Does Disappointing European Productivity Growth Reflect a Slowing Trend? Weighing the Evidence and Assessing the Future

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Does disappointing European productivity growth reflect a slowing trend? Weighing the evidence and assessing the future*

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Abstract

In the years since the Great Recession, many observers have highlighted the slow pace of productivity growth around the world. This paper focuses on the European experience, where we highlight that trend TFP growth has been slowing since the 1960s. Part of that slowdown reflected the relatively benign effects of convergence—TFP levels were catching up to U.S. levels. However, since the mid-1990s, European economies have typically been diverging from the U.S. level of TFP. The pre-recession timing thus suggests that it is important to consider factors other than just the deep crisis itself or policy changes since the crisis. In our view, European economies have still not managed to adapt fully to a knowledge based economy, in terms of the necessary flexibility, skills, management, and such. In other words, the productivity challenges are much the same as they were prior to the Great Recession.

Keywords: Productivity Growth; Great Recession; Convergence
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1. Introduction:

In the past few years, the healing process from the Global Financial Crisis has finally become entrenched across advanced economics. But with the global cyclical upswing has come the increasing recognition of a different, and potentially longer lasting, concern: Trend growth rates are slow. The "surprise," relative to expectations from before the Global Financial Crisis, has been in trend productivity.[1]

In this paper, we survey the European productivity experience. We document that the weakness in labor productivity growth in the past decade is not the result of weakness in measured capital formation—plant, equipment, software, and the like. Rather, the source of weak labor productivity growth has been the tepid pace of total factor productivity (TFP) growth. TFP growth, which adjusts for observable capital growth as well as the skills of the population, has been anemic in Europe as well as in the United States. In the long run, TFP is a broad summary measure of innovation and efficiency.

There is no shortage of stories for weak TFP growth. Many of them are linked—directly or indirectly—to the Great Recession and slow recovery itself, though some are independent of that event. A superficial look at the data does suggest reasons for focusing on the post-Great Recession period: Conference Board data show that aggregate TFP growth in virtually all major European economies was zero or negative in the 2007-2016 period.[2]

A challenge in assessing trends is that TFP is procyclical—it tends to fall in recessions and rise strongly early in recoveries. The literature suggests that variations in factor utilization

[1] For example, the International Monetary Fund's World Economic Outlook (WEO) in April 2015 made the following observation: "Potential output growth across advanced and emerging market economies has declined in recent years. In advanced economies, this decline started as far back as the early 2000s…" (p.69). Each of the twice-annual WEO's since then has taken this slow potential growth as a given.

[2] See the Conference Board's Total Economy Database. Over this period, TFP growth was positive in Malta and Iceland. The numbers are weak, though not quite as weak, in the EU KLEMS data we report later, though the broad trends are similar.

(labor effort and capital's workweek) explain this procyclicality. As we discuss in Section 3, our working hypothesis at this point is that these cyclical factors had largely played out in terms of TFP by 2015 (the end date of the EU KLEMS data that we use for much of this paper).

A deep recession could have other adverse effects, as well. These include reduced incentives to innovate, or to adopt innovations, following an adverse demand shock (e.g., Bianchi et al, 2018; Anzoategui et al, 2018; Garga and Singh, 2017); rising misallocation of resources in some economies (e.g., Gopinath et al); and credit frictions that may have led to reduced investment in intangibles (e.g., Duval et al, 2017).[3]

Despite these stories, the dominant feature of the data in our view is that the slowing trend predated the Great Recession. This suggests that stories in which the Great Recession knocked TFP growth off track are probably second order. Figure 1 illustrates this point, showing that European TFP growth has been slowing since the 1960s (!). Of course, some of that slowdown is benign, reflecting the end of the convergence "boost" that Europe received after World War II. But some of it reflects a shortfall relative to growth at the "frontier"—a renewed divergence. Indeed, in the early- to mid-2000s, the puzzle that a large literature addressed was why Europe had seen a mid-1990s productivity slowdown even as the U.S. had seen a pickup. Timmer, et al., 2010 provide a comprehensive review of that debate, focusing primarily on data prior to the Great Recession. They concluded that European economies had not managed to adapt fully to a knowledge based economy, in terms of the necessary flexibility, skills, management, and such.

In the U.S. context, the mid-1990s productivity boom ended in the mid-2000s, prior to the Great Recession (Fernald, 2014). Because of this fact, the leading hypothesis for the disappointing recovery of U.S. output after the Great Recession is that the deep recession was

[3] Adler et al (2017) review many of the possible channels.

superimposed on a sharply slowing output growth trend (Fernald, Hall, Stock, and Watson, 2017). That waning trend plausibly reflected a pause in (if not the end of) the exceptional gains from information and communications technology (ICT) that the U.S. economy received in the mid-1990s. A related argument is the view that, at the frontier, "ideas are getting harder to find" (Bloom et al., 2017).

We view Europe's experience as broadly consistent with the same narrative. There was an unusually deep and long recession—leading to a sizeable but temporary decline in factor utilization in many countries—that was superimposed on a sharply slowing productivity trend. Given that many countries in Europe have been diverging from the frontier since the mid-1990s, the trend in this case is more than just what has been happening with growth at the frontier. In terms of a conditional convergence perspective, it remains unclear where the new steady state is for many European economies is relative to the United States.

This paper is structured as follows. Section 2 of this paper documents some key facts that inform the debate. We focus especially on TFP growth because, as we document, we do not see weak capital formation as an important independent channel for explaining weak growth in labor productivity. Section 3 of the paper looks at cyclical aspects of TFP dynamics. It is challenging, in the European context, to control for cyclical effects directly because of the heterogeneity in institutions and the lack of suitable proxies for cyclical mismeasurement. However, we view most of the cyclical mismeasurement issues to have run their course by 2015. In Section 4, we (will eventually) examine break tests of productivity growth, since some stories suggest that the recession might have caused a change in trend. (We do not expect to find much, based on the visual evidence and some preliminary tests). Section 6 provides a discussion of how to interpret the facts so far, and draws some lessons for the future. We then conclude.

2. Key facts and conceptual framework

This section starts by motivating our focus on TFP growth. In our view, weak TFP growth is the key to understanding weak labor productivity growth. Specifically, we do not view a shortfall of capital formation as an important independent contributor to weak labor productivity growth. We then highlight some of the key heterogeneities across countries, and discuss how the trends fit into a framework of conditional convergence.

The takeaways from this section are that TFP is the right place to look for understanding weak labor productivity growth in Europe; that the pace was slowing, and heterogeneity was rising, even before the Great Recession; and that stories that focus on particular sectors in particular countries (e.g., construction in Spain) won't explain the broadbased slow pace of TFP growth.

A. Is capital also a source of weak labor productivity growth?

Figure 1 showed the slowing pace of overall TFP growth in Europe. But is that the only source of weak labor productivity growth? Some observers have pointed to weak capital growth, stemming from weak investment, as an independent contributor. Certainly, unusual credit constraints or heightened uncertainty might have led to unusually weak capital formation.

The challenge in assessing this argument is that capital is endogenous. As Fernald et al (FHSW, 2017) point out, weak TFP growth or declining labor input will naturally lead firms to demand less capital. They suggest looking at the growth accounting for labor productivity in terms of the capital-output ratio, in order to (partially) adjust for this. In particular, a rearrangement of the standard (Solow-Jorgenson) growth accounting yields the following useful expression:

$$\Delta \log\left(\frac{Y_t^{Bus}}{Hours_t^{Bus}}\right) = \frac{\Delta \log TFP}{(1-\alpha_t)} + \left(\frac{\alpha_t}{1-\alpha_t}\right) \cdot \Delta \log\left(\frac{K_t}{Y_t^{Bus}}\right) + \Delta \log LQ_t \,. \quad (1)$$

In this expression, growth in output per hour *(Y/Hours)* depends on TFP growth, in labor-augmenting form, labor quality, and the capital-output ratio (*K/Y*). α is capital's share in revenue. This expression is useful because, even though capital formation is endogenous, in many models the capital-output ratio is stationary (through possibly with a trend). In other words, slower growth in technology and labor naturally lead to a lower path of capital—but a roughly stable path for the capital/output ratio. Thus, the capital-output ratio can help diagnose whether there are special influences on capital from, say, unusual credit constraints or heightened uncertainty.

Figure 2 plots the capital-output ratio for selected major European economies. We have plotted it in levels (the integral of the term in equation 1) for visual clarity. The series have an upward trend (consistent with investment-specific technical change). The capital-output ratio is also strongly countercyclical. That is, in recessions, the capital-output ratio naturally rises. This happens mechanically, since capital is relatively smooth but output falls in recessions. For this reason, it would be helpful to have a cyclical adjustment to the capital-output ratio (as FHSW do), but this is more challenging in Europe. Thus, we make the assumption (which we defend in the next section) that the main cyclical adjustments were largely complete by the end of the sample.

By this benchmark relative to output, the figure suggests little evidence that a shortfall in capital formation is a major additional contributor to weak labor productivity growth as of 2015. In all cases shown, the capital-output ratio in 2015 is above its level from 2007; indeed, it always appears at, or above, a trend lines fit to the 2000-2007 period.

Thus, the data do not obviously suggest a reason to think that exogenously weak capital formation was an independent contributor to weak labor productivity growth, in addition to weak TFP growth. For this reason, in what follows, we continue to focus on TFP. [4]

B. TFP growth across countries and industry groups

Figure 1 already showed the long downward trend in TFP growth for a European aggregate. The long-term slowing trend in Figure 1 reflects several forces. One force is the end of post-war economic convergence. By most accounts, convergence had run its course by the mid-1990s, if not earlier (see Timmer et al, 2010). A second, and more worrying, force is some deterioration relative to the U.S. frontier following the U.S. ICT boom of the mid-1990s. This renewed divergence is a major focus of Timmer et al (2010, Cette et al., (2016), and considerable other literature.

Figure 3 shows this divergence, and provides a different perspective on the trends. It shows TFP levels from 1995 to 2015 for the market economy, combining data on growth rates from EU KLEMS (the 2012 and 2017 vintages) with levels estimates from Inklaar and Timmer (2009). In these data, the U.S. economy is always at the overall frontier, as shown by the blue solid line at the top of the figure. In EU KLEMS data, TFP growth from 1995 to 2005 averaged 1.1 percent per year, but slowed to 0.2 percent thereafter. Fernald et al (2017) find a statistically

[4] Of course, the cyclical dynamics of the capital-output ratio will add additional cyclical dynamics to labor productivity, above any cyclical dynamics in TFP. This suggests further reasons not to focus on the short-term dynamics of labor productivity in seeking to understand trends. Given the absence of cyclical adjustment, and the possibility that some economies (such as Spain) might still have an output gap as of 2015, the test is certainly not dispositive. In the absence of a fully specified model, it is challenging to fully assess the counterfactual.

significant break in TFP growth in 2006:Q1; if growth is modeled as having smoother changes in trend, rather than discrete breaks, the slowdown was even earlier.[5]

The red solid line in the figure shows the average TFP level for 10 major European economies, with the shaded region showing the range across these economies. In these data, all of the levels lie below the U.S. frontier. But they also show that, on average, countries were diverging from that frontier—European growth rates were below U.S. rates. On average, European TFP growth was only 0.4 percent from 1995 to 2005, but has slowed to only 0.0 percent since then.

In other words, the average pace of post-2005 TFP growth in Europe has been somewhat similar to (if a bit below) the U.S. pace. The good news is that "puzzle" of apparently faster IT-fueled growth in the U.S. than in Europe has been solved. The bad news is that it was solved by having the U.S. pace slow even more than in the average European economy, rather than seeing a pickup in Europe. TFP growth rates everywhere have been anemic.

Of course, as the red shaded region shows, the European experience has been heterogeneous, both in levels and in growth rates. Indeed, the cross-sectional standard deviation of European TFP levels has risen since the early 2000s, as shown by the solid line in the bottom panel of Figure 3.

In this regard, while the slowdown at the frontier of growth might affect everyone, the fact that European countries have been losing ground relative to that frontier at different rates is important. It is *not* just a story of slowing frontier growth, but country-specific factors also matter. Of course, these country-specific factors might interact with the shocks that have been hitting the global economy.

[5] The Fernald et al (2017) analysis uses quarterly business-sector TFP data from Fernald (2014b). That dataset has an even sharper slowdown in TFP growth from 1.8 percent per year from 1995:Q4-2004:Q1 to 0.4 percent from 2004:Q4 through 2018:Q1.

It is also important to note that the divergence relative to the frontier, and the rising cross-sectional standard deviation, was underway even before the Great Recession.

Figure 4 provides another perspective on the cross-country heterogeneity by using EU KLEMS data to decompose aggregate TFP growth into its industry sources. The height of the bars in each panel shows average TFP growth for nine European countries as well as the United States, ordered from slowest growth to fastest growth. The left panel shows growth from 1995-2005, and the right panel shows growth from 2005-2015. Market-sector TFP growth is decomposed into four broad groupings of industries: IT production, market services, "bubble sectors" of finance and construction, and everything else (e.g., non-IT manufacturing).

From 1995-2005, the contribution of TFP growth in market services (such as wholesale and retail trade) was a key distinguisher between strong- and weak-growth countries. This is essentially the "original EU KLEMS story" of Timmer et al (2010). In Spain and Italy, the contribution of market services was particularly negative, dragging overall TFP growth to be negative. This is the case even though many observers point to construction in the case of Spain; but construction (together with finance) was only a small direct negative contributor. In Germany, the contribution of market services was also negative, and in France it was negligible. In contrast, countries towards the right-hand side of the figure tended to have strong contributions from market services.

What's the story here? Think about distribution. Walmart and Costco and similar firms were much better than competitors at using IT to manage their distribution systems. They substantially reorganized what they did to do. They were so much more efficient, they expanded fast. And competitors closed or downsized. So reallocation towards these high productivity firms and away from inefficient Mom and Pops drove productivity gains. In some countries, this

sort of reorganization of the distribution sector was easier than in others. These differences then show up in the bar chart.

The pre-2005 contribution of industry groupings other than market services were more heterogeneous across countries and less consistently linked to strong versus weak overall performance. Of course, the countries towards the right of the panel typically got more of a direct contribution from ICT goods and services. But that contribution was positive everywhere.

Since 2005, the industry pattern across countries is more mixed. The main feature is that overall growth has been anemic, with little clear smoking gun in the industry data. Most countries had weaker TFP growth in the 2005-15 period than in the preceding decade, with the exception of Spain and Italy—where TFP growth was marginally less negative.

The takeaways from this section are that TFP is the right place to look for understanding weak labor productivity growth in Europe; that the pace was slowing, and heterogeneity was rising, even before the Great Recession; and that stories that focus on particular sectors in particular countries (e.g., construction in Spain) won't explain the broadbased slow pace of TFP growth.

3. Cyclical dynamics and the role of the Great Recession

The story suggested by the previous section has little role for the Great Recession. And yet, one of the challenges in disentangling productivity trends is the magnitude of the Great Recession itself. Considerable literature, mainly on U.S. data, has explored the cyclical properties of productivity—documenting that measured productivity can move substantially over the business cycle (see Fernald and Wang, 2016, for a survey). To understand what we are seeking to "filter out", this section explores the role of cyclical dynamics. Our tentative

conclusion is that residual cyclical dynamics are probably not the story for weak TFP growth in Europe.

Figure 5 shows TFP growth for four major European countries. In all cases, TFP growth fell in the depths of the Great Recession—mostly fairly sharply. On the flip side, TFP growth rebounded in 2010, with the rebound inversely proportional to the decline.

The TFP decline in 2009 and rebound in 2010 were sharpest in Germany. Bellman et al (2016) document that institutions in Germany (such as short-time work) encouraged use of the intensive margin (hours per worker, and perhaps effort per hour) rather than the extensive margin of hiring and firing. They also point out that economic conditions and business expectations in Germany supported the use of the intensive margin. For example, manufacturing surveys show that businesses thought the downturn would be temporary, so they had an incentive to hold onto workers they would want in the recovery (page 206).

Spain, in contrast, saw the smallest TFP decline in 2009 and the smallest rebound in 2010. That is, TFP growth was only slightly procyclical. As Hospido et al (2016) argue, firms disproportionately used the extensive margin of labor-input adjustment, in part because a high share of workers had temporary contracts. In addition, Spanish firms were, in general, covered by collective agreements at a sector level that specified hours of work, making it harder to use that intensity margin. Thus, the strong responsiveness of employment/unemployment to output, and the limited response of TFP from the use of the intensity margin, is not surprising.

Interestingly, in terms of trend, Spain's TFP growth was negative before the recession and for most of the period since. In the figure, TFP growth only turned positive after the recovery turned strongly positive in 2015 and 2016. Until then, there was little apparent pickup in TFP growth after the recession. (This is consistent with the bar chart in Figure 4.)

Of course, as many observers have noted, Spanish labor productivity (output per hour) did look quite different—it rose in 2009 and was relatively strong for the next few years. This short-term disconnect between the performance of TFP and labor productivity is not surprising from the point of view of growth accounting. Indeed, the literature on cyclical productivity points out that TFP is likely to be procyclical (because of cyclical factor utilization), but all the other cyclical forces affecting labor productivity are countercyclical. After all, the capital-output ratio is strongly countercyclical (Figure 2). Moreover, in recessions, low-productivity workers disproportionately lose jobs. Both of these factors work to make labor productivity countercyclical—consistent with Spain's experience.

Indeed, given the depths of Spain's recession, rising labor productivity in the recession is not surprising. TFP was only weakly countercyclical because all the incentives were to adjust labor input through the extensive margin, not the intensive margin. And all the other forces push strongly for countercyclical labor productivity.

In Figure 5, the U.K. and France were intermediate in terms of the cyclical TFP decline in 2009. Arguably, labor market institutions are not at either of the extremes illustrated by Germany and Spain. That is, firms had incentives to hoard labor, but not to the same extent as in Germany.

Have the cyclical forces completely played out in the European data? In the U.S. context, Fernald (2014) argues that by the end of 2010, the major cyclical dynamics on TFP from variation in the intensity of labor and capital utilization had played out. Thus, his estimates suggest the utilization margin recovers quickly, consistent with the burst in European TFP growth in 2010 that is visible in Figure 5. Those estimates would give one reason to hope that, by 2015, cyclical factors were no longer quantitatively important in assessing TFP trends.

Of course, Europe had a double-dip recession, which makes this assessment a bit less clear. Given Europe's much slower recovery, it is possible that, in some cases, the cyclical rebound has not occurred in the data we are using. If that is the case, then as the temporary cyclical factors reverse, productivity growth could pick up relatively quickly.

Nevertheless, our working hypothesis is that, by 2015 (the end of the EU KLEMS data) residual cyclical dynamics from labor hoarding and low capital utilization are not central to the story. For one thing, the U.S. evidence suggests that these factors tend to recovery relatively quickly. For another, if the cyclical elements were, in fact, central, then as the cyclical recovery took root since 2015, we should have seen a rebound in European productivity figures. In quarterly data on output per worker from Eurostat, there is little evidence through 2018:Q1 of a sizeable rebound in labor productivity growth.[6]

Certainly, there are potential channels through which the recession could have made the trend worse, perhaps by pushing Europe further inside the "frontier." But the pre-recession timing of the slowdown in TFP growth, as well as the pre-recession widening of TFP dispersion (noted in Figure 3), suggests that one cannot focus solely on the recession. Nevertheless, we now explore whether a break in the TFP data is visible after 2007.

4. Evidence from break tests

[NEED TO ADD TESTS…!][7]

We use aggregate and industry data to explore the two hypotheses of a pre-recession slowdown in trend versus a crisis-induced break in trend. These two hypotheses are not mutually

[6] http://ec.europa.eu/eurostat/tgm/table.do?tab=table&plugin=1&language=en&pcode=tipsna71. We would also note that a renewed cyclical recovery is not visible in the Conference Board's Total Economy Database, which has data through 2017.

[7] I have quickly done break tests on French market-sector TFP growth which, in EU KLEMS 2017, goes back to 1981. There is evidence of a break in 2000, which is significant at the 10 percent level. There is no evidence of a second break in the series. This is consistent with the view that breaks plausibly predated the Great Recession.

exclusive. For example, even if the trend were slowing (as shown in Section 2), it is possible that in some or many countries, the recession itself might then have been an important additional contributor to the disappointment. The experience could differ across countries depending on factors such as the depth of the downturn, the sectoral composition of production, and the degree to which the financial sector was impaired in the country.

There is some evidence that deep recessions (financially related or otherwise) may cast "long shadows" (Fatas, 2000)—permanently reducing the level of GDP compared with its pre-recession trend (e.g., Cerra and Saxena, 2008, Martin, Munyan, and Wilson, 2015, and Blanchard *et al.* 2015).

Nevertheless, there is much less evidence for advanced economies that the level or growth rate of *TFP* is permanently affected by recessions. For example, the Great Depression was an extraordinarily innovative period (Field, 2003; Alexopoulos and Cohen, 2009). More broadly, Oulton and Sebastiá-Barriel (2014) look at growth-accounting variables following financial crises. They find that, for advanced economies, the long-run level of TFP is not significantly affected. According to their estimates, advanced-economy GDP per capita is permanently lower after a financial crisis because employment per capita is permanently lower, whereas capital per worker as well as TFP are unchanged.[8] The facts from Figure 1 and Section 2—that a lot was happening in terms of TFP trends before the crisis—are consistent with this literature.[9]

[8] For developing economies, in contrast, financial crises do appear to permanently reduce TFP and capital per worker, as well as employment per capita. Furceri and Mourougane (2012) discuss GDP effects through hysteresis in labor markets or persistent effects on capital deepening if there are changes in risk premia. They also find that impact of financial crises varies according to structural features such as the degree of openness, macro-economic imbalances, financial deepening, and the quality of governance.

[9] That said, without a formal model, we cannot say what would have happened to the path of global or country-level TFP in the absence of the Great Recession. Anzoategui *et al.* (2015) estimate a model where aggregate technology is endogenous to the cycle. According to their estimates, the Great Recession did, indeed, lower the path of TFP. For our purposes, the important point is that it's not the only factor.

Nevertheless, now that a longer time series since the crisis is available, it is worth revisiting this debate.

[NEED TO ADD TESTS. CONJECTURE: The U.K. will find a break at the crisis itself. Other countries will not. But this needs to be checked. Would be great to have a broader takeaway view on hysteresis in Europe. Is there evidence so far of hysteresis in labor, even if not in TFP or labor productivity?]

5. Market power and intangibles

Two issues that have received a lot of attention in recent literature are an apparent rise in market power, and the increasing share of intangibles. We find little evidence so far that either of these stories can explain the slowdown in European productivity growth—at least through direct measurement channels.

As Karabarbounas and Neiman (2018), among others, point out, rising market power and rising intangibles could both explain apparently increasing economic profits in the data (what Karabarbounas and Neiman call "factorless income"). The link is direct, of course, in the case where rising market power leads to pure economic profits. (It doesn't need to, if the rising market power is needed to offset rising returns to scale, say, from fixed costs.) With intangibles, the issue is that the returns to intangibles show up in residual payments to capital, but our usual measures of the capital stock might not include those intangibles. Concretely, Apple has a market capitalization of $1 trillion (as of early August 2018), but it has few tangible assets. Its cash flow derives from a return on its enormous stock of intangible design and marketing skills.

Both stories have implications for measuring innovation, as well. First, if here are pure economic profits, then the typical default of estimating capital's factor share as a residual is

misleading—that residual includes pure profits as well as the implicit rental cost of capital services. Second, if the story is rising (unmeasured) intangibles, that has implications for measurement of both output (the intangible investment) and inputs (the accumulated intangibles stock).

Figure 6 takes a first look at this story by looking at the implicit internal rate of return to measured capital in the EU KLEMS dataset. That is, for each country, there is an implicit nominal return in the user-cost formulas (with one user cost equation for each type of capital) such that the sum of the implicit capital rental payments exhaust non-labor factor costs in value added. To adjust for inflation and for the overall level of interest rates, we subtract the nominal government bond yield. The rates in the figure just can be interpreted as reflecting risk, financial frictions—or pure profits.

In the figure, 7 out of the 10 countries shown saw an increase in this premium over the sample. This increase could be consistent with rising economic profits. That said, the evidence is not dispositive, in that of the five largest European economies, only Germany and the U.K. saw an increase; France, Spain, and Italy did not.

Still, if we interpret rising internal rates of return as reflecting rising market power, it would imply that measured TFP growth did not not necessarily track innovation and technology. In the simplest case of constant returns, the issue is that we are underweighting labor and overweighting capital. One could investigate this directly by imposing a fixed premium over the government bond rate in calculating implicit rental cost. We have not done that, but as a first test, we can see how large a difference it would make to shift weight towards labor and away from capital. Specifically, as a benchmark, we simply impose that because of rising economic profits, the true capital share of value added revenue falls 10 percentage points after 2005—a quite large

effect—with labor's share rising 10 percentage points.[10] Under the assumption of constant returns, this increases the implied growth rate of aggregate technology by 0.1*(dk-dl). In EU KLEMS data, many countries did see faster growth of capital than labor since 2005, so the adjustment would raise technology growth. But the magnitude is typically no more than 0.1 percentage point, and often smaller. (It is larger in the case of Spain, about 0.2 percentage points, since capital kept rising even as labor fell from 2005 to 2015; but Spain was *not* a case where there is evidence of a rising internal rate of return.)

Our conclusion is that rising market power probably cannot, through measurement channels, explain weak measured TFP growth.

Of course, as noted, another interpretation of Figure 6 is that it is capturing intangible investments. Indeed, one channel through which a recession might cast long shadows is through reduced intangible investments—that is, reduced investments in the future. Some of these investments are measured in the national accounts, but others are not. As a pure measurement issue, if intangibles are not measured, there is missing investment output as well as missing intangible capital input.

Figure 7 looks at the share of intangible investments relative to market-sector value added. Intangibles here are measured by INTAN-INVEST, which attempts to measure many of the harder-to-measure types of intangibles (organizational change, training, and branding, for example). The intangibles share has been rising in virtually all countries. But there is no obvious change in trend before/after 2005. Byrne et al (2016) incorporate additional intangibles from INTAN-INVEST more formally into U.S. growth accounting on both the input and the output

[10] This is only to gauge the plausible magnitude of the effect. With markups, other issues arise, including the fact that aggregate technology cannot in general be written just as a function of aggregate output and aggregate capital and labor.

side. They find that it makes little difference to the TFP trends before/after 2004, consistent with the visual impression from the figure.

We conclude that neither rising market power nor rising intangibles provide a clear rationale for weak productivity growth, at least through direct measurement channels.

6. Discussion and implications for the future

So far, we have largely documented facts. Those facts suggest that some popular stories related to the Great Recession are at best incomplete, given that the major trends were well underway before the recession. (Of course, it is challenging with macro data to rule them out completely).

For Europe, we are left with the many of the same challenges that were highlighted by the pre-recession comparative U.S.-Europe literature: European productivity has been diverging from the frontier. That earlier literature (e.g, Timmer et al, 2010) highlighted the challenges in adapting to a knowledge-based economy, in terms of its demands on skills, innovation, management, and organizational change.

Even if the pace of divergence has slowed—so the U.S. is no longer pulling away as fast—there is not yet evidence that Europe is beginning to close the gap that has opened up. And of course, slower growth at the frontier (reflecting a pause, at least, in the widespread gains from information technology) does not help Europe to grow fast.

Of course, the divergence from the frontier does create an opportunity for fast productivity growth, if European countries can implement reforms and get back on the convergence path. This is the basis of the Bartelsman (2013) view that Europe has the potential for quite fast productivity growth. That path would likely require ambitious structural reforms in

many European economies to reverse anticompetitive regulations on labor and product markets and to reduce the importance of financial frictions.

That said, structural reforms face substantial institutional and political difficulties. Moreover, limited or non-appropriate reform programs could even make things worse (see, for example, Fatas, 2015). So, renewing the convergence process is far from assured.

7. Conclusions

A challenge in telling a simple story about Europe is that it is so diverse. Italy, for example, has different challenges than, say, Germany. Yet, stepping back, the big picture story is the same as in the United States: Europe suffered a deep recession superimposed on a slowing trend. That slowing trend appears to reflect first that, at the frontier, there has been a pause in the diffusion of the ICT revolution to other sectors; and second the fact that many European countries have been moving away from the frontier—at varying paces—for several decades.

The fact that slow growth reflects divergence, not just slow frontier growth, suggests one source of optimism. If Europe can get back on the convergence path, it could grow relatively fast. Unfortunately, it is unclear exactly what steps need to be taken, and the political will might not be there to take the necessary steps.

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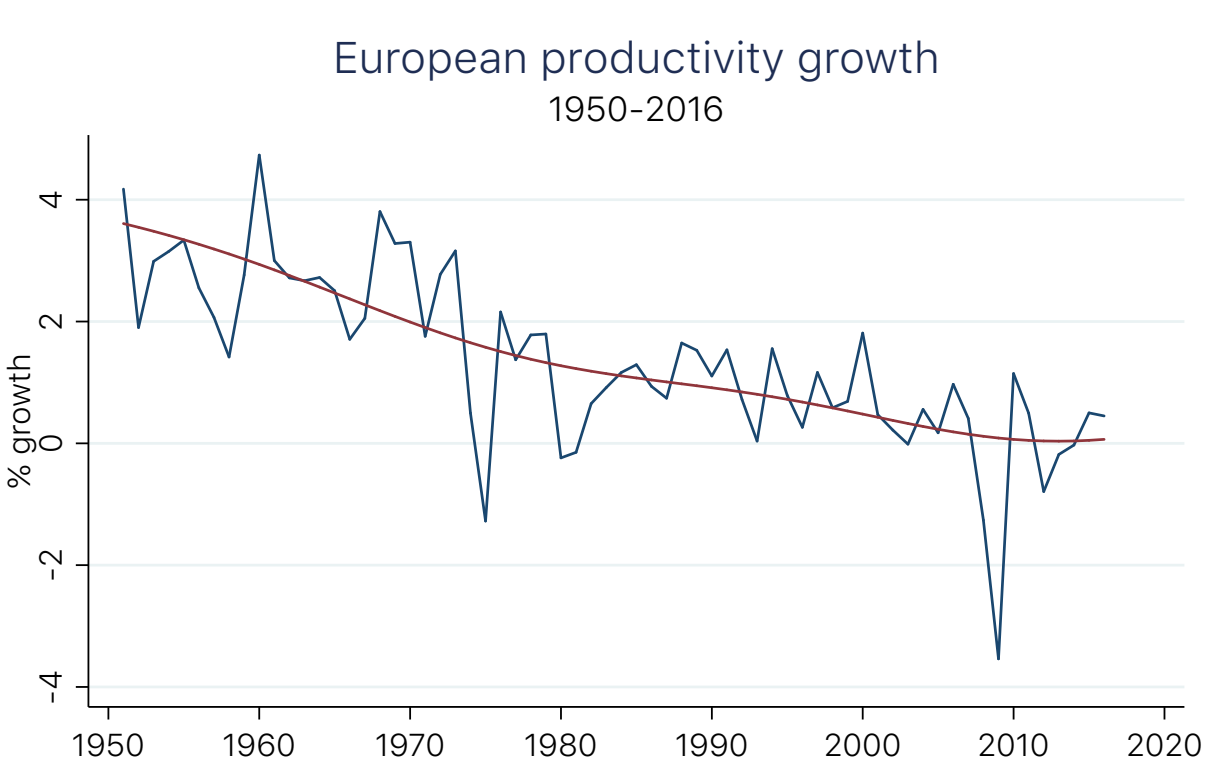
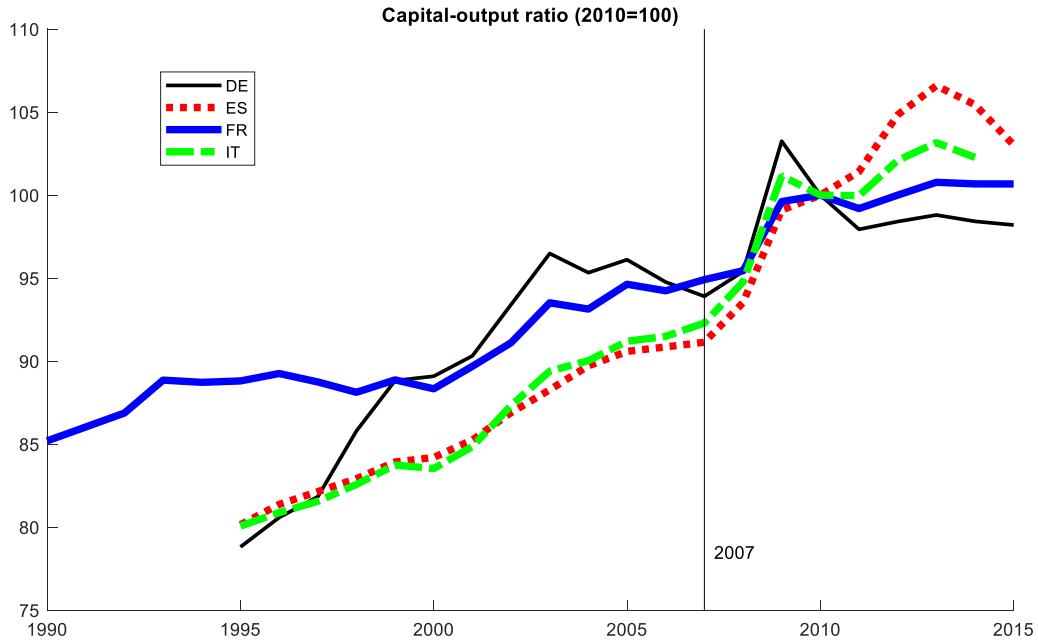
Figure 1: European productivity growth: A long downward trend



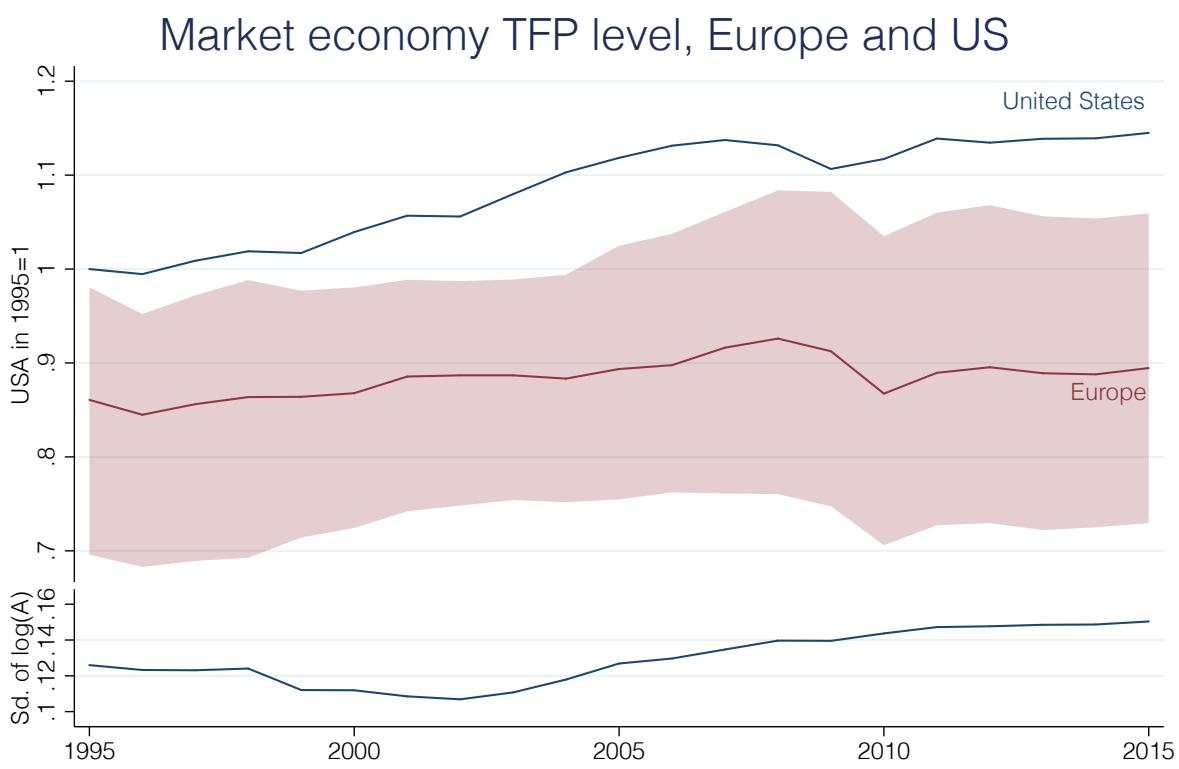
Source: Penn World Table 9.0 (Feenstra, Inklaar and Timmer, *AER* 2015) and The Conference Board *Total Economy Database*, March 2018 (2013-2016).
Notes: Europe covers the 15 countries that were members of the European Union. before 2004. Trend line is esimated using a lowpass filter with a minimum period of 2 years.

Figure 2. Capital-output ratio not falling short of trend



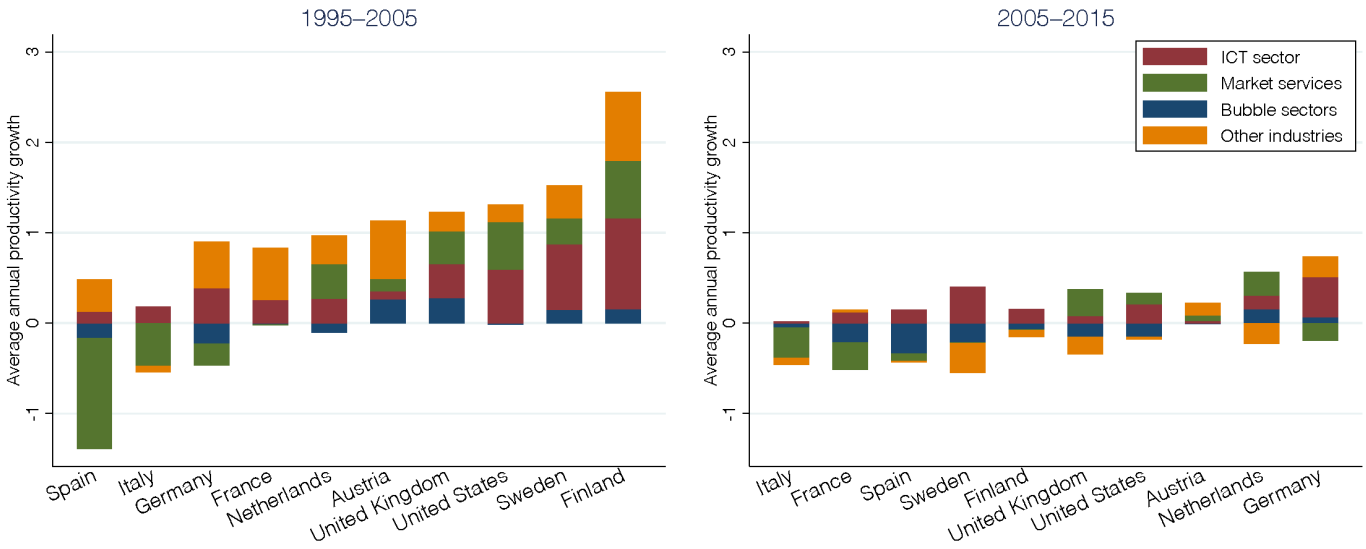
Source: EU KLEMS 2017

Figure 3. Slower frontier growth *and* divergence



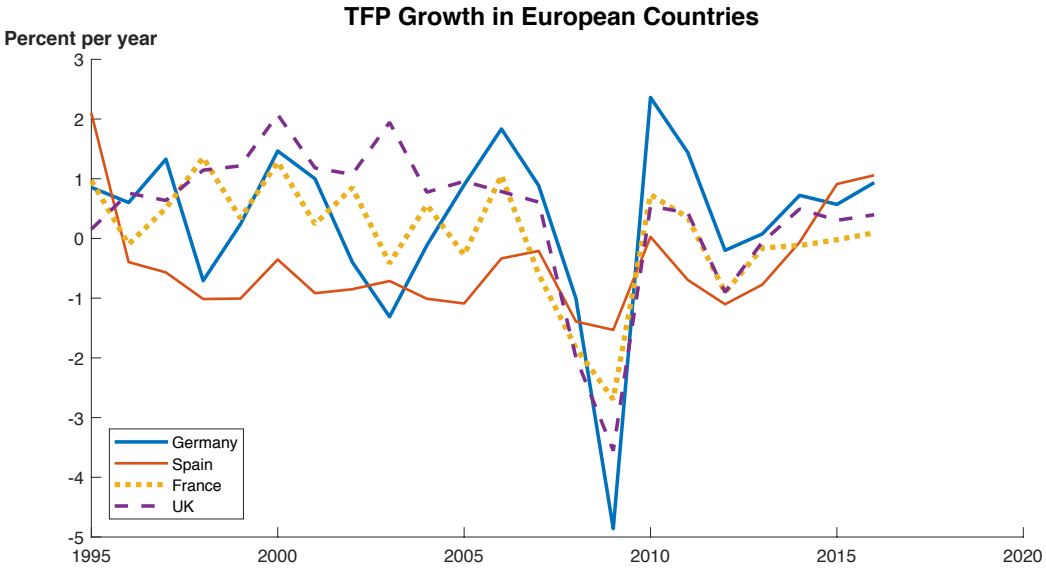
Sources: Inklaar and Timmer (2009), extended with EU KLEMS 2012 and 2017.
Notes: European countries covered are Austria, Belgium, Finland, France, Germany, Italy, Netherlands, Spain, Sweden and UK. Red area indicates the range of productivity levels and the solid red line is the weighted average European productivity level.

Figure 4. Since 2005, anemic TFP growth is the new normal



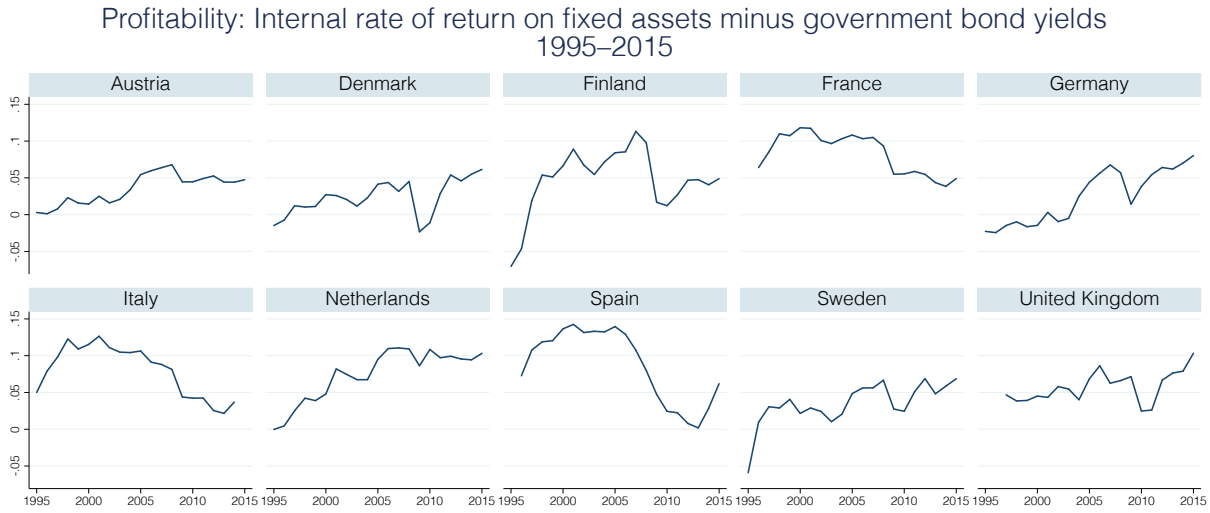
Source: EU KLEMS 2017, combined with EU KLEMS 2012.
Notes: ICT sector covers ICT goods and services, Bubble sectors are finance and construction.

Figure 5. TFP fell in 2009, rebounded in 2010



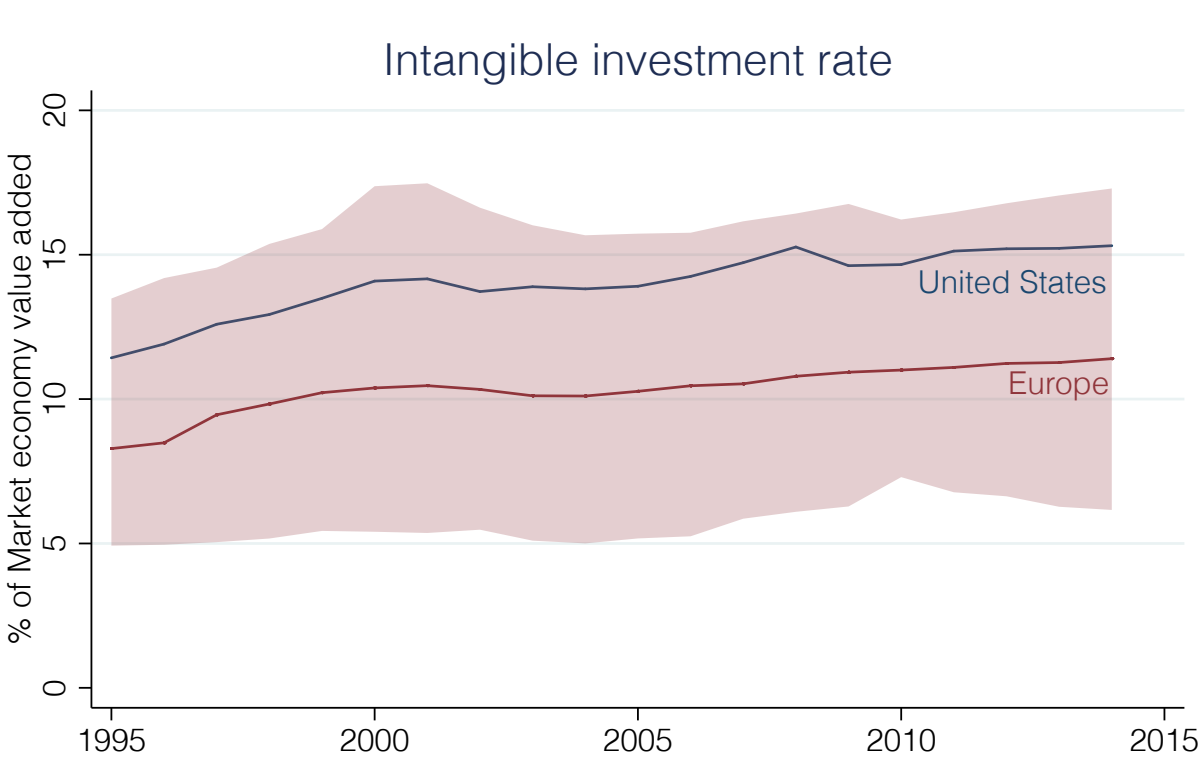
Source: Conference Board Total Economy Database.

Figure 6. Market power: increase in apparent profits in many countries



Source: IRR: EU KLEMS 2017, computations by Daan Freeman. Government bond yields: ECB

Figure 7. Steady rise in intangible investment



Source: INTAN-Invest Database, Corrado et al. (2016).
Notes: European countries covered are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luexmbourg, Netherlands, Portugal, Spain, Sweden and UK. Red area indicates the range of investment rates and the solid red line is the weighted average European productivity level.