBERT J. GORDON

*Stanley G. Harris Professor in the Social Sciences,
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Many recent discussions of the U.S. productivity growth slowdown focus on the sharp slowdown from the rapid 2.5 percent annual pace briefly achieved between 1996 and 2004 to the 1.1 percent that the economy has registered since 2004. I prefer to take a longer view and emphasize the two stages of the slowdown, the first step downward occurring between the 2.8 percent registered over the five epochal decades from 1920 to 1970 to 1.8 percent from 1970 to 2004, followed by the second step downward to 1.1 percent since 2004. And things are getting worse, not better, as the rate between mid-2010 and mid-2017 was only 0.6 percent (all these numbers refer to the total economy, not the private economy).

The United States is not alone in experiencing this slowdown, as Western Europe and Japan have experienced even more severe decelerations from productivity growth rates well above that of the United States prior to 1996 to an even slower pace than the United States over the past decade. This common experience of slowdown suggests a common explanation, that innovation today—while many-faceted and ongoing—does not have as great an impact on productivity growth as earlier generations of inventions.

The devastating loss of power and shortages of fuel after the recent hurricane in Puerto Rico stand as reminders of how fundamental were the invention of electricity and the internal combustion engine to the functioning of the modern economy. The post-1970 digital revolution made possible by personal computers turned out to have less impact on productivity growth than earlier inventions, and the transition those computers achieved in business methods from typewriters, paper files, and mechanical calculators to our current world of wordprocessing and spreadsheet software, broadband, web access, and search engines, was largely completed by 2006. Smartphones are ubiquitous but are mainly used by consumers for social

networks and photography rather than as tools to boost business productivity growth.

Some critics claim that productivity growth is currently understated because of mismeasurement, due to the upward bias in price indexes that fails to take account of the benefits of quality change and new products. But this has always been true, and so is not a source of slower productivity growth now than earlier in the twenty-first century, for which a case can be made that the benefits of the transition from horses to motor vehicles, or from the scrub board to the automatic washing machine, or of the invention of elevators, subways, and commercial air travel, caused even more measurement bias than the arrival of smartphones in the past decade. Similarly, unmeasured consumer benefits from medical advances must be assessed in comparison with the conquest of infectious diseases and infant mortality that allowed life expectancy to grow twice as fast in the first half of the twentieth century as in the last half.

Surely productivity growth will revive soon from the unprecedented 0.6 percent growth rate of the last seven years. As the unemployment rate inches down toward 4.0 percent, labor shortages are emerging that will revive investment in labor-saving devices. But the productivity growth heyday of the mid-twentieth century, with growth rates of close to 3 percent for five straight decades, is nowhere in sight.



Technological developments bring benefits, but also negative side effects that may contribute to the slowdown in productivity and growth.

JEFFREY A. FRANKEL

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There are a variety of explanations for the declining growth rates in productivity and GDP that have been observed in recent years. The most prominent explanations involve technology.

On the one hand, Robert Gordon (2016) has argued persuasively that we should not expect information and communications technology and other technological innovations of recent years to have as big an economic

payoff as electricity, the automobile, and other technological revolutions of the past. On the other hand, Martin Feldstein (2017) has argued persuasively that productivity growth is higher than we realize because government statistics “grossly understate the value of improvements in the quality of existing goods and services” and “don’t even try to measure the full contribution” of new goods and services, and that these measurement errors are probably becoming more important over time.

Not much attention has been given to another possibility: while information and communications technology and other technological developments bring many heralded benefits, they have some less-heralded negative side-effects that may contribute to the slowdown in productivity and growth. At the risk of being thought a Luddite, I offer a partial list.

- The advantages of each new incarnation of computer software or hardware are partially offset by the hours that everyone has to spend learning how to use the latest iteration.
- Employees spend part of each workday on non-work emails, social media, internet videos, and videogames. Even work-related emails can interfere with productivity because of excessive interruption of concentration.
- Addictive videogames may undermine job skills and hours worked for some of the young. A recent study by Mark Aguiar and co-authors finds recreational computer activities partly explain a decline in labor supply by men ages twenty-one to thirty.
- I will try to forebear expanding into things that merely undermine quality of life without showing up in the productivity statistics. (Have you stopped answering your phone due to the proliferation of robocalls? And how about the dangers of texting while driving?) But spam, viruses, and security breaches impose big costs on businesses as well as on households.
- Those are just negative side effects of information technology. A list of other technological innovations with obvious downsides would include opiates, advanced weaponry, and more.

To be clear, I am not suggesting that the net effects of recent technological advances are negative. But some innovations have negative side effects, including for productivity, and they seem often to be ignored.



I remain a techno-optimist. We can be confident that this will change. We just can't say when.

BARRY EICHENGREEN

George C. Pardee and Helen N. Pardee Professor of Economics and Political Science, University of California, Berkeley

In approaching this question, a considerable dose of humility is in order. We—meaning economists, technologists, and policymakers alike—don't have a very good record of forecasting productivity growth. Few contemporary observers anticipated that the 1930s would be a decade of exceptionally fast productivity growth in the United States. Alvin Hansen then famously forecast continued stagnation on the eve of the post-World War II acceleration in productivity growth. The economics profession utterly failed to anticipate the post-1973 productivity slowdown. The acceleration in productivity growth around 1995 came as a surprise to most observers, as did the renewed slowdown around 2005. And the slow pace of productivity growth not just in the United States but globally following the global financial crisis, once again, was not widely anticipated. This is reason for caution when making forecasts. To my mind, it is reason for making conservative assumptions, including the possibility of large unanticipated variations, when using estimates of future productivity growth as inputs into policy.

But if you force me to throw caution to the wind, I remain a techno-optimist. I see no evidence that the progress of science and technology is slowing down. What I see is the need to further reorganize how enterprises interact with their customers and organize their workforce to better exploit the productivity-enhancing potential of new technologies. My own favorite example is electronic medical records. At the moment, with the transition from handwritten charts and transcriptions, doctors are being forced to grapple with unfamiliar software and awkward laptops, and to re-input old information along with new. Different electronic recordkeeping systems are incompatible, and it remains impossible to transmit information across platforms. New technology is therefore a drag on productivity rather than a boost. With more time to adjust and more work on systems compatibility, we can be confident that this will change. We just can't say when.



We do not have to fully understand the productivity problem in order to do something about it.

RUDOLPH G. PENNER

Institute Fellow, Urban Institute, and Former Director, Congressional Budget Office

The “conventional wisdom about productivity” might better be labeled a “state of ignorance.” We do not really understand productivity or the reason that its growth has slowed so significantly in recent years. Therefore, it is dangerous to assume that the slowdown is a temporary phenomenon that will cure itself if we give it more time.

However, being in a state of ignorance does not mean that we are paralyzed when providing policy advice. We may not understand all the determinants of productivity, but we do understand a few, and that limited understanding can shape policies. For example, enhanced business investment will improve labor productivity if it is efficiently allocated. That increases the importance of pursuing a tax reform that reduces distortions in investment decisions and that focuses on encouraging new investment. Expensing would do that and it is a shame that the Administration's recent proposal promises it for only five years. The tax cuts now being emphasized lose a lot of revenue and do little more than provide capital gains on old investment.

Of course, reducing future budget deficits would provide more domestic savings to finance investment, but neither political party is much interested in that.

Increasing the average skill level of the labor force would also increase labor productivity. It is difficult to design general purpose labor training programs that provide sufficient wage increases to compensate participants for taking time off for the program, but recent sector-specific training programs seem to hold more promise.

An immigration policy that emphasizes skills and education is a more direct approach to the problem. Canada does this and it appears to have been successful. Our policies emphasize humanitarian considerations by giving priority to uniting families. We need not do less of that if we are willing to increase the total number of immigrants.

Increased federal nondefense spending on research and development should also help productivity growth. Its relative importance grew in the years after World War II to about 1 percent of GDP by the mid-1960s. It has been on

a downward trend ever since, falling to only 0.3 percent of GDP in fiscal 2016. It is but one of many federal activities that is being crowded out by the inexorable growth of Social Security and health spending.

We do not have to fully understand the productivity problem in order to do something about it. The policies outlined above provide a start. We think that we know the direction of their effects even if we do not know the magnitude.



Assume productivity growth between 1.5 and 2 percent going forward.

JASON FURMAN

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Perhaps the biggest surprise about the growth slowdown over the last decade is that it was not, in fact, a surprise. It was predictable and predicted. In fact, we might want to ask why growth rates have been surprisingly high in recent years, not why they have been so low.

This may surprise you. Growth has generally come in below forecasts almost every year for the last decade. And the economy is now 12 percent below where the Congressional Budget Office had expected it to be in its forecast a decade ago. These forecasts were, in retrospect, giddily overoptimistic (I say this as someone who was responsible for some of them), overweighting what, in retrospect, was the unusual and temporary experience of rapid productivity growth from 1995 to 2005 while ignoring the longer sweep of economic history.

The forecasts that turned out to be correct—or even too pessimistic—were the ones made earlier, in the 1990s and first years of the 2000s. Projections from the Government Accountability Office, the Congressional Budget Office, and the Social Security trustees in the mid-1990s all projected that growth from 2010 to 2020 would be below 2 percent. No one predicted the Great Recession but the Social Security trustees might as well have—in 1999 they predicted that the economy would grow at an annual rate of 2 percent through 2016—almost exactly the rate it actually grew.

These forecasts understood that labor force growth was going to slow dramatically as the first baby boom became eligible for Social Security starting in 2008, turning into the first wave of a retirement boom with prime-age population growth slowing from its previous high of more than 2 percent in the 1980s to essentially zero. More importantly, these forecasts also placed more weight on the longer sweep of history than on the tech bubble.

This experience contains two important lessons for thinking about the future of economic growth. The first is that some parts of growth are readily predictable, specifically demography, and we ignore these at our peril. The good news is that there is no other shoe to drop on demography—we have seen just about the most unfavorable growth rates of the potential labor force we are going to see. The bad news is that these unfavorable growth rates will continue.

The second lesson is the danger of overweighting very recent experiences in predicting over longer stretches of time. This appears, in retrospect, to have been at least part of the error that forecasters made at the time. The Congressional Budget Office's pre-crisis forecasts, for example, assumed that productivity growth going forward would be closer to productivity growth during the two best postwar periods of growth, rather than the average rate from 1973 to 2005.

Heeding these two lessons, it would be reasonable to assume productivity growth between 1.5 and 2 percent going forward—the experience of the last half-century—which together with our demography would result in overall growth a bit below 2 percent going forward. We should try our best to get higher than this, but it would be a mistake to assume in advance that we will succeed.



Both views—tired impotence and dangerous omnipotence—are wrong.

BRET SWANSON

President, Entropy Economics, and Fellow, U.S. Chamber of Commerce Foundation

The recent productivity slowdown is real but does not signal sustained stagnation. Robert Gordon argues we are out of ideas, and thus productivity will remain

low; Elon Musk argues technology is so powerful that it will soon take all the jobs. I think both views—tired impotence and dangerous omnipotence—are wrong.

Technology is still powerful. We just haven't had enough of it in the right places. Over the last fifteen years, productivity in the digital industries in the United States grew 2.7 percent annually. Productivity growth in the physical industries, however, was just 0.7 percent. Why the disparity? Maybe because the physical industries—healthcare, transportation, manufacturing, education, retail—account for 70 percent of economic output but make just 30 percent of the investments in information technology.

Entrepreneurs in the digital industries have used information technology not only to make existing processes more efficient but, more importantly, to launch new and explosive products and platforms. I think this “information gap” is an important factor in the physical industries' lagging innovation.

What should we do about it? Fortunately, many of the physical industries are on the cusp of transformations into information industries. It was relatively easy to exploit infotech in data-rich industries like media and finance. Applying infotech to more tangible processes was a bigger challenge. Now, however, we are learning how to connect the physical world and infuse it with intelligence. Data-driven healthcare, smart transportation platforms, and lifelong online education are just a few examples where greater infotech intensity will make products and services radically better and cheaper.

Government policy can either retard or accelerate this process. Many of the physical industries happen to be heavily regulated with loads of outdated rules that discourage competition and innovation. It's why, for example, thirty years on we still do not have ubiquitous electronic health records. Unleashing radical entrepreneurship in healthcare and education could jolt these sectors from productivity laggards to leaders.

The physical economy labors under additional policy burdens in tax and finance. Technology has enjoyed deep venture capital markets and a number of large, acquisitive firms who provide “exit” opportunities for startups. The bulk of the physical economy, however, enjoys many fewer funding possibilities. With the IPO market closed for the last fifteen years and bank lending severely constrained after the financial crisis, small- and medium-sized firms struggled to invest.

The anticompetitive U.S. corporate tax code, meanwhile, discourages domestic investment, especially in more capital-intensive, lower-margin sectors. These two factors compound the productivity plunge in the physical economy. Freeing up financing for the physical economy—via smarter monetary and banking policy and through tax reform—would encourage the massive investments needed to transform these sectors.

We do underestimate the productivity and output of some sectors, especially information technologies (see especially David Byrne, Steve Oliner, and Dan Sichel). But correcting for these mismeasurements in the digital economy only deepens the productivity slowdown in the bulk of the non-technology economy and strengthens our case: unleashing the rest of the economy to innovate with information will revive economic growth over the next two decades.



The events since World War II that affected productivity are unlikely to happen again.

JAMES K. GALBRAITH

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My 2014 book, *The End of Normal*, deals with this question in detail. Here's a brief adaptation:

In the postwar growth years, the effect of the car and truck and the aircraft, of the suburb and the appliance, was to make possible a growth in total employment, absolutely and in relation to the population, even greater than the prior collapse of the horse-and-plow economy had reduced it. At the same time, the family became the well-spring of mass effective demand. As machines replaced family labor, GDP grew by a process of substitution. Eventually the family house became a bulwark of purchasing power, detaching the ability to spend, for a time, from the ability to earn.

With the digital technologies and the financial crisis, these effects are reversed. The price of the equipment required to make the new digital products falls, so the share of business investment in GDP also falls. The equipment is imported, also a subtraction from GDP. And digital products replace marketable output. Communications, information, education, entertainment, and retail sales, previously paid for on a per-unit basis, start arriving for free. They are still part of life, of activity, but they drop out from the economy. They no longer provide income, and so they no longer provide jobs or form part of what we measure as economic growth. The new technologies save both

labor and capital, reducing GDP growth, which accounts for the fact that measured productivity has not increased.

On the financial side, the middle class has moved from being cash-wealthy, to being house-wealthy-but-indebted and now, in deep financial trouble. Working off debts—and caution about incurring new ones—remains the way forward. And so the great well from which we drew high-employment prosperity in all of living memory has gone dry, and the alternatives—exports, business investment, and government spending—are all too shallow to make up the deficiency.

The normal response of economists to creative destruction has been to wave it away: something will turn up. Theorists of the “real business cycle” assume a cycle: if there is a downturn, an upturn will follow. Modern Keynesians argue that more spending can always bring the creation of more jobs. But contrary to the real business cycle theorists, technology does not move in smooth, repeating waves. The scope of a technology and its effects on the workforce depend on its characteristics. The new digital technologies don’t increase output; they exist mainly to cut costs and to capture market share. And given more money, consumers will mainly pay down debt. Given more money, businesses will mainly try to cut costs. Given more money, but not better borrowers or business prospects, banks do nothing at all. The great contingent events of the last century which created conditions for sustained growth—such as the effect of World War II on the financial wealth of American households into the 1950s—happened once. There is no compelling reason to expect them to happen again.



*Consider the
perverse effect of
corporate affirmative
action.*

EDWARD N. LUTTWAK
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Productivity growth is the summation of several things, notably including technological advancement, but insofar as it also requires better work by existing workers, a lower rate of growth would appear to be “over-determined.”

To begin with, there is the smartphone factor: properly dutiful employees do not of course watch films or football games during working hours, but even they cannot entirely focus on their work—they really must keep up with husbands, wives, lovers, mistresses, children, uncles in hospital...and close friends, of course. Those urgent familial and social duties done, they are ready to focus on their work, with just a quick look at the sports news.

Distraction there has always been, so the smartphone syndrome merely increases it to some unknown degree (though the frequency of known smartphone vehicular accidents suggests that there must be a lot of it), but “incorporated disaffection” is a much newer phenomenon.

Employees in small enterprises may or may not like their bosses, but in corporate America that hardly matters: it is a common managerial duty to control costs, including, of course, manpower costs, and if possible to reduce them, which can most often be done by dismissing employees. At the highest corporate level, stock options can directly reward managers if they fire employees, an action commonly interpreted by analysts and advised investors as evidence of profitably “tough-minded” management.

This has been going on for a long time, but the difference now is that the secret is out, the phrase “stock options” is no longer exotic, and very many employees therefore now see themselves as the herbivores down below constantly being sized up by the carnivores higher up for profitable disposal. Given that, few are likely to emulate the Toyota employees who sneak back into the plant after their shift because they suddenly seem to remember leaving a tool in a car, but then no Toyota manager has ever earned one more yen because he fired employees.

Then there is the educational effect of social media content, to wit the very low ratio of words to images. Images are fun and require little or nothing by way of reading or writing skills, and that is why supervisors report plain illiteracy as a drag on productivity in very many tasks.

Finally there is the perverse effect of corporate affirmative action.

By now everyone has internalized the nexus between diversity and innovation that was first famously explained by the “marginal man” theory of the pioneering sociologist Georg Simmel, whose own original term *Fremde* (literally “stranger”) denotes someone who has arrived inside while still retaining an outsider’s different perspective that may allow him to see what insiders miss: the potential of the entirely new, of macro-innovation. Admiral Hyman G. Rickover, the fanatically determined developer of nuclear propulsion, exemplifies the type: born in Maków Mazowiecki in Russian-ruled Poland into a Yiddish-speaking, Hebrew-educated family, he arrived in the United States via bread-and-herring steerage into a

life of acute poverty that forced him to work full-time as a telegram delivery boy while in high school, only to be rescued by a nomination to the U.S. Naval Academy by a Congressman on his route, where he nevertheless graduated with the highest grades.

There are plenty of contemporary young Americans who still today live in acute distress because of catastrophically bad parenting, many of whom belong to one of the castes scheduled for affirmative action; but the problem is that their high schools and even their colleges offer only snakes and no ladders, while most corporate employers for their part do not carefully look for Rickovers among them, but merely hasten to fill quotas all the more mechanically applied for being stridently denied.

Productivity growth is not a simple phenomenon, and all of the above is terribly simplistic. But as an old wine-maker once said when confronted by contemporary oenological wizardry, “Wine can also be made with grapes.”



Change the tax system to shift the balance of investment incentives and returns.

JIM O'NEILL

Former Commercial Secretary to the Treasury, United Kingdom, and former Chairman, Asset Management, Goldman Sachs International

I had responsibility for the productivity issue when I was a member of the Cameron government, working as Commercial Secretary to the Treasury under Chancellor George Osborne. I would think about these questions frequently, and still do.

On the measurement issue, I am in the camp that it is highly likely the productivity data is not measured accurately especially in the service sector of the economy, because it is extremely difficult to measure the output of many service sector businesses and firms. Given how service sector-driven the U.S. and UK economies are, then it is probably the case that overall GDP is under-recorded, and with it, productivity.

Despite this belief, I also believe it is dangerous to explain the productivity issue exclusively as a data management problem. If actual productivity were that much

stronger than reported, then you would expect to see other symptoms of stronger productivity, including stronger government tax receipts and especially higher wages, as it is normal for productivity and wage performance to go hand-in-hand.

These thoughts, as well as many others, have led me to another view about the broad topic, which is quite simple but a bit unconventional. If you think about the issue from the very big picture, a company has the choice of employing labor and or capital—it can invest in people or machines. When I (and many other *TIE* contributors) were being trained in economics at school or college, it was standard belief there was some sort of rigidity in the labor markets, in that wages would only ever adjust upwards but never downwards when economic activity weakened and demand for workers slowed. This belief dominated 1960s and 1970s thinking, not least as there was a lot of evidence to support it.

Partly as a result of this, but also as a result of globalization, active government policies to reduce the power of trade unions, and of course technology, in many western economies including the United States for the past twenty to thirty years a labor market has emerged where both the supply and especially demand for labor is much more flexible. Indeed, it has shifted so much that, all else equal, it is easier, cheaper, and therefore more apparently profitable for companies to employ labor than capital. As a result, many economies, including that of the United States, have extremely strong employment conditions, but still weak wages. In the United Kingdom, we currently have historic records of overall and full-time employment.

This situation has been compounded by how policy-makers have allowed the use of finance to evolve, and how corporate leaders can use finance. In my view, many publicly quoted companies across a number of industries are so driven by trying to report positive quarterly results to the markets, and use finance cleverly to bolster their aims, not least because their own remuneration is so strongly linked to their price-to-earnings ratio and overall stock market performance. I have become especially persuaded by the excessive and inappropriate use of share buy-backs to reduce the number of shares in circulation to boost ratios and boost reported goals. Why take genuine and very unpredictable long-term investment risk, when you can use cash to buy your own shares?

The consequence is persistently weak business investment, lopsided recovery but still strong supposed profits, but also weak productivity and weak wage growth. Policymakers should change this using the tax system to shift the balance of investment incentives and returns. Many corporate leaders, and others, often talk of too much long-term uncertainty when it comes to investing. But the future is always, and has always been, uncertain. We need to rebalance incentives.



As the infotech revolution spreads to the physical industries, we'll see an acceleration of productivity.

MICHAEL MANDEL

Chief Economic Strategist, Progressive Policy Institute

The United States is currently running a two-track economy. Digital industries, such as tech, telecom, content, finance and insurance, and professional and technical services, are showing strong performance on a variety of measures, including productivity, prices, and real wage growth. Meanwhile the physical industries—manufacturing, construction, retail, transportation, health-care, and accommodations—are performing quite poorly on these measures.

Why is this? The fast-growth digital industries simply are investing much more in information technology equipment and software per worker (which we will call infotech investment). The digital sector accounts for 25 percent of private sector employment, but 70 percent of infotech investment. Meanwhile, the physical sector accounts for 75 percent of private sector employment, but only 30 percent of infotech and software investment. So on average, infotech investment per worker is seven times higher in the digital industry compared to the physical sector.

Workers in the digital sector simply have much more IT available to them—and that shows up as faster productivity growth. Labor productivity in the digital sector has risen at a 2.6 percent annual rate since 2000 by my calculation, compared to a 1 percent annual rate in the physical sector (without healthcare and education included).

To focus further: In 2016, internet, software, and tech hardware (tech) companies invested \$26,000 per worker in infotech equipment and software, while manufacturing firms outside of tech invested only \$2,800 per worker in infotech. It perhaps should not be surprising that tech companies have much higher productivity growth than manufacturing (6.7 percent versus 2.3 percent).

However, we're beginning to see a movement towards "tech-enabling" physical industries, which should significantly accelerate their productivity growth. A case in point is ecommerce, which is transforming the retail/wholesale/distribution sector by tech-enabling the movement of goods. Our analysis shows the shift to ecommerce since 2007 has created 400,000 jobs in ecommerce firms

and fulfillment centers, while only costing 140,000 jobs in the brick-and-mortar retail industry. Moreover, the jobs in fulfillment centers pay 31 percent higher, on average, than brick-and-mortar retail jobs in the same area.

Ecommerce offers an important vision of the future. As other physical industries become tech-enabled, we may very well see a rise in productivity, wages, and good jobs, just like we did in the first half of the twentieth century.

In particular, the combination of 3D printing and ecommerce fulfillment networks may change the economics of local factories. Small-batch and custom local manufacturing, delivered rapidly to customers, may offer a compelling business model versus foreign competitors who produce in bulk and must ship the goods 10,000 miles.

The United States suffers from too little investment in information technology, not too much. As the information technology revolution spreads to the physical industries, we'll see an acceleration of productivity and a rise in living standards.



Look to the lessons of the 1990s.

J. W. MASON

Assistant Professor of Economics, John Jay College-CUNY, and Fellow, Roosevelt Institute

Stories that see the productivity slowdown as the result of exogenous technological factors require a remarkable coincidence—that the worst demand shock in sixty years just happened to coincide with the worst shock to productivity growth. What's more, textbook macroeconomics says that such a negative supply shock should be inflationary. So even if we believe a technological story, we still need some other source of demand weakness in order to explain why we see low inflation and interest rates and not the reverse.

Coincidences do happen. But it would be simpler if we could find a way to link the fall in productivity growth with the financial crisis and deep recession.

It is not hard to find reasons why demand conditions could affect productivity growth, either directly or via the labor market. The incentive to substitute capital for labor

is stronger when workers are scarce and wages are rising. Similarly, when labor is scarce, higher-productivity firms are more likely to bid workers away from lower-productivity ones. Investment is also responsive to demand conditions—even if profits are high and credit is cheap, there is no reason to expand if existing capacity is underutilized. Since new technologies and business practices normally require new investment, weak demand will hold back productivity growth through that channel as well.

In other contexts, we have no problem explaining productivity growth this way. It's not controversial to suggest that in response to a higher minimum wage, businesses will look for ways to produce the same output with less labor. Fast food restaurants, say, may replace cash registers with automatic kiosks. Extended to the economy as a whole, this is a story of productivity responding endogenously to employment and wages. It implies that a "high pressure economy" with sustained low unemployment should see faster productivity growth—and a period of sustained weak demand, like the past decade, should see stagnant productivity.

It's interesting in this light to look back at the late 1990s, when both wages and productivity rose at well above their historical average rates. The conventional view is that the more rapid productivity growth created space for the rise in wages. But it's worth considering whether causality might run the other way. In a provocative essay ("Productivity and the Labor Market: The 1990s in Historical Perspective"), economic historian Gavin Wright argues that there is good reason to think it was accelerating wages that led to accelerating productivity, and not the other way round. Gains in productivity followed, rather than preceded, the pickup in real wage growth in the mid-1990s. Productivity gains of the 1990s did, of course, involve new uses of information technology. But much of those gains came in sectors such as retail, where the key technologies already existed ten or even twenty years earlier—but were not adopted without the pressure of rising wages.

The 1990s are relevant in another way. At that time, like today, the Fed faced the choice of raising rates in response to low measured unemployment, or holding them low until inflation actually rose. Alan Greenspan famously chose the second—in the face of many in the Fed who, like today's FOMC majority, favored a preemptive hike. Greenspan's willingness to hold rates low set the stage for the strongest, mostly broadly shared growth in a generation.

It is sometimes argued that the failure of forecasters a decade ago to predict the productivity slowdown was the result of their extrapolating too much from the 1990s. As I argue in a recent report for the Roosevelt Institute ("What Recovery? The Case for Continued Expansionary Policy at the Fed"), this is exactly backwards. For decades, monetary policy has been guided by a parable of the 1970s, about the dangers of letting demand run ahead

of the economy's productive potential. In today's world of zero interest rates, jobless recoveries, and year after year of below-target inflation, this lesson has outlived its usefulness. It's time to pay more attention to the lesson of the 1990s, on the dangers of underestimating the economy's potential, and its responsiveness to demand.



Policymakers should consider three paths to pursue.

ROGER B. PORTER
*IBM Professor of Business and Government,
Harvard University*

There are some things in which we can have considerable confidence, while others remain puzzles. We are confident that productivity, perhaps more than any other economic measure, contributes to the standard of living in a society. It is also clear that measuring productivity is difficult. We underestimate economic growth and productivity in part because certain qualitative improvements are inadequately captured. Many public goods and quality-of-life measures to which we devote considerable resources are not included in the national income accounts. These include the cleanliness of the air we breathe and the water we drink, the safety of the products we consume and the places where we work—all of which have improved significantly in recent decades and which are not reflected in the way in which we measure productivity. In these ways we are adding value that is unreported.

At the same time, many qualitative improvements in both goods and services are not easily measured with precision. In this respect as well, we may also underestimate the advances we have made. As in many other things in life, we do the best we can.

Productivity improvements in agriculture and manufacturing over the past century have been impressive. We also recognize that for reasons that are not fully clear, we have experienced a productivity slowdown in the United States during the past decade. While absolute productivity continues to rise, the growth rate, as currently measured, has slowed, averaging roughly 1 percent over the past

decade, between one-third and one-half the productivity growth rate during the previous decade.

Whatever the measurement problems, productivity deserves priority attention. There are at least three important paths for policymakers to pursue. Each of them can contribute to enhancing productivity growth; none of them has the prospect of diminishing it.

The first is to adopt policies that will encourage investments in physical (plant and equipment), intellectual (research and development), and human capital (education and training). More capital per worker, fresh innovations, and greater ability to utilize those investments has a proven track record.

The second is to embrace policies, especially regulatory measures, which permit individuals and companies to deploy these investments efficiently. This is reflected in a host of ways including the flexibility of labor market arrangements, the efficiency of venture capital markets, the quality of labor-management relations, and the costs associated in complying with provisions in the tax code.

Finally, policymakers should embrace policies to enhance the competitiveness of an economy as measured by not tolerating monopolistic and oligopolistic behavior as reflected in antitrust laws and their enforcement, as well as in trade policies that create a level playing field for the healthy competition that spurs innovation.



*Stop the arbitrary
pulverization of
large, efficient
enterprises.*

MICHAEL LIND

*Visiting Professor, Lyndon B. Johnson School of Public Affairs, University of Texas in Austin, and co-author, with Robert D. Atkinson, of **Big Is Beautiful: Debunking the Myth of Small Business** (March 2018, MIT Press)*

Public policies to boost productivity growth need to be informed by the insights of the Schumpeterian school of innovation economics. Technological progress is not continuous, but consists of successive techno-economic paradigms, in which the economy periodically must be rebuilt on the basis of a radical new general-purpose technology such as the steam engine, the electric motor, the

internal combustion engine, or the computer. According to the Schumpeterian school's sequence of invention-innovation-diffusion, the invention of new technologies like the steam engine is followed by a period of entrepreneurial innovation that produces new products like steam locomotives, steamships, and steam-powered factories. Economy-wide productivity gains tend to occur during the subsequent diffusion phase, in which entire laggard sectors are modernized, often with the help of new infrastructure like railroads.

Where are we in the sequence? The basic elements of the information and communication technology paradigm were invented, largely with U.S. military funding, between the 1940s and the 1980s. This period was followed by the entrepreneur-centered innovation era that saw the development of the personal computer, the iPhone, and the internet. While macroeconomic factors such as the damage to demand from the Great Recession play a part in holding back productivity growth, the greatest danger is that the diffusion of information and communication technology, beyond the low-hanging fruit of telecommunications and accounting and finance to "old" industries like agriculture, manufacturing, and home construction, will be slowed or stalled by a combination of three factors: cheap-labor policies, legacy regulations, and too many small, inefficient firms.

Globalization can promote productivity growth if it enables the rise of transnational firms and supply chains that can deploy technology to reap economies of scale and scope and network effects. But making it easier for existing technology to be brought to low-wage workers abroad, or importing low-wage immigrants and guest workers to use existing technology at home, reduces the pressure on firms to invest in labor-saving, more productive equipment and organization that high wages caused by tight labor markets can provide. "Cheap-labor globalization" may boost GDP and yet retard per capita productivity growth.

Legacy regulations are another barrier to the diffusion of information and communication technology to vast sectors of the economy such as manufacturing, agriculture, transportation, health care, and energy. Because these sectors will continue to be regulated in the interest of public safety, the challenge is for entrepreneurs, existing firms, public authorities, and universities to work together to move from old regulatory systems to new ones adapted to the digital era. But vested interests that benefit from legacy legal and regulatory systems have an incentive to fight reforms that can threaten their profits or their existence.

Last but not least, we should expect that the proliferation of startups in the post-1980s innovation phase of information and communication technology is naturally being succeeded today by consolidation in the diffusion stage of the current techno-economic paradigm. Large firms with deep pockets and research and development budgets, along with "gazelles" that can scale up rapidly alone or in partnership with existing big firms, will tend

to lead the modernization of the laggard sectors of the economy. This process can be expected to produce greater sectoral concentration by driving less-productive small enterprises into extinction. In a modern economy, technological progress is driven disproportionately by oligopolies and potential oligopolies at the technological frontier, not by the competition of vast numbers of low-profit, low-productivity firms in highly fragmented markets.

The misguided revival of support for aggressive antitrust policy not only mistakes this normal evolutionary trend toward scale as a conspiracy against the public, but it also confuses the tiny number of innovative technology-based “gazelles” with the vast majority of mundane “mom-and-pop” businesses, which do not aspire to innovate and lack the capacity to do so. The harmful social side effects of concentration should be dealt with by policies other than the arbitrary pulverization of large, efficient enterprises.



We have been overstating price inflation and understating productivity advances.

RICHARD N. COOPER
*Maurits C. Boas Professor of International Economics,
Harvard University*

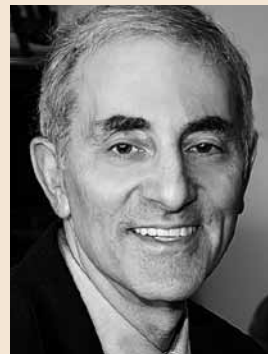
Growth in modern economies depends on advances in labor productivity, so a decline in such growth is obviously a concern. On conventional measures, productivity growth in the U.S. economy seems to have slowed, as it has in most other rich countries. The conventional measure involves increases in real gross domestic product divided by man-hours worked. Real GDP in turn involves deflating components of nominal GDP by price indices, to adjust for changes in the general price level. Thus, measuring “productivity” accurately requires lots of high-quality data plus some judgement about weights to be given to the various components.

There are reasons to believe this measurement has gotten worse over time, as the economy has shifted employment from goods to services, from wheat and steel to education and health care. Manufacturing employment fell from 17 million to 11 million over the period 1990 to 2015 (and agricultural employment from three million to

two million), while employment in private education and health care grew from 11 million to 22 million and state and local government employment (much of which is for education) grew from 15 million to 19 million.

What is the significance of these changes for overall productivity growth? We measure prices relatively well for agricultural and manufactured goods, hence also productivity, which involves changes in value of production divided by changes in prices. Prices are measured much less well for constantly advancing medical care. And for education and most government employment, we do not even try to measure productivity. Outputs are measured by inputs, for example, teacher-hours rather than what is taught. That is, productivity growth in these (growing) sectors is assumed to be zero. I am prepared to concede that the subject of economics has not advanced much over the last half-century. But the content of science courses, especially biology and geology, has been radically transformed. Students are learning much more today than in the past, and the content is continually improving. That is, there would be great advances in productivity if we measured educational outputs rather than inputs.

As the share of employment in well-measured goods production declines and that in poorly measured services production rises, as it has done and will continue to do, average measured productivity growth will decline. But the well-being of people provided by these services will continue to rise. As it has been asked: would you rather be provided with the medical services of thirty years ago at the prices of thirty years ago, or the medical services of today at the higher prices of today? We have been overstating price inflation and by the same token understating productivity advances.



It's essential to encourage entrepreneurship.

ROBERT LITAN
Adjunct Senior Fellow, Council on Foreign Relations

Let's be frank. Economists know a lot more about measuring productivity growth—in output per worker, or in output taking account of growth of both capital and

labor—than about what causes it to rise and fall, or how government policies can raise it. But there are some things we do know and policymakers should act on them.

One thing we know is that there is a long lag between two of the more important government measures—maintaining or ideally increasing investments in research and development and infrastructure—and the impacts they have on raising productivity growth. Policymakers have to muster the political will and patience to increase funding for both.

Second, encouraging entrepreneurship is key because entrepreneurs, especially those who commercialize disruptive innovations and who later build large companies, enhance productivity growth. Think of the key technologies that have brought us the modern age—the telegraph, telephone, television, computer software and hardware, internet search, and air conditioning. All were introduced by entrepreneurs.

The lowest-cost way to induce more startups, which has been flagging since the Great Recession, is to let in more immigrant entrepreneurs. I know any immigration reform is a political minefield, but the data are clear: immigrants are much more likely to launch businesses, especially tech businesses, than native-born Americans. So after letting the “Dreamers” stay here (what a waste, beyond cruelty, to make them leave!), immigrants with an entrepreneurial record, especially those who have already helped launch a business in the United States, should go to the head of line for permanent green cards, and ultimately citizenship.

Entrepreneurship can also be encouraged at the state and local levels. States should shorten non-compete clauses that inhibit the formation of new high-growth companies, as California has long done. States and localities should also streamline occupational licensing restrictions that inhibit formation of new companies, and movement of people to higher opportunity areas of the country. One idea: states should grant reciprocity to licenses from other states; eventually restrictions would be relaxed nationwide (this is how the United States launched interstate banking).

Mayors should encourage local entrepreneurs to mentor others, while facilitating regular networking events, like the Kauffman Foundation’s highly successful “One Million Cups” programs, now in roughly one hundred cities around the country. Local school superintendents need to infuse entrepreneurship and creativity into schools, at all grade levels.

Finally, talk to the owners or presidents of any growing new business (or most larger businesses, for that matter), and he or she will tell you that one of their most difficult challenges is finding workers with the right skill sets, much of it related to information technology. We need a far more comprehensive policy for encouraging and enabling people to pursue lifetime learning, so the skills of

our workers can keep up with continuing technological advances. Toward this end, the federal government should establish lifetime learning loan accounts for all adults, with repayments based on income, so borrowers will not be unduly burdened by debt service they cannot meet if they get laid off or their incomes do not increase as rapidly as desired.



*Forget the
extravagant claims
about growth over
the next four years.*

MARTIN NEIL BAILY

*Bernard L. Schwartz Chair in Economic Policy
Development and Senior Fellow and Director
of the Business and Public Policy Initiative,
Brookings Institution*

GDP per hour worked in the U.S. economy rose at only 1.1 percent a year from 2004 to 2016. The United States is not alone in facing weak productivity growth as GDP per hour in Germany grew at only 0.9 percent a year, France at 0.6 percent, Japan at 0.8 percent and the United Kingdom at 0.4 percent. Data are from the OECD. Productivity growth was strong in advanced economies in the years after World War II but started to slow in the early 1970s. The computer boom pushed up the growth rate for about ten years starting in the mid-1990s, but growth has flagged again since then. Slow productivity growth is a major reason for the slow growth of average living standards and makes it much harder to deal with problems like the budget deficit.

The measurement of real GDP, and hence productivity, is far from perfect. The U.S. economy is increasingly a service economy—17 percent in health care alone—and it is very hard to measure service sector output. Today’s hospitals have better tools for diagnosis, better surgical procedures, new medical devices, new drugs, and yet very little of this quality improvement is accounted for. Many of the benefits of smart phones are provided in free apps, such as Google search, and these are counted as “consumer surplus,” not as part of GDP.

It is hard to know exactly how important is the mismeasurement, and of course there was mismeasurement in the

past. My best guess is that true productivity grew at around 1.4 percent per year from 2004 to 2016, rather than the recorded 1.1 percent. This is not enough to overturn the slow growth problem, but it helps. Living standards have been rising a little faster than the official data suggest.

Labor productivity growth can be divided into the contribution of technological progress plus the contribution from increases in capital per worker. Capital investment has been very slow, especially since the Great Recession, partially explaining slow productivity growth.

Why has investment been so weak? One answer is that businesses do not see opportunities for profitable investment. Slow investment may be simply a consequence of an economy with a slowly growing workforce and (perhaps) stagnant technology.

It may be possible to offset, in part, business resistance to making new investments. Tax and regulatory reform could spur domestic investment. That is certainly the hope of this administration and a motivation for their efforts to simplify the complex corporate tax code.

What can be accomplished through tax reform is controversial, as critics note that most companies already pay taxes that are far below the statutory rate of 35 percent. Despite this reservation, I support efforts to reform the corporate tax code by eliminating deductions and bringing the tax rate more in line with that of our competitors. I even like the border-adjusted cash flow tax, although it is an idea that now seems dead. A better tax system could encourage more investment in the U.S. economy and add a couple of tenths to the growth rate for some years.

The persistence of slow growth seems to fly in the face of evidence of new technologies emerging everywhere. Amazon is adding robots to its warehouses; artificial intelligence is finally coming of age; companies are using the internet of things and big data; 3D printing is getting cheaper; new synthetic materials have been developed; self-driving vehicles are coming closer to reality; and CRISPR and other technologies are transforming biotech. We see so much technological change, with so little productivity growth.

One explanation is that these new technologies are more hype than reality, but my own view is that we are in a temporary lull and productivity will rebound from its recent dismal performance once the new technologies move into the mainstream economy. I do not know when a rebound may happen or how large a growth improvement there could be. My best guess is the rebound will be five or ten years into the future and GDP per hour could then grow at 1.8 percent to 2.0 percent a year. This is within the range achieved historically and is much better than the past decade. That growth in labor productivity would translate into GDP growth of 2.3 percent to 2.5 percent per year. I caution, though, that this is more a hope than an evidence-based forecast.

My advice to this administration: Forget the extravagant claims about growth over the next four years. Ours is an aging economy with slow growth in the labor force and an entrenched productivity weakness that is not fully understood nor easily reversible by policy means. Tax reform would be helpful to growth but watch out for growing budget deficits. They could derail a growth rebound. There are ways to streamline regulation and make it more efficient (like a carbon tax), but avoid demolishing hard-won protections for the environment, consumer and worker safety, and financial stability. Remember that talented immigrants helped build Silicon Valley and they contribute enormously to our economy and to the pace of innovation.



It would be wise to take seriously the risk that Robert Gordon may be partially correct.

MICHAEL J. BOSKIN

Tully M. Friedman Professor of Economics and Hoover Institution Senior Fellow, Stanford University, and former Chair, President's Council of Economic Advisors

A modest rise or fall in productivity growth, well within the historical range, compounded over a generation, is immensely consequential. So is the recent sharp decline in productivity growth temporary, recession-related? A harbinger of a gloomy future? Or a measurement mirage?

The Boskin Commission report (1996) and much subsequent research concluded that official statistics were overstating inflation, and therefore understating productivity and real GDP growth, by about 1.1 percent per year due to a combination of inadequate adjustment for quality improvement, new products, and substitution bias. Several statistical improvements since have reduced the bias by 40 basis points or so per year.

The productivity growth decline, as opposed to level, could only be due to measurement issues if the underlying biases had recently gotten worse—an open empirical issue, which will become increasingly paramount. Consider two trends: the aging population raises spending on health-care as a share of GDP. So it will be even more important

to determine what part of the increased spending is buying improved quality, currently undercounted, and what is pure inflation. And technology-enabled unpaid personal productivity is replacing paid market activity, gains that go underreported in measured output.

Pessimists such as my Boskin Commission colleague, Northwestern University's Bob Gordon, claim recent technological gains aren't improving, nor are they likely to improve, productivity nearly as much as previous innovations such as electricity, the automobile, and computers.

Optimists counter with smartphones, nanotechnology, and robotics, plus Moore's Law having room to run with three dimensions likely presaging a new era of productivity improvement. The optimists dismiss the Gordon argument, too cavalierly, by saying it is not possible to predict the next "killer app" from these technologies, but they always arrive. Indeed, the main commercial value from new technology is not always what the inventor had in mind. James Watt's steam engine was originally for pumping water out of coal mines, not powering railroads or ships. Marconi was competing with the telegraph in point-to-point communication and never envisioned mass broadcast radio. And as legend has it, Thomas Edison's most original invention, the phonograph, was designed to help the blind and he sued to stop its use for music.

Economists are still debating the extent to which technology has driven economic growth as compared to investment in tangible capital, a larger and more educated work force, scale economies from larger, including global, markets, or other factors. Larry Lau, Helen Guo, and I conclude, for example, that technology has played a very large role in post-World War II G7 nations' growth. We also find that technology has been what we call generalized Solow-neutral, that is, capital- and human capital-augmenting.

That implies the realized rate of technical progress likely slows over time unless capital and human capital investment accelerates; since they haven't, this bias is another explanation for the productivity slowdown. That also helps explain the failure of western Europe and Japan to converge to U.S. income levels and is consistent with other recent studies suggesting that, at least so far, technology has not caused a total net increase in structural unemployment, as job growth in other sectors has made up for employment declines in sectors where technology has heavily substituted for labor.

Of course, the past is not necessarily prologue. Hopefully the optimists will prove correct, but it would be wise to take seriously the risk that Gordon may be at least partially correct. That should prod us to redouble the focus on productivity-enhancing economic policies such as tax, regulatory, entitlement, and education reforms that promote productive investments in tangible and human capital.



It's premature to talk about a productivity slowdown as being the "new normal."

EV EHRLICH

President, ESC Company, former Undersecretary of Commerce, 1993–1997, and former Chief Economist and Head of Strategic Planning, Unisys Corporation

Those who see slower measured productivity growth as the "new normal" should consider two fundamental challenges to that view.

The first, and more widely understood, issue is that while productivity is the ratio of outputs to inputs, we are coming to realize how murky our definitions of "output" are. It's easy to count tons of steel or boxes of Cheerios, but less so financial services, or drugs that replace surgeries, or electronic goods that burgeon in functionality, or music streaming services that expand consumer access while dramatically reducing nominal receipts, or cloud-based services such as Yelp or Maps that collapse information-gathering costs. And all this is before we think about sectors that traditionally pose measurement problems, such as owner-occupied housing or government. (And these problems affect more than output measurement. If we really don't know what "output" is, then perhaps the Fed should be targeting nominal GDP rather than its inflation component.)

The second issue is yet to receive similar attention—the current decidedly and widespread anti-growth policy mix. We are fixated on public sector austerity, and within that austerity, tend to favor consumption (entitlements) over investment. (Even the Trump infrastructure plan appears to be little more than a tax gimmick to move such spending off the government's books, rather than a much-needed overhaul of how infrastructure is appraised, approved, and funded.) Other aspects of policy are as bad or worse. The skewed income distribution means less demand at any level of national income; tax reform could pour gas on this fire by turning our tax system into one based almost wholly on labor income. High-volume financial trading and new synthetic products lead our markets to focus on rearranging wealth rather than creating it. We seem more willing to celebrate the new "platform" monopolies than regulate them. The current stop-gap Obamacare program—and the cheap histrionic attempts

to eliminate it—have stalled any progress toward rationalizing a sector that soaks up one-sixth of national output, twice the proportion of other, similarly healthy societies. The liberal trade regime is under assault. And we will encounter a new, short-term headwind if we prematurely unravel a monetary policy consistent with the current disinflationary environment.

These “mezzo-economic” issues affect growth as surely as does the Keynesian toolbox. And, consequently, they contribute to slow growth and slow growth expectations, which inhibit productivity-enhancing investment. So it’s premature to talk about a productivity slowdown as being the “new normal.”

But it’s unfortunate that policies to reverse the deterioration in the income distribution, eliminate potentially destabilizing financial practices, restrain market power, reform the bloated health care sector (starting with a long-overdue single-payer framework), and promote public investment are not part of the “new normal” as well. Those are the issues that must be addressed, rather than omphaloskeptically contemplating the death of productivity.



*The honest answer:
Who knows?*

JARED BERNSTEIN

*Senior Fellow, Center on Budget and Policy Priorities,
and former Chief Economist and Economic Adviser to
Vice President Joe Biden*

Simple arithmetic dictates that, along with slow labor force growth (a significant part of which is due to aging workforces), slow productivity growth is contributing to the deceleration of GDP growth in economies across the globe.

To be clear, in the U.S. case, conventional forecasts, like those of the Congressional Budget Office, attribute most of the deceleration (70 percent) in potential growth to slowing labor force growth.

Still, even if we accept potential measurement issues, the productivity slowdown is real, and extremely important. Cutting to the chase, outside of accounting

exercises that raise as many questions as they answer, economists do not understand the underlying forces that make productivity speed up and slow down. This creates the dreaded “empty hole problem”: since no one knows the answer, partisans fill the hole with their favorite candidate, which in today’s Washington is “tax cuts and deregulation.”

There are two broad schools in this debate: productivity pessimists and optimists. The pessimists are a larger group and, at least in my judgement, have better evidence. They suggest that the slowdown began before the Great Recession, so it’s unlikely to be demand-driven. Their focus is on the slowdown in total factor productivity, the part of output growth left over after you subtract out the growth of all the inputs. The residual is a proxy for innovation, and for all the talk, no one really knows what drives innovation cycles.

The optimists largely depend on mismeasurement claims and long-term mean reversion arguments. There’s some evidence for both.

Since we’re talking about growth rates, showing evidence of mismeasurement is not proof of anything. It must be shown that mismeasurement is getting worse, that is, we’re increasingly leaving out value added in our measures of real output. Some mismeasurement claims stem from the observation that sectors wherein it is harder for national accountants to pick up true declines in quality-adjusted prices—health care, software, the “app” economy—are the very sectors that are growing as a share of value added, meaning even constant mismeasurement in those sectors could lead to downward bias in measured output and thus productivity.

However, careful research challenges these claims, I think convincingly. Some of this work points out that if anything, we’re doing a better job of measuring hardware and software, thus the productivity slowdown may be understated (in the United States, we’re also producing less hardware). Other work finds that, yes, our price indices are missing tech improvements, such that total factor productivity in that sector has hardly slowed at all. But this just implies total factor productivity outside of tech has decelerated even faster than we thought. Other work shows that productivity is falling across many countries, and its decline is uncorrelated with their production of information technology.

Finally, estimates of mismeasurements, even if they’re right, are not large enough to offset the full extent of the slowdown or replace much of the implied lost output.

At the risk of my own filling of the empty hole, I’ll offer three explanations that make sense to me. First, some of the most interesting research in this space shows an historically unique divergence between the productivity growth of so-called “frontier” and “laggard” firms. Why

have the latter failed to adopt the technologies of the former, and why hasn't that failure led to their demise? This may be an important market failure.

Second, though the productivity slowdown predates the Great Recession, "secular stagnation" has been upon the land for quite a while now, and thus it might be a mistake to reject the "weak demand" hypothesis. I can think of a simple, intuitive model wherein strong demand boosts unit labor costs, squeezing unit profits, such that maintaining profit margins means finding ways to produce more efficiently.

Third, simple regressions show that the most accurate forecasts of productivity growth use very long—as in forty years—autoregressive lags.

Perhaps we will eventually mean-revert back to healthier productivity growth rates. But the honest answer must be: Who knows? On the other hand, putting aside challenging and often toxic politics, there's a simple lever that would boost labor force and thus GDP growth: welcoming immigration reform.



The dynamics of productivity growth and real compensation are masked by the aggregate and the averages.

CATHERINE L. MANN

Chief Economist and G20 Deputy, Organization for Economic Cooperation and Development

A key challenge facing virtually all economies is a decline in productivity growth over the last few decades. This decline poses problems of both meeting expectations (that people have for themselves and their children) and commitments (that policymakers have made with regard to health care, pensions, and bond holders).

So we need to be thinking a lot about productivity. Work at the OECD using firm-level data shows that looking below the averages is key to setting out an evidence-based policy agenda to respond to the productivity challenge.

OECD research has documented three important characteristics of the time series of productivity growth. First, the decline in the average growth in productivity masks a widening divergence in productivity performance

among the top firms in each sector and the rest of the firms in that sector—the so-called “Best *versus* the Rest.”

Second, the lagging firms in each sector have had essentially no productivity growth in twenty years. Why? Research shows that important factors holding back the productivity growth of lagging firms include policies that inhibit exit (such as bad loan forbearance, judicial delays for restructuring, and negative attitudes toward personal bankruptcy); some of these also inhibit the financial sector from extending credit to support new investment that would aid productivity growth by allowing new firms to expand. Other hypotheses focus on the slowing diffusion of innovation from the “best” to the “rest.” Research points to policies ranging from housing costs to skill training that inhibits the matching of workers to the right jobs. An important corollary of failure to exit and poor matching is the slowdown in business dynamism, another feature of the productivity slowdown. A further hypothesis requiring additional research focuses on the frontier firms, and whether intellectual property hoarding by those firms could limit diffusion.

A third observation from this firm-level perspective is that, up until around the financial crisis, the pace of productivity performance of the top firms in each sector continued to increase. Since then, the performance of frontier firms in different sectors has started to diverge, with productivity growth in services sectors, particularly information technology services, continuing to strengthen. Productivity among frontier firms in other sectors has flagged, again showing the importance of looking below aggregates and averages. Some hypotheses for this slowdown for some sectors at the frontier include: Lack of demand to encourage investment to complement productivity; the slowdown in trade intensity and concomitant lack of technology and management skills transfer; and mergers that reduce competitive pressures that induce innovation to stay ahead. Research is ongoing.

Finally, but importantly, a fourth observation gained from the firm-level analysis is the divergence of workers' real compensation. Workers' real compensation tracks well the sluggish productivity among the laggard firms, thus helping to explain the dismal income performance for many workers in the advanced countries. However, there is a gap between productivity and real compensation at the frontier firms. Those workers earn a lot more than their colleagues in lagging firms in each sector, but they apparently do not earn their marginal product. Is this real wage divergence at the frontier between productivity and compensation related to the flagging productivity itself or is there something else at work?

In sum, rethinking productivity growth—and policies to change the trend—is all about using micro data to parse through the very significant differences in the dynamics of productivity growth and real compensation masked by the aggregate and the averages.



Be skeptical of the defeatist theory.

MARCO ANNUNZIATA

Chief Economist and Head of Business Innovation Strategy, General Electric

U.S. productivity has slowed to a crawl: a mere 0.5 percent average in this recovery (2011–2016) compared to 3 percent in 1996–2005 and a long-term average over 2 percent. Most advanced economies have suffered a similar fate. This has fed into a gloom-and-doom narrative: some economists argue we have entered an era of permanently slow growth, and business expectations and policy priorities should be reset accordingly.

Policymakers should be skeptical of this defeatist narrative. Nothing is inevitable or irreversible in the recent productivity slowdown. Productivity is propelled by innovations in technology and in business models—and innovation is alive and well, beginning to transform key sectors of the economy, from manufacturing to energy, from transportation to health care. The digital innovations that have transformed our personal lives are spreading to industry.

Additive manufacturing, or 3D printing, now allows us to build lighter and stronger components, faster and at lower cost. Augmented reality-enabled wearable devices (think an industrial-grade Google glass) augment the skills of factory floor workers—improving productivity by 30 percent on first use in GE pilot projects. Equally impressive advances are taking place in precision medicine, in power generation and distribution, and in autonomous vehicles.

From my vantage point in GE, I see a constant flow of technological advances and the efficiency benefits they yield. There is no doubt in my mind that the growth-enhancing power of innovation is as strong today as it has ever been.

Some of these benefits are going unmeasured, if not unnoticed. Economic statistics lag changes in the economy, and when the changes are as fast and profound as today, the degree of mismeasurement increases. But I do not think mismeasurement is the main issue.

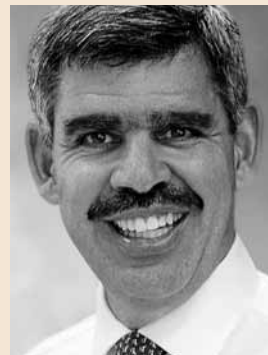
The bigger problem is the lackluster pace of investment that has so far prevented new innovations from scaling across the economy. U.S. private investment has

averaged only 16 percent of GDP in the last few years, well below the pre-crisis 19 percent. High uncertainty and the pessimistic bias of press headlines pushed businesses into a defensive stance, focused more on cutting costs than on investing for growth.

As investment picks up, thanks to an improved global growth outlook and stronger business confidence, new technologies will get incorporated into the capital stock at a faster pace. Companies will need to retrain and redeploy workers, adapt processes, and change management practices—turning the magic of innovation into productivity takes hard work. Productivity will accelerate.

Policymakers should focus on creating the conditions for stronger investment: a simpler tax framework, effective but leaner regulations, an education system better able to create the right skills, including through closer collaboration with industries, and with a strong foundation of basic research. They should invest in infrastructure, not just to “fix the potholes,” but to incorporate digital technologies in the basic infrastructure for transportation, energy, and communication, and to facilitate the diffusion of digital-industrial technologies.

Human ingenuity is as strong as it ever was. We should focus our efforts on innovation and investment, and faster productivity growth is well within our reach.



Don't let the productivity puzzle become a distraction.

MOHAMED A. EL-ERIAN

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In today's unusually fluid global economy, solving the productivity puzzle will take time and a lot of smart analytical efforts. Success requires untangling and isolating an inherently complicated set of possible contributing factors involving mismeasurements and data collection problems, changing investment functions, ongoing domestic and cross-border structural changes, institutional decay factors, demographic changes, and spillovers from years of deficient aggregate demand.

An important issue for the policymakers—and, more importantly, for politicians in several advanced countries who are yet to step up fully to their economic governance responsibilities—is to keep this baffling complexity from delaying the urgent need to revamp growth models that continue to rely excessively on finance and central bank liquidity. We don't need a definitive solution to the productivity puzzle to validate the need for modernizing infrastructure, enhancing skill acquisition and labor retraining, reducing the imbalance in demand management, expanding public-private partnerships, and improving global policy coordination.



*The reason for the slowdown?
The return on capital is higher in emerging markets.*

RICHARD C. KOO
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Low productivity growth in the advanced nations is attributable largely to the fact that the return on capital, especially in manufacturing, is now substantially higher in the emerging economies than at home. Since manufacturing is where the greatest productivity gains can be expected, its relocation to countries where wages are a fraction of those at home has curbed domestic investment in productivity-enhancing equipment.

CEOs under shareholder pressure to maximize the return on capital also have little choice but to invest where expected returns are the highest, even if they can still earn a positive return domestically. In other words, businesses continue to invest in an attempt to satisfy shareholder expectations for ever-larger profits, but the bulk of their investment is now taking place abroad.

As evidence of this reorientation, factories operated by or producing for corporations in the advanced countries now blanket China's entire coastal region along with vast areas of Vietnam, Bangladesh, and other parts of Asia. Emerging economies are also making tremendous efforts to attract foreign direct investment by providing better infrastructure and more highly educated workforces.

Economists, meanwhile, never envisioned a world in which the return on capital is higher abroad than at home. The profession continues to operate on the assumption that investment in productivity-enhancing equipment will pick up if only real interest rates fall far enough. That assumption may have been valid thirty years ago, but it no longer holds today. This fundamental misreading of the global environment has prompted monetary authorities in advanced countries to engage in astronomical amounts of quantitative easing and implement negative interest rate policies, the benefits of which have been modest at best.

At the same time, the decline in domestic private investment means government borrowings are much less likely to "crowd out" private investment. And with domestic businesses exhibiting only weak demand for funds, bond yields have fallen to extremely low levels. These indicators suggest that governments in the advanced countries should mobilize fiscal policy to rebuild and expand long-neglected public infrastructure. That, in turn, would boost national productivity by minimizing the time people spend in slow and unreliable trains or in traffic jams on overused but under-maintained roads and bridges.



It is safer to rely on what we know, rather than speculate on what may happen.

MAREK DABROWSKI
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There are many conventional wisdoms about productivity growth and its perspectives. Some of them have been mentioned in your question. Moreover, forecasting future productivity trends is even more difficult because too many factors will affect them.

Therefore, it is safer for policymakers to rely on what we know rather than speculate on what may happen. Sadly, the available statistics demonstrate that productivity growth in the United States and other advanced economies slowed down in the last ten to fifteen years after spectacular increases in 1990s and early 2000s. If mismeasurement has any impact on these statistics, it overestimates productivity growth rather than underestimates

it due to underestimation of the contribution of investment in the growth accounting methodology. Most statistical agencies do not capture all investments in intangibles, so they are added to productivity growth, which is a residual parameter.

We also know that slower productivity growth can be explained, to a large degree, by the slower pace of absorption of technological innovations, especially those related to information and communication technologies, as compared to the period of 1990s and early 2000s. The impact of demography, that is, slower growth (as in the United States) or decline (as in Europe and Japan) of the working-age population and population aging on productivity is less clear and requires further analyses.

Perhaps optimists who speak about the revolutionary character of many current and prospective technological

innovations are right and one may expect acceleration of productivity growth ten or fifteen years from now, but it is not a very likely scenario in short term. Policymakers cannot build their macroeconomic and fiscal projections based on too-optimistic assumptions because this is a recipe for big trouble.

Policymakers must also create a favorable business climate and enact policies which facilitate breakthrough innovations and their fast spreading. This involves, among others, free trade, stable and innovative financial systems, flexible labor markets, open immigration policies, simple corporate taxation at moderate rates, support to start-ups, and better education. Protectionism of any kind, closing borders, and defending incumbents against competition of newcomers (including foreigners) and “creative” destruction will kill innovation and productivity growth. ◆

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