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Productivity in the world economy during and after the pandemic

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Abstract

This paper reviews how productivity has evolved around the world since the pandemic began in 2020. Productivity in many countries has been volatile. We conclude that the broad contours of productivity growth during this period have been heavily shaped by predictable cyclical patterns. Looking at U.S. industry data, we find little evidence that the sharp rise in telework has had a notable impact, good or bad, on productivity. Stepping back, the data so far appear consistent with a continuation of the slow-productivity-growth trajectory that we faced before the pandemic.

JEL Codes: E01, E23, E24, O47

Keywords: Growth accounting, productivity, remote work

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1. Introduction

This paper reviews how productivity has evolved around the world since the pandemic began in 2020. Productivity, or output per hour, is an important input into the economy's "speed limit," or how fast it can safely operate. In the long run, productivity growth raises material living standards—after all, by definition, increases in productivity allow you to produce more output with the same or less labor input. In the short run, productivity also affects inflationary pressures. This short-run concern has been a notable issue in the aftermath of the pandemic. As aggregate demand recovered following the pandemic, it turned out supply couldn't keep pace. Much of it was a shortage of workers as well as various post-pandemic supply-chain challenges. But a healthy and persistent dose of productivity growth would have helped.[1]

The productivity statistics in many countries have been volatile since the pandemic began. Indeed, the statistics have ridden a roller coaster, in that productivity in advanced economies initially soared but then crashed. Lahart (2023, in the Wall Street Journal) suggests that uncertainty about productivity trends mean that "the economy's odometer is broken." Although there are always plenty of uncertainties about the productivity statistics, an important point of this article is that the broad contours of productivity growth during and since the pandemic are heavily shaped by predictable cyclical patterns.

The broad context is that we came into the pandemic with concerns about the pace of productivity growth—which was slow in many advanced economies and slowing in many emerging markets. Unfortunately, that trajectory does not, so far, seem to have changed. We remain on a slow-productivity-growth trajectory.

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[1] See Fernald and Li (2023) for further discussion of supply constraints in the pandemic.

Initially, productivity in advanced economies, especially, boomed. There were many stories about how the pandemic might have affected the level, at least, of productivity. These include forced digital innovation and learning or the productivity benefits of working from home. Of course, there were many stories on the other side, including increases in production costs, challenges with supply chains, and problems with monitoring or coordination.

But then the boom ended and the level of productivity retreated to roughly its pre-pandemic trend. As predicted by Fernald and Li (2021) (and analyzed in detail in Fernald and Li, 2022), the boom and bust in productivity growth were mainly cyclical. Indeed, U.S. productivity growth largely followed its Great Recession cyclical path.

This paper is structured as follows. Section 2 discusses the conceptual framework. The basic notion is one of conditional convergence; the section then discusses how the pandemic might have affected the path of productivity. Section 3 discusses the slow pre-pandemic trend as well as an initial perspective on the pandemic period. Section 4 delves into the pandemic productivity experience in advanced economies, especially the United States. Section 5 reviews the U.S. industry experience. Section 6 concludes.

2. Conceptual framework

To proceed, it is useful to provide a conceptual framework with which to interpret the data for different countries. When we look across countries, a standard conceptual framework is one of conditional convergence. There's a technological frontier, and countries have the possibility to catch up to the frontier.

That said, countries may have different steady-state *levels* of output per hour. Differences depend on structural aspects of the economy such as labor and product-market institutions, rule of

law, education, population growth, and so forth. But once countries achieve this steady-state level relative to the frontier, then growth rates should roughly equal the growth rate of the frontier. [2]

Figure 1 illustrates several examples of how this process works. The figure assumes that the U.S. is always at, or close to, the frontier. So it normalizes the U.S. level of labor productivity, defined as real GDP (at purchasing power parity) per hour worked, at 100 in every year. Hence, for other countries, it shows labor productivity relative to the United States. The data come from the Conference Board.[3]

One group of countries is advanced economies like France and Germany. After WWII, these two countries started at about 40 percent of the U.S. level of GDP per hour. In the 30 years that followed, it grew fast and caught up to the United States. Indeed, in the Conference Board data, France and Germany since 1980 have sometimes been ahead on productivity, and sometimes behind. The important takeaway is that the level of productivity in these countries has been close to the frontier level since around 1980.[4]

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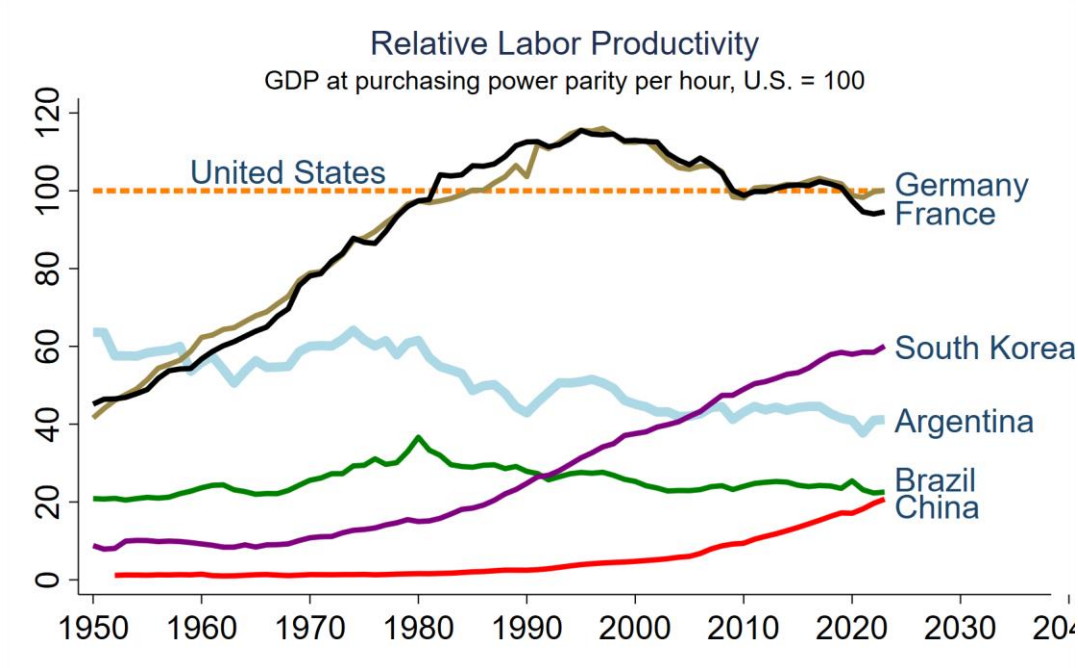
[2] Conditional convergence implies that countries with the same structural features will have the same steady-state level and growth rates. Club convergence implies that countries with the same structural features, as well as the *same* initial level of GDP per capita, will have the same steady-state level and growth rates (Galor, 1996). The implications for our discussion here are the same in either case. Most of the empirical growth literature is in terms of per capita quantities; but the logic applies to labor and total-factor productivity.

[3] See Conference Board Total Economy Database (TED) https://www.conference-board.org/data/economydatabase/total-economy-database-productivity .

[4] Cross-country comparisons are subject to sizeable measurement and conceptual challenges. Fernald, Inklaar, and Ruzic (2023) look at total factor productivity (TFP) in the market economy (TFP is output per unit of combined capital and labor; and the market economy excludes non-market activities that are part of GDP such as government, education, and health care.) Using data back to the 1980s, Fernald, Inklaar, and Ruzic find that the U.S. is always the market-economy TFP leader. In addition, even though the market economy is easier to compare across countries than the non-market economy, there are sizeable differences in relative market-economy rankings of countries depending on which year is used as the benchmark for price comparisons used in purchasing-power-parity calculations.

Figure 1: Productivity levels (and growth rates) differ across countries



Source: Conference Board Total Economy Database. 2023 is Conference Board projection.

Thus, France and Germany are clear examples of convergence. They started out with productivity far below the world frontier, and those initial conditions allowed them to grow fast and catch up to the frontier. Once they did, productivity growth was fairly similar to the rate of other frontier countries like the United States.

A second group of countries, especially in Asia, looks like South Korea or China. These countries are behind the frontier but are catching up. Loosely speaking, South Korea looks like France or Germany—only half a century behind. And China looks like South Korea, but three decades behind.

Intuitively, if you start off far from the technological frontier—as emerging markets are, by definition—you have the potential to grow fast. You can invest, you can build factors and office

parks and infrastructure. You can educate your labor force. When you do these things, you grow quickly.

But of course, not all countries that are far from the frontier do, in fact, grow fast. Many countries get stuck and just grow at the more or less the frontier rate. Brazil in the figure is roughly where it was in 1950…or 1970…or 2000. In some decades, like the 1970s, they converged towards the U.S. level; in other decades, like the 1980s and 1990s, they diverged. But on average, they grew at only the U.S. rate.

Finally, sometimes countries do even worse, and fall away from the frontier. Argentina was about 60% of the U.S. level of labor productivity up until 1980—roughly where South Korea is today. But it then fell off sharply in the 1980s and stabilized at roughly 40% of the U.S. level ever since.

Of course, some countries not shown look like a mix of the country-experience discussed above. For example, Japan looked much like South Korea, only thirty to thirty-five years early. It reached 70 percent of the U.S. level of labor productivity by the mid-1990s; it has slightly receded since then. By 2008, Japan had eased slightly to about 65 percent of the U.S. level and has remained roughly constant in relative terms ever since.

The challenges facing the different countries in this figure are different. For advanced economies—the U.S. France, or Germany—it is mainly innovation, broadly construed, that drives growth. If the world frontier speeds up, that's good for everyone because ideas diffuse. Argentina will get richer even if it just says at 40% of the US level.

For countries that aren't at the frontier, the challenge is to get onto a convergence path, or to stay on the convergence path. This is, of course, a massive challenge, and many countries fail at it. A full discussion is beyond the scope of the current paper, with its focus on the post-pandemic

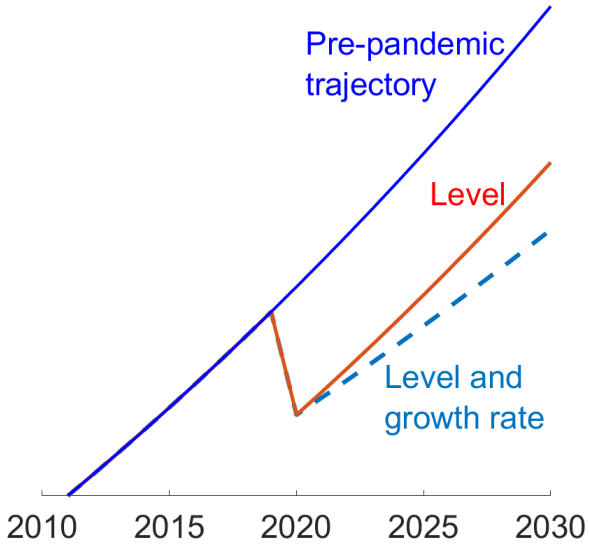
experience. But it is clear that countries need high levels of investment, broadly construed—in infrastructure, factories, equipment, software, education, and a wide range of intangibles. Achieving those high levels of investment requires that businesses and individuals have the appropriate incentives, so that they expect a fair return. Broadly, a country needs to have institutions that provide these incentives to invest. "Institutions" here is a broad term, encompassing a stable macroeconomic environment as well as the rule of law, property rights, political institutions and governance, taxes, social norms, culture, and so forth. It is thus a broad rubric that captures the overall "environment for doing business" (Fatas and Mihov, 2009).[5]

Much of the remainder of this paper focuses on advanced economies. If advanced economies grow more quickly, that is going to help everyone, since ideas spill across borders. Conversely, if they grow more slowly, that is worse for everyone.

With this backdrop of conditional convergence, we can consider how the pandemic might have affected the path of the economy. Fernald and Li (2022) argue that the pandemic might have affected the level or the growth rate of underling potential (or true) productivity.

[5] Fatas and Mihov (2009) provide a nice framework for summarizing the drivers of growth, which they label "the 4Is": Innovation (for advanced economies), Initial Conditions (countries far from the frontier have the potential to grow fast, Investment (what you need to do to take advantage of your potential), and Institutions (what determines whether countries will, in fact, do the investment needed to grow fast). Much work has been done on the nature of institutions that promote growth. One recent discussion is in Aghion, Antonin, and Bunel (2021).

Figure 2: The pandemic might affect the level or growth rate of productivity



Source: Fernald and Li (2022)

Conceptually, the blue line shows the economy's pre-pandemic trajectory. The red line shows a possible downward shock to the level of potential productivity, though some arguments suggest a possible upward shock. As drawn, it's a permanent effect, but it could dissipate over time.

At one level, the striking thing was that we were able to keep producing as well as we did. We could substitute a lot of home capital for business capital, for example, by working from the kitchen table and connecting to the business using our home internet.[6] But we did make that substitution, we did keep producing.

[6] See, for example, Eberly, Haskel, and Mizen (2021).

There were a range of possible level effects on productivity. One the one hand, the pandemic was certainly disruptive. Businesses faced supply chain challenges. And with remote work, there were problems monitoring/coordinating far flung labor force. Bloom et al. (2023) find in a survey of UK firms that the disruptions were sizeable.

On the other hand, there was forced digital innovation, as we learned new ways to work. The fact that this was coordinated across many businesses arguably helped. It became normal to meet clients or coworkers remotely. There were also possible productivity benefits (or perhaps costs) from working from home. In surveys, for example, employees report being at least as productive remotely as in person.

The empirical evidence on the productivity of remote work is mixed. Most of the evidence comes from narrow tasks where output is easy to measure, such as call centers. For example, Bloom, Liang, Roberts and Ying (2015) find that, in a call center in China, workers who were randomly assigned to remote work were more productive than in-person workers. In contrast, Emanuel and Harrington (2023) find that call-center workers at a Fortune 500 company were slightly less productive after they were forced to work remotely at the onset of the Covid pandemic. Emanuel and Harrington (2023) discuss other literature as well, some of which finds productivity gains, while others find productivity costs.

The dashed line in the figure shows a post-pandemic change in the growth rate. Here I've drawn it as a slowdown, but it could either rise or fall. The key questions in terms of growth, as discussed in Fernald and Li (2022), are whether the pandemic hindered, or boosted innovation. For example, it opened up new directions and possibilities for innovation, such as developing tools to make online work and online life better. These new directions could raise the returns to innovation. Concretely, researchers are used to having collaborators around the globe. The tools

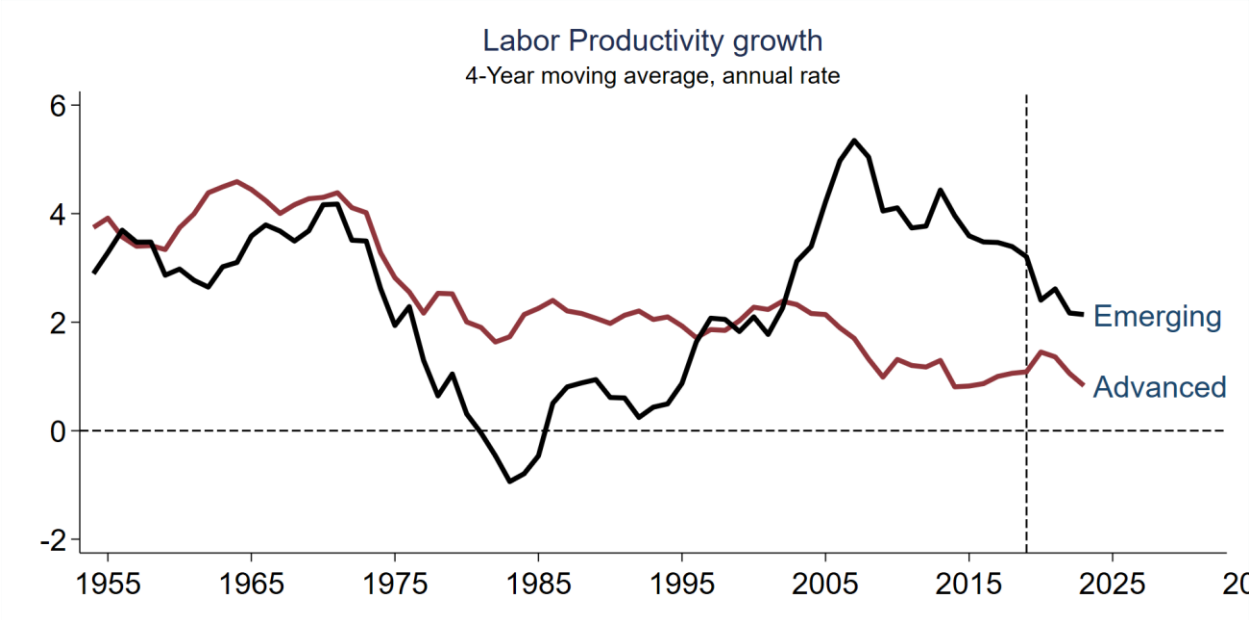
for that collaboration may have gotten better. In addition, the normalization of hiring remote workers could relax geographic constraints on hiring specialized talent.

On the other hand, more remote and hybrid work may reduce the in-person contact that fosters the cross-fertilization and spread of ideas. Anderson and Dalgaard (2021) argue that business travel boosts the diffusion of ideas and promotes growth. Video tools may be a poor substitute for these in-person interactions. For example, Brucks and Levav (2022) find that idea generation is more difficult over video.

3. The Slow Pre-Pandemic Trend

With this conceptual backdrop, we return to the data to back up the claim that we came into the pandemic on a slow-productivity-growth trajectory. Figure 3 shows growth in labor productivity, or GDP per hour worked, back to 1950, for both advanced economies and emerging markets. (The sample is limited to the 130x? countries for which the Conference Board has data on GDP per hour.). It's a four-year moving average to slightly smooth through the year-to-year fluctuations.

Figure 3: Continuing slow/slowing productivity growth since the pandemic



Source: Conference Board Total Economy Database. 2023 is Conference Board projection. For advanced economies, labor productivity is real (PPP adjusted) GDP per hour. For emerging markets, because of data limitations, the figure shows labor productivity in terms of real (PPP adjusted) GDP per employee.

Over the past 70 years, advanced-economy labor productivity growth ratcheted down several times. It was about 4 percent from the 1950s to the early 1970s—a period when advanced economies such as France, Germany, and Japan were converging quickly. Then it stepped down to about 2 percent. But since the early to mid-2000s, it has stepped down again to only about 1 percent.

There has obviously been a ton of discussion of, how could all the great digital innovations and advances in IT hardware and software have left so little mark in the productivity statistics?[7]

[7] For example, Fernald and Wang (2015), Byrne et al. (2016) and Gordon (2016).

There are debates now about generative artificial intelligence might (or might not) finally break us loose. When it comes to the data, though, productivity growth has been slow.

The vertical line shows 2019. After the pandemic, advanced-economy productivity initially bumped upwards! We return to that bump below. Unfortunately, by the time you get to 2023, the bump has disappeared. Growth since the beginning of the pandemic in advanced economies looks pretty close to the slow pre-pandemic pace.

For emerging markets, the patterns are quite different. Productivity growth in the pre-1975 period was close to, though on average a little below, the advanced economy pace. In other words, during this period, there was no overall tendency for emerging markets to converge to advanced-economy levels. That is, looking back at Figure 1, the overall emerging-market experience was more like Brazil or Argentina than like South Korea or China.

The situation worsened in the 1980s and early 1990s. Productivity growth in emerging markets disappeared. Emerging markets were, on average, falling back from the global frontier.

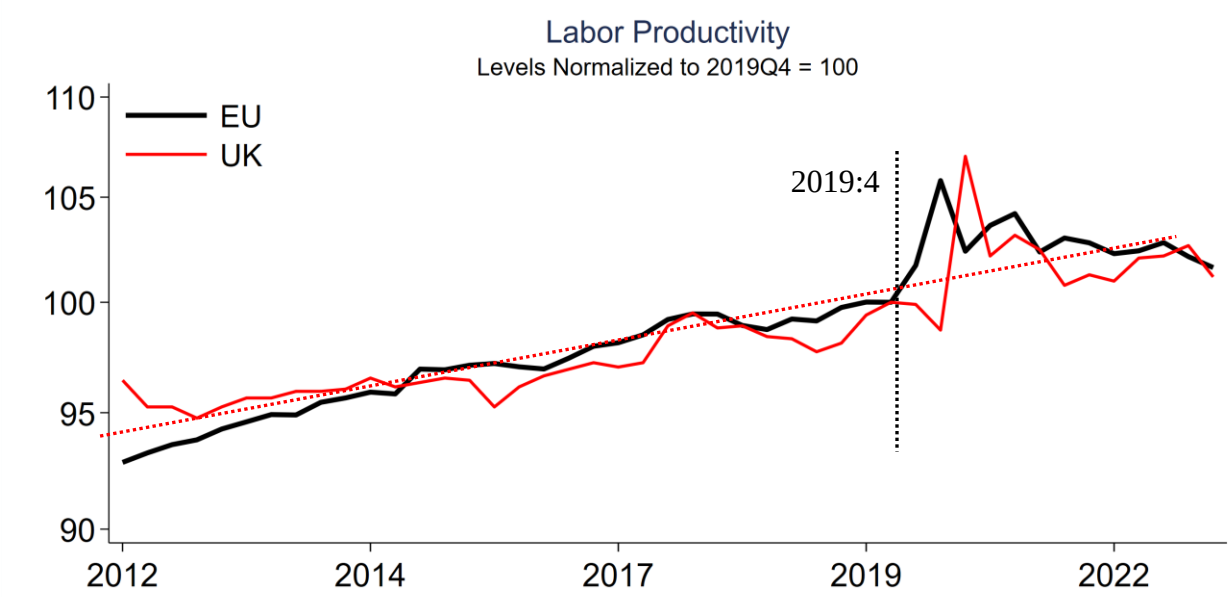
In the 2000s, however, productivity growth in emerging markets soared. Unfortunately, the fast pace of the late 2000s/early 2010s didn't persist. The pace of productivity growth in EMs has been steadily slowing. The pandemic period has seen further slowing. At least visually, it looks like there has been a persistent hit to productivity from the pandemic.

We thus see in the data that productivity growth was slow before the pandemic; and it looks like the pandemic continued—and maybe intensified—the slow pace. The remainder of this paper explores the pandemic period in more detail in order to understand the productivity movements we saw over this period.

4. Cyclicality of advanced-economy pandemic productivity

Many commentators have found the recent performance of productivity confusing. Indeed, Lahart (2023, *Wall Street Journal*), mentioned in the introduction, argues that "the productivity figures have turned into a real mess." In this section, we focus on advanced economies and argue that although the productivity figures may be surprising, the broad patterns are largely cyclical and predictable. By 2023, it is not qualitatively clear that productivity is far different from its pre-pandemic trend.

Figure 4: Euro area and UK saw productivity surge in 2020 and then retreat



Source: U.K. Office of National and Eurostat

Figure 4 shows the level of market-sector labor productivity in the euro area and UK. The red dashed line shows a rough pre-pandemic trend for the two regions.[8] In both cases, labor

[8] The figure starts in 2012 because the series track somewhat less well earlier than that. From 1997 to 2007, productivity growth was much stronger in the UK than in the euro area.

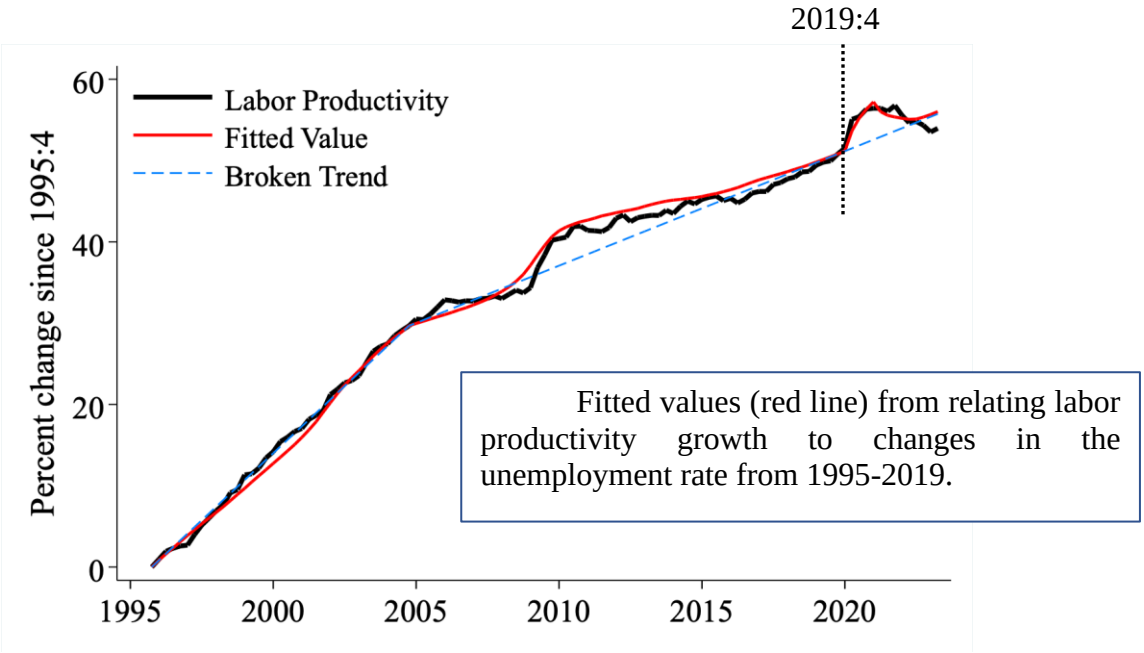
productivity, or output per hour, surged early in the pandemic. Although the timing of the surge was slightly different, productivity in both cases rose well above pre-pandemic trends. But the surge did not last. Instead, productivity retreated to more or less its pre-pandemic trajectory.

Figure 5 dives more deeply into the U.S. experience. The black line shows the level of labor productivity. The blue dashed line is a statistically estimated trend, estimated through 2019 and then extended. The trend is allowed to change after 2004; the slowdown in trend captures the end of the late-90s/early 2000s Internet-led boom.[9]

Starting in 2020, you can see the sizeable productivity boom, as the black line moved well above the trend. Press discussions at the time were often quite exuberant about the possibilities. For example, *The Economist* wrote in December 2020 that "the pandemic could give way to an era of rapid productivity growth." The article argues that the pandemic "quickened the pace of technology adoption" and that the boost could persist. And a Bloomberg headline (Torres, 2021) asserted that the "Pandemic blows up old business habits, opening path to a [productivity] boom." That article starts with the example of a business whose founder and chief executive was a major skeptic of remote work before the pandemic but was now a convert. "Employees say there's happier, and the numbers say they're more productive."

[9] The figure and discussion is updated from the one in Fernald and Li (2022); the conclusions are largely the same.

Figure 5: U.S. labor productivity:
Accelerated Great Recession cyclical dynamics, little obvious level effect



Notes: Business sector. The fitted statistical relationship in red is from the following regression, estimated from 1996:1 through 2019:4: $\Delta \ln LP_t = c_t + 0.84\, \Delta^4 U_t$,where $\Delta \ln LP_t$ is quarterly labor-productivity growth and $\Delta^4 U_t$ is the four-quarter change in the unemployment rate. The constant term (not shown) is allowed to change after 2004:4. The 2020:1- 23:2 fitted values are predictions conditional on actual pandemic unemployment path. Labor productivity is from Fernald (2014).

Unfortunately, since that bump, productivity has retreated right back to its pre-pandemic trend or, even, by early 2023, a little below the trend.

But of course, there were always conflicting arguments about how the pandemic per se would affect productivity. As noted in the previous section, many businesses appeared to find new ways to be productive digitally and many workers reported they're more productive at home. But at the same time, businesses reported that production costs had increased, and supply-chain disruptions kept some businesses from getting key inputs. There's also the ongoing risk of losing cross-fertilization of ideas and creativity.

Arguably more important, however, is that there are important cyclical influences on productivity that most of the commentary has ignored. Indeed, if you look at the Great Recession period, you see a qualitatively similar effect: During and immediately after the Great Recession, productivity was very strong. But then, in the years immediately thereafter, productivity growth was relatively weak and the level of productivity gradually returned to its trend.

In other words, in both the Great Recession and the pandemic, when the economy had a recession and the unemployment rate went up, labor productivity went up. So productivity was countercyclical. This countercyclicality has been the general pattern since the mid-1980s. A body of literature has explored this pattern.[10]

The red line in Figure 5 illustrates the pre-pandemic statistical relationship between labor productivity and the business cycle, as measured by the unemployment rate. It shows that that this pre-pandemic relationship works well in the pandemic period.

Specifically, the red line shows the fitted values from a simple relationship, estimated from 1995 to 2019, between productivity growth and four-quarter changes in the unemployment rate. The relationship is statistically significantly positive. The red line cumulates the fitted, or predicted, values from the regression.

The estimation ended in 2019. But during the pandemic period, we can predict productivity growth conditional on the observed path of the unemployment rate. The equation fits the pandemic experience surprisingly well.

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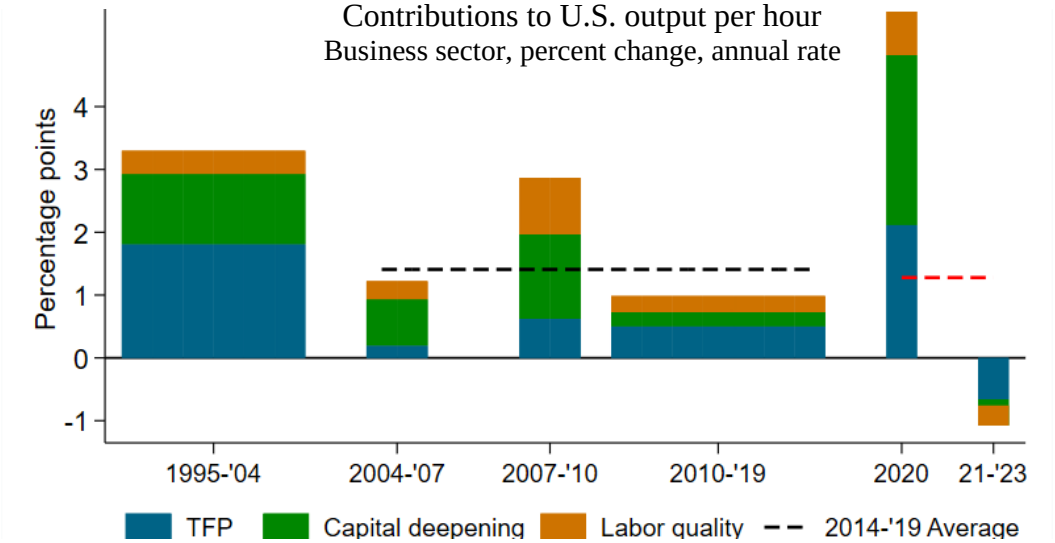
[10] See Fernald and Wang (2016) and Gordon and Sayed (2022) for extended discussions of the cyclicality of labor productivity, including its countercyclicality since the mid-1980s.

The fitted value is mainly driven by what happened in the Great Recession, since that's the only period from 1995-2019 when there were big moves in the unemployment rate. In other words, the regression supports the view that productivity growth has followed a very similar cyclical pattern to what it did following the Great Recession, even though the shocks have been very different.

Of course, what we've seen has been accelerated related to what we saw then. The reduced-form regression in Figure 5 suggests that it is because the recovery in the unemployment rate has been so fast this time.

We can look at the boom and bust in productivity growth a different way, using so-called growth accounting. Figure 6 shows this accounting. The height of each bar is labor productivity growth in selected time periods shown. The dashed black line shows the average pace from 2004-2019 of about 1.4 percent per year. It has varied a bit over subperiods within that 2004-19 periods. You can also see the surge in 2020, followed by the retreat—negative productivity growth—since the beginning of 2021 through the middle of 2023. The red dashed line shows the average pace since the end of 2019, which is very close to its 2004-19 average pace.

Figure 6: Boom and bust largely explained by capital deepening and labor composition



Notes: Source is Fernald (2014), quarterly. Black dashed line is average labor productivity growth from 2004-19. Red dashed line is average since the end of 2019. 2020 is Q4/Q4. 21-23 is the nine quarters ending 2023:2. Capital deepening is contribution of capital relative to composition-adjusted hours.

Growth accounting gives a proximate explanation for the drivers of productivity growth. It decomposes growth into the standard growth-accounting contributions of total factor productivity (blue), capital deepening (green), and labor composition (orange)

First, consider capital deepening in green. Capital deepening is the contribution of equipment, structures, intellectual capital per hour worked. It's a measure of the "tools" that workers have. Over time, for example, businesses invest in order to increase their productive capacity. When we see countries like South Korea or China that are far from the productivity frontier, but who are catching up, much of that catch-up reflects that they are doing a lot of investment and boosting capital deepening. You saw that in France and Germany after WWII.

But in the pandemic, capital deepening was boosted artificially, because hours worked fell. So each worker who remained had more capacity (capital) to work with. So we get an artificial, not sustainable boost to productivity through this cyclical channel.

Intuitively, an important part of what we saw in the pandemic, though not everything, was a shift in the mix of industries. Industries with a low level of productivity, like restaurants, that don't use a lot of capital, shut down. High level-of-productivity industries, like mining, expanded. That showed up here as capital deepening.

Second, consider labor composition in orange. That captures changes in the mix of workers in terms of observable characteristics such as education and experience. Over time, an important way a country can boost productivity is to invest in educating its population, giving people better skills.[11]

But in recessions, labor composition rises for undesirable reasons: younger, less-educated workers disproportionately lose jobs. So in a downturn, those who keep working on average have more education and experience.[12] Thus, labor composition contributes more to productivity.

In the recovery, there are good reasons for weak productivity growth—that is, weak growth is a reflection of positive developments in the economy. People with less education and experience returned to employment, so labor composition has added less. And low-capital-intensity/low-productivity industries, such as restaurants and retail, reopened. Thus, the contributions of both

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[11] This composition adjustment has been standard in growth accounting since Jorgenson and Griliches (1967). It assumes that productivity differences across workers are proportional to observed wage differences. See Bosler et al (2016) for an extended discussion and analysis.

[12] Again, during the pandemic, this effect was accentuated by the intense contraction in output and employment for high-contact service sectors, such as restaurants and accommodations. These service sectors tend to employ workers who are younger and less educated than the average. Hence, as these sectors contracted, the average experience and education of the people who continued to work rose.

capital deepening and labor composition naturally reversed as the economy recovered. In sum, these two drivers of productivity artificially boosted productivity for cyclical reasons early in the pandemic but have since reversed.

The third growth-accounting contributor to labor productivity is TFP, in blue. It is measured as a residual, so that it captures changes in output that can't be explained with observed inputs of capital and labor. In the long run, it's a broad measure of innovation because it captures anything that makes us more efficient at converting inputs into output.

The contribution of TFP went up in 2020 but then reversed. Just as with capital deepening and labor composition, it is also affected by the business cycle. So this should not be interpreted as, innovation rose and then retreated.

The most important cyclical influences on TFP are variations in worker effort and the workweek of capital. Consider worker effort. At times, firms push workers harder than at other times, depending in part on how much work needs to be done. Similarly, in booms, firms might add extra shifts—thus each machine is used more at these times. For both capital and labor, this implies that true inputs may be mismeasured relative to what is observed; and since TFP is a residual, the mismeasurement shows up in TFP.[13]

Anecdotally, in 2020, people reported working unusually hard. That extra effort showed up in TFP, the residual here. Since then, people have been working less hard—the anecdotal evidence suggests considerable "burnout" and "quiet quitting"—and that has held down TFP

[13] See Basu, Fernald, and Kimball (2006) for a discussion of the role of cyclical mismeasurement of effort as well as references to earlier literature. Basu and Fernald (2002) discuss a range of non-technological forces that may affect measured TFP when perfect competition does not hold. Ruzic (2023) discusses how factor misallocation affects measured TFP with references to a sizeable literature.

growth. Thus, in principle, variations in factor utilization can explain why measured TFP surged in 2020 and has fallen since.[14]

Qualitatively, the pandemic pattern was somewhat similar to what we saw in the Great Recession. In both cases, cyclical increases in capital deepening (green sections) and labor composition (in orange) account for much of the surge. [15]

This is a detailed look at the U.S. data. Let us now consider the global economy. TFP is, in the long run, typically taken as a measure of innovation. Figure 7 shows a global perspective on TFP growth. It uses Conference Board data for the total economy (not just the business sector, as the U.S. figures showed) and takes a four-year moving average to smooth volatility. As a result, the 2023 value in the figure shows the experience since pandemic.

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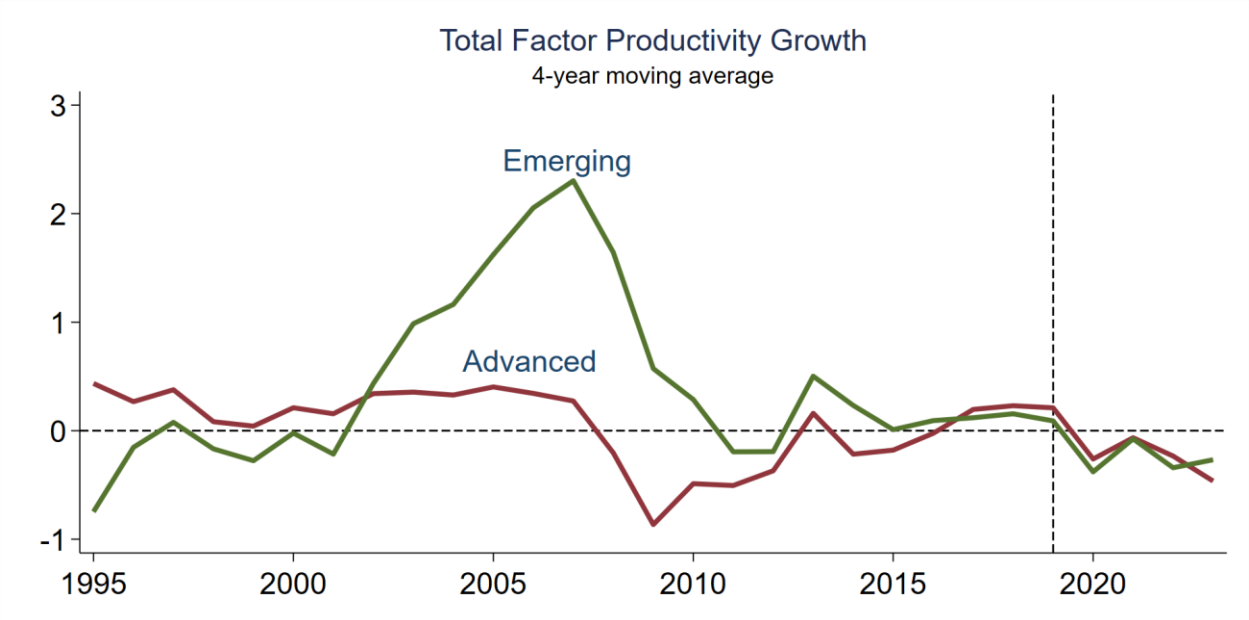
[14] The Fernald (2014) dataset contains a utilization adjustment, based on Basu, Fernald, and Kimball (2006). The utilization adjustment is designed to capture variations in labor effort and capital's workweek. Qualitatively, this measure suggests that rising factor utilization boosted measured TFP growth by almost 1½ percentage points (annual rate) from the end of 2019 through the middle of 2021, but has since subtracted about ¾ percentage point.

[15] For capital deepening, available capital (as measured) changed little, but as unemployment went up, each remaining worker had more capital to work with. The capital deepening effect was even larger during the pandemic, because the industries that shrank the most, such as leisure and hospitality, are less capital-intensive than average. So there was a composition effect towards industries with higher LEVELS of productivity

In 2021-22, looking at the far-right bar, the capital-deepening and labor-composition effects reversed. Both contribute negatively to growth, helping to explain the overall negative growth in labor productivity over this period.

Figure 7: Global perspective on TFP growth…still slow? Or even slower?



Source: Conference Board Total Economy Database. 2023 is Conference Board projection.

Starting with advanced economies, TFP growth over this period has never been high—at most about 1/3 percent per year. For some years after the Great Recession (which, in annual data becomes apparent in 2008), TFP growth actually turned negative in these data. TFP returned to persistent positive territory only in the years right before the pandemic.

But since 2019, advanced-economy TFP growth has turned negative once again. There is no evidence of a persistent positive effect. Qualitatively, TFP growth looks worse than it was before the pandemic.

In emerging markets, TFP growth was high in emerging markets in the early 2000s. TFP growth slowed in the 2010s to modestly positive values. But since the pandemic, emerging-market TFP growth has been negative—and, indeed, not much different from advanced-economy growth.

Thus, for neither advanced nor emerging-market economies is there evidence of any positive TFP boost from the pandemic.

5. Patterns in U.S. industry data

One of the major changes around the globe is a large increase in the share of time workers spend working from home. For example, as of early 2023 in the U.S., 1.4 days per week were, on average, spent working remotely. In Argentina, it's a little less than 1 day per week. Before the pandemic, working from home was extremely rare.[16]

The evidence on the productivity effects of hybrid or remote work arrangements mainly involves relatively narrow sets of well-defined tasks, such as call centers. Fernald and Li (2022) and Fernald, Goode, Li, and Meisenbacher (2023) look across all industries in the private economy. Here, we summarize their key results.

There is not a granular industry quantification of how much teleworking is actually done by industry. But it is possible to look at how *teleworkable* different industries are. Dingel and Neiman (2020) measure the teleworkability of different occupations based on the tasks performed by these workers. The Bureau of Labor Statistics (BLS) has data on the occupational mix of different industries. Combining these gives a measure of teleworkability by industry. We can then relate these measures to average quarterly labor productivity growth, where labor productivity is measured as GDP by industry relative to industry hours as measured in the monthly establishment survey.[17]

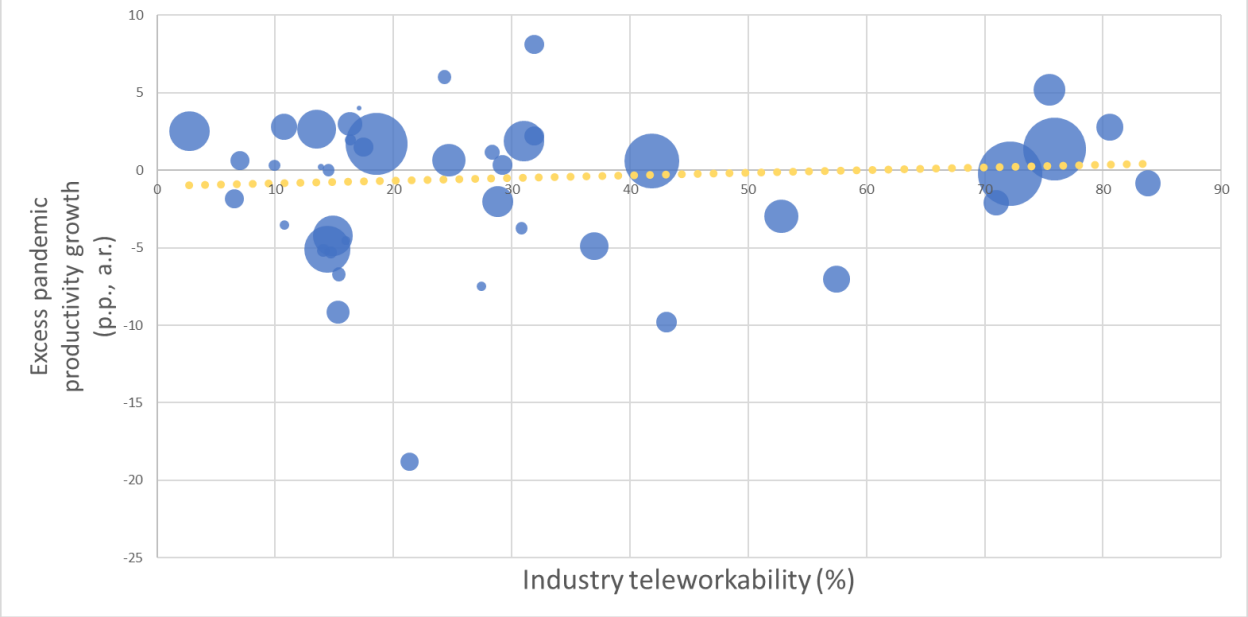
Figure 8 shows the relationship between teleworkability and pandemic productivity performance. The horizontal axis measures teleworkability by industry. The vertical axis is average annualized productivity growth since the end of 2019—so from the end of 2019 through

[16] Aksoy et al. (2023).

[17] There are limitations of the hours measures. Hours are measured in the establishment survey as hours *paid*, which can differ from hours *worked*. Fernald and Li (2022) assess possible biases from this mismeasurement.

the first quarter of 2023 (the latest data available as of this writing)— relative to its pre-pandemic 2006-19 pace. (It is important to look at *excess* pandemic productivity performance because more teleworkable industries had faster average productivity growth before the pandemic.)

Figure 8: Little relationship between pandemic productivity and teleworkability



Source: Fernald, Goode, Li, and Meisenbacher (2023), based on Dingel and Neiman (2020), BLS and BEA data.

The figure shows that there is essentially no relationship between teleworkability and pandemic productivity performance. The dashed line shows a fitted regression line, which is statistically insignificant.[18]

One takeaway from the industry data is that there is a lot of variation in industry performance. Another takeaway, and our main takeaway from this section, is that the variation is

[18] Although the relationship is with *teleworkability*, it doesn't necessarily reflect just productivity effects of remote work. For example, high-teleworkability industries typically produce products that are less tangible and more likely to be digital. And low teleworkability industries, by their very nature, necessarily suffered disruptions and dislocations during the pandemic that challenged businesses.

not related to teleworkability. In other words, as important as the shift towards remote and hybrid work is, it is not on its own a dominant factor affecting the level or growth rate of productivity.

6. Conclusion

Productivity has been on a roller coaster since the pandemic started. It rose steeply, then fell sharply. Now, this is what you expect when you get on a roller coaster. And in fact, this productivity pattern is more or less what you'd expect, given how the economy has evolved. The U.S. pattern followed an exaggerated, accelerated Great Recession cyclical path of boom and bust.

To strain the analogy just a little bit more, a roller-coaster ride drops you off at the same place it picked you up. And the data across countries so far seem broadly consistent with the pre-pandemic slow trend. Even the big shift to hybrid and remote work does not seem like it's important for the productivity statistics overall.

Of course, there are plenty of uncertainties and open questions as businesses and individuals continue to adjust. To name just a few: First, the data sample is short—even 3-1/2 years of data since the start of the pandemic may be too short to be sure of productivity trends. Second, there could be a lot of ongoing adjustment costs: We all had to learn how to work remotely, and now we need to learn how to coordinate with hybrid work; and geopolitical challenges are leading to ongoing supply-chain reorganizations. Finally, generative AI or other innovations might change the trends going forward.

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