Is weak productivity growth a fatality ?

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Introduction

Economic growth in the advanced economies has been relatively subdued since the global economic and financial crisis of 2008-9. This both when compared with growth figures recorded in the years before the crisis and when compared with growth figures recorded shortly after previous crises. To an extent, this unexpected sluggishness reflects shrinking labour productivity growth, which continues to be slow at this time. With productivity gains a key driving force of living standards in the long term, this situation naturally raises concerns.

Against this backdrop, this article attempts to outline recent productivity trends in the major advanced economies. The first section defines what productivity means, while the second delves deeper into the stylised facts for the United States, the euro area, Japan and the United Kingdom. The third and final section sets out a range of factors that have contributed to recent falls in productivity gains, making a distinction between structural and cyclical forces.

1. Productivity : what exactly is it ?

In conceptual terms, an economy's total production of goods and services is underpinned by two fundamental elements : labour volume and labour productivity. The labour volume is the total number of hours worked in the economy and reflects such varying factors as labour force participation, employment rate, regulatory working hours and even the population's age pyramid. Labour productivity, in turn, equals production volume per hour worked and to some extent measures the efficiency of working hours. It depends, for one thing, on the capital intensity of production – i.e. the amount of capital per hour worked – as hourly production per employee can be enhanced by the purchase of equipment and other means of production. A second determining factor is what economists call total factor productivity, or multi-factor productivity. This factor captures the general efficiency with which a country manages to bring together labour and capital to produce, and is informed by such drivers as innovation, the general level of education, management practices, competitiveness, quality of institutions, economies of scale, the regulatory framework within which companies develop and more.

Equation – Labour productivity growth

- $\Delta \frac{Real\ GDP}{Hours\ worked} = F(\Delta capital\ intensity, \Delta total\ factor\ productivity)$

Total factor productivity reflects the level of production efficiency in companies on the one hand and, on the other, how well these resources – i.e. labour and capital – are allocated across companies (IMF, 2017). Companies' production efficiency typically depends on discoveries by innovating firms and by other firms adopting such innovations and best practices. In turn, innovation and the integration of new technologies in the production process require investment

in both tangible assets (buildings, equipment and machinery, infrastructure, etc.) and intangible assets (R&D, education, intellectual property, organisational expertise, etc.). Obviously, then, capital intensity and total factor productivity are closely linked, all the more so because technological progress is partly incorporated in capital: new capital goods integrate new technologies and these new goods are typically more efficient than the old ones. How optimal an economy's resource allocation is depends on its ability to effectively shift such resources to the most efficient sectors and firms. Such efficacy should be part and parcel of a smoothly running financial system as well as an economy's processes of creative destruction and reallocation of resources. These processes should ensure that the least productive companies and sectors disappear and make way for the most efficient firms and the most innovative activities.

An increase in total factor productivity equals real GDP growth that is explained by neither labour nor capital as a factor. It measures residual growth that turns out to be dependent on the degree to which production inputs are used.

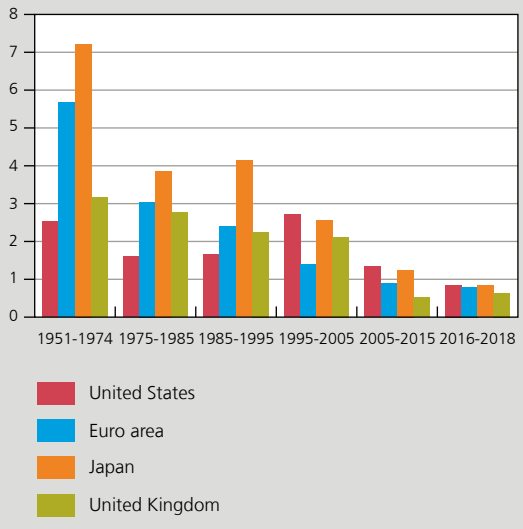
Total factor productivity is a hot issue: in the longer term it is the only recurrent source of economic growth (Van Ark, 2014). Unlike the two factors labour and capital, it does not have any clear physical limitations. Through technological progress and innovation, it is a key determinant of a country's average living standards, and particularly so in societies facing demographic ageing, in which labour volumes grow less rapidly that the total population.

2. Productivity growth in the advanced economies: stylised facts

Following thirty years of prosperity after the Second World War, labour productivity growth in the advanced economies slowed for the first time, and not just in the euro area countries and Japan, which had staged a remarkable economic catch-up after the war. In the United States, too, productivity gains broadly halved between the post-war period and the decade between 1974 and 1984.

CHART 1 LABOUR PRODUCTIVITY

(real GDP per hour worked, average annual growth)



Sources: Conference Board, OECD.
(1) Before 1996: GDP-weighted average for Germany, France, Italy and Spain.

Ignoring some divergence between these economies, the three subsequent decades generally witnessed a new, gradual deceleration in productivity growth. Bucking this overall trend were the productivity gains notched up through the rapid development and spread of information and communications technology (ICT) in the United States between

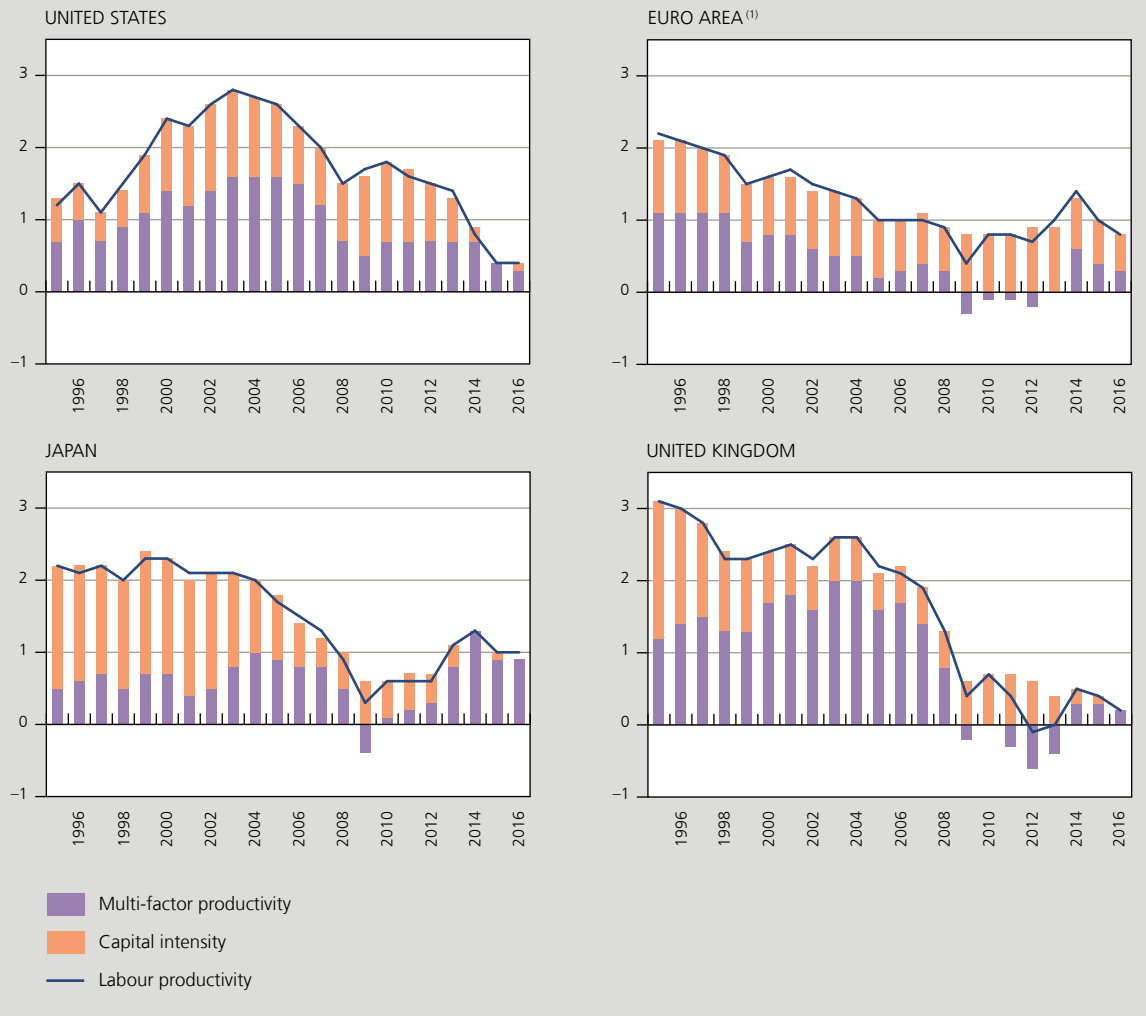
the mid-1990s and the mid-2000s. From 2004, however, these gains gradually evaporated, even before productivity growth lurched down again in the aftermath of the 2008-9 global financial crisis. Compared with the previous decade, the years after 2005 saw labour productivity gains more than halve in the key advanced economies, and productivity has staged only subdued growth since, despite the economic recovery.

A deep dive into the components of labour productivity reveals that contracting gains initially reflected slowing total factor productivity growth, both a persistent and general phenomenon in the advanced economies. That said, both Japan and the euro area have recently shown some tentative signs of recovery.

At the same time, the capital intensity of production went up in the early stages of the crisis. This was a consequence of the reduced number of hours worked due to slowing economic activity and hence an increased amount of capital per hour worked – a much more pronounced phenomenon in the United States and the United Kingdom, as their labour markets tend to be more flexible.

CHART 2 CAPITAL INTENSITY AND MULTI-FACTOR PRODUCTIVITY

(five-year moving average annual growth)



Sources: Conference Board, OECD.

(1) GDP-weighted average for Germany, France, Italy and Spain.

However, since the end of the crisis, capital intensity has plummeted under the joint impact of a cyclical upturn in the number of hours worked and a particularly slow recovery in capital spending compared with previous business cycles (see Section 3). These effects are more notable in the United States, the United Kingdom and Japan, which have seen unemployment come sharply down over the past few years. That said, the former two experienced increased employment in sectors that are not all that productive, which also acted as a curb on total factor productivity growth (OECD, 2018 and Oulton, 2018).

The slowdown in productivity growth in the advanced economies affects most economic sectors and is not linked to the respective shares of these sectors in the overall economy. Generally speaking, though, slowing activity in key sectors such as energy and finance has hit aggregate productivity harder (Goldin *et al.*, 2018).

With productivity growth displaying the same dynamics as compound interest, small percentage changes can have major implications in the long term. Productivity, profitability, wages, aggregate demand, investment and economic growth all come together in a mix that can move from virtuous to vicious. A persistent slowing in productivity growth is, then, a legitimate source of concern.

3. Which factors inform declining productivity gains ?

The recent slowdown in labour productivity growth started before the global financial crisis of 2008-9 and intensified post-crisis. It is therefore relevant to make a distinction between structural factors already at play before the great recession and related cyclical factors. With IT an increasingly important factor in the economy and given the difficulty in accurately measuring its full contribution to GDP, the discussion must also touch on the issue of measuring productivity.

The different forces the literature uncovers typically hold back productivity by curbing innovative power or opportunities to integrate new technologies into production processes. These forces may also hinder smooth allocation of resources to firms or economic sectors. Identifying all factors and mechanisms at play is a complex business and their respective contributions are even more difficult to estimate. This article limits the discussion to the main elements explaining the decline in productivity gains, most of which are complementary and even interrelated.

3.1 Structural factors

3.1.1 Less revolutionary innovations

According to the proposition defended by Gordon (2012), among others, the innovations of the third industrial revolution (1960 to the present day) were less significant than those of the second industrial revolution (1870-1900). In other words, electricity, the internal combustion engine or running water contributed more to rising productivity than computers, the internet or mobile phones.

During the second industrial revolution, inventions included heating and cooling systems, lighting, the telephone, radio, motorcars, aircraft and antibiotics, which dramatically and pervasively changed living standards, communications, trade flows and mobility. These inventions fostered quick productivity gains across multiple decades between 1890 and 1972.

By contrast, the third industrial revolution, characterised by the development of information and communication technology (ICT), arguably spurred productivity only temporarily, and mainly between 1996 and 2004 along with the development and growing reach of the internet. Gordon (2012) claims that the inventions of the 2000s mainly related to entertainment and communication devices. These devices have become smaller and smarter, and offer growing numbers of features, but are less of a major influence on labour productivity or living standards than previous generations' innovations. In other words, the marginal benefit of iPhones is small compared with that of running water, the light bulb or television. Along the same lines, it could be argued that various recent innovations have only modestly enhanced earlier innovations. Electric or driverless cars are clearly less revolutionary than the original motorcar. Today's aeroplanes are more energy-efficient and less noisy, but they do not fly at any greater speed than those manufactured fifty years ago.

According to Bloom *et al.* (2017), return on R&D is declining, implying that it is becoming increasingly difficult to develop new ideas. Drawing on US examples, they argue that research efforts would have to double every thirteen years to keep GDP growth per capita at a constant level.

3.1.2 A new productivity paradox

Robert Gordon, who argues there has been a permanent slowdown in productivity gains, take a contrary view to that of the techno-optimists. The latter believe that the productivity slowdown is mainly due to the fact that GDP measurements fail to factor in massive quantities of information, entertainment and free services available on the internet. They emphasise that the consumer surplus in terms of digital products is exceptionally large and argue that GDP underestimates investment in intangible assets (Wolf, 2015). Techno-optimists reckon that the underlying acceleration of technological progress has not slowed and that the IT revolution will continue to transform economies (Brynjolfsson *et al.*, 2014, and Mokyr, 2013). More specifically, in the years ahead artificial intelligence, robotics, 3D printing and genetics may well provide for significant progress in areas such as mobility, production processes and medical science. As a result, the observed slowdown in productivity gains could well be temporary.

In 1987, the US economist Robert Solow wrote: "You can see the computer age everywhere but in productivity statistics". Between 1970 and 1980, it was obviously difficult to relate productivity gains to ICT developments. These gains became evident only from the start of the 1990s, mainly in the United States. Techno-optimists assume the possible emergence of a new productivity paradox: recent innovations and those currently under development will only have an impact in the years ahead, when the new technologies are mastered and gradually filter through to the wider economy.

3.1.3 Slowdown in the technology diffusion process

Regarding the idea of a new productivity paradox, it looks as if the aggregate slowdown in productivity growth since the start of the 2000s is masking a clear divergence between what the OECD refers to as global frontier firms and laggard firms (OECD, 2016). The best-performing companies continued to post high productivity gains of 3.5 % annually in manufacturing industry during the 2000s. By contrast, less high-performing companies reported a clear productivity slowdown, with productivity gains of around 0.5 % over the same period. The gap is even larger in the services sector, where the best-performing companies, concentrated in the ICT sectors, recorded productivity gains of almost 5 %, while other companies saw their productivity stall in the same period (Andrews *et al.*, 2015).

The differences between companies could partly explain the current paradox between lagging productivity gains and rapid technological advances in some areas (robotics, artificial intelligence, digitalisation, etc.). These may be attributable to a weakening competitive environment and growing winner-takes-all dynamics (Oulton, 2018). These dynamics are a particular hallmark of the digital technology sector, where dominant players often grab the lion's share of the market, leading to dominant positions and profits. These differences may also reflect the obstacles standing in the way of the diffusion of new technologies, notably related to the complexity of these technologies and the outlays and organisational changes that they require.

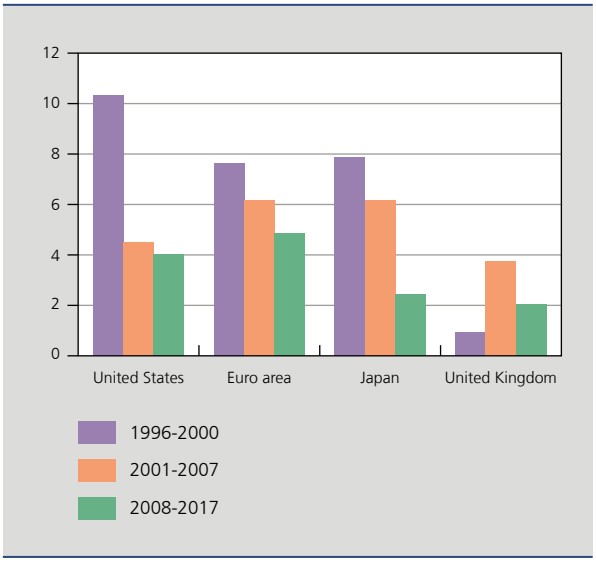
3.1.4 Flagging economic dynamics

In most advanced economies, the pace of growth of investment in intangible assets slowed during the 2000s (OECD, 2015). Such investment typically underpins innovations and encourages the spread of technology and knowledge-sharing between companies and sectors.

At the same time – and possibly in connection with these developments – the number of newly incorporated firms declined, evidenced by the drop in the number of start-ups relative to the total number of companies (ibid.). The decline started before the crisis and continued after its end. New, fast-growing companies, however, tend to play an important role in innovation. Drawing on data for eight European countries (Denmark, Finland, France, Italy, the Netherlands, Norway, Sweden and the United Kingdom), OECD (2015) demonstrated that, between 2002 and 2010, total factor productivity growth would on average have been at least 0.25 percentage points higher if the proportion of new companies had remained at 2002 levels.

CHART 3 INVESTMENT IN INTANGIBLE ASSETS

(average annual growth rate)



Sources: OECD, own calculations.

The literature does not shed any clear light on why economic dynamics are flagging. It does, however, mention several factors, including the ageing population, which arguably account for growing risk aversion; regulatory measures, which may have caused an increase in costs for new market entrants; and the notion that innovation is the prerogative of large, established corporations (Fernald and Jones, 2014).

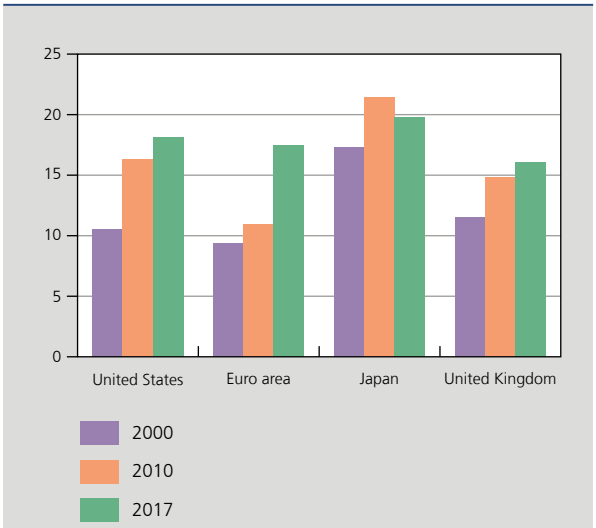
3.1.5 Ageing labour force

Generally speaking, labour productivity shows an inverted U-curve reflecting the age of the workers, with a significant decline after the age of 50 (Castellucci *et al.*, 2016). This change relates to the accumulated experience, the drop in the value of the gained expertise, and age-related trends in physical and mental fitness. A 2010 study by Vandenberghe and Waltenberg focusing specifically on Belgium, for example, shows that the productivity gap between older workers and those in the prime of their lives can be as high as 20 to 40 %.

Since the start of the 2000s, the number of older workers has, however, risen significantly. Relative to the total labour force, their number increased to over 15 % from around 10 % between 2000 and 2017 in the United States, the euro area and the United Kingdom. In Japan, where population ageing has advanced even further, older workers account for almost 20 % of the total workforce. A recent study (IMF, 2017) reveals that the ageing labour force may explain a decline in productivity gains in the advanced economies of between 0.2 and 0.5 percentage points annually in the course of the 2000s.

CHART 4 AGEING LABOUR FORCE

(workers aged 55 and over, in % of the total labour force)



Source: Thomson Reuters Datastream.

3.1.6 Slowing world trade

International trade allows economies to specialise in the production of goods and services in which they have a comparative advantage, and to capitalise on economies of scale and range. International trade also facilitates the spread of knowledge and technologies. And, by fostering competition, it boosts new product development and the implementation of more efficient production processes. In this way, trade supports productivity gains.

World trade growth, however, slowed down sharply in the wake of the global financial crisis. Compared with the levels recorded before 2009, the pace of growth in international trade has, on average, halved since 2012. The slowdown does not just reflect the fragility of the post-crisis economic recovery – it also reflects the waning pace of trade liberalisation over the past few years, increased protectionism as well as the maturation of both global value chains and the integration of China into the world economy (IMF, 2016).

3.1.7 Rising inequality

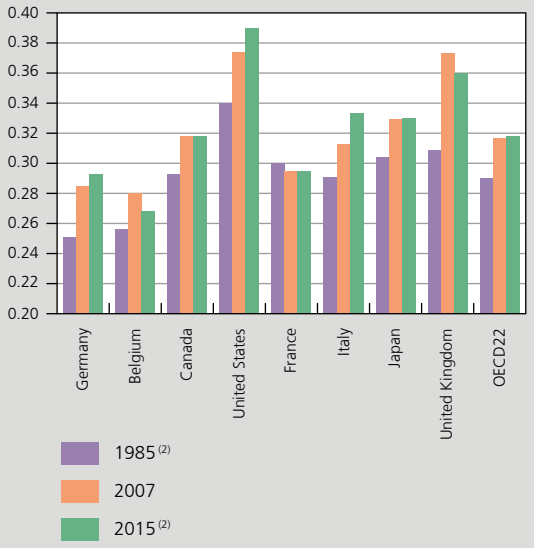
Since the mid-1980s, most advanced economies have shown growing inequalities in income and wealth distribution, particularly the United Kingdom and the United States. These inequalities reflect both a clear rise in the level of the highest income brackets and the fact that median income is growing more modestly; indeed, the lowest income brackets are even stagnating (OECD, 2016). On average, income inequalities in OECD countries as measured by the Gini coefficient have gone up by around 10 %.

These developments reflect several structural trends including technological progress[(1)], automation and globalisation. Technological progress has translated into a premium for the highly educated, while globalisation and international trade have depressed the wages of less educated workers. The lowest income brackets have also been hit harder by the 2008-9 global financial crisis (OECD, 2016). Song *et al.* (2015) have shown that the increasing inequalities in the United States are attributable to growing income disparities between different firms rather than

(1) There is no clear-cut relationship between technological progress and inequality, however. On the one hand, new technologies seem to be exacerbating inequalities as they appear to be boosting demand for highly educated staff and curbing demand for less educated employees. On the other, new technologies may help to reduce inequality, a case in point being ICT developments that reduce the cost of knowledge acquisition and facilitate access to funding. At the same time, current innovations in the services sector (Uber, AirBnB, Deliveroo, etc.) may boost the integration of less educated workers into the labour market.

growing income inequalities within individual firms, corroborating the observation of higher productivity disparities between corporations.

CHART 5 GINI COEFFICIENT OF INCOME DISPARITY [1]
(after tax and transfers)



Source : OECD.
(1) The Gini coefficient varies between zero (fully equal distribution of income among the population) and 1 (fully unequal distribution of income, with all income held by a single person).
(2) Data from 1984 for France and Italy and 2012 for Japan.

The distribution of wealth is around seven times more unequal than the distribution of income (OECD, 2016), implying that, in 2014, over 40 % of the wealth in the majority of OECD countries was in the hands of the wealthiest 10 % of the population. In the United States, the figure was almost 80 % [1]. Despite the economic recovery of the past few years, inequality has remained high, or has even grown.

Inequality is impacting individual opportunities for access to education, new technologies, training and healthcare. It has the effect of lowering the general educational level of a society and the quality of jobs in an economy. Indirectly, it weighs on the distribution of productivity and on aggregate productivity (OECD, 2016).

3.1.8 Slowing growth of human capital

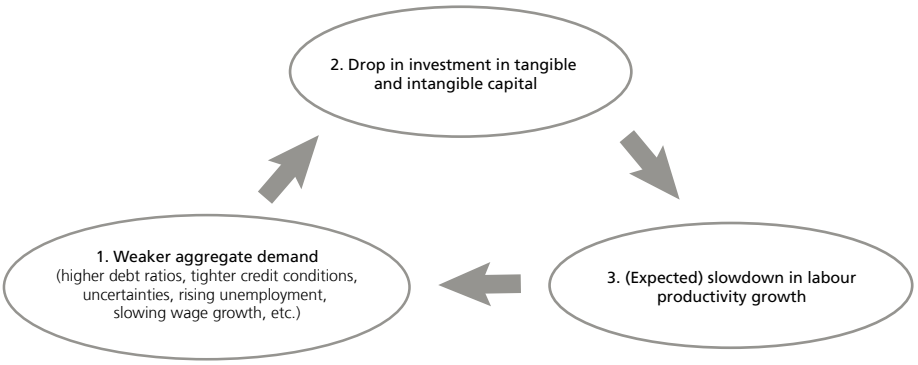
The individual and social benefits of education are high, particularly in terms of productivity and incomes. The secular rise in the level of education seen in the past decades has, for instance, made a significant contribution to productivity growth in the advanced economies (IMF, 2017). Since the 2000s, and in some countries even before then, the accumulation of human capital has been slowing, as evidenced by – among other things – a slowdown in the growth of highly educated people. This deceleration may have contributed to the fall in labour productivity growth by 0.3 % annually (ibid.).

(1) 2016 figures.

3.2 Cyclical factors

The global crisis of 2008-09 set in motion a vicious cycle : (1) in a highly unpredictable economic environment – featuring high debt ratios, rising unemployment and tightening credit conditions – a fall in aggregate demand prevented or dissuaded firms from investing ; (2) in turn, the investment deceleration held down labour productivity by reducing capital intensity and delaying the introduction of new technologies ; (3) lastly, the decline in productivity gains put pressure on consumption and investment, mainly through slowing wage growth and narrowing margins. Although the shock was temporary, its intensity and persistence contributed to long-term total factor productivity losses.

DIAGRAM NEGATIVE FEEDBACK LOOP OF THE GLOBAL FINANCIAL CRISIS



Source : NBB.

3.2.1 Bank credit tightening

During the crisis, banks responded to the increase in perceived risk, balance sheet constraints and funding costs by tightening their lending criteria. Given that smaller firms depend largely or even exclusively on the banking sector for their financing, they were hit harder than large firms, which have easier access to the capital market.

This impact was particularly apparent in the euro area, whose non-financial private sector relies heavily on bank financing, and even more so in the countries hit hard by the sovereign debt crisis between 2010 and 2013. It curbed not just investment by established firms (ECB, 2018) but the incorporation of new firms. However, the largest productivity gains are often generated by new and fast-growing firms. Although credit conditions have eased markedly, the earlier effects of the crisis on the establishment and entry of new firms could have a lasting negative impact on productivity growth (Dumont and Kegels, 2016).

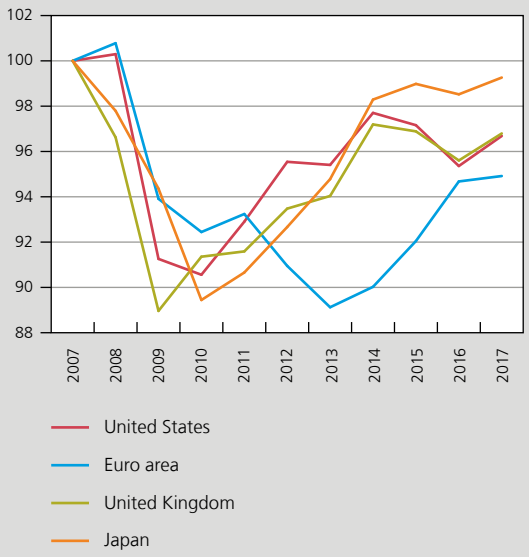
3.2.2 Sharp investment drop

In the face of tightened credit standards and significant uncertainty, the crisis severely weighed on tangible and intangible asset investments. The steep decline in investment had direct implications for capital intensity and impacted total factor productivity indirectly by curbing the adoption of new technologies. R&D cuts curtailed firms' innovation capacity, thereby potentially jeopardising the future growth of productivity gains (IMF, 2017). Given the unpredictable economic climate, firms also shifted their focus to lower-risk but less profitable investment projects (ibid.).

Compared with previous recovery phases, investment rebounded only modestly after the crisis, in particular in tangible assets and in the euro area. This sluggishness is indicative of a persistently uncertain climate and rising debt ratios in the private and public sectors alike. All in all, post-crisis public investment in the advanced economies fell markedly relative to GDP, potentially holding productivity down in the long term (Goldin *et al.*, 2018).

CHART 6 GROSS INVESTMENT IN FIXED ASSETS EXCLUDING HOUSEBUILDING

(in % of GDP, 2007 = 100)



Source : Ameco.

3.2.3 Hysteresis effect and loss of human capital

In the advanced economies, the great recession of 2008-09 drove up the general unemployment rate. Long-term unemployment (12 months or over) also increased, much more distinctly and persistently in the euro area than in the United States, the United Kingdom and Japan. Prolonged periods of unemployment, which erode the skill level among workers, may lead to a loss of human capital. What is more, long-term unemployment increases the risk of poorer professional matching, particularly increased overqualification, as the unemployed more readily accept positions for which they are overqualified. There are evidences that the crisis has deteriorated the matching of labour supply and demand in the euro area (ECB, 2012). Incidentally, in the United Kingdom the percentage of overqualified workers rose significantly against the background of the post-crisis economic recovery (ONS, 2016). Overqualification implies a waste of resources and threatens to exacerbate wage inequalities.

3.2.4 Poor capital allocation between sectors and firms

It would appear that capital misallocation in advanced economies worsened before as well as after the crisis (IMF, 2017).

The accumulation of household debt during the pre-crisis boom in the real estate sector may have slowed productivity growth in some countries, with funds being allocated to projects yielding little or no profit. Compared with other, more productive sectors, the real estate sector used up an excessive portion of available funds. This happened chiefly in the United States, the United Kingdom and some euro area countries, for instance Spain.

At the same time, the crisis may also have affected smooth capital allocation between firms, because non-performing firms continued to mobilise funds, shrinking total average productivity. This is reflected by the growing number of 'zombie firms' recorded since 2007-08 [1]. Zombie firms are non-viable firms that would have ceased to

(1) The OECD defines zombie firms as firms more than ten years old with an interest coverage ratio (EBIT/interest payments) of less than one for three consecutive years. See Adalet McGowan, M., D. Andrews & V. Millot (2017), "The Walking Dead? Zombie Firms and Productivity Performance in OECD Countries".

exist in a normal economic environment but continue to operate thanks to the absence of competitive pressure and the ease with which banks renew their loans ('evergreening'). Some banks tend to extend subsequent loans to borrowers, keeping them from recognising potential losses that would compel them to raise fresh capital. Against the backdrop of an accommodating monetary policy, they can charge low interest rates. The problem is that zombie firms use up labour and capital that could be allocated more efficiently, thereby stifling the growth of healthy firms (Adalet McGowan *et al.*, 2017).

The phenomenon of zombie firms was initially studied for the Japan of the 1990s, where it had contributed to the country's economic stagnation. More recently, however, Japan has been relatively spared from them. The number of zombie firms increased particularly in some euro area countries (Greece, Spain and Italy), where they eventually mobilised up a considerably portion of the available capital (ibid.). Having reformed its banking sector earlier, the United States has produced only few zombie firms.

3.3 Is productivity being mismeasured ?

Against the background of the rapid development of ICT-related goods and services, whose economic gains are particularly difficult to gauge, measurement problems are regarded as one of the factors explaining the slowdown in productivity gains. The underlying idea is that current estimates, which are based on official national account statistics, could underestimate productivity gains.

It is argued that the benefits of numerous recent innovations – smartphones, social networks and all kinds of digital applications – are not apparent from their usage charges, which would explain why only a small portion of these benefits are included in GDP. More specifically, the time saved by shopping or consulting information online is reportedly not taken into account when measuring total income. For example, a study focusing on the United States conducted by Byrne *et al.* (2016) showed that annualised growth in labour productivity was higher when adequately factoring in intangible asset investments, software and IT equipment prices, or even internet access and e-commerce.

Although the debate is still lively and measurement errors are a reality, the available data do not suggest that the productivity slowdown during the recent period can be largely explained by them (IMF, 2017). If anything, measurement problems are more likely to affect productivity levels rather than productivity growth.

It is worth stressing that the issue concerning the social benefit of innovations relative to their contribution to GDP growth is not new and extends beyond the digital economy. Over the years, medical advances have done much to reduce child mortality and mobile phones have helped enhance safety by allowing direct contact with emergency services. However, it is quite possible that the digital revolution has added to the problems of underestimating economic growth (Crafts, 2018).

Conclusion

Productivity growth has been under pressure in all advanced economies since the early 2000s. Many factors have been put forward to explain this state of affairs : structural factors including the less revolutionary nature of recent innovations, obstacles to technology spread, flagging economic dynamics, an ageing labour force, slowing world trade, rising inequality and the slowing growth of human capital. Cyclical factors relate closely to the 2008-9 great recession and include past credit tightening, a sharp investment drop, loss of human capital due to hysteresis effects, and poor capital allocation within the economy.

The big question that many economists are grappling with is whether these are permanent or temporary phenomena. Who is able to predict how productivity gains will evolve going forward ? Such gains will depend on the economic benefits of current and future technological breakthrough while also being influenced by structural trends such as demography. And lastly, they will reflect policy measures taken to encourage investment and the establishment of corporations, to foster competition, reduce inequality, improve access to education and even to smooth the process of creative destruction.

The almost secular slowdown of productivity growth of the past decades suggests that the low-hanging fruit of economic development has now been picked. Growing focus on the environment and fighting global warming might well curb future productivity gains while ushering in growth of greater quality, more sustainable and fairer. In that context, it looks risky to assume a return to the growth percentages of the past. At the level of individual countries, the ability to implement visionary structural change could well make the difference.

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