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The Widening Productivity Gap and the Underperformance of ICT-Intensive Sectors in France

Sébastien Bock, *OFCE*
Penelope Gelman, *OFCE*

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Over the last three decades, labor productivity increased more rapidly in the U.S. than in Europe. In 2019, hourly productivity in the euro area was 82% of that in the U.S., compared to 98% in 1995.[1] The widening transatlantic productivity gap sparked interest recently with the 2024 European Elections and the recent report on the future of European competitiveness conducted by Draghi (2024). Amongst other features, the report documents the innovation gap between Europe and the U.S. highlighting the crucial role of digital sectors which the author believes to be *"already lost"*. Policy Brief 128 (2024) and Policy Brief 130 (2024) also reassess the European and notably French growing divide in revenue per capita with respect to the U.S. over the 2000-2019 period. Both contributions reveal a worrying European anemia in productivity growth. As expected, European countries are still marked by a severe lack of investment per worker both in ICT and non-ICT tangible capital potentially contributing to the growing productivity gap.

Meanwhile, in his famous book review *"We'd Better Watch Out"*, Solow (1987) noted that *"You can see the computer age everywhere but in the productivity statistics"* as if Information and Communication Technologies (ICT) induced little to no productivity gains despite an apparent technological revolution since the 80s. This phenomenon is famously known as the Solow Paradox. Acemoglu et al. (2014) argue that the paradox persists, at least in the U.S., insofar as the productivity gains associated with ICT remain difficult to measure.

The above elements raise questions about the potential role of ICT in driving the widening productivity gap: Do ICT-intensive sectors experience more pronounced productivity

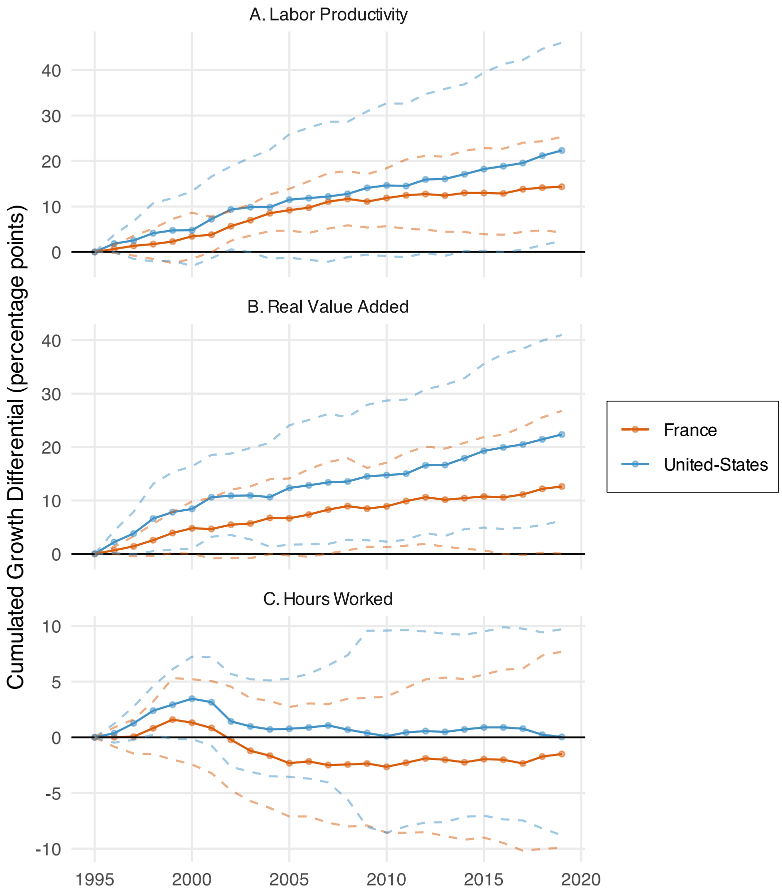
[1]The 19 Eurozone countries considered are Germany, Austria, Belgium, Cyprus, Spain, Estonia, Finland, France, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Portugal, Slovakia, and Slovenia. Labor productivity is calculated as the ratio between GDP, expressed in constant 2015 purchasing power parity, and the number of hours worked. Sources: OECD and authors' calculations.

gains than non-ICT intensive sectors? Are those sectors performing worse in France than in the U.S. thus contributing to the growing productivity divide between both countries? What are the sources of the aggregate and sectoral productivity growth divergences? In this blog, we assess whether ICT-intensive sectors experience greater productivity gains. We also explore the sources of performance differences between France and the U.S. Finally, we briefly discuss the implications of this divergence for the deployment of Artificial Intelligence (AI).

Differential productivity gains in ICT-intensive sectors

Figure 1 plots differences in sectoral outcomes between ICT-intensive and less intensive sectors in France and the U.S., over the period 1995-2019. The comparison concerns three indicators: hourly labor productivity, real value added and hours worked. Higher labor productivity gains are observed in ICT-intensive sectors over the period. Sectors whose ICT investment rate was one standard deviation above the mean recorded differential gains productivity of 22.3 percentage points (pp) between 1995 and 2019 in the U.S. In France, this differential is also positive but significantly lower for a total of 14.3 pp over the period. The asymmetric growth of labor productivity in ICT-intensive sectors reflects a relatively greater increase in real value added in both countries. This growth differential in real value added amounts to 22.4 pp in the United States and 12.6 pp in France over the entire period. The relationship between hours worked and ICT intensity is almost zero for both countries. The difference in variation in hours worked is almost zero in the United States and −1.5 pp in France in the ICT-intensive sectors during the period.

Figure 1: ICT-intensive sectors growth differential in France and the U.S. between 1995 and 2019



Note : The cumulative growth differential of the variable considered of ICT-intensive sectors (solid lines) is estimated from a regression presented in Box 1. The 95% confidence intervals (dotted lines) are based on clustered standard deviations by sector. We consider a panel of T=25 periods from 1995 to 2019 period and J=26 sectors excluding agricultural (A), pharmaceutical products (C21), activities of households as employers (T) and activities of extraterritorial organizations and bodies (U). Source : EU KLEMS National and Capital Accounts (Bontadini et al., 2023), authors' computations.

It appears that productivity gains were higher in ICT-intensive sectors in both countries. These results support the idea that investments in ICT improve the productive efficiency of the economy, thus leading to an expansion of economic activity. However, the relative growth of economic activity in ICT-intensive sectors is less pronounced in France than in the U.S., revealing lower economic performances. ICT-intensive sectors did not experience a substantial variation in hours worked compared to less ICT-intensive sectors. These sectors may have experienced an increase in labor demand induced by the expansion of economic activity, offset by a drop in labor demand arising from the automation of certain tasks by ICT.

Box 1 : Estimation of outcome differentials in ICT-intensive sectors

In order to measure the productivity gains differential of ICT-intensive sectors with respect to less ICT-intensive sectors, we estimate a set of descriptive regressions as in Acemoglu et al. (2014):

$$Y_{jt} = \delta_t + \gamma_j + \sum_{t=1995}^{2019} \beta_t \times ICT_j + \varepsilon_{jt}.$$

We regress several sector-level outcome variables Y_{jt} (hourly labor productivity, real value added, and hours worked expressed in logarithm) on a static measure of sector-level ICT intensity, TIC_j. This measure of ICT intensity is computed as the sector average ratio of ICT gross fixed capital formation expenditures over total gross fixed capital formation over the 1995 to 2019 period. ICT gross fixed capital formation expenditures include both tangible capital in information and communication capital. We also add softwares and databases which are intangible capital assets in order to properly capture the digitalisation of the economy. This average ratio is then standardized to have zero mean and unit standard deviation in order to focus on relative differences across sectors of different ICT-intensity. Regressions are weighted by hours worked and include sector γ_j and year δ_t fixed effects. We conduct these regressions for France and the U.S. separately in order to capture potential differences in performances of ICT-intensive sectors between the two countries. Labor productivity is measured as the ratio of real value added over total hours worked.

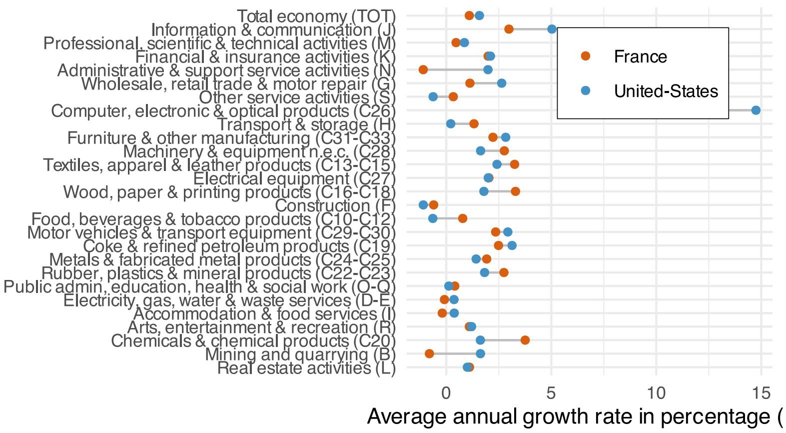
The coefficients of interest β_t represent the estimated effect, measured in log points, of a one standard deviation increase in the sector-average ICT investment rate on the variable of interest over the 1995 to 2019 period. As such, the estimated parameters grasp the cumulated differential growth in the variable of interest in ICT-intensive sectors relative to less ICT-intensive ones, with 1995 being the reference period ($\beta_{1995} = 0$). The estimated coefficients are converted into percentage points.

It is noteworthy that these regressions do not capture a causal link between ICT use and growth in labor productivity. They provide descriptive relationships and preliminary elements on the differences in performance of ICT-intensive sectors between France and the United States.

France's anemic productivity growth in key ICT-intensive sectors

Figure 2 provides the compound annual growth rate of aggregate labor productivity for France and the U.S. between 1995 and 2019, for the whole economy (top line) and for each sector ranked by decreasing order of ICT intensity as measured in the U.S. Labor productivity grew by a compounded annual growth rate of 1.1% in France compared with 1.6% in the U.S. between 1995 and 2019. This seemingly narrow gap of .5 percentage point (pp) represents an impressive cumulative growth differential of 15.7pp over the 24 year period, i.e. 45.3% for the U.S. against 29.6% for France.

Figure 2: Average annual growth rate of labor productivity in France and the U.S. between 1995 and 2019



Note : The total economy's average annual growth rate for each country is positioned first at the top of the Y-axis. Sectors are then ranked according to the U.S. ICT-Intensity measure. Average annual growth rates are expressed in percentage. Source : EU KLEMS Growth Accounts (Bontadini et al., 2023), authors' computations.

Among the sectors that experienced the largest differences in productivity growth are some of those that are the most ICT-intensive, highlighting the lower performance of ICT-intensive sectors in France compared to the U.S. Indeed, there is a growth rate difference of 2pp between the two countries in the Information and Communication sector (J), a 3.1pp gap for the Administrative & Support Service Activities (N), a 1.5pp gap for the Wholesale and Retail Trade sector (G) and a massive 7pp gap for the manufacturing of Computer, Electronic and Optical Products sector (C26). These substantial differences in labor productivity growth confirm the lower performance of key ICT-intensive sectors in France.

It is worth noting that these sectors encompass manufacturing, service and trade. This points to their potential interdependence in generating productivity gains (Blog OFCE, 2024). Manufacturing is essential to produce high quality hardware while information and communication sectors supply the embedded software and digital services. These products are then used and diffused through by midstream sectors such as wholesale and retail trade to finally be further utilized by service providers through support activities. It is reminiscent of Solow (1987)'s words that *"high productivity business services are really inseparable from the production of the goods they service"*.

Sluggish capital deepening and TFP growth in France

Growth accounting provides us with the necessary tools to grasp some understanding of the growing productivity gap between France and the U.S.[2] EU KLEMS Growth Accounting database provides a growth accounting of labor productivity by country and sector. It decomposes annual labor productivity growth into five components:

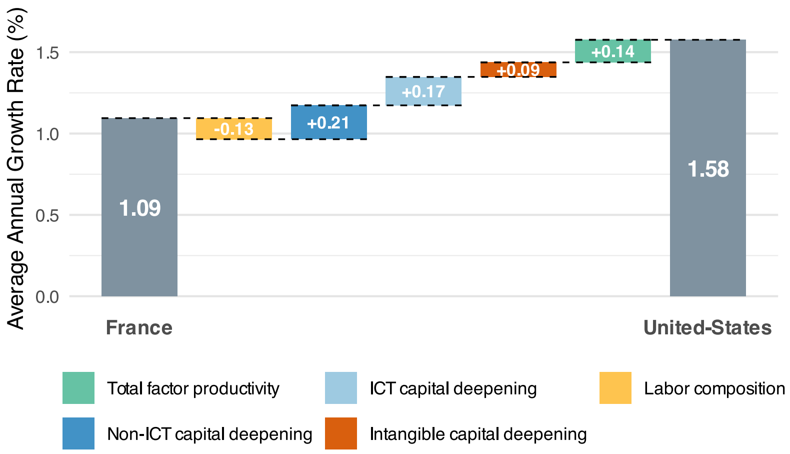
[2]See Solow (1957).

Productivity Gains (%) = Total Factor Productivity Component
+Non-ICT Tangible Capital Deepening Component
+ ICT Tangible Capital Deepening Component
+ Intangible Capital Deepening Component
+ Labor Composition Component

The first component captures the contribution of Total Factor Productivity (TFP), i.e the part of labor productivity growth that remains unexplained by changes in input uses. The next three components capture changes in labor productivity accounted for by capital deepening in three asset categories: non-ICT tangible assets (dwellings, buildings and structures, transport equipment), ICT tangible assets (computer hardware, telecommunications equipment) and intangible capital assets (R&D, software and databases, and other intellectual property products). Capital deepening refers to an increase in the amount of capital used per hour worked. As capital deepening occurs, each worker has more tools and resources to work with which boost productivity. The labor composition component captures the role played by changes in the quality of labor in terms of gender, age and education.

Figure 3 documents the difference in annual growth rates of aggregate labor productivity by comparing the contributions of the different components of growth accounting between France and the U.S. This analysis determines to what extent the differences in productivity gains between the two countries can be explained by differences in the evolution of TFP, capital intensity and the composition of labor. Over the 1995-2019 period, the French total economy is marked by a lack of capital deepening compared to the U.S. Of the 0.5pp difference of labor productivity annual growth, 0.4pp is accounted for by slower capital deepening in France from which 0.2pp is captured by slower ICT capital deepening and 0.2pp is accounted for by slower non-ICT capital deepening. The growth gaps in TFP and intangible capital intensity each account for 0.1pp. The dynamics of labor composition contribute negatively for −0.1pp in favor of France. The contribution of ICT is all the more notable as it reflects only the direct effect of ICT investment per worker on labor productivity, without including its indirect effect on TFP. Indeed, ICT adoption influences business organization, increasing output with constant production factors, thereby strengthening labor productivity through TFP.

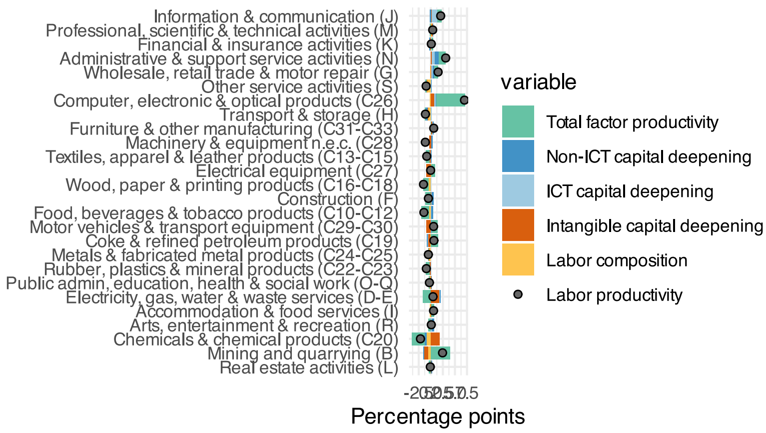
Figure 3: Decomposition of the average annual growth rate gap in labor productivity between France and the U.S. over the 1995-2019 period



Note : The difference in the average annual growth rate of labor productivity between France and the U.S. is decomposed into five components: differences in the contribution of total factor productivity growth, non-ICT capital deepening, ICT capital deepening, intangible capital deepening and in labor composition. Source : EU KLEMS Growth Accounts (Bontadini et al., 2023), authors' computations.

We now turn to the four key ICT sectors highlighted previously. To this end, Figure 4 depicts the breakdown of the differences in annual growth rates of sectoral labor productivity between France and the U.S. In the Information & communication sector, the 2.1pp gap in annual productivity growth is accounted first and foremost by a lower contribution of ICT capital deepening (1.2pp) with TFP contributing to a lesser extent (0.9pp). In the Administrative & support service activities, the 3.1pp gap is driven by slower TFP growth (1.4pp), along with weaker capital deepening both in non-ICT (1pp) and ICT capital (0.6pp). In wholesale and retail trade, the 1.5pp gap in productivity gains is explained by slower TFP growth (0.8pp) and a smaller contribution from capital deepening both in ICT assets (0.4pp) and non-ICT assets (0.4pp). Finally, the manufacturing of computer, electronic & optical products sector is plagued by a substantial productivity growth gap of 7pp. Most of this difference is accounted for by weaker TFP growth (5.9pp) followed by weaker Intangible capital deepening (0.7pp). Anemic ICT and non-ICT capital deepening each account for 0.2pp.

Figure 4: Decomposition of sectoral average annual growth rate gaps in labor productivity between France and the U.S. over the 1995-2019 period



Note : Differences in the average annual growth rate of labor productivity between France and the U.S. are decomposed into five components: differences in the contribution of total factor productivity growth, non-ICT capital deepening, ICT capital deepening, intangible capital deepening and in labor composition. A positive difference implies a higher contribution in the US than in France. Sectors are ranked according to the U.S. ICT-Intensity measure. Values are expressed in percentage points. There are missing values for labor composition and thus TFP components in the machinery and equipment (C28) sector due to missing values in the U.S. Source : EU KLEMS Growth Accounts (Bontadini et al., 2023), authors' computations.

Altogether, capital deepening and TFP growth both play a key role in explaining the widening labor productivity gap between France and the United States. These results suggest that France is on a less favorable growth path. Furthermore, the shortfall in ICT investment per worker is not only borne by ICT-producing sectors, but also by other sectors that use these technologies. However, ICT investment per worker is not sufficient to generate productivity gains for the overall economy if it remains concentrated in a few sectors. For these investments to fully benefit the economy, non-ICT-producing sectors must fully integrate these new technologies. Otherwise, bottlenecks are likely to appear: sectors lagging behind hold back overall productivity, even as leading sectors continue to progress.[3]

Fostering investment to harness AI's benefits, despite substantial uncertainty surrounding its potential productivity gains

Standard economic theory, particularly the Solow growth model, argues that economic growth results both from capital deepening and technical change. However, only technical change, as measured by TFP growth, can generate sustained economic growth, whereas capital deepening produces only temporary growth due to decreasing returns to capital. However, capital deepening, particularly in ICT assets, remains critical in light of current technological developments such as AI, which relies on digital assets.

[3] See Acemoglu et al. (2023).

Empirical evidence of AI productivity gains remains scarce. Amongst the most optimistic forecasts, McKinsey & Company (2023) has reported that generative AI could lead to labor productivity gains of 0.1% to 0.6% annually through 2040. When combined with other technologies, these gains could reach 0.5% to 3.4% per year depending on their level of adoption. Goldman Sachs (2023) predicts that AI could drive a 7% (or almost $7 trillion) increase in annual global GDP and increase U.S. productivity growth by an annual 1.5pp over the next decade. In contrast, Acemoglu et al. (2014) estimate that the effects of AI on TFP will be no more than an annual TFP increase of 0.07% to 0.05% over the next decade in the U.S. In terms of GDP growth, the effect of AI is expected to range between 0.092% to 0.11% annually. On one hand, AI has the potential to boost productivity by lowering production costs through automation and by creating new productive jobs. On the other hand, productivity gains from AI might be constrained by its limited capacity to automate more complex tasks as well as to sufficiently increase the productivity of more simple newly automated tasks. Moreover, AI might have sizable adverse macroeconomic effects, such as through misinformation, manipulation without proper regulation.

As for now, the lack of long-term empirical evidence prevents us from making a definitive claim about AI's impact on productivity gains. Despite this uncertainty, one can reasonably assume that in order to harvest the potential benefits of AI, firms must already be equipped with ICT capital assets on which AI heavily relies. Without substantial investments in these assets (Blog OFCE, 2024; Draghi, 2024), AI implementation will likely fall short of productivity gains, causing France and other European countries to fall further behind the U.S.

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