

The « Productivity Puzzle »



Keywords: productivity, innovation, secular stagnation, human capital

Summary:

- Productivity growth has slowed down considerably since the financial crisis in many developed countries and does not seem to be gaining pace, in the UK and the US in the first place;
- This “productivity puzzle” is partly the result of cyclical factors in line with impaired financial markets and reluctance to invest;
- In the same vein, the maturation of the innovation wave of the New Information and Communication Technologies as well as the existence of drags to the diffusion of these innovations are as many structural factors to this puzzle;
- Difficulties to measure the benefits of digital innovations to the economy, as well as the perspectives of “secular innovation” in the wake of Big Data and Artificial Intelligence however soften the fearmongering perspectives on an indefinite stagnation of productivity;
- The stimulation of demand and the easing of political uncertainties appear as key solutions in the short term, as well as the stimulation of free-trade and entrepreneurship, the reduction of inequalities, and the stress on human capital over the longer term

An essential component of long-term economic growth, the question of productivity improvement is a key element for public policies as well as for the growth perspectives at company level.

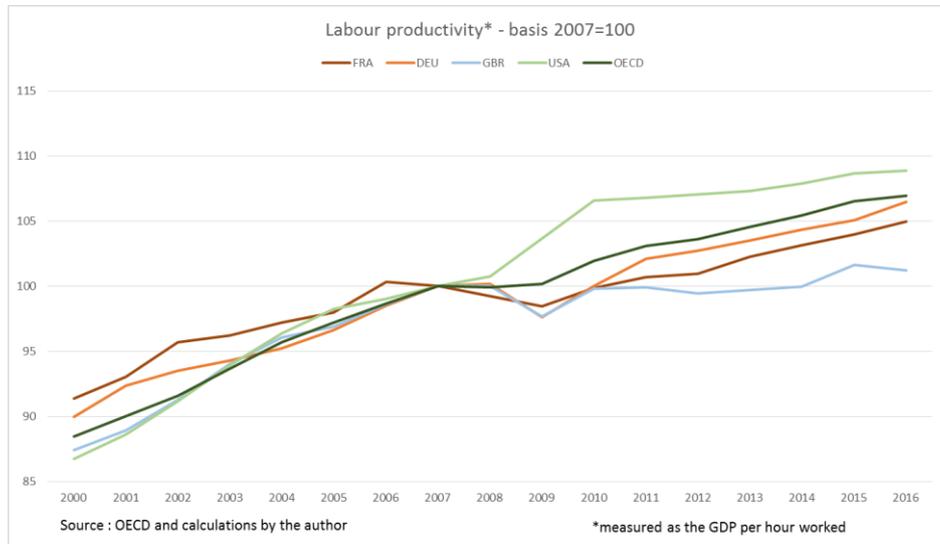
“Productivity isn’t everything, but, in the long run, it is almost everything. A country’s ability to improve its standard of living over time depends almost entirely on its ability to raise its output per worker.”

It is no accident that Nobel Prize laureate in Economics Paul Krugman attached such an importance to productivity – that we will measure in this article as the output we get from every hour worked or from every worker (labor productivity). It does play a central role among the determinants of long-term economic growth. Companies’ long term growth is indeed backed by a productivity growth which can allow them to pass the efficiency gains as investments; in the same vein, this allows consumers to benefit from lower prices (subsequent to lower unit costs).

On the macro side, improved competitiveness and trade performance are a positive point for the more productive industry. To summarize, productivity growth is the only way through which to keep sustained economic growth without inflationary pressures. Labor productivity is even more paramount in developed economies whose low birth rates slow the labor force expansion. According to the economic theory, labor productivity can be measured from three elements: human capital, innovations and economies of scale. The same model (R. Solow, 1956) predicts that in the long run, permanent growth is achievable only through a higher technological progress by worker.

In an era marked by the surge of digital technology, it is expected that productivity growth will soar, at least in the developed countries - the rise of the robots, artificial intelligence, Big Data and the Internet of Things has even coined the term of “secular innovation” or “second machine age” as [Brynjolfsson and McAfee](#) have put it.

However, it is surprising to notice that for many developed countries – and especially the UK and the US – productivity growth since the financial crisis is significantly lower than it would have been had the pre-2008 growth trend continued, and even as economic growth and labor market conditions have improved. The graph below shows that the UK and to a lesser extent the US have been experiencing a hysteresis in their productivity growth – a permanent stall after the financial crisis, whereas the other major countries and the OECD as a whole have only seen a temporary decrease before getting back to the pre-recession trend.



Limited growth in the aftermath of the financial crisis is often associated to this phenomenon. As we will see, the productivity puzzle is the result of both cyclical factors and structural factors.

1) Cyclical factors

Crisis legacies play an important role in the productivity puzzle; the lack of confidence as well as the impaired financial markets this crisis had led to are as many persistent factors that prevent productivity and growth from taking off.

1.1 Labor hoarding instead of investment?

Strong employment figures may first be a part of the answer about this sluggish productivity, as it shows that companies prefer to hire people rather than investing on new technologies or infrastructure, showing that companies are still highly uncertain about the future, especially in the UK where the effects of Brexit are still to be determined. Firms might be hoarding labor in anticipation of a bounce back in demand or because of minimum staffing levels required to keep the business going. As UK's [Office for Budget Responsibility](#) reports, weak real wages as well as permanent corporate goods surplus suggest a high degree of spare capacity, and productivity growth is locked until demand bounces back. The problem is, as [Martin and Rowthorn](#) point out, that this spare capacity is mainly concentrated among high productivity sectors. This labor hoarding theory is illustrated by the analysis of UK's [Engineering Employers' Federation \(EEF\)](#) which shows that the latest financial crisis saw large contractions in GDP but not the same extent of employment losses compared to previous recessions. Cazenove Capital's [Richard Jeffrey](#) also points the potential damages of trans-national labor mobility, which can allow access to cheaper labor for companies and discourages them from undertaking productivity-enhancing investments; while this is definitely the case for the UK within the EU, we can wonder about the following as Brexit is taking shape.

1.2 A persistent consequence of impaired financial markets?

What if this sluggish productivity was nothing more than a persistent (or even permanent) consequence of the financial crisis? Poor credit conditions in the immediate aftermath of the financial crisis ([Bank of England](#)) have hardly hit companies' investment plans, and especially for young companies, for whom productivity growth is the fastest ([Edgerton, Chodorow-Reich](#) as well as [Greenstone and Mas](#)) - the relative inefficiency in the transmission of the expansionary monetary policy to the real economy has not allowed afterwards a significant improvement of the credit conditions to companies. The ability of SMEs to mobilize credits has also been limited in the aftermath of the financial crisis by the drop in the value of the collateral that they can use to back their loans, as [Bahaj et al.](#) show for instance with the drop in housing prices in the UK over the period 2008-12.

Eventually, limited resource reallocation between firms and across sectors has long restrained the diffusion of technologies and ideas. However, the progressive easing in credit conditions as well as the rebound in housing prices (mainly in the UK) have not allowed productivity to rebound; the explanation to the puzzle might then be hidden somewhere else. In their analysis paper "Gone with the Headwinds", the [IMF](#) also points the vicious circle effect of weak aggregate demand leading to weak investment, and weak capital-embodied technological change – especially in the developed countries, as well as elevated economic and policy uncertainty which may have more persistently weakened TFP growth (Total Factor Productivity – a measurement of the efficiency of the combination of production), partly by tilting investment away from higher-risk, higher-return projects.

Some economists also blame low nominal interest rates for the productivity stagnation, as cheap money from banks and financial markets have helped to keep afloat unproductive or "zombie" companies and prevented the "creative destruction" of firms necessary for the innovation process. Bank forbearance may also have had a similar non-negligible effect, as [Arrowsmith](#) points out. However, on the opposite side of the spectrum, the [Bank of England](#) has estimated in a study that higher interest rates also have mitigated effects on productivity: indeed, even though they tend to "eliminate" the weakest companies, they also have harsh effects on high-leverage, high-productivity companies; according to the authors, a Bank rate increase from 0.25% to 4.25% would have an overall effect to boost productivity by around 1 or 2% relative to the baseline – but with 1.5 million jobs sacrificed Britain-wide.

To summarize, the effects of impaired markets have led potential 'zombie firms' to keep operating despite lower returns, but also to some distortion in capital allocation, as companies with high rates of return had benefitted from the same conditions as the others and the ambient uncertainty had prevented bank and funds from fully appreciating the profitability of projects of the most profitable businesses. A side issue of that distortion is that SMEs have been hit harder by capital constraints than bigger companies which have the ability to ensure other accesses to funds; however, as [Scarpetta et al.](#) point out, new (small) firms can have relatively large contribution to productivity

growth possibly because they enter with a more efficient mix of capital and labor and new technology.

2) Structural factors

A longer-term analysis also suggests that the current productivity crisis needs to be analyzed as part of an innovation wave, whose dynamics are essential to understand the puzzle issue. Other structural elements as demographics and diffusion dynamics are also paramount to that understanding.

2.1 An illustration of the secular stagnation?

A structural issue described by [McKinsey Global Institute](#) is linked to the demographics dynamics in the developed world, where the ageing population puts a strain on future economic growth. The authors have estimated that in order to prevent an expected decrease by 40% of the rate of GDP growth due to a shrinking pool of available labor, productivity growth would need to accelerate by 80 percent from its historical rate. Illustrating the theory of “secular stagnation¹”, [NBER’s Gordon](#) points six headwinds that permanently drag down growth in the case of the US: demography, education, inequality, globalization, energy/environment, and the overhang of consumer and government debt. As [Larry Summers](#) also highlights, a lower global investment of businesses, households, and the public sector puts a permanent constraint on developed countries’ growth.

2.2 A long-term slump in innovation?

An associated theory of the secular stagnation is that the slump in productivity that we have been focusing on for the last decade needs to be analyzed as the prolongation of a long term decreasing trend over the last 30 years - with the exception of the uptick during the years of the Dotcom/Internet Bubble of the late 1990s. In this view, the current Kondratiev wave of innovation², grounded in ICT, does not have the same potential as past innovations – such as the assembly lines (Fordism) for instance; an extension of that theory would even be that the ICT innovation wave has already matured and the subsequent productivity enhancements have already faded – [Decker et al.](#) indeed illustrate it by observing a fall in entrepreneurship in high tech sectors over recent decades; a linked issue pointed by [Frey](#) is that digital technologies are much less capital-absorbing, creating only little new investment demand and jobs creations relative to other revolutionary technologies. However, numerous emerging technologies with the potential to revolutionize the economy, such as robotics, artificial intelligence, Big Data or the transcription of human genome are expected to skyrocket productivity in the future. A study by [Accenture](#) evaluates for instance up to 40%

¹ A BSI Talks presentation of the Secular Stagnation theory is available through [this link](#) (in French only)

² Highlighted by Nikolai Kondratiev in 1926 and later theorized by Joseph Schumpeter, the Kondratiev waves are hypothesized long-term economic cycles ranging from 40 to 60 years, linked to the appearance and diffusion of “innovation clusters” in the economy, so to technical progress. Once these innovations are fully diffused in the economy, the decrease in demand and the heightened competition between producers lead to a process of “creative destruction” through which the least profitable companies and sectors are “eliminated”, until the start of a new cycle through the appearance of a new wave of innovations

productivity growth by 2035 in 12 developed countries thanks to Artificial Intelligence. [Janeway](#) even shows by the comparison of the duration of the two historical Industrial Revolutions to diffuse to the whole economy that 50 years onwards from the invention of the microprocessor, the digital “revolution” might in fact be in full maturity, as shown by the combination of Open Source software tools and cloud computing resources which reduces significantly the cost of experimentation for new web services (Uber is actually the perfect illustration of the new provision of services these evolutions allow). As we see, the structural productivity trend still raises debates among economists; it could in fact hide two side issues: mismeasurement of productivity growth and a brake in diffusion dynamics.

2.3 A problem of measurement?

The measurability of productivity is complicated by the wave of digital innovation in the services – and the surging digital economy as a whole. Rapidly falling prices in the telecommunications industry and innovations such as smartphones have increased productivity greatly, but in ways that are hard to measure, compared with factory output. For example, between 2010 and 2015, UK data usage rose ninefold, but because the cost of delivery had plunged, the official figures suggested the output of the telecoms industry had fallen by 4%, says [Hamish McRae](#). The mismeasurement of the productivity gains new technologies offer seem to make official statistics underestimate economic activity, as [Feldstein](#) or [Bean](#) highlight (productivity growth in the UK might be under-estimated by around 0.5 percentage points per year, as a result of the failure fully to capture elements of the digital economy). However, [Syverson](#) stresses that mismeasurement issues are unlikely to account for the majority of the productivity puzzle, for several reasons:

- First, the productivity slowdown has occurred in dozens of countries, and its size is unrelated to measures of the countries’ consumption or production intensities of information and communication technologies;
- Second, the surplus created by internet-linked digital technologies only represents a small share of the estimated \$2.9 trillion of “missing output” resulting from the productivity growth slowdown in the US;
- Eventually, the evolution of the “productivity gap” is not linked to the pace of diffusion of new technologies in the economy, showing that both elements are not totally intertwined.

2.4 A brake in diffusion dynamics?

Observations from OECD’s [Andrews](#) have indeed shown that the rates of diffusion of innovations between companies and between countries have progressively stalled with the development of the digital economy; strong network economies of scale and scope, as well as higher competition and restrictions on patents and intellectual property have encouraged the development of natural monopolies or oligopolies and prevented the trickle down of innovations. According to an analysis from the [OECD](#), the sluggish average productivity might in fact hide a growing divergence between “frontier” companies (top 5%) who have maintained historic trend growth in productivity and average “laggards” who have stagnated in the meantime. Broadband access to Internet, as well as the effort to develop and deploy ways to mine and monetize the data that their business activities

generate are the quoted elements that differentiate frontiers (epitomized by the GAFA) and the laggards in an era where the driving source of value in the IT has shifted from hardware to software and ultimately to data (through machine learning in the first place). Other elements are also advanced such as poor managements practices ([Bloom and Van Reenen](#)) or increased regional / sectoral dispersion, especially in the case of UK where the City's financial services have widened their productivity gap with the other regions and sectors. In the same vein, export-oriented firms outperform domestically-oriented ones as they are more likely to be exposed to global competition and to be integrated into global supply chains; the openness to trade and FDIs is indeed a catalyst of productivity through global competition and innovation. Eventually, historically, at the macro level, the progressive increase of the services over the industries in the developed countries has also been costly in terms of productivity growth, the former reading less productivity gains than the latter. This divergence in productivity trends refutes the hypothesis that stalling innovation has been the key driver of the productivity slowdown. In fact, this widening productivity dispersion means that secular innovation and stagnation are complementary, not competing, hypotheses.

Recommendations

As we have seen, the productivity puzzle relies on structural factors such as demographics dynamics and a fading innovation cycle, themselves amplified by persistent legacies of the financial crisis. What can be done to fight against these damaging factors?

Addressing the legacies of the crisis should be the highest priority in the short term: policy uncertainties have indeed highly restrained companies' investment and risk-taking in the European Union; in the same vein, stimulating demand appears as a short-term priority to counter the effects of the crisis. Infrastructure spending has also been described as a priority, notably in [UK's Budget 2017 Autumn Statement](#), which emphasizes transport and broadband investment, notably to fight against geographical inequalities.

However, several structural challenges also need to be considered over the medium term: nurturing open trade and migration policies, which have delivered sizeable TFP gains in past decades by allowing a better allocation of the production factors to the most efficient sectors, as well as dealing with inequalities to redistribute income to those with a higher propensity to spend, would be ways to ensure gains are widely shared across and within countries. The issue of business skills for new generations has also been widely brought by professionals and recruiters ([PwC UK](#)) – collaboration, resilience and adaptability are often quoted; in the same vein, rising health or wellbeing issues at work also raise concerns; the aim is then to develop the “human capital” to support productivity. Addressing education and training policies may then be a priority for governments. Creating an environment that encourages more entrepreneurial risk taking would also be complementary; Gordon suggests a basic guaranteed income, which would help this purpose by capping the downside to entrepreneurial failure while boosting spending and combating inequality. Eventually, greater recognition of the importance of companies' intangible assets, such as intellectual property is key to

technological innovation – the under-valuation of this class of assets compared to more “tangible” assets indeed raises the cost of capital for these companies to sub-optimally high levels; supporting the financing of innovative companies in their long-term investment efforts (the UK’s Finance Ministry suggests for instance in their [2017 Industry Panel Review](#) the creation of a Patient Capital Investment Vehicle to combat the lack of capital availability for UK’s entrepreneurs) as well as the diffusion of innovations to the long tail of less-efficient companies is also a key priority.

Sacha TENEBAUM