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The productivity slump in the advanced  
economies: Explanations and need for action

# Working Paper

## No. 194

### The productivity slump in the advanced economies: Explanations and need for action

1. Introduction.....	3
2. Development in labor productivity in Germany.....	6
2.1 Development in the individual sectors.....	6
2.2 Comparison with the US .....	10
3. Possible reasons behind the productivity trend .....	15
3.1 Investment slump .....	15
3.2 Globalization of labor markets.....	18
3.3 Digitalization .....	19
3.4 Aging societies .....	23
3.5 Regulation .....	24
3.6 Statistical measurement issues .....	25
4. Productivity development scenarios in Germany .....	28
5. Summary and outlook .....	31
6. Literature .....	33

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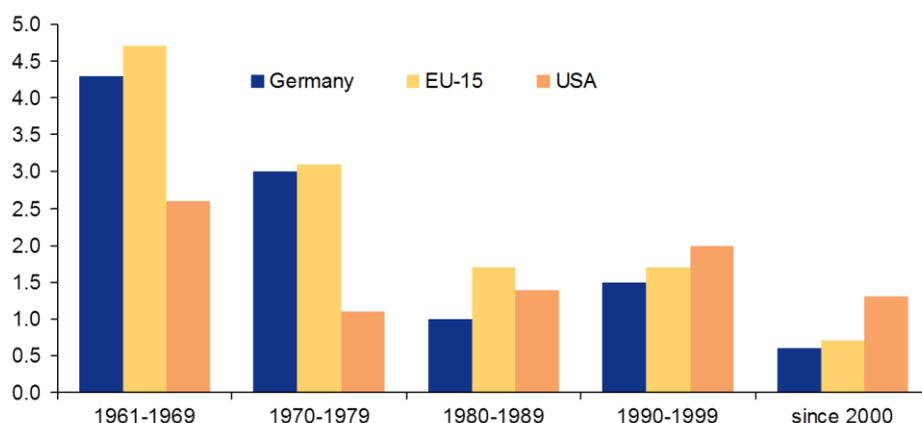
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**1. INTRODUCTION**

Almost seven years may have passed since the collapse of Lehman Brothers set the latest global economic crisis in motion – yet the lingering feeling of crisis remains. Although the global economy has bounced back since the traumatic year of 2009, the pace of recovery has been anemic in most cases, particularly in the developed countries. And that's not all: expected potential growth has weakened virtually across the board as well, meaning that the years of financial and economic crisis are likely to have been more than just a temporary blip, but rather an event resulting in irreversible damage. In the case of the US, for example, this drop in potential growth is estimated to total around five percent since 2007<sup>1</sup>; this brings the total estimated loss in prosperity to around USD 900bn in 2014. So it comes as little surprise that many observers are already describing the situation as one of "secular stagnation", a prolonged phase of disappointing growth.

There is a myriad of reasons behind the weak development of late: ballooning debt, antiquated labor markets, a lack of competitiveness, to name but a few. Their significance also varies from country to country. Almost all countries, however, have one thing in common; productivity growth is very weak (see Chart 1 and box).

Chart 1

**Labor productivity stagnating****Annual labor productivity growth in % (GDP per person employed)**

Source: EU Commission (AMECO).

This development is deeply alarming. After all, in the medium to long term, productivity growth is the main factor driving general economic growth. This applies all the more so if we consider that, in the not-too-distant future, one of the key growth engines that drove the world's advanced economies in the past, a growing working population, will turn into exactly the opposite. Without productivity growth, the European countries, in particular, will see their economic strength dwindle. If this happens, it will be virtually impossible to master the challenges that the future has in store, from the costs associated with an aging society to the costs of the energy transition. In a nutshell: without productivity growth we will be unable to maintain the level of prosperity we have become accustomed to.

Given its tremendous importance, it is hardly surprising that a growing number of studies are now looking into the phenomenon of the productivity standstill in a quest to

<sup>1</sup> Summers (2014).

find an explanation. To date, however, this quest has not met with resounding success. A conclusive, universally valid answer continues to elude us (and may indeed never be found). Possible answers to the productivity puzzle center around various different aspects, such as a lack of investment, more flexible labor markets, a lack of innovation, delayed learning effects associated with new technologies, excessive regulation or simply problems relating to how to measure things: in the "Zero Marginal Cost Society"<sup>2</sup>, what is an appropriate way of calculating output?

But the real question – and one which is even more difficult to answer – is whether the stagnation seen in recent years will continue, or whether we might not see a revival in productivity growth again after all? In other words: are the reasons behind the productivity standstill, all of which can be attributed to some extent to the blow to confidence dealt by the financial crisis, of a merely temporary nature and will they lose clout as we gradually put the crisis behind us? Or does the financial crisis mark a structural break, the start of a "new normal", with no prospect of a return to the status quo ante?

In this study, we have taken an empirical approach to answering this question by breaking overall productivity growth down into its individual components, i.e. putting trends in the individual sectors under the microscope. Looked at from this angle, it becomes clear that there is no such thing as *the* productivity trend in the first place. Rather, even within individual economies, a number of different, sometimes contradictory trends, can be identified: if we scratch beneath the surface of overall productivity, standstill is not the only thing we see.

This is encouraging, because it suggests that productivity growth is not currently being hindered by all-encompassing forces, like a general lack of new ideas, but rather by specific obstacles affecting only individual sectors of the economy in each case – which should be easy enough to resolve with the right package of measures: after all, why shouldn't economic sector A be able to achieve what economic sector B has already achieved under the same macroeconomic conditions? Based on this assumption, we can outline possible scenarios for future productivity development.

This analysis allows us to present a slightly less pessimistic view of what the future holds: "secular stagnation" is by no means inevitable. If we apply realistic assumptions regarding how productivity trends in the individual sectors will converge in the era of digitalization – in which the differences between production methods in the industrial and service sectors will become increasingly blurred – then we could be looking at a return to productivity growth of more than 2 percent over the next 20 years, which would be sufficient to compensate for the shrinking working population.

The rest of the paper is organized as follows: in the next chapter, we will once again take a detailed look at how productivity has developed in Germany, including a comparison with the US. This analysis clearly shows that, while measuring labor productivity is a far from trivial matter, a marked flattening of the growth curve is impossible to ignore. This is why the subsequent chapter provides a brief overview of the main theories explaining this productivity puzzle – setting out arguments regarding future developments at the same time: which explanations relate to temporary phenomena and which hold true for the future, too? In the fourth chapter, we then use this information to arrive at different scenarios. The last chapter summarizes the results.

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<sup>2</sup> Rifkin (2014).

### Labor productivity and total factor productivity

In statistical terms, labor productivity refers to real output (in macroeconomic terms: real GDP) per person in work or per working hour. Calculations performed per working hour are preferable to those per person in work, because they are not influenced by changes in working hours structures. Having said that, working hours data is not always available, especially not over prolonged periods of time.

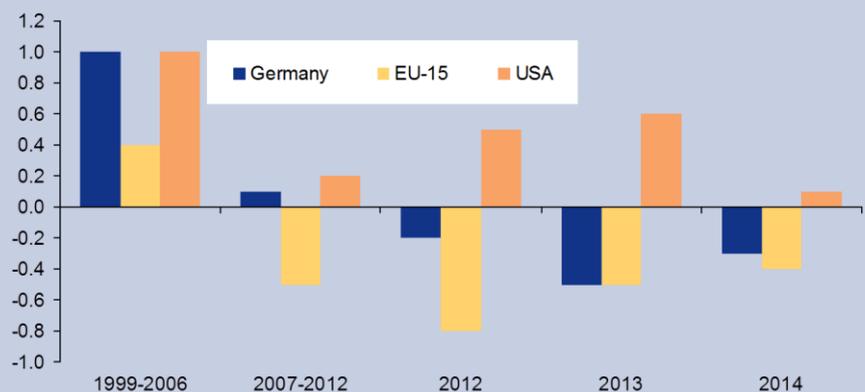
Macroeconomic growth is determined by the extent to which labor productivity and the volume of labor grow. This means that the growth contributions made by greater capital investment and technical progress become apparent in labor productivity. Studies examining productivity trends often also look at total factor productivity as opposed to labor productivity. Total factor productivity (sometimes referred to as the Solow residual) includes the share of growth that cannot be explained by the use of more labor and more capital. This explains why total factor productivity is often described as the rate of innovation, because it measures the share of economic growth that can be attributed to technical progress alone. It tends to be lower than labor productivity because, as mentioned above, the latter also takes the greater input of capital into account.

There are various ways of calculating total factor productivity. The Conference Board, for example, includes quality aspects in both the labor and capital factors. This approach has actually resulted in *negative* productivity trends for Germany and the EU in recent years (see Chart 2).

Chart 2

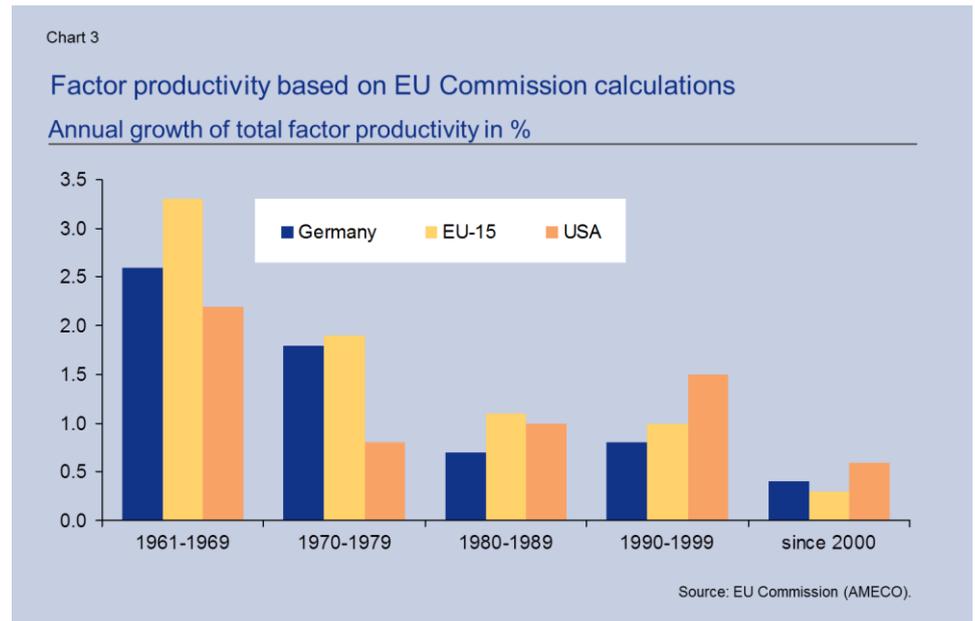
#### Factor productivity based on Conference Board calculations

Annual growth of total factor productivity in %



Source: The Conference Board.

The European Commission, on the other hand, only looks at quantitative changes in labor and capital; this produces a somewhat more encouraging productivity trend (see Chart 3).



## 2. DEVELOPMENT IN LABOR PRODUCTIVITY IN GERMANY

### 2.1 Development in the individual sectors

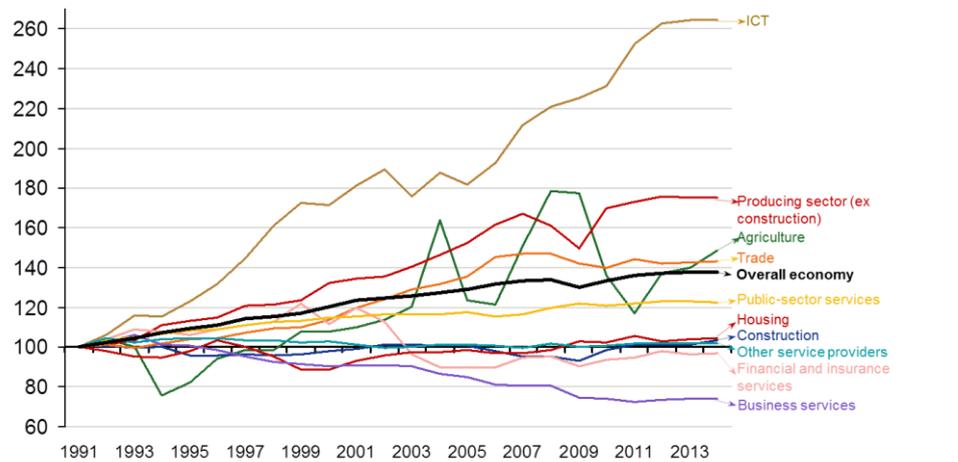
Developments in labor productivity per working hour have varied considerably from sector to sector since German reunification: whereas it has more than doubled in the "Information and communications" sector, for example, it has plummeted by almost 30% in the "Business services" sector. So we certainly would not be justified in referring to *the* German productivity trend. (see Chart 4)

Several similarities can, however, be identified even in this very heterogeneous growth landscape. Developments in the service sectors, for example, have been weaker in general and the growth curve has flattened in most sectors of the economy (with the exception of the agricultural sector) in recent years. So in that respect – and also considering the very strong performance of the "Information and communications" sector – Germany is roughly in line with international trends.

Chart 4

### Labor productivity per employee hour worked

Real gross value added per employee hour worked, 1991=100



Sources: Statistisches Bundesamt, own calculations.

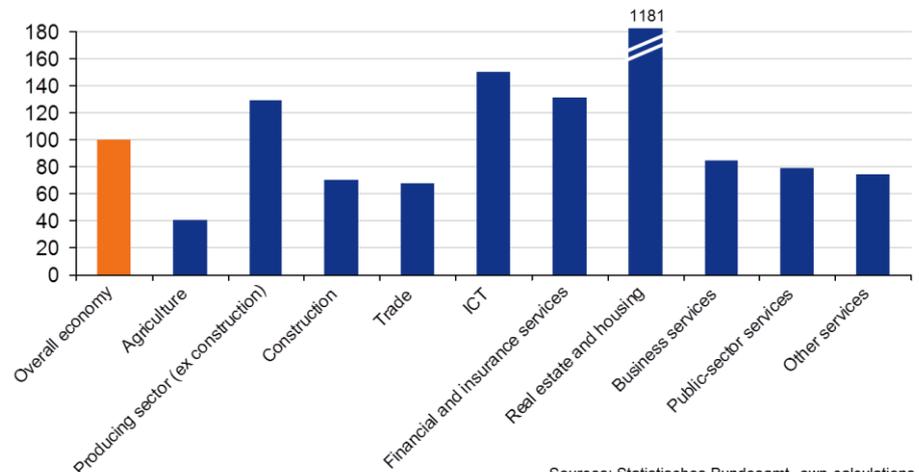
Yet it is not just growth, but also the level of labor productivity that differs considerably from sector to sector. (see Chart 5) One sector of the economy really stands out: the real estate sector. Gross value added (after price adjustments) in this sector is more than ten times higher than the average for the economy as a whole – at the same time, however, salaries are much lower. This evident contradiction is due to statistical factors: the "real estate" sector accounts for the entire property rental segment, including owner-occupation.<sup>3</sup> In other words: the productivity reported by this segment has little to do with the actual efficiency of estate agents, etc., but is primarily a statistical artefact.

As a result, it makes sense to exclude this segment from any further analysis. Statistical distortions like these and measurement-related problems in the national accounts also,

Chart 5

### Nominal labor productivity per employee hour worked

Nominal gross value added per employee hour worked, 2014, overall economy =100



Sources: Statistisches Bundesamt, own calculations.

<sup>3</sup> See German Federal Statistics Office (2014), p. 28.

however, affect other sectors of the economy.<sup>4</sup> This is why (see box) we have also left the three service sectors "Public service providers", "Other service providers" and "Financial and insurance service providers" out of our further analysis.

### Measurement-related problems in the "Public service providers", "Other service providers" and "Financial and insurance service providers" sectors

The "Public service providers" sector includes sectors such as public administration, defense and healthcare. Most of these providers are government institutions whose output is not determined based on market prices, but rather on their input, which makes it impossible to measure the actual development in productivity. While this certainly does not apply unconditionally to the healthcare sector, there is no doubt that this sector is one of the most regulated in the entire economy, not least with regard to prices. This means that changes in measurable output would be less likely to be attributable to productivity progress (or setbacks), but rather more to the success (or failure) of the latest health system reform.

The "Other service providers" sector is relatively small – accounting for around 4% of overall output – and mainly includes activities whose output is virtually impossible to quantify: art and culture, lobbies, religious associations and "largely personal service providers".

The main aspect that makes measuring the output of financial and insurance service providers so problematic is that this output tends to be measured indirectly using the differential method. Taking banks as an example, the production value is calculated primarily based on the difference between interest received and paid<sup>5</sup>, while with insurers, the calculation looks at the difference between the gross written premiums received and the insurance benefits paid out. This can distort things considerably: does, for example, the current zero interest rate policy being pursued by central banks, which is putting pressure on the interest margin, make banks "less productive"? Or, based on the same logic, do natural catastrophes (= rising insurance benefits) make insurers less productive?

This is compounded by problems with price adjustments using the volume extrapolation method.<sup>6</sup> Ultimately, although the statistics show a productivity trend for this sector, the trend is anything but plausible: over the past 20 years, productivity has been on a virtually constant downward trajectory while the number of employees has also declined. This can hardly be reconciled with the developments in the sector, which – especially in the banking business – has undergone more drastic change than any other during this period: moving away from the "bank clerk" sat behind a desk to the world of internet and mobile banking. Insurance policies, too, are no longer sold primarily by agents in an individual's living room, but rather are taken out on the internet at the click of a mouse.

<sup>4</sup> For more details, please refer to section 3.6.

<sup>5</sup> For information on the "FISIM" (Financial Intermediation Services, Indirectly Measured) measurement method, see German Federal Statistics Office (2014), p. 23.

<sup>6</sup> See Section 3.6.

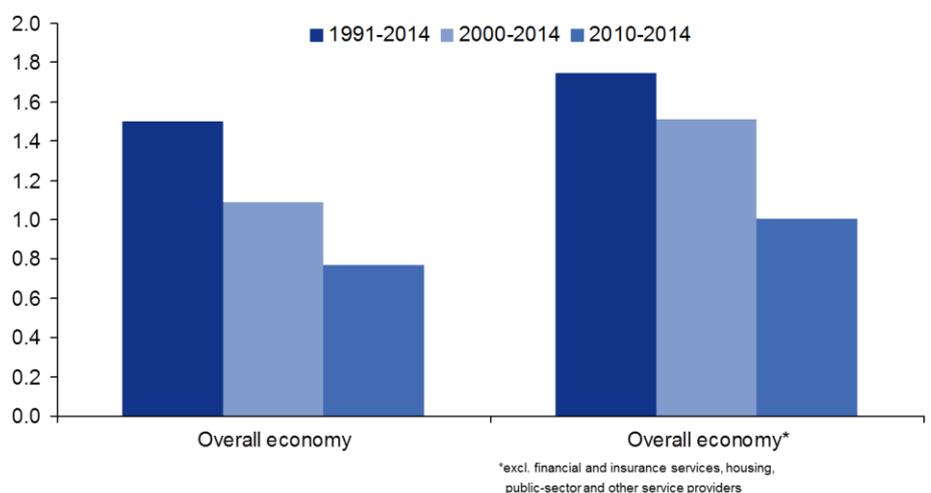
What is more, productivity would appear – astoundingly enough – to have improved again since the financial crisis, i.e. in the very same period in which most other sectors have stagnated. We suspect that this is largely due to the price adjustment method selected: when the volume extrapolation method is applied, lower total assets result in considerable deflation, with a positive impact on the "measured" real gross output and, as a result, on productivity; vice versa, rising total assets in the financial sector's golden age, ante Lehman, result in pronounced "inflation" with the opposite effect. At the end of the day, the statistical productivity figures hardly reflect the actual developments in this sector at all, which is why we have also chosen to leave the financial and insurance service providers out of our analysis below.

The chart below (Chart 6) shows the development of labor productivity in this sort of "adjusted" economy, namely excluding the sectors that are problematic from a statistical point of view, as described above. What we notice is that the developments are more positive and that productivity growth is higher overall, even in the recent years of supposed "standstill". So the "productivity problem" is partly down to incomplete statistics, with statistical analysis reaching its limits when it comes to measuring real output in the service sectors, with their intangible products, in particular. The general growth profile, however, namely the slump in growth seen in recent years, is no different in the "adjusted" analysis either.

Chart 6

### Labor productivity per employee hour worked

Real gross value added per employee hour worked, annual growth rate in %



## 2.2 Comparison with the US

Which factors are responsible for these variations in productivity development within an economy? Can similar trends be identified within an international context? Our first step involves taking an empirical approach to answering these questions. In this section, we will compare the development of productivity per working hour in the US and Germany in selected major sectors of the economy in order to get a more accurate impression of differences and similarities. We have restricted our analysis to the period from 2000 onwards, because this is when the productivity slump really started to bite. The US is an ideal candidate for this sort of comparison because the country is generally seen as the ultimate benchmark as far as innovation and progress are concerned; it is, after all, also

where the "digital revolution" unfolded. It is, however, important to remember that the US price measurement statistics make greater use of hedonic methods, which serve to reflect quality progress, than their German counterparts do. This means that, in general, labor productivity growth in the US appears higher than in Germany.

### Special features of productivity measurement within the US

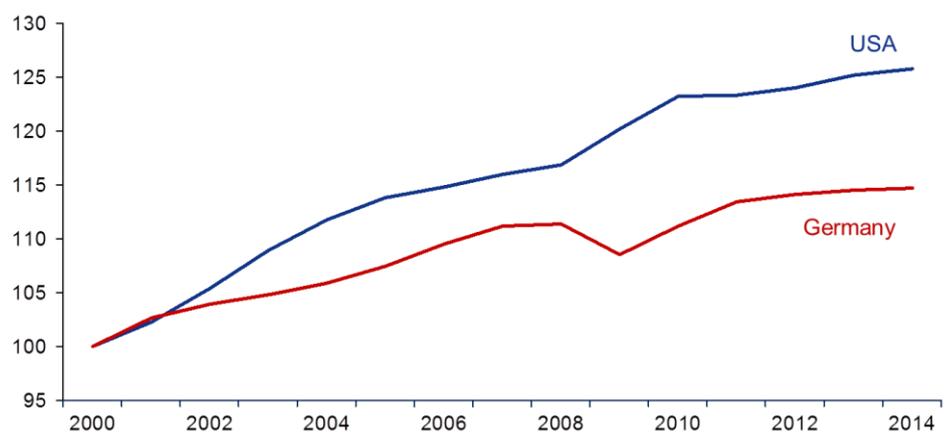
Whereas in Germany, all data on productivity can be found in the German national accounts (VGR), the productivity statistics in the US are drawn up outside of the national accounts prepared by the Bureau of Economic Analysis, namely by the Bureau of Labor Statistics (BLS). These statistics are based on productivity trends in the business sector excluding areas like "owner-occupied residential space", for example. When measuring labor productivity at sector level, however, the BLS bucks the general trend by taking gross production, as opposed to gross value added, as a basis. Unlike value added, gross production includes intermediate inputs purchased from outside the sector in question. The argument used to justify the inclusion of these intermediates is that companies reduce labor input by "outsourcing" and "offshoring" intermediate products, pushing labor productivity up. As a result, our analysis below shows both the US productivity data calculated based on the national accounts and the productivity levels based on the BLS methodology.

Overall working hour productivity in the US has been rising at an average annual rate of 1.7% since 2000, compared with only 1.0% in Germany.<sup>7</sup> Since 2012, German productivity growth has come to a virtual standstill (+0.4% a year). Productivity growth in the US has been mired at a similarly low level (+0.5% a year) since 2011.

Chart 7

### Overall labor productivity per hour worked

Index 2000=100



Sources: Statistisches Bundesamt, Bureau of Economic Analysis (BEA), The Conference Board, own calculations.

A look at productivity trends in the industrial sector paints a more favorable picture. German industry, which accounts for 20% of GDP, has been reporting average annual productivity growth of 2.1% since 2000, putting it well ahead of the economy as a whole. The fact that the capital stock in German industry has not expanded in real terms since 2000, whereas productivity in the sector has increased significantly, only goes to show

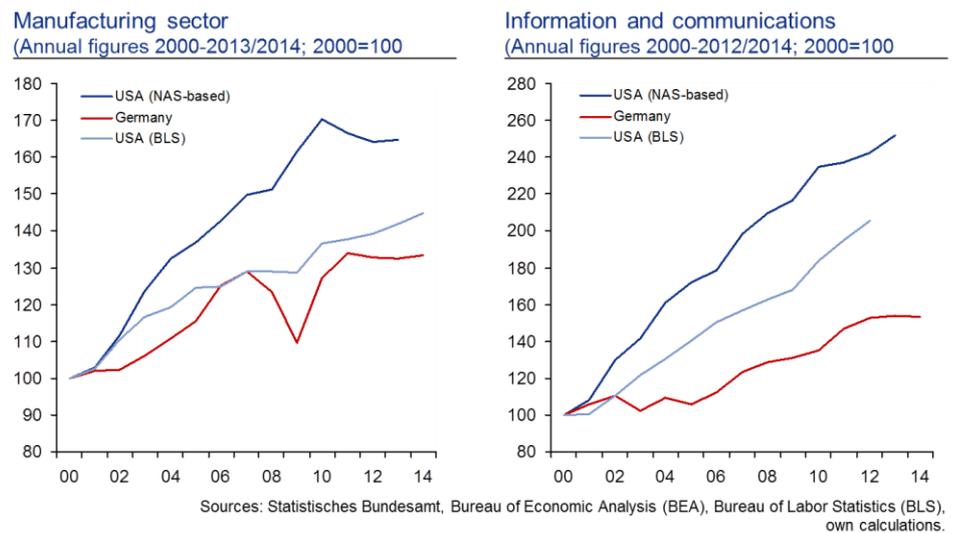
<sup>7</sup> In order to facilitate an international comparison, we have looked at the economy as a whole, including the statistically problematic areas.

that productivity growth can be achieved even without constant growth in the capital stock. Conversely, we can conclude that the investment slump is not the sole explanation for the weak productivity growth in the German economy.

In the US, hourly productivity in the industrial segment, which, admittedly, only accounts for 12% of GDP, has risen considerably since 2000 (by 3.9% a year on average) – despite the weaker development witnessed over the past few years. This only applies, however, if productivity is calculated based on value added (based on the national accounts). If we apply the BLS method (gross production divided by the number of working hours), the rate of labor productivity growth starts to look a lot more moderate (average of 2.7% a year). What is surprising is that, since 2000, real output in the US has been growing at a much faster rate than real gross production. This can only be explained by a lower proportion of intermediates in relation to output and swims against the tide of globalization, which tends to involve shifting value chains abroad and buying intermediates from foreign suppliers. On the whole, however, productivity growth in US industry is impressive – irrespective of the calculation method – and does not point towards any secular stagnation trend for this sector.

Chart 8

### Hourly productivity: Manufacturing sector, Information & Communications



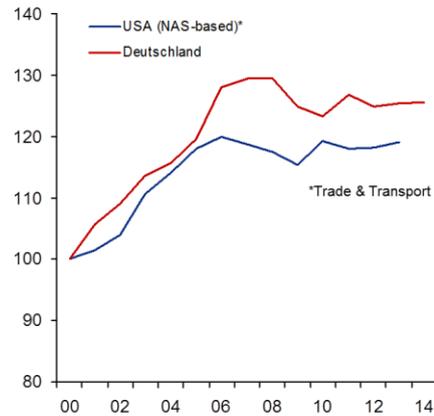
Productivity growth is exceptionally high in the US information and communications sector (based on the national accounts: 7.4% a year, BLS: 6.2% a year). This suggests that the positive impact of digitalization on productivity is certainly coming to the fore – at least for the sector responsible for implementing it. Germany fares a lot worse in comparison. Although productivity in the German information and communications sector<sup>8</sup> has been rising at an average rate of 3.1% a year, this is well below average compared with developments in the US. The fact that in recent years productivity in this sector has actually been virtually stagnant in Germany is particularly worrying.

<sup>8</sup> The German information and communications sector includes the provision of information technology services, data processing, hosting, web portals, publishing, the production, distribution and sale of films and television programs, cinemas, recording studios and music publishing, broadcasters and telecommunications.

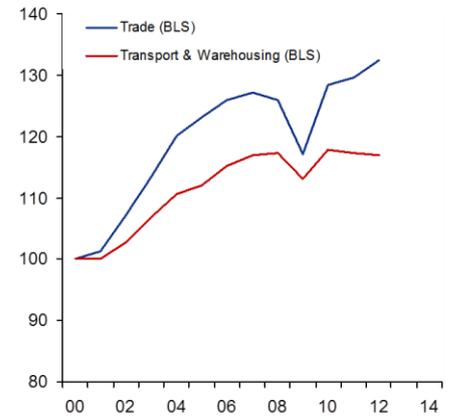
Chart 9

### Hourly productivity: Trade, Transport, Accommodation & Food Services

Trade, Transport, A&FS  
(Annual figures 2000-2013/2014; 2000=100)



USA: Trade, Transport & Warehousing  
(Annual figures 2000-2012; 2000=100)



Sources: Statistisches Bundesamt, Bureau of Economic Analysis (BEA), Bureau of Labor Statistics (BLS), own calculations.

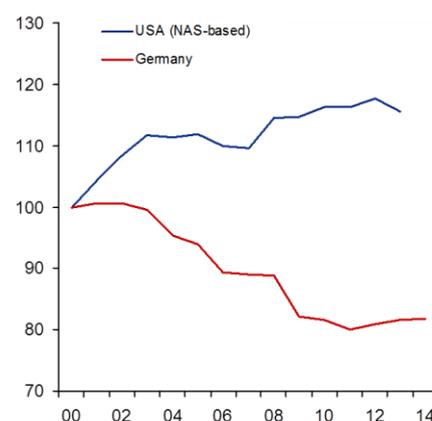
The productivity trends in the trade and transport sector are fairly similar in the US and Germany. What is striking, however, is that the upward trend in productivity has come to a halt over the past few years.

Productivity developments among business service providers in the US and Germany vary widely. Whereas in the US, the productivity of these service providers has been increasing by 1.1% a year on average since 2000, it has been falling at a rate of 1.4% a year in Germany. This large, but very heterogeneous sector, employs around 5.6 million people in Germany and contributes 9.8% (US: 11.8%) to the country's GDP. It encompasses legal and tax consultancy, management consultancy, architects and engineers, research and development, but also leasing, buildings management, gardening and landscape architecture, surveillance and security systems, copy shops, call centers, travel agencies and the sector involved in the placement and supply of labor, which has grown considerably.

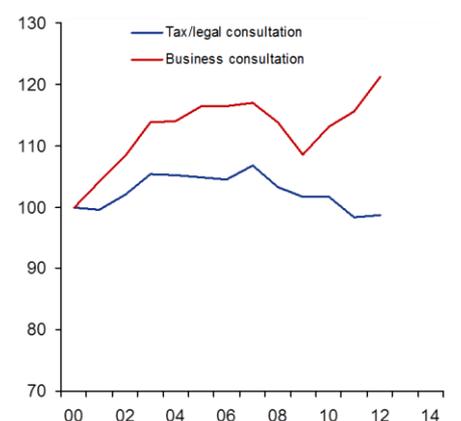
Chart 10

### Hourly productivity: Business services

Business services  
(Annual figures 2000-2013/2014; 2000=100)



USA: Tax/legal and business consultation  
(Annual figures 2000-2012; 2000=100)



Sources: Statistisches Bundesamt, Bureau of Economic Analysis (BEA), Bureau of Labor Statistics (BLS), own calculations.

One might assume that the drop in productivity among business service providers is not due to the area of largely highly qualified freelance, academic and technical service providers (a good 2.5 million employees), but to that of other business service providers (just under 3 million employees) which include the supply of temporary labor, facility management and the leasing business. This is not, however, the case. The drop in labor productivity is evident in both areas in roughly equal measure. One factor that is likely to have played a key role in this development is that the number of solo entrepreneurs with fairly low incomes has risen considerably, also among the highly qualified. Freelance professions have been experiencing a real boom in recent years, with the number of freelancers up by more than 50% on 2005.<sup>9</sup> Within this context, it is also important to remember that, out of the large sectors of the economy, business service providers constitute the sector with the fastest growth in capital stock (2000 – 2012: +3.1% a year). This once again suggests that, in addition to the investment slump, there are other reasons behind Germany's low productivity growth. Substantial employment growth coupled with the emergence of the "low-wage and low-income segment" is likely to play a considerable role.

To summarize, developments in labor productivity vary considerably from sector to sector, both in the US and in Germany. In the US, a general trend towards weak productivity growth has only emerged in recent years, and is not a hallmark of the entire period since 2000. The developments in Germany are less favorable. Productivity growth can be described as moderate over the entire period since 2000, and has actually slowed further over the past few years. In addition to the effect of low investment ratios putting a damper on production, however, the marked increase in labor force participation among individuals with relatively low income expectations and opportunities is also likely to be a major factor. A scenario in which people move from unemployment to jobs with relatively low incomes obviously pushes average overall labor productivity down, although this can be classed as labor-intensive growth.

Finally, we have attempted to look at the level of labor productivity in the US and Germany. International comparisons of productivity levels always stumble at the hurdle of setting an appropriate exchange rate to be taken as a basis for the comparison. The national productivity data is then often adjusted to reflect what are known as purchasing power parities, i.e. notional exchange rates. They represent the exchange rate that would be needed to buy a certain basket of goods for exactly the same amount of money in various different countries. International comparisons, however, usually use baskets of consumer goods that are not particularly representative due to differences in international consumer habits and provide few hints as to the exchange rate level that could be deemed appropriate in light of the competitive landscape. One example is the external value of the dollar, which could generally be described as undervalued based on purchasing price parities over the past ten years. Nevertheless, the US economy has been left grappling with a chronic current account deficit, which could be seen as one argument for the need for further depreciation.

This is why Chart 11 looks at nominal labor productivity – nominal gross domestic product per working hour – in the US and Germany in the respective national currencies of these countries. It comes as little surprise to see that, since 2000, it has shown a much more dramatic increase in the US than in Germany. In addition to the real component, higher underlying inflation in the US compared with Germany will also have been a factor. In 2014, nominal working hour productivity in the US stood at around USD 67, compared with around EUR 50 in Germany. This means that productivity levels in the

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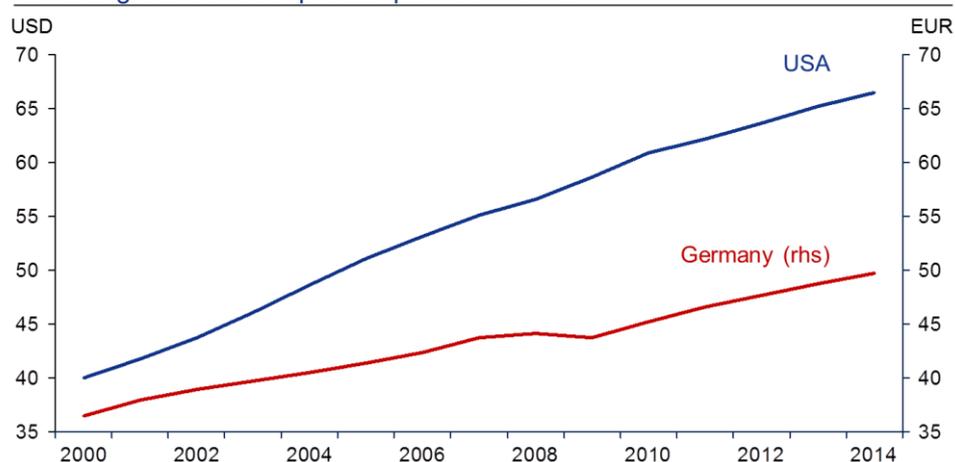
<sup>9</sup> Cf. FAZ, issue dated June 20, 2015.

two economic areas would be identical if the fundamentally appropriate exchange rate stood at 1.34 USD/EUR – i.e. the average rate witnessed over the past 10 years. The extent to which this sort of rate is, in fact, appropriate is anyone's guess. Given that the US had a trade deficit of around EUR 50bn with Germany in 2014, however, the current exchange rate of 1.10 - 1.15 USD/EUR can certainly be seen as pointing towards an undervalued euro based on the German-American fundamental factors. So all in all, the American productivity lead – if it exists at all – is likely to be very small indeed.

Chart 11

### Nominal labor productivity

#### Nominal gross domestic product per hour worked



Sources: Statistisches Bundesamt, Conference Board, own calculations.

## 3. POSSIBLE REASONS BEHIND THE PRODUCTIVITY TREND

The preceding empirical investigation unveiled a number of possible causes of weaker productivity growth: for example, a lack of investment or changes on the labor market. Literary sources now offer a cornucopia of possible explanations for the productivity puzzle. The section below aims to provide a brief description of what we deem to be the most important – investment slump, changes on the labor market, digitalization, demographic change, regulation and statistical measurement problems - and to assess how relevant they are.

### 3.1 Investment slump

It is generally acknowledged that investments are a key factor behind productivity growth. As a result, it makes sense to assume that the relative slump in investment activity witnessed over the past few years is one of the main reasons behind the sluggish labor productivity growth.

Based on the Solow approach<sup>10</sup>, economic growth can be broken down into labor input growth, growth in the capital employed and a residual value that is generally referred to as total factor productivity. In particular, it reflects the contribution made by technical progress and efficiency gains within the production process. This implies that changes in capital intensity (the capital resources for labor input) and changes in total factor

<sup>10</sup> Solow (1956).

productivity influence changes in labor productivity. Capital resources tend to be measured based on the capital stock. Since technical progress can be assumed to be predominantly "capital-linked", i.e. linked to investments, sluggish investment activity leaves its mark on labor productivity via both weaker capital intensity development and slower development in total factor productivity. According to the joint forecast produced by the main German research institutes (spring 2015), the estimated labor productivity trend in Germany (per working hour) currently comes in at 1.0%, with growth in total factor productivity coming to 0.8% and the capital stock contributing 0.4% to growth.

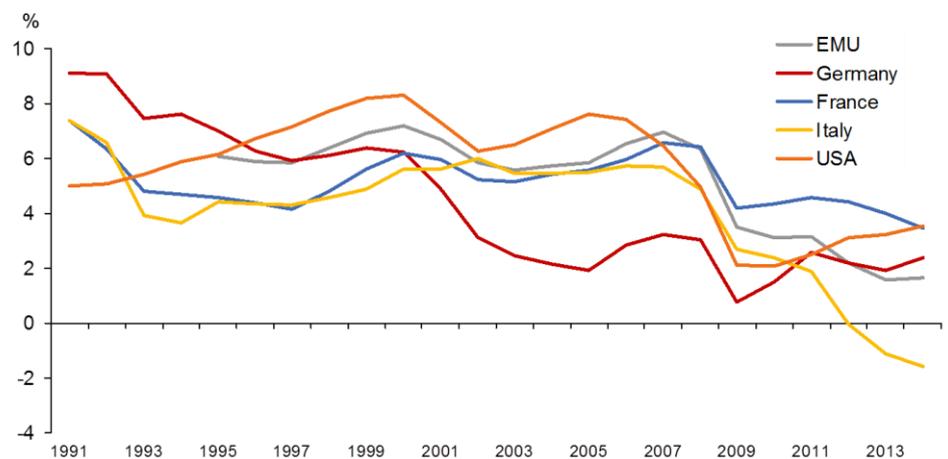
Based on these considerations, it would appear plausible to consider investment activity growth as a factor that plays a key role in determining productivity growth. Recent empirical analyses on this link tend, however, to be few and far between. A new study published by the Aspen Institute (April 2015) looks into the reasons behind the investment slump in the US and its impact on productivity trends<sup>11</sup>.

The rates of growth in total factor productivity and labor productivity have been on the decline for some time now. Chart 12 shows that net capital investment (construction and equipment investment less depreciation and amortization) has also been on the decline in relation to gross domestic product, with a certain degree of fluctuation, since the early 1990s in both the US and major European countries. In Italy, the ratio was actually negative of late. The ratio only seems to be on the mend in the US and, to a lesser degree, in Germany.

Chart 12

### Declining investment ratios

#### Nominal net fixed capital formation, as % of GDP



Source: AMECO.

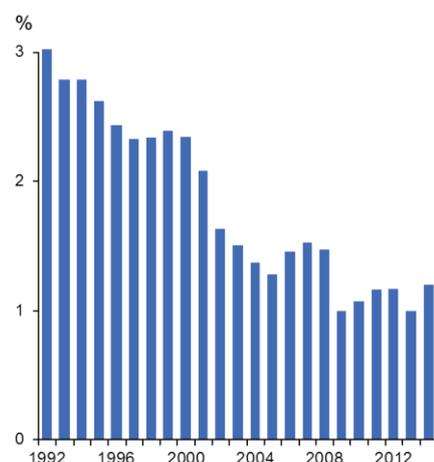
The moderate investment activity is also evident if we look at how the capital stock has developed in Germany. Whereas in the early 1990s, gross fixed assets were still growing at a rate of around 3%, since 2009 this figure has slipped back to 1% or just above. Of course, investment demand was slightly exaggerated in the aftermath of German reunification 25 years ago. Nevertheless, growth rates hovering around 1% are worryingly low if we also consider that capital stock growth is concentrated on the service sector and that the capital stock in the industrial sector has been on a slight downward trend for years now.

<sup>11</sup>Duesterberg/Norman (2015).

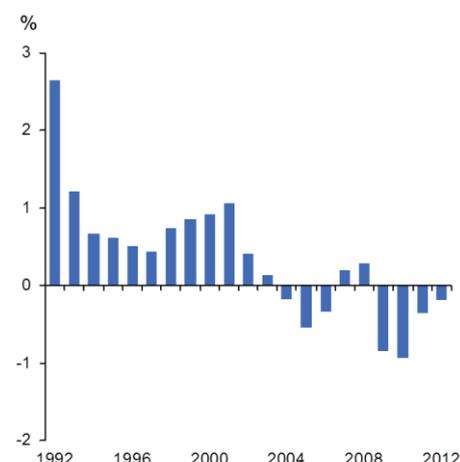
Chart 13

### Germany: Capital stock growth rate declining

Change in gross capital stock  
overall  
(price adjusted, chain index 2010=100, in %)



Change in gross capital stock in  
manufacturing sector  
(price adjusted, chain index 2010=100, in %)



Source: Statistisches Bundesamt.

In its 2013/2014 Annual Report<sup>12</sup>, the Bank for International Settlements (BIS) cited a number of reasons why the downward trend in investment ratios should not be overemphasized. The Bank wrote that it was unrealistic for the ratio of investment to GDP to return to the pre-crisis level because the drop in construction activity was necessary to correct the over-investment trend that had preceded the crisis. The Bank argued that, since the capital coefficient has now stabilized in most countries, the proportion of GDP that has to be invested is lower. The BIS also pointed out that the production structure had shifted away from capital-intensive sectors like industry, to less capital-intensive service sectors. Finally, the BIS pointed out that the relative prices of capital goods had dropped in general, meaning that companies had to spend less in nominal terms to keep their capital stock at the same level.

Although these arguments are plausible, we do not believe that they offer sufficient explanation for the restrained investment activity in the developed countries, especially given that the financing conditions for investment spending are, in most cases, very favorable at the moment and that companies have generous liquid assets at their disposal. The Aspen Institute study referred to above argues that the uncertainty associated with entrepreneurial decisions has increased over the past ten to fifteen years and that this is a contributing factor to the investment slump. The study refers to a whole number of empirical analyses confirming this theory. It says that uncertainty can be traced back to a range of different factors (geopolitical uncertainty, volatility on the financial and currency markets, fluctuating energy costs, major regulatory changes, etc.) that all have an impact on investment decisions. In our view, there is no doubt that the considerable uncertainty triggered by the global economic and financial crisis of 2008/2009 and the European debt crisis from 2010 onwards have their part to play in explaining the subdued investment momentum.

Another theory pinpoints a lack of investment opportunities as the root cause of the current investment slump. This sort of secular stagnation, an idea which has been brought to life again by Tyler Cowen<sup>13</sup> and Robert J. Gordon<sup>14</sup>, occurs in times when no

<sup>12</sup> BIS (2014).

<sup>13</sup> Cowen (2011).

<sup>14</sup> Gordon (2012).

technological breakthroughs are being made and population growth is on the wane. The theory has provoked widespread discussion. While we believe that this theory raises a number of interesting points, we cannot subscribe to the idea that it is one of the main causes of the investment slump given just how much the world has been turned on its head by digitalization and globalization.

Insufficient overall demand, a feature typical of balance sheet recessions, is also continually cited as the reason behind the investment slump seen in recent years (see BIS (2014)). Investment spending remains limited because companies are busy repairing their balance sheets, pushing the incomes of other market participants down in the process. At least for the German corporate sector, however, which was not subject to any balance sheet recession but is nonetheless investing only moderately, this explanation is of little relevance.

In summary, there is no doubt that most of the world's developed countries are faced with an investment slump that is likely down to a number of different factors. We do not, however, believe that a lack of investment opportunities is the main culprit. In our view, the fact that the uncertainty surrounding the economic outlook has increased in the course of the many crises is likely to have played much more of a role. As a result, hope remains that expectations in the corporate sector will become more stable again in the medium term as macroeconomic imbalances are resolved, making it easier for companies to make investment decisions. Based on supply-oriented considerations, we can assume that the investment slump is closely linked to the drop in productivity growth.

In order to take a closer look at the quantitative relevance of this link, we have calculated the correlation between labor productivity and capital productivity for the German economy in the period between 1991 and 2014. High net investment drives up the production volume and, in the process, labor productivity due to the increase in the capital resources allocated to specific jobs – or so the theory goes. A simple regression of (logarithmic) labor productivity in relation to the (logarithmic) capital intensity produced an  $R^2$  (ratio of the explained variation compared to the total variation in the time series) of 0.95, pointing towards a close link. On average, a 1% increase in capital intensity would translate into labor productivity growth of 0.6%.

### 3.2 Globalization of labor markets

The extent of globalization is often measured in terms of the expansion of international trade and international capital and financial flows. The labor markets tend to be considered to be less "globalized", as freedom of movement beyond national borders among people in work is still extremely limited in many regions of the world. But it would be a big mistake to see globalization as something that is of only minor significance to the national labor markets. Thanks to capital mobility, companies have the option of shifting jobs to lower-cost foreign locations. Furthermore, large economic areas like the EU now guarantee freedom of movement among members of the workforce. All of these factors naturally have an impact on the wage-setting process in "high-wage countries" like Germany, but also in many other developed countries.

The reforms implemented on the German labor market in the first half of the last decade (Hartz reforms) laid the foundation for a large number of new jobs in Germany. At the same time, the EU's labor markets were gradually opened up. These developments gave rise to a low-wage sector in Germany. Labor force participation rose considerably and unemployment dropped significantly. Germany's unemployment rate based on the ILO

definition recently stood at less than 5%. Based on the Phillips curve theory (negative link between unemployment and wages/prices), this ought to have gone hand-in-hand with a marked acceleration in wage increases and inflation. In actual fact, however, the increase in nominal effective earnings in recent years has been fairly subdued. This sort of flat Phillips curve is likely due primarily to external wage pressure and a less centralized wage-setting process.

If wages only chart a moderate increase, more or less independently of the unemployment level, this should mean that the substitution of labor by capital progresses at a slower pace than in the past. As a result, the rising cost of the factor labor, as driver of the use of labor-saving technologies and investments, should no longer be as significant. This also leads to the conclusion that an environment of moderate wage growth curbs labor productivity growth.

We can assume that this trend, which is relevant from Germany's perspective, plays a key role in other countries as well. The low labor costs in the emerging markets put pressure on the wage-setting process in the developed countries, limiting the substitution of labor by capital.

### 3.3 Digitalization

Digital information processing, which lies at the core of the progress made in the 3rd industrial revolution, fueled a marked increase in productivity growth in the mid-1990s. This was the first time since the effects of the 2nd industrial revolution began to subside in around 1970 that the US was once again able to report productivity growth to the tune of almost 2.5 percent. Hopes of a new, prolonged phase of constantly high productivity growth, driven by innovation in the IT sector, started to emerge. But starting in 2004, even before the financial crisis hit, growth took another hit and doubts started to emerge as to the sustainability of the digital productivity surge. Ever since then, views on the impact of digitalization vary considerably: while some observers believe that new technology brings little more than incremental improvement, others believe that the world is on the cusp of a new industrial revolution. The section below takes a brief look at the main arguments behind both viewpoints: in line with the relevant literature, they concentrate on the situation in the US, the undisputed pioneer of digitalization.

#### Digitalization: Much ado about nothing?

Since its launch, and in particular since it has been made available at a low cost, modern IT infrastructure has resulted in fundamental restructuring in many sectors of the economy. This cannot be disputed.

The development started in the semiconductor industry. From around the mid-1990s onwards, increased competition reduced product development cycles dramatically, making newly developed semiconductors available at low prices. Back then, IT producers were responsible for more than half of total productivity growth in the US, although they only accounted for five percent of the country's total industrial sector. So the productivity boom witnessed during this period was, in fact, attributable to a relatively small branch of industry. Since the start of the 21st century, however, the pace of development in the semiconductor sector has slowed considerably, meaning that it is making less of a contribution to productivity development and that production growth is also on the decline in general<sup>15</sup>.

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<sup>15</sup> Fernald/Wang (2015); Gordon (2014).

Alongside the progress made in the semiconductor industry itself, the far-reaching restructuring of those sectors of industry that made intensive use of IT in the period leading up to 2004 also spurred on the new phase of productivity growth. Commerce and the manufacturing industry, in particular, contributed to the high growth as a result of their process reforms. These restructuring measures, however, have now been completed, which has logically resulted in productivity growth falling back from its temporary high to a "normal" level. This theory is supported by the fact that the growth slumps seen in recent years have emerged largely in IT-producing sectors and sectors that make intensive use of IT<sup>16</sup>.

This would suggest that the innovations witnessed over the past ten years have increasingly been of a merely incremental nature. While the widespread introduction of computers or the internet still resulted in fundamental transformation, our office and household technology remains virtually the same as it was a decade ago. Since the launch of flatscreens in 2005, there have been no more revolutionary changes in workplace technology. Instead, recent innovations have been increasingly limited to improving performance or reducing size. In private households, too, the microwave of 1972 is basically the last fundamental innovation. While there has been constant progress in energy efficiency, audio and video technology since then, these improvements could all be seen to be more incremental in nature. So compared with the social transformation that came about as a result of electrical light, the combustion engine, commercial aviation or penicillin, many observers consider the digital innovation witnessed over the past few years as palling in significance<sup>17</sup>.

Based on this theory, the continuing effects of the financial crisis cannot serve as the reason behind the current low productivity growth either. Rather, the inherent reasons lie in the IT revolution and in digitalization. As a result, "digitalization skeptics" do not hold much hope for productivity gains in the future either.

Several arguments are said to support this theory. First, there is the drop in the speed at which technical innovations are launched on the market. This is unlikely to change any time soon. On the contrary: since today's IT users can use what are known as "cloud solutions" to achieve considerable economies of scale without having to make any substantial investments of their own, it is argued that the overall demand for computers, software and peripheral devices will fall. Instead of having to make major IT investment, companies only need a few specialized IT service providers. What is more, the lower development speed has already increased the useful life span of IT technology: the fact that equipment does not need to be replaced as often is also stifling demand. This development has switched off one of the main engines driving improvements, and productivity increases in the IT sector, the main source of productivity growth in the past, are also likely to be less pronounced in the future<sup>18</sup>. Many observers also remain skeptical as far as the outlook for future innovation is concerned, and have their qualms about the extent to which robots or 3D printing will, in fact, translate into new productivity increases. Since the former are already in widespread use in the manufacturing industry and in commerce, households are the only area in which robots could still unfold their potential. Given their mental and physical limitations, however, it remains questionable whether they will really be able to make any difference to speak of. The same, it is argued, applies to increasing individualization thanks to 3D printing. Even the "big data" phenomenon is one that many "digitalization skeptics" see as a zero-sum game on closer inspection: if the costs per byte edge towards the zero mark, growth per byte will

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<sup>16</sup> Fernald (2014).

<sup>17</sup> esp. Gordon (2013); Gordon (2014).

<sup>18</sup> Labelle (2015); Caranci/Feltmate (2014).

inevitably also tend towards zero, or so the argument goes. A similar trend emerges if two providers end up fighting for one and the same customer using all of the information they have collected: ultimately, it is merely about distributing existing demand, not generating new growth.

Even the "autonomous driving" of the future offers little potential: it will still be about transporting people from A to B. Although there is more potential in the logistics segment, this would require much better systems. After all, even if a delivery truck is able to reach its destination without a driver, the unloading and final distribution processes remain too complex for extensive automation. From this angle, the "digitalization skeptics" believe that there is little, if any, potential for substantial, IT-driven productivity growth in the future<sup>19</sup>.

The conclusion drawn by the skeptics: the era dubbed the "third industrial revolution" was short-lived, much less significant than its predecessor and only had a temporary impact on productivity development. In the years ahead, productivity growth will remain at its "natural" level and will not return to the peaks seen at the turn of the millennium. The skeptics would sum up the digitalization hype as follows: much ado about nothing.

#### Digitalization: The 4th industrial revolution?

There is no getting around the reality that the productivity figures are currently languishing at a low level. But the "digitalization optimists" do not believe that this signals the end of IT-driven transformation and refuse to consign the phenomenon of productivity growth spurts to the history books. Rather, they believe that the current phase of low productivity growth is merely a breathing space, for which there are in some cases quite trivial reasons.

The slump in the semiconductor industry, for example, is mainly due to the fact that the production of these IT components has been shifting increasingly away from the US to other countries. As decisions to shift production processes elsewhere became a more common occurrence, namely from 2004 onwards, this sector not only started to account for a dwindling share of the economy as a whole. Rather, a scenario was created in which further productivity gains in the IT manufacturing sector were largely being realized abroad.

The optimists also stress the importance of viewing the low productivity growth within the context of mounting measurement problems which, in a digitalization environment, tend to center around one key question: how can the progress made thanks to digitalization be measured if a large number of digital services – from Google and Facebook to Skype and Youtube – are available free of charge? That old question, namely to what extent gross domestic product, as it is currently calculated in the national accounts, is an appropriate way of measuring everyday reality and quality of life in a given country, is turning into a new, more pressing one as digitalization continues to advance.<sup>20</sup>

Although there is little chance of these fundamental measurement problems being resolved any time soon, the "digitalization optimists" have high expectations as far as future productivity progress is concerned.

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<sup>19</sup> Gordon (2014).

<sup>20</sup> To quote Hal Varian, Chief Economist at Google: "There is a lack of appreciation for what's happening in Silicon Valley because we don't have a good way to measure it.", in <http://www.wsj.com/articles/silicon-valley-doesn-t-believe-u-s-productivity-is-down-1437100700>.

These expectations tend to rest, not least, on the observation that there are still many areas in which digitalization has not yet truly left its mark. These also include major sectors like healthcare, education and infrastructure. The optimists feel that these areas, together with the manufacturing industry, offer even further major potential for IT-driven productivity surges:

- **Healthcare:** Individual treatment methods and personalized medication should usher in fundamental changes in this segment. The fact that large volumes of data can be analyzed more quickly and at a lower cost also has the potential to make decisive improvements to the process involved in developing new pharmaceuticals.
- **Education:** Digitalization opens up a wealth of completely new opportunities for knowledge transfer, not least as far as the outreach and individualization of learning content and progress are concerned.
- **Infrastructure:** Networked city infrastructure, achieved via intelligent transport systems and "smart grids", offers considerable potential for efficiency and productivity gains.
- **Industry:** In the future, higher-precision robots will be able to perform even the most sensitive, detailed assembly work, e.g. cellphone assembly, that is currently still performed by hand; enhanced 3D printing would not only enable individualization, but also real just-in-time production; what is more, greater networking between production facilities using intelligent control systems has the potential to ensure that resources are used more efficiently.

The "digital optimists" are convinced that these concrete examples clearly show just how much can still be done in terms of future transformation via IT. They feel that these and other innovations that cannot even be envisaged as yet will have a real impact on productivity growth in the future<sup>21</sup>.

Another argument in support of a renewed acceleration in productivity growth is that technology-driven transformation will be enabled first and foremost by interrelated innovation. The real value of the steam engine, for example, lay in its role as the basis for the numerous inventions that followed it. Similarly, information and communications technology is tipped to be a catalyst and basis for future innovation. One crucial factor in this respect is that digital information cannot be used up. Thanks to increasing networking and the ongoing reduction in IT infrastructure costs, this allows everyone to benefit from this information without any risk of a supply bottleneck. Because information and communications technology can be used anywhere and everywhere as general purpose technology, all sectors of the economy can use these innovations and information to generate productivity growth<sup>22</sup>. The "digitalization optimists" believe, however, that political measures are needed in order to free up this potential – which also makes the political shortcomings seen in the past another explanation for the low productivity figures that prevail at the moment. Promoting fundamental research and, in particular, investments in education are key levers that could be used within this context. After all, the main problem is currently said to lie in the fact that human capital cannot keep pace with technological developments: people are at risk of losing the "race against the machine".<sup>23</sup> Anyone looking for ample evidence of this only has to look at the high unemployment figures. On the other hand, however, the prospect of bringing

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<sup>21</sup> Bailly/Manyika/Gupta (2013).

<sup>22</sup> Brynjolfsson/McAfee (2012); Miller/Atkinson (2014).

<sup>23</sup> Brynjolfsson/McAfee (2012).

human capital and technology back into line with each other offers real hope: the ongoing changes in the division of labor (the move from the PC to the post-PC era) are a source of considerable potential as far as future productivity development is concerned. Using Solow (1987) as an inspiration, one could say: large-scale networking and the move towards ever-cheaper computing power is visible everywhere – except in the productivity data. Just like its predecessors, the 4th Industrial Revolution will take decades to unfold its full potential<sup>24</sup>.

To sum up the stance taken by the optimists: information and communications technology is general purpose technology that will continue transforming every sector of the economy, bit by bit. The ongoing process of interlinked innovation will form the foundation stone for productivity growth during the 4th Industrial Revolution. We are only at the very beginning of this learning curve.

It is virtually impossible to draw any sort of binding conclusion from these diametrically opposed narratives on digitalization. At the moment, the data would tend to give the skeptics the edge, whereas our own life experiences, the all-pervading presence of the smartphone and new, digital services lend support to the optimists' arguments. That aside, it is actually impossible to perform any quantitative assessment of the effects of digitalization – as is the case when it comes to assessing how much of an impact investment has on productivity growth. In general, however, we expect to see positive impetus for further development on the whole, especially in the service sectors. This belief is backed up by two arguments in the main:

1. Digitalization is transforming business models fundamentally. As the world is transformed from an analog to a digital one, it is certainly not impossible for negative productivity effects to arise: old business models become obsolete and their output falls because resources cannot be diverted in time; on the other hand, the introduction of new business models gives rise to high start-up costs, as well as initial setup and learning work. All in all, this transition period can eat away at the productivity figures in the national accounts.
2. Digitalization is currently still taking place in the shadow of the credit boom witnessed in the first half of the noughties. The credit boom left a trail of negative developments in its wake: not only the major financial crisis, overindebted states and households, but also lower productivity growth due to the misallocation seen during the boom years. According to calculations performed by the BIS, this effect is said to account for around half a percentage point of annual productivity growth in the US, for example<sup>25</sup>. The more time that separates us from the excessive trends of the pre-Lehman era, the more evident the positive effects of digitalization should become on the statistics, too.

### 3.4 Aging societies

Slower productivity growth can also be seen as mirroring processes of social change. A glance at the differences between productivity trends in the developed countries and the emerging markets would appear to confirm this. Edmund Phelps points out that, as prosperity levels rise, people also become less keen on taking risks; considerable importance is attached to security in order to protect the wealth one has already accumulated.<sup>26</sup>

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<sup>24</sup> cf. Bryne/Oliner/Sichel (2013); Kortum/Pillai (2014); Miller/Atkinson (2014).

<sup>25</sup> See BIS (2015), pp. 50 et seq.

<sup>26</sup> See Phelps XXX

This growing risk aversion is closely linked to the social aging process and has tangible consequences: one third of entrepreneurs in the SME segment are now 55 and over. The German development bank, KfW, believes that this slows down investment and innovation.<sup>27</sup> But the reduced risk appetite in an aging society is not something that only affects the "old". Similar trends can be observed among the younger, up-and-coming active generations. One example can be found in career aspirations, which often focus on security – for instance a lifelong position as a civil servant. Fewer and fewer young people are prepared to take entrepreneurial risks.

### 3.5 Regulation

Regulation is not good or bad for productivity growth *per se*. Regulations that have the ability to create a level playing field can actually foster competition – and, later on down the line, innovation. Regulation – or to put it more precisely: excessive regulation – however, can also have a negative impact on productivity development. This tends to happen when (excessive) regulation hinders competition, creating less of an incentive for efficiency gains. When this happens, resources are no longer used to improve products and processes, but rather to secure political influence in order to maintain the protected status quo (rent seeking): lobbying instead of innovation.<sup>28</sup>

There are many sectors of the economy in which regulation has stood in the way of progress. In the service sector, for example, many sectors have to overcome strict admission barriers; in some cases, prices are governed by fee scales and cross-border business is either prohibited or restricted. In industry, stringent regulation can become a bind in the field of research, in particular, be it when it comes to obtaining approval for new treatments in the medical field, or the use of genetic engineering in the food production sector. These are good examples of how regulation can limit the absorptive capacity for new technology. Developments in digitalization, too, can be frustrated by regulations, for example data protection provisions. So it comes as little surprise that the voices calling for extensive deregulation and liberalization often cite the argument that these measures would have a positive impact on growth by boosting productivity. Admittedly, it is also important to note that some forms of regulation – e.g. data protection, genetic engineering – are by all means justified – even if they undermine growth.

Since the financial crisis, however, regulation has also been having a different, more direct impact on productivity growth: the barrage of new provisions and regulations, coupled with new information and documentation obligations, quite simply mean that more employees are required to perform these activities. In many banks, for example, operational units are shrinking while strategic functions, in particular Legal & Compliance but also new departments for "regulatory lobbying", are going from strength to strength. So at least as far as the financial sector and its related segments of the economy are concerned: increasing regulation has recently created a situation in which the distribution of working hours between productive and non-productive activities has shifted towards the latter – with a knock-on effect on productivity development.

So all in all, regulation remains a key factor in the productivity equation – and the negative aspects have tended to prevail of late. We do not, however, expect this spiral of regulation, which was triggered by the loss of confidence during the financial crisis, to continue indefinitely. Some political programs, such as the planned far-reaching trade

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<sup>27</sup> KfW (2015).

<sup>28</sup> For details on product market regulations that have a harmful effect on competition, see Arnold/Nicoletti/Scarpetta (2011).

agreement between the US and the EU (TTIP), the planned capital markets union within the EU or the completion of the EU single market for services definitely offer considerable potential for "good" regulation, the sort of regulation that promotes competition and innovation, meaning that it also has a positive impact on productivity.

### 3.6 Statistical measurement issues

The problems associated with measuring digitalization as discussed in the section above – namely, how do I measure the progress made thanks to free digital services? – extend far beyond the national accounts. What is more, there are a large number of measurement problems even within the national accounts themselves which make it very difficult to put a precise figure on productivity growth.

The productivity figures contained in the national accounts are not collected directly, but rather are derived from other parameters. Labor productivity, for example, is based on the ratio of real gross output to working hours worked; it can be calculated for all areas of the economy. Measurement problems can also arise in other areas: when it comes to collecting the fundamental data, making price adjustments and allocating figures to individual sectors. The service sectors are a particularly tricky example, because their services tend to comprise complex, idiosyncratic bundles of products, making allocation and price adjustments a laborious process.

In particular, the following aspects are potential sources of error when it comes to measuring labor productivity correctly:

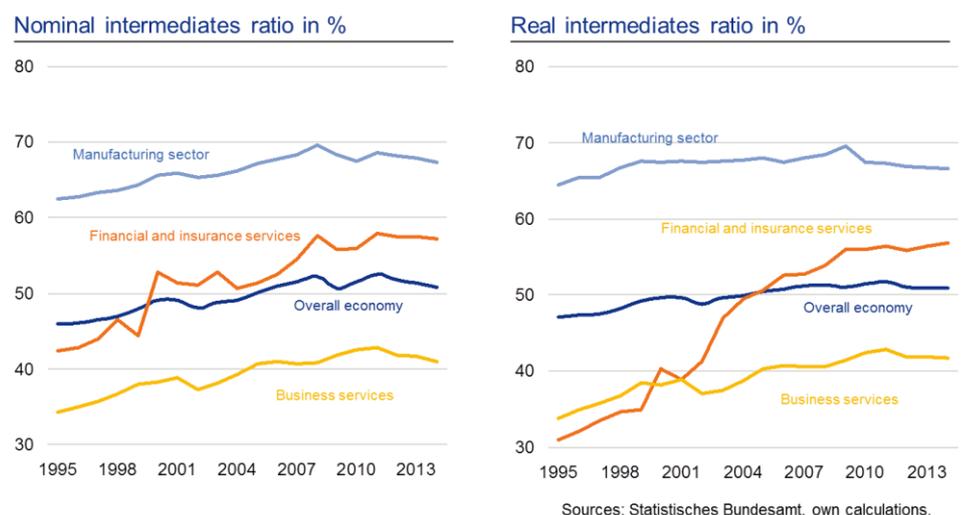
- **Data sources:** For some sectors of the economy, the data sources available are insufficient. This applies in particular to the self-employed who, in turn, tend to be employed mainly in service sectors. The contribution these people make to gross output, for example, is recorded based on VAT statistics; this method can result in the actual economic output being underestimated. Recording working hours, which is based on surveys, is also problematic; this is a parameter that is likely to be overestimated.
- **Market prices:** Gross output (production values minus intermediates) is recorded based on the revenue generated by the sector in question. But market prices are not available for some services and areas; this applies, for example, to software that is created and used in-house and, in particular, to public services. These measurements are based on the input factors – meaning that productivity increases can be ruled out by definition. Statisticians try to alleviate this problem by working with mark-ups and mark-downs for the assumed productivity trend in certain areas. Although the labor productivity calculations based on the fundamental data in the national accounts can show whether development is more or less dynamic, this numerical series does not reflect actual, measured efficiency gains, but rather assumed efficiency gains based on models. In other words: the extent of productivity increases is based on assumptions regarding "plausible" productivity development, and not on actual improvements made to the organization of labor.
- **Classification problems:** Correctly allocating the activities performed to individual sectors of the economy proves virtually impossible for complex corporate structures, e.g. holding companies. The agency employment sector raises a particular problem within this context. Although it technically counts as a service industry, its employees often work in industry. Last but not least, gross output on the one hand, and the number of people in work and working hours on the other, are not always

recorded based on the same sources. Rather, the data is sometimes collected from different surveys. As a result, it is impossible to rule out a scenario in which the numerator and denominator used in the labor productivity quotient relate to slightly different populations.

- Temporal consistency:** The debate regarding labor productivity focuses primarily on changes over time: productivity gains play a key role in determining economic growth. In this respect, consistent time series are essential, something which cannot, unfortunately, always be ensured, particularly in the service sector. There are two main reasons behind this: first, it is not uncommon for the segments of the economy that are grouped under the "service sector" umbrella to be reclassified (one prominent example is the decision to split the "information and communications" segment in Germany in 2008). Second, ongoing improvements to, and measures to refine, the data collection process can result in distortions, for example if they change the understanding of vertical integration in a particular branch of the economy. The development of the input ratios in Germany provides a good illustration of this (see Chart 14): input ratios have generally been on the rise in recent years due to the increasing specialization and globalization of the value chain. Looking at the economy as a whole, the increase over the past 20 years comes in at around five and four percentage points in nominal and real terms, respectively. In the "financial and insurance services industry", by contrast, the input ratio has virtually doubled – in real terms – over the same period; even expressed in nominal terms, the increase of 15 percentage points is remarkably pronounced. There is at least reason to suspect that inconsistencies in data collection might account for some of this trend. If changes in productivity are, indeed, infected by statistical influences, then their informational value can be assumed to be limited.

Chart 14

### Development of intermediates ratio in the overall economy and selected sectors



In addition to these source-related problems, price adjustments create another grey area when it comes to calculating labor productivity. In general, statisticians face major challenges trying to take quality changes into account when calculating price increases (e.g. using the hedonic method). These problems are compounded when the service industry is in the spotlight.

This is mainly because it is very difficult to draw up price indices for this sector due to the specific characteristics of the products and services that it covers. These price indices tend to be based on surveys conducted at a handful of companies, as well as on assumed "model services". It is, at the very least, doubtful whether it is even possible to adequately record price movements – and ultimately also quality changes – on the fragmented and extremely fast-changing service landscape.

In many cases, there are no suitable price indices available at all, for example in the "financial and insurance services sector". In cases like these, statisticians have to make do with designing a volume-based indicator, i.e. an extrapolation from a starting price level using a volume indicator – e.g. total lending and deposit volumes (volume extrapolation). This is problematic in two respects:

- First of all, the method leaves quality changes out of the equation – although improvements like better services, faster processing times or additional included benefits can, of course, be made in the financial sector, too.
- Second, the assumed link between volume and business activity is anything but linear and stable: in the banking business, for example, securitization can result in lending volumes (as reported in the balance sheet) stagnating although lending business is, in fact, on the up.

The extent to which price adjustments impact the calculation of labor productivity (which is generally calculated in real terms) is once again highlighted by the example of financial and insurance services (see Chart 15). Whereas in nominal terms, the average increase over the past 20 years comes in at 2.1% a year – which is roughly in line with the productivity gains made by the economy as a whole (2.2%) – this annualized rate slides into the red in real terms, dropping to -0.5%. This implies that, over the past two decades, the financial sector has become a little bit more inefficient every year on average. Looking at the economy as a whole, on the other hand, the drop in productivity development, expressed in real terms, is much less dramatic. Here, the productivity increase still comes in at a respectable 1.3% p.a. If we take a closer look, we also notice that this negative trend in the financial sector is consistent with a drop in real gross output; this, in turn, is attributable primarily to a very pronounced increase in intermediates during this period – which is even higher in real terms than in nominal terms, a development that cannot be observed anywhere else. In other words: over the past few years, the financial sector has become increasingly reliant on its suppliers, who have, at the same time, become cheaper and cheaper; at the same time, however, the sector's own output has fallen, with only prices increasing. This "finding" is virtually impossible to reconcile with the actual price pressure on many financial products – from bank account management services to credit cards and car insurance.

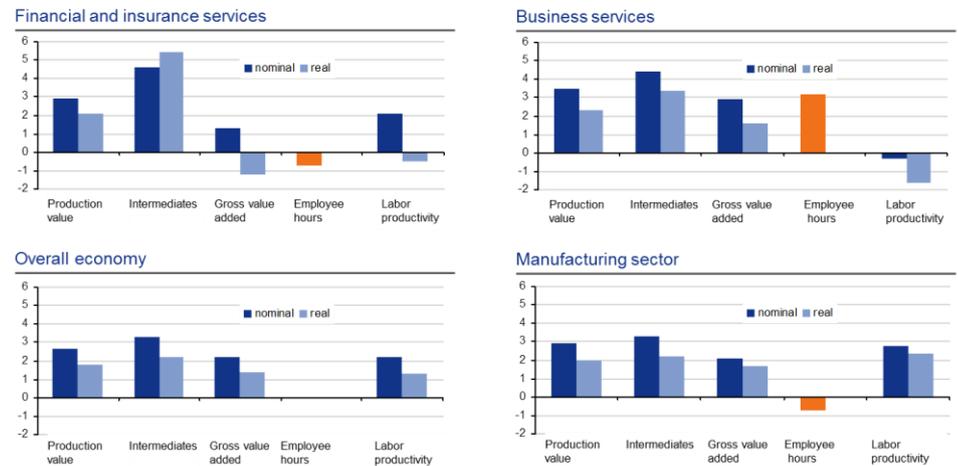
By contrast, the other sector of the economy that has reported a negative productivity trend, namely the business services sector, certainly shows a positive development in gross output in both nominal and real terms. Here, it is the pronounced increase in the number of hours worked, a development that bucks the general trend, that is putting a damper on productivity.

So in both cases, it is doubtful whether these results, which are based on the figures in the national accounts, provide an accurate reflection of reality. The fundamental difficulties associated with data collection and price adjustment are serious ones.

Chart 15

### Comparison of nominal and real figures for the overall economy and selected sectors

Production values, intermediates, gross value added, employee hours and labor productivity  
CAGR 1995 – 2014 in %



Sources: Statistisches Bundesamt, own calculations.

One conclusion can be drawn from these musings on the productivity data derived from the national accounts for the service sector, in particular: despite considerable statistical efforts – including the introduction of special producer price indices for services – the recording and adjustment problems arguably leave the productivity data reported subject to a large margin of uncertainty.

## 4. PRODUCTIVITY DEVELOPMENT SCENARIOS IN GERMANY

The reasons behind the current productivity standstill naturally give rise to the question as to how things will develop in the future: is the trend we are witnessing merely a temporary slump or does it, in fact, point to a structural break? We have neither the metaphorical crystal ball required to answer the question, nor enough imagination to speculate in detail about the virtual world of tomorrow. We can, however, use plausible assumptions to at least outline possible scenarios for future development. We have taken the explanations set out above, in particular the questions regarding the investment slump, the changes on the labor market and the significance of digitalization, as a starting point. The pivotal point is the development witnessed in the manufacturing industry.

We believe that two possible trends could emerge in the manufacturing industry: a return to the average growth rates seen over the past 20 years (2.3%) or a scenario in which growth continues to languish at the low level seen over the past five years (0.9%). There are a few arguments propping up the first scenario: as the economy starts to pick up again and monetary policy returns to normal, the remaining cloud of uncertainty could gradually start to clear; so a return to more buoyant investment activity is not entirely unlikely. If "Industry 4.0" delivers on the expectations, average productivity growth of a good two percent would certainly not appear too ambitious for the next two decades.

There are, however, also a few (good) reasons suggesting that the low growth path seen during the crisis years will continue: the smoldering unresolved crisis in the eurozone, rising geopolitical tensions, financial imbalances and demographic developments.

These adverse factors could leave the economy locked in a (permanent) state of uncertainty for some time to come.

In this sort of environment, how will the other areas of the economy analyzed in this study develop?<sup>29</sup> With the exception of the "information and communications" segment, all sectors have much lower productivity levels than the manufacturing industry. And that's not all: this productivity gap has widened across the board of late. This comes as little surprise if we assume that industry tends to be the first sector to implement new technology and processes and to exploit networking opportunities. By contrast, the service sectors, in particular, find the implementation of new technology much more of a challenge because – provided they want to implement them in a truly systematic manner – this tends to involve the need for fundamental changes to business models. Today's world is full of prime examples of this: while online services are the order of the day, the "analog" and the "digital" worlds continue to co-exist, with the internet serving as more of an added extra over and above existing sales channels. Truly novel business ideas and models are still rare, and so it is hardly surprising that this hotchpotch of services is more a hindrance than a help to productivity development. Furthermore, the changes on the labor market, particularly the establishment of a low-wage sector and the boom in freelancing, are likely to have frustrated productivity development in many service sectors.

But this is not necessarily a situation that is set in stone for the next 20 years. Rather, in the long term, new services and structures are likely to prevail – because they are more efficient. Digitalization will allow each and every work process, including white collar activities, to be carved up into individual steps in order to realize specialization and efficiency gains; the decomposition – and, as a logical consequence, the globalization – of the value chain will leave its mark on the service industry, too, in the future: as a result, systematic digitalization means nothing other than the industrialization of all activities. As a result, we are not unlikely to see the productivity gap between the manufacturing industry and other areas of the economy narrow again in the future<sup>30</sup>.

This trend would also imply that the considerable job creation seen in recent years will not continue unabated, i.e. that the labor intensity of production will fall again as the availability of labor declines. Especially in light of the current wave of immigration (and continued high rates of unemployment in many developed countries), however, it is also impossible to rule out the opposite: the low-wage sector will continue to grow and labor productivity will continue to stagnate in the service sectors, in particular, meaning that it will drop further behind the level seen in the industrial sector.

As a result, we believe that there are three specific possible development paths: first, productivity development in the other sectors will catch up relatively quickly, i.e. reducing the gap by half a percentage point per year; second, the trend will lose considerable momentum and while the gap will not narrow, it will no longer widen either; or third, the productivity gap will continue to grow at a rate of half a percentage point a year. Even in the optimistic scenario, however, no sector of the economy will manage to close the gap entirely: so even this scenario is light years away from a virtual utopia.

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<sup>29</sup> The analysis below only includes those areas of the economy that we deem to be free of any serious statistical distortions, i.e. our point of reference is the "adjusted" economy as a whole.

<sup>30</sup> We expect to see the same trend in the "information and communications" segment, i.e. this sector will retain its lead, but will not be able to extend it any further.

We have used these assumptions to come up with a total of four scenarios for the future development of labor productivity (see also Chart 16):

- **Scenario 1: Back to the Future:** productivity growth in the producing sector will bounce back from the post-crisis low and return to the average values for the past 20 years; at the same time, the trend towards industrialization will gain momentum in the other sectors and the productivity gap will narrow.
- **Scenario 2: Industry 4.0:** productivity growth in the producing sector will bounce back from the post-crisis low and return to the average values for the past 20 years; the other sectors of the economy, however, will be unable to keep pace with this development and will prove very hesitant in moving towards industrialization, with the productivity gap continuing to widen.
- **Scenario 3: Lingering on:** productivity growth in the producing sector will remain stuck at the post-crisis low; the other sectors of the economy will keep up with this development and the trend towards industrialization in these sectors will move in parallel with that witnessed in the manufacturing industry, i.e. the productivity gap will remain unchanged.
- **Scenario 4: Secular stagnation:** productivity growth in the producing sector will remain stuck at the post-crisis low; what is more, the other sectors of the economy will continue to lag behind and will prove very hesitant in moving towards industrialization, with the productivity gap continuing to widen.

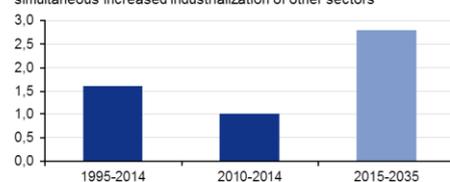
Chart 16

### Labor productivity per employee hour worked: Scenarios for the future

Real gross value added per employee hour, overall economy\*, average growth rate in %

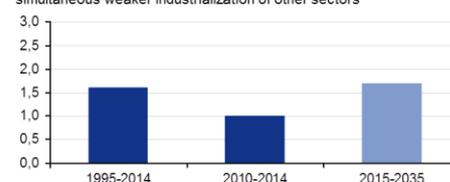
#### Scenario I: Back to the Future

Productivity growth in producing sector as since 1995 and simultaneous increased industrialization of other sectors



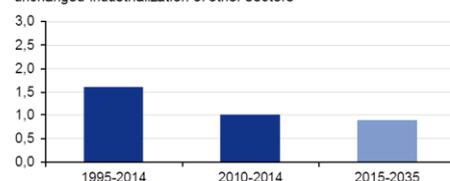
#### Scenario II: Industry 4.0

Productivity growth in producing sector as since 1995 and simultaneous weaker industrialization of other sectors



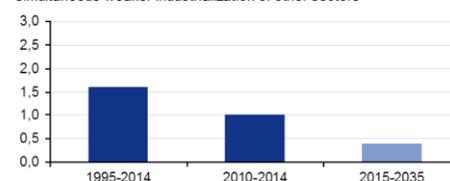
#### Scenario III: Lingering on

Productivity growth in producing sector as since 2010 and unchanged industrialization of other sectors



#### Scenario IV: Secular stagnation

Productivity growth in producing sector as since 2010 and simultaneous weaker industrialization of other sectors



\*excl. Financial and insurance services, housing, public-sector and other services

Sources: Statistisches Bundesamt, own calculations.

Depending on the scenario, productivity growth is likely to come in at between 0.4% and 2.8% over the next 20 years. This means that a return to growth rates in excess of two percent cannot be ruled out, at least in the "best case". It is, however, important to bear one limitation in mind: these calculations are based on an "adjusted" macroeconomic aggregate that leaves those economic sectors that are exposed to statistical recording difficulties out of the equation. Obviously, the national accounts cannot take such liberties, meaning that the official figures will continue to encompass all areas of the economy. Looking ahead, if we assume that these service sectors will report similar

figures, on average, to those reported in the past, then official productivity growth will be lower than in our scenarios, coming in at between 0.5% and 2.1%. One source of consolation, however, is that the actual situation is probably better than the aggregate figures from the national accounts would suggest.

## 5. SUMMARY AND OUTLOOK

Productivity growth has come as a disappointment in many developed countries in the recent past. This is particularly relevant to the European Union, because this region of the world looks set to see a dwindling supply of labor in the long run, meaning that productivity gains will essentially be the only source of growth. Even long-term growth projections for Europe such as those released by the OECD, or by the European Commission, expect productivity growth to pick up again compared to the level seen in recent years. This working paper attempts to identify the reasons behind the current investment slump and the implications for future development. There are, of course, many reasons explaining the productivity slump witnessed in recent years, although the main culprits are the downturn in investment and the changes on the labor markets, which are feeling the heat of globalization.

These two factors are also unlikely to change in the near future. There are signs pointing towards a slight slowdown in globalization, as the current slowdown in China and other emerging markets, as well as the less dynamic development in global trade show. Nevertheless, there is no indication that this will translate into less price and cost pressure on the international competitive landscape and that an upward trend in wages, which would force companies into more capital-intensive production with higher labor productivity, is on the horizon in the developed countries. High unemployment figures in many developed countries and, in particular, high levels of immigration tend to suggest that this scenario will not materialize. Companies will only have more of an incentive to substitute labor with capital, and increase labor productivity in the process, when the supply of labor becomes significantly constrained, as is likely to happen in the longer term.

There is no doubt that the investment slump seen in recent years is one of the main reasons behind the poor development in average labor productivity and technical progress in general. Is this something that we will be able to overcome in the near future? The economic recovery in the developed countries, coupled with favorable financing conditions, suggests that investment activity will pick up. On the other hand, the uncertainty surrounding future global economic development has certainly not subsided, despite – or perhaps because of – the continued zero interest rate policy pursued by the central banks. In particular, however, the demographic trend in the world's developed countries sets clear boundaries as far as future demand expectations are concerned. In this sort of environment, we are unlikely to see the sort of pronounced increase in investments that would have a decisive impact on long-term growth potential, especially in the EU. Economic policymakers in the developed countries, particularly in the EU, will have to do more to improve the conditions for investment.

But it is digitalization that remains the "great unknown" when it comes to predicting productivity levels in the future. The skeptics doubt the ability of digitalization to bring about any major increases in efficiency and expect any benefits to be limited to making customers' life more convenient and saving them time. This is not a view that we share. Rather, we believe that the digitalization of economic processes offers considerable efficiency potential. The fact that this has not yet been reflected in the productivity figures in our national accounts is likely due to two factors:

1. We are unable to measure productivity in a reasonably accurate manner, particularly in service sectors. Identifying appropriate price adjustments to apply to services is likely to become increasingly difficult as products and services become more customized. And yet although it is difficult to measure digitalized products, they definitely serve to boost incomes and productivity. Private households and companies alike save time and money by processing a whole range of information and transactions free of charge online.
2. The second reason behind the weak productivity trend witnessed in recent years despite the "digital revolution" is likely to lie in the fact that many companies are still going through a "learning" or "adjustment" phase. Since production digitalization not only requires technical changes, but also alters the face of entire business models, the transformation from the analog to the digital world can certainly go hand-in-hand with a few negative productivity effects. Old business models become obsolete and their output drops, while the introduction of new business models calls for substantial start-up investments and it takes time before these new models achieve the scale required to surpass the break-even mark. This process can eat away at the productivity figures in the national accounts. Making the transition from the analog to the digital business world without frictional losses is certainly an entrepreneurial challenge. Efficiency gains can only come to light when the digitalization process has reached each and every process and when physical and digital value chains have been intertwined. On traditional markets, this process can easily last for a number of years. In the long term, however, digitalization should provide a productivity boost.

Services are of key importance in this respect, as we have investigated in a number of scenarios, taking Germany as an example. A substantial productivity gap has emerged between the service sectors on the one hand, and industry on the other. Whereas average labor productivity in the industrial sector has risen considerably, it has actually dropped back in parts of the service sector. This means that it is the service sector, in particular, that holds the key to a return to improved overall productivity growth. We predict that the sector will manage to keep the gap separating it from the industrial sector from widening and that systematic digitalization will help to narrow the gap to some extent.

Setting the arguments for and against future productivity gains aside, one thing is clear: this issue, which is particularly important for all of the world's developed economies, has been somewhat neglected by economic policymakers in recent years. If the supply of labor shrinks, which is virtually inevitable in many countries, and an economy cannot generate any more productivity gains, then it is destined for stagnation, which makes it all the more difficult to keep a tight rein on sovereign debt and finance the country's welfare systems. There are numerous ways in which economic policy could encourage more positive development. First and foremost, moves to improve employee qualifications and the overall framework for investment and innovation, efforts to prevent excessive restrictions being imposed on new technology and the development of suitable capital markets. We expect economic policy areas like these to be pushed back into the spotlight over the next few years. There is certainly no time to waste.

## 6. LITERATURE

Arnold/Nicoletti/Scarpetta (2012), Regulation, resource allocation and productivity growth, *Productivity and growth in Europe*, EIB Papers 16:1, pages 91-115.

Baily/Manyika/Gupta (2013), U.S. Productivity Growth: An optimistic perspective, *International Productivity Monitor*, 25, pp. 3-12.

BIS (2015), 85th Annual Report, Basle.

BIS (2014), 84th Annual Report, Basle.

Bryne/Oliner/Sichel (2013), Is the Information Technology Revolution Over?, *International Productivity Monitor*, 25, pp. 20-36.

Brynjolfsson/McAfee (2012), *Race Against The Machine: How The Digital Revolution Is Accelerating Innovation, Driving Productivity, and Irreversibly Transforming Employment and The Economy*, MIT Center for Digital Business Research Brief, January, pp. 1-8.

Caranci/Feltmate (2014), The Lost Years: U.S. Business Investment poised for better days, *TD Economics Special Report*, October 23rd, pp. 1-8.

Cowen (2011), *The Great Stagnation*, New York, 2011.

Duesterberg/Norman (2015), Why Is Capital Investment Consistently Weak in the 21st Century U.S. Economy, *The Aspen Institute*.

Fernald (2014), Productivity and potential output before, during, and after the Great Recession, *National Bureau of Economic Research*, w20248, pp. 1-50.

Fernald/Wang (2015), The recent rise and fall of rapid productivity growth, *FRBSF Economic Letter*, February 9th, pp. 1-5.

Gordon (2014), The demise of U.S. economic growth: Restatement, rebuttal, and reflections, *National Bureau of Economic Research*, w19895, pp. 1-41.

Gordon (2013), U.S. Productivity Growth: The Slowdown has returned after a temporary revival, *International Productivity Monitor*, 25, pp. 13-19.

Gordon (2012), Is U.S. Economic Growth Over? Faltering Innovation Confronts the Six Headwinds, *National Bureau of Economic Research*, Working Paper No. 18315.

KfW (2015), *Demografie im Mittelstand*, Fokus Volkswirtschaft 92.

Labelle (2015), The new normal: Low rates in advanced economies for the long run, *TD Economics Special Report*, February 24th, pp. 1-7.

Miller/Atkinson (2014), Raising European Productivity Growth Through ICT, *The Information Technology & Innovation Foundation*, June, pp. 1-43.

Rifkin (2014), *Die Null-Grenzkosten-Gesellschaft: Das Internet der Dinge, kollaboratives Gemeingut und der Rückzug des Kapitalismus*, Frankfurt am Main.

Solow (1956), A Contribution to the Theory of Economic Growth, Quarterly Journal of Economics, Vol. 70, pp. 65-94.

German Federal Statistics Office (2014), Fachserie 18, Reihe 1.4.

Summers (2014), U.S. Economic Prospects: Secular Stagnation, Hysteresis, and the Zero Lower Bound, Business Economics, 49, pp. 65 – 73.

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