Is Slow Productivity and Output Growth in Advanced Economies the New Normal?

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Abstract

Advanced economies have seen a notable slowdown in potential growth in the past decade or so. Demographics look much less favorable to output growth than in the past, and productivity growth has been only modest. The demographic and productivity factors driving this slowdown in potential growth look to be largely independent of the Great Recession. These factors do not at this point look likely to change rapidly, despite considerable uncertainty about the future contribution of artificial intelligence and robots.

Growth since the Great Recession has been disappointing across advanced economies. For example, prior to 2007, U.S. growth in gross domestic product (GDP) of 3 per cent or more seemed normal.[2] But growth from the trough of the Great Recession in mid-2009 has averaged only 2.3 per cent (through the third quarter of 2018).

Moreover, the disappointing U.S. growth figures came in the context of a recovery that was strong enough to bring the unemployment rate down from nearly 10 per cent to under 4 per cent. So even the disappointing pace of growth during the recovery has been much faster than the underlying trend, or potential, pace that would have been consistent with a constant unemployment rate.

Unfortunately, the fundamentals of potential growth do not look much better now than they have in the past decade. Advanced economies face challenging demographics and productivity growth remains only incremental. We can hope for better outcomes (particularly in terms of productivity) but we should not be surprised if we do not obtain them.

Demographics

Let us start with demographics. Chart 1 shows growth rates by decade of the "prime-age" population (aged 25

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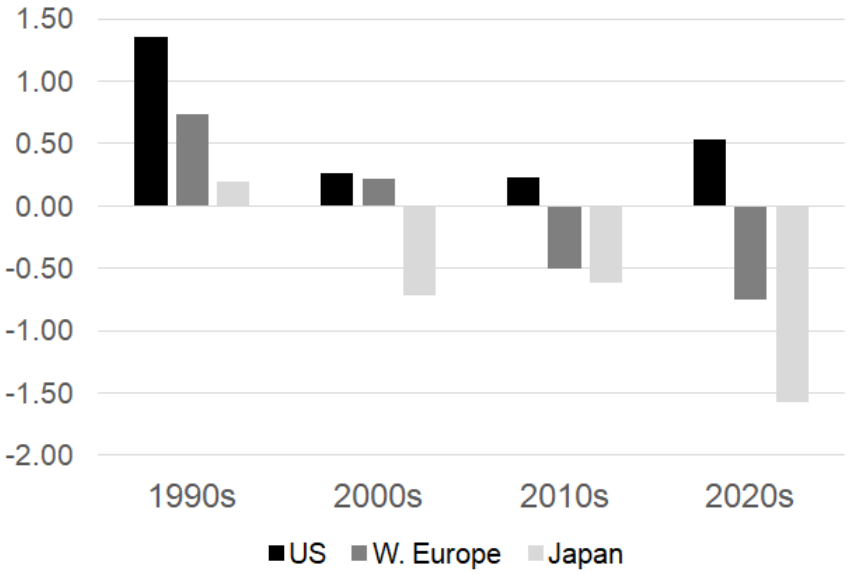
2 For example, the lowest growth rate over any 25 year period from 1929-2007 was 2.97 per cent, reached in 1993.

Chart 1: "Prime" Working Age Population Aged 25-54 in the United States, Western Europe and Japan, Annual Per Cent Change



Source: UN Population Projections. Europe excludes Eastern Europe.

to 54), using U.N. data and population projections for the United States, Western Europe and Japan. Most people in this age group are working.

In the 1990s, US prime-age population growth was nearly 1-1.5 per cent per year and Western Europe about 0.7 per cent, while Japan was barely growing. By the 2010s, the prime-aged population in the United States was barely growing, whereas Western Europe and Japan were both shrinking.

Looking ahead to the 2020s, the United States prime-age population will continue to grow, albeit modestly. But Western Europe and Japan will shrink even faster than in the recent past – dramatically so in the case of Japan.

These demographics are the biggest reason why potential GDP growth in the future will be faster in the United States than in Western Europe or Japan. After all, the United States workforce will not be shrinking, whereas it will in many other major advanced economies. But, importantly, across almost all advanced economies including the United States, the demographics look worse for growth than in the past.

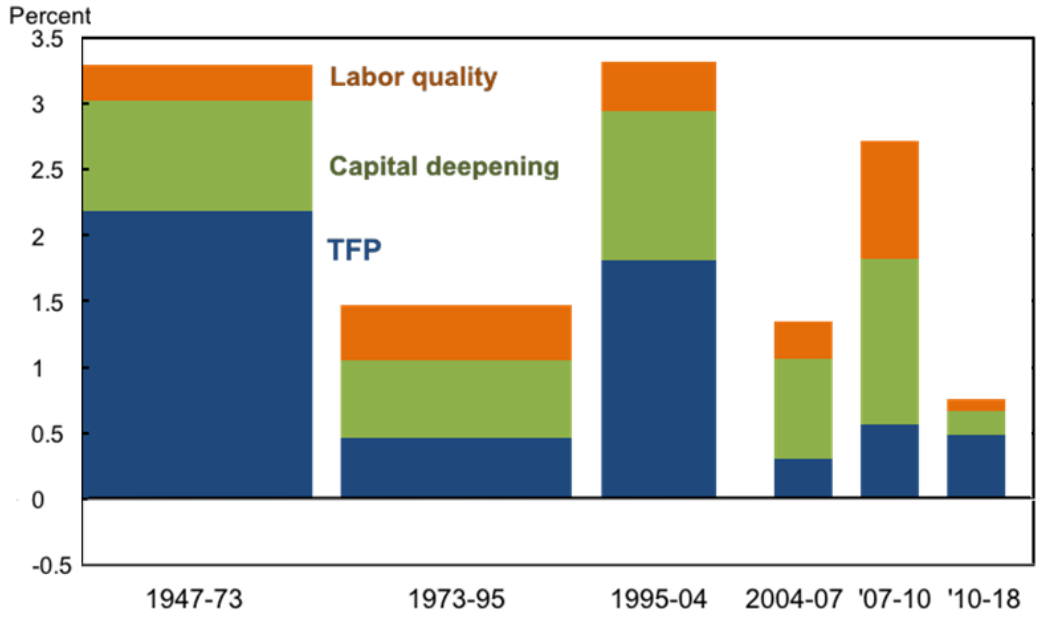
Understanding Recent Productivity Patterns

Now let us turn to productivity growth. How productive will the people who are working be at producing GDP?

To understand the future, Chart 2 starts by looking to the past. It shows conventional growth accounting results for the United States business sector economy since 1947. The blue bar shows the contribution of total factor productivity (TFP), a broad measure of innovation that captures any output growth that is not explained by growth in measured inputs of capital or labour.

TFP growth was very strong before 1973 and in the period 1995-2004. Apart from that period, it has more typically

Chart 2: Contributions to Growth in U.S. Business Sector Output per Hour (average annual rate of change)



Source: Fernald (2014). Quarterly; samples end in Q4 of years shown except 1973 and 2018 (end Q3). Capital deepening is contribution of capital relative to quality-adjusted hours. Total factor productivity measured as a residual.

averaged around 0.5 per cent per year — whether one looks at the 1973-95 period, or at the 2004-2007 run-up to the Great Recession, or during and since the recession.

A considerable body of research examined the pickup in U.S. TFP growth in the mid-1990s. The United States had a decade of rapid and transformative gains associated with the internet and other uses of information technology, including reorganizations of businesses and industries.

But that burst of exceptional TFP growth clearly came to an end before the Great Recession, as shown by the much slower growth rate from 2004-2007. Fernald *et al.* (2017) use a variety of statistical approaches to confirm the pre-recession timing of the slowdown.[3]

The time pattern of labour productivity, or output per hour, looks broadly similar to TFP. But when you look at the final two bars, there are some noticeable differences. Notably, labour productivity growth was strong relative to TFP during Great Recession but has been weak relative to TFP ever since. This post-2007 divergence between TFP and labour productivity reflects cyclical dimensions of labour productivity growth during the recession itself (2007-2010) that subsequently unwound (2010-2018).

First, during the recession, firms disproportionately fired low-skilled workers. That provided a substantial boost to labour quality. During the subse-

3 See also Diaz *et al.* (2017) and Kahn and Rich (2018).

quent recovery, those lower-skilled workers found jobs again, so the average skill level of the labour force has grown much more slowly.

Second, during the recession, the number of workers fell sharply, whereas measured capital input never fell. So the remaining workers had more capital to work with. As a result, capital deepening (in Chart 2, capital per quality-adjusted worker) rose rapidly and contributed exceptionally to labour productivity.[4] Since 2010, firms had plenty of capital. What was missing was demand. As demand returned, they could meet it by hiring workers. More technically, as Fernald *et al.* (2017) argue, capital-output ratios were very high in 2009 and 2010, which muted incentives to invest for some years. As a result, capital deepening contributed much less to growth, and labour productivity growth has been weak relative to TFP.

Looking ahead, even without any change in the TFP trend, labour productivity growth is likely to pick up. Businesses will not be able to continue meeting demand by hiring people given demographics, they are likely to run out of people. Rather, they will return to adding capacity, which should boost capital-labour ratios in a normal way.[5]

Turning to Europe, Chart 3 shows that TFP growth has been slowing since the 1960s. Most of this slowdown is, in fact, a striking indication of success. Europe came out of World War II far behind the United States in terms of productivity levels. Productivity in European economies grew fast and, by the 1990s (if not earlier), had largely caught up.

But, especially since the mid-1990s, productivity growth in Europe has, by and large, fallen short of the U.S. pace.[6] There remains a debate whether some of that further slowing since 2007 reflected the Great Recession itself, but the dominant feature is the pre-recession slowdown (Cette, Fernald and Mojon, 2016).

Forecasting the future of TFP growth is extremely hard. Fernald (2016) argues for a regime-shift model for TFP. In some periods, TFP growth has been fast, in other periods, it has been slow. And in the past 45 years, there was only one decade with high TFP growth (from the mid-1990s to the mid-2000s). Otherwise, the slow regime of about 0.5 per cent TFP growth looks "normal."

Intuitively, there were important and innovative technological developments taking place in the 1970s and 1980s, just as there are today. But for most of this period, this innovative activity led to business sector TFP growth of about 0.5 per cent per year.

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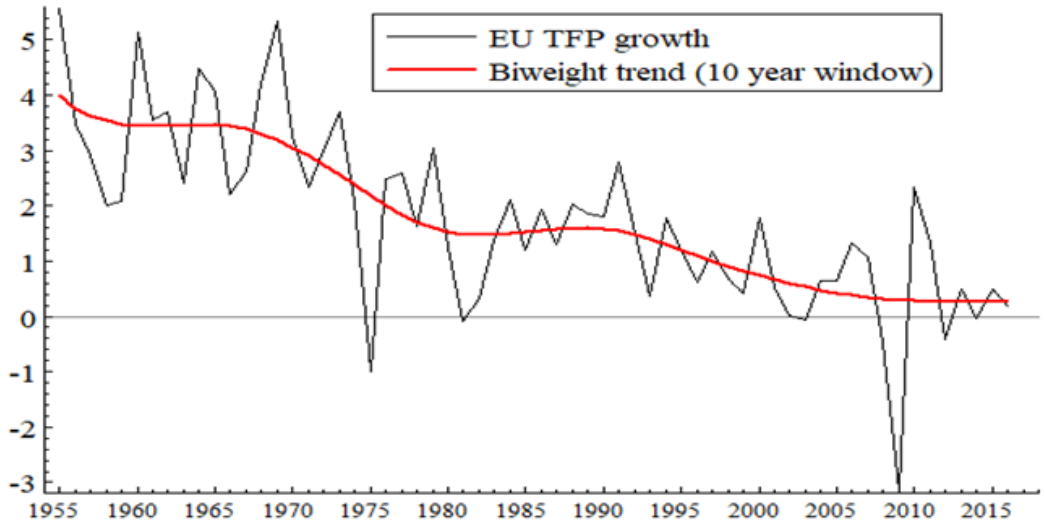
4 Much of this capital could have been idle, of course, and low capital utilization would show up in measured TFP growth. However, Fernald (2015) argues that by the end of 2010, much of the decline in utilization had been unwound.

5 The 2018 cut in U.S. capital taxes is also likely to provide some boost to capital deepening, though it seems hard to detect in the data so far.

6 A large literature from the early 2000s explored this shortfall in growth. For a summary of this debate, see Timmer *et al.* (2010 and 2011).

Chart 3: Total Factor Productivity Growth, the European Union, Annual Per Cent Change, 1955-2016



Source: Bergeaud, Cette and Lecat (2017).

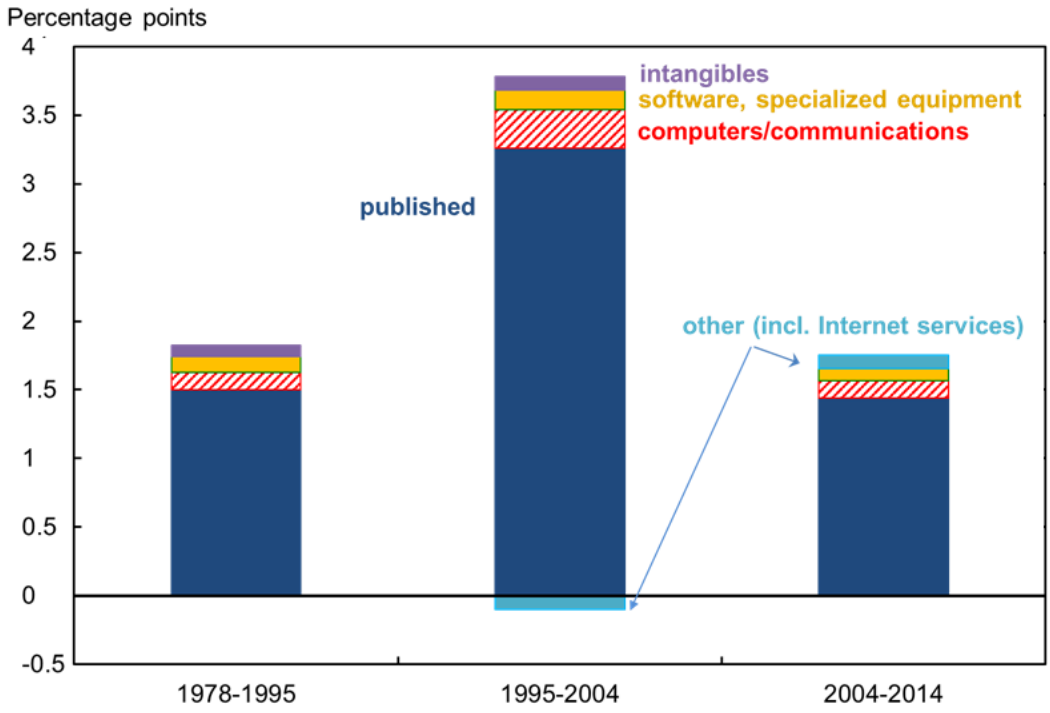
One reason the pace has not been faster is something that even the techno-optimists highlight, which is that there are sizeable adjustment and adoption costs (e.g., Brynjolsson *et al.* 2018). Learning how best to harness artificial intelligence (AI) in, say, health care delivery at a day-to day level is hard. Indeed, whether the future TFP figures look incremental, or extraordinary, is determined not by possibilities that we see, but by the pace through which society is able to overcome the myriad barriers to adoption.

For forecasting, the fact that we have been in a slow-growth regime suggests that slow TFP growth is the most likely outcome for a while. But what we do not know is how long that regime will last. It is certainly possible that we could see another burst in broad-based innovation related to artificial intelligence, robots, and other digital innovations. Until we do, my base case is that TFP growth will remain relatively slow.

Finally, looking at U.S. data, I would note that labour quality is also likely to be a drag on future labour productivity growth. Labour quality, which measures the contribution of education and experience, rose 0.42 per cent per year in 1973-95. Hence, it "explained" a substantial share of productivity growth. In contrast, Bosler *et al.* (2016) estimate that in 2022-2025, labour quality will rise only about 0.1 to 0.2 per cent per year. Jorgenson *et al.* (2016) is qualitatively similar: They estimate that labour quality will rise less than 0.1 per cent per year in 2014-2024.

On its own, then, reduced labour quality growth suggests marking down labour productivity and GDP projections by at least 0.2 of a percentage point and possibly more. (In economic models, the mapping from labour quality growth to labour productivity growth is one-for-one.)

Chart 4: Adjustments to Growth in Output per Hour, Business Sector, Percentage Points per Year



Source: BLS, Fernald (2014a), Byrne *et al.* (2016), and author's calculations. Other comprises Internet, free digital services, globalization, and fracking.

Did Productivity Growth Really Slow?

The above discussion takes the measured TFP and output figures at face value. But an important counterargument is that maybe the 1995-2004 TFP surge never ended, but we just stopped measuring the gains? Maybe the statistics are missing most of the benefits of our smartphones, Google searches, and other IT-related hardware and software?

Byrne, Fernald, and Reinsdorf (2016) and Syverson (2016) dig into that story of growing mismeasurement. The fundamental problem with the story is we have always had mismeasurement. And, while Byrne *et al.* find plenty of evidence of mismeasurement, they find no evidence that mismeasurement has become worse. In fact, their point estimates were that IT-related mismeasurement was even larger in the late 1990s and early 2000s. So adjusting for mismeasurement made the post-2004 productivity slowdown even more severe.

You can see the argument in Chart 4, taken from Byrne *et al.* (their Figure 1). The dark blue portions of the bars show the published data on average growth in business sector labour productivity, that is, real output per hour. Productivity growth was exceptional from 1995 through 2004 but has since slowed by about 1.75 percentage points per year.

The bars also quantify several potential sources of mismeasurement. The main challenge is determining the appropriate quality-adjusted prices used to deflate nominal expenditures. For example, when one buys a new computer

it could cost the same as your previous one but might be much more powerful - with a faster processor, better image quality, and more memory. The true price of the computer has dropped to account for your spending the same nominal amount for a better computer. Adjusting for quality change is challenging: If the statistics do not incorporate enough of an adjustment for quality, then we also do not measure the full increase in the inflation-adjusted real quantity produced.

The bars incorporate improved and more consistent deflators for computers/communication equipment and software and specialized equipment. They also incorporate the effect of including additional intangible capital. Finally, there are an assortment of other small adjustments.[7] The important point is that, although there is mismeasurement in all of the time periods, there is no evidence that the mismeasurement has grown.[8]

Of course, even if growing mismeasurement is not the reason for weak measured productivity growth, it is important to acknowledge that there is mismeasurement. There is still much work to be done to improve the estimates. We need to continue to improve the deflators. In addition, statistical agencies can increasingly seek to tap new sources of big data from major retailers, payment processors, and the like. Obviously, there are challenges of whether concepts are the same, and whether samples are representative; and there are privacy concerns by data owners. But there is at least the hope that these data can improve the accuracy, timeliness, and relevance of economic statistics.

Finally, when we think about welfare, one of the major issues we could address is to think hard about the market/nonmarket boundaries. We could work to create satellite accounts to understand those boundaries better, and to assess the benefits, as there has been a blurring of those boundaries.

Explanations for Slow TFP Growth

So why did U.S. TFP growth slow after 2004? I would highlight three main hypotheses to explain why the 1995-2004 productivity surge did not last.

The first hypothesis, which is my preferred one, is that we have returned to normal after an exceptional information-technology (IT) linked decade after 1995 (Gordon, 2016 and Fernald, 2015). Every story from the early 2000s regarding the productivity surge pointed to IT. And much of that literature acknowledged that the gains were a sequence of one-off improvements. One does not know ex ante how many Walmarts and

7 See Byrne *et al.* (2016) for details.

8 The figure, of course, is in terms of labour productivity. For economy-wide TFP, the effects are much smaller because there is not only missing output but also missing capital input. Byrne *et al.* (2016) note, almost in passing, that this economy-wide effect masks the fact that the corrections raise TFP growth in producing IT-related productsmany of which are capital goodswhile reducing TFP growth in the rest of the economy. Byrne *et al.* (2017) expand on this point, which they interpret as deepening the productivity puzzle.

Costcos will be opened, at the expense of smaller, less efficient retailers. But nearly every job, and every industry, was transformed in some way between the mid-1990s and mid-2000s. For most of us, the changes to our work life have been much more incremental since then.

Of course, over the past decade smartphones and other technologies have had major effects on how we communicate, entertain ourselves, inform ourselves about the world, and much more. Nevertheless, consumer-oriented technologies such as smartphones have plausibly transformed how we live much more than they have transformed how we work.[9]

What this line of argument suggests is that modest productivity growth is the new normal. There are certainly upside surprises possible. We might well experience another wave of IT-linked productivity gains, but we do not know when they will arrive.

A second hypothesis is that it was the Great Recession that slowed investment in innovation or otherwise made the economy less efficient? Adler *et al.*, 2017 discuss a range of channels through which a recession (financial or otherwise) or period of slow growth might endogenously slow innovation. For the United States, the fundamental problem with that story is that, as already noted, the slowdown in productivity growth predated the recession. The bar chart in Chart 2 shows that U.S. productivity growth in the three years preceding the Great Recession (2004-2007) was already far short of its 1995-2004 pace.

More broadly, the Great Recession was unusually traumatic. But the productivity experience of the past decade and a half is not unusual. As Chart 2 showed, TFP growth of around 0.5 per cent per year has been the norm since the early 1970s.

A final hypothesis is declining dynamism, possibly caused by increases in regulation or other causes (e.g., Decker *et al.*, 2016; Barro, 2016). Both dynamism and regulation surely are related to productivity. After all, the dynamic process of productivity growth in part involves reallocating resources from less productive to more productive uses; and innovators need an incentive to innovate. Across countries, regulatory barriers do seem to affect growth rates. For example, many studies have argued that labour and product-market rigidities made it more difficult for European economies to undertake the business reorganizations necessary to benefit from information technology (Cette *et al.*, 2016).

There are a range of frictions that might affect entrepreneurship and reallocation. Starting with regulation, however, it is not clear for the United States that rising regulatory burdens are a first-order cause for why the 1995-2004 productivity surge did not last.

First of all, a common story that post-

9 Of course, there is a counterargument that new technologies are making us less productive. For example, Ward *et al.* (2017) find that even having proximity to a cell phone reduces our cognitive capacity.

2008 increases in regulation somehow caused the slowdown does not fit the timing. As noted already, the slowdown started much earlier – 2004 or 2005, if not 1973. Second, even for longer time periods, it is challenging to find a direct empirical link between fluctuations in industry-specific federal regulations and industry productivity dynamics. Fernald *et al.* (2017) look for such a link but do not find it.

In terms of dynamism more broadly, the relationship with productivity growth is a priori unclear. In some cases, technology may favor large firms so that reduced job and firm turnover is associated with productivity gains. That represents a largely benign decline in dynamism. In other cases, innovation is associated with new establishments and firms, and may require substantial reorganization of jobs. In that case, barriers to dynamism are likely to impede productivity growth. Of course, declining dynamism could in some cases simply be a symptom of declining opportunities for startups. For example, in the late 1990s, the internet caused a gold rush in Silicon Valley – startup activity and other measures of dynamism were very high. The gold rush ended and, while some firms were big winners, many others disappeared.

It is not certainly not clear that the frictions that have reduced reallocation explain the post-2004 slowdown in business sector labour productivity. A challenge is to figure out what the most efficient level of dynamism is, as well as to identify and quantify the importance of specific frictions and barriers that cause deviations from that efficient level. For now, I see declining dynamism as a symptom, but I do not yet know what it is a symptom of.

Conclusion

With all of the above in mind, let us summarize what has changed in terms of potential output growth relative to the past decade: Not much.

Demographics are not going to change rapidly. Migration can rearrange the global population somewhat, but few advanced countries are pushing to increase immigration these days.

And productivity growth has not yet shown signs of recovery. Corporate tax cuts in the United States could help at the margin. Easing regulation makes some companies more profitable but, as noted, there is limited empirical evidence to suggest it will do all that much for economic growth. (Fernald *et al.*, 2017).

The biggest wild card for productivity growth is the future of technology, and the degree to which the gains from artificial intelligence and robots will spread more broadly across the economy. It could happen. We just do not know when.

In the absence of such a major pick-up in TFP growth, my current view remains roughly consistent with Fernald (2016). U.S. trend labour productivity growth, in particular, is likely to be in the 1.5 to 1.75 per cent range. Indeed, an update of the formal analysis in Fernald (2016) suggests a point estimate for long-run growth (say, 5 to 7 years out) of only 1.6 per cent. This is consistent with the

labour productivity growth rates we saw in the 1970s and 1980s. Even that would require a substantial pick-up from the labour productivity growth rates since 2010, and a modest pick-up from the average pace since 2004.

To conclude, there is no question that the recovery has been much slower than we would have liked. Unfortunately, as Fernald *et al.* (2017) argue, the evidence suggests that the Great Recession was a deep recession superimposed on a sharply slowing trend. There is no evidence yet that trend labour productivity and output growth are poised for a substantial pick-up.

References

Adler, G., R.A Duval, D. Furceri, Sinem Kili elik, Ksenia Koloskova, and Marcos Poplawski-Ribeiro (2017) "Gone with the Headwinds: Global Productivity," IMF Staff Discussion Note, April.

Bloom, Nicholas A., Charles I. Jones, John Van Reenen, and Michael Webb (2017) "Are Ideas Getting Harder to Find?" Research Papers repec, Stanford University, Graduate School of Business.

Barro, Robert J. (2016) "The Reasons behind the Obama Non-Recovery," *The Wall Street Journal*, September 20. http://scholar.harvard.edu/files/barro/files/wsj_published_version_092116.pdf.

Barro, Robert J., and Jason Furman (2018) "The Macroeconomic Effects of the 2017 Tax Reform," *Brookings Papers on Economic Activity*, Spring.

Bergeaud, A., G. Cette, and R. Lecat (2017) "Total Factor Productivity in Advanced Countries: A Long-term Perspective," *International Productivity Monitor*, No. 32, Spring, pp. 6-24. http://www.csls.ca/ipm/32/bergeaud_cette_lecat%20version%202.pdf.

Bosler, Canyon, Mary C. Daly, John G. Fernald, and Bart Hobijn (2016) "The Outlook for U.S. Labor-Quality Growth," Federal Reserve Bank of San Francisco Working Paper 2016-14. http://www.frbsf.org/economic-research/publications/working-papers/wp2016-14.pdf.

Brynjolfsson, Erik, Daniel Rock, and Chad Syverson (2018) "Artificial Intelligence and the Modern Productivity Paradox: A Clash of Expectations and Statistics," forthcoming in Agrawal, Gans, and Goldfarb (eds.) *The Economics of Artificial Intelligence: An Agenda* (Cambridge, MA: NBER).

Byrne, David M., John G. Fernald and Marshall B. Reinsdorf (2016) "Does the United States Have a Productivity Slowdown or a Measurement Problem?" Conference paper prepared for *Brookings Papers on Economic Activity*, March.

Byrne, David, Stephen D. Oliner, and Daniel E. Sichel (2017) "Prices of High-Tech Products, Mismeasurement, and the Pace of Innovation," *Business Economics*, Vol. 52, No. 2, pp. 103-113.

Cette, Gilbert, John G. Fernald, and Benot Mojon (2016) "The Pre-Great Recession Slowdown in Productivity," *European Economic Review*, Vol. 88, pp. 3-20.

Decker, Ryan A., John Haltiwanger, Ron S. Jarmin, and Javier Miranda (2016) "Declining Business Dynamism: What We Know and the Way Forward," *American Economic Review*, Vol. 106, No. 5, pp. 2037.

Diaz, Juan-Antolin, Thomas Dreschel, and Ivan Petrella (2017) "Tracking the Slowdown in Long-Run GDP Growth," *Review of Economics and Statistics*, Vol. 99, No. 2, May, pp. 343-256.

Fernald, John G. (2014) "A Quarterly Utilization-Adjusted Series on Total Factor Productivity," Manuscript. Data available at http://www.frbsf.org/economics/economists/jfernald/quarterly_tfp.xls.

Fernald, John G. (2015) "Productivity and Potential Output Before, During, and After the Great Recession," *NBER Macroeconomics Annual*.

Fernald, John G. (2016) "Reassessing Longer-Run U.S. Growth: How Low?" Federal Reserve Bank of San Francisco Working Paper 2016-18. http://www.frbsf.org/economic research/publications/working-papers/wp2016-18.pdf.

Fernald, John G., Robert E. Hall, James Stock, and Mark Watson (2017) "The Disappointing Recovery of Output after 2009," *Brookings Papers on Economic Activity*, Spring, pp. 1-58.

Jorgenson, Dale W., Mun S. Ho, and Jon D. Samuels (2016) "Education, Participation, and the Revival of U.S. Economic Growth," National Bureau of Economic Research Working Paper Series No. 22453.

Kahn, Robert A. and Robert W. Rich (2018) "Kahn-Rich Productivity Model Update," https://www.newyorkfed.org/medialibrary/media/research/national_economy/richkahn_prodmod.pdf.

Syverson, Chad. (2016) "Challenges to Mismeasurement Explanations for the U.S. Productivity Slowdown," Working Paper no. 21974, National Bureau of Economic Research.

Timmer, Marcel P., Robert Inklaar, Mary O'Mahony and Bart van Ark (2010) *Economic Growth in Europe: A Comparative Industry Perspective* (Cambridge: Cambridge University Press).

Timmer, Marcel P., Robert Inklaar, Mary O'Mahony and Bart van Ark (2011) "Productivity and Economic Growth in Europe: A Comparative Industry Perspective," *International Productivity Monitor*, No. 21, Spring, pp. 3-23. http://www.csls.ca/ipm/21/IPM-21-Timmer-et-al.pdf.

Ward, Adrian F., Kristen Duke, Ayelet Gneezy, and Maarten W. Bos (2017) "Brain Drain: The Mere Presence of Ones Own Smartphone Reduces Available Cognitive Capacity," *Journal of the Association for Consumer Research*, No. 2, April, pp. 140-154. https://doi.org/10.1086/691462.