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The Global Productivity Slowdown: Diagnosis, Causes and Remedies

This paper addresses the long-term slowdown in labour productivity for a panel of 25 countries. First, we look at productivity shifts and trends based on structural break tests and modern filtering techniques. The productivity slowdown is evident in almost all countries we investigate. Second, we deepen the analysis by decomposing labour productivity growth. Third, we use dynamic models to test for Granger causality in the trends and find that there is strong evidence that a slow GDP growth trend causes the subsequent productivity trend. We conclude that the productivity slowdown is a global phenomenon and should therefore be tackled at the international level.

Productivity growth has always been a key indicator for the possible long-term prosperity and growth opportunities of societies. Changing trends in labour productivity growth have been factors for stabilising or destabilising distributional conflicts between capital and labour: as long as capitalism produced higher incomes for the majority of working people around the globe – as in the decades after the Second World War – the legitimacy of income and wealth inequality was a less pressing social question due to the diminished distributional conflict between capital and labour. For long periods, capitalism seemed to deliver what it promised, i.e. to make everyone better off. However, if, on the contrary, labour productivity growth should ever slow down in comparison to capital growth, as it has from the 1970s and onwards, social tensions stemming from grossly unequal income distribution would be sure to rise.[1]

A look at labour productivity trends in recent decades reveals that – with the exception of a short productivity miracle in some countries in the second half of the 1990s and early 2000s – the overall trend in measured productivity growth is declining. After the financial crisis, the productivity growth trends of most countries stabilised closely to a growth rate of slightly above zero. This can be easily exemplified through some simple econometrics for several prominent OECD countries, as shown in Figure 1.

There are two explanatory factors for this development in the debate: one is that the overall innovation process has seemingly slowed down. As Robert Gordon illustrated, the rate of technological progress, measured by total factor productivity growth (TFP), has quite steadily diminished over the past few decades – particularly in the highly industrialised countries like the US, Japan and the large Western European nations.[2] The second is a global lack of effective demand.[3] Economic growth in most countries has furthermore become more and more debt-driven.[4] To reduce the demand gap, long-term public and private debt must increasingly be created. In the long run, this is unsustainable if productivity growth does not move towards significantly higher levels, as the case of Greece is impressively demonstrating. Debt restructurings and "haircuts" are becoming inevitable necessities at some point as a result of this long-term trend. This in turn causes major global economic disruptions, as defaulting

1 N. Roubini: Globalization's Political Fault Lines, Project Syndicate, 4 July 2016; and J.E. Stiglitz: From Brexit to the Future, Project Syndicate, 6 July 2016.

2 R.J. Gordon: Is U.S. Economic Growth Over? Faltering Innovation Confronts the Six Headwinds, NBER WP 18315, National Bureau of Economic Research, August 2012.

3 L. Karabarbounis, B. Neimann: The Global Decline of the Labour Share, NBER WP 19136, National Bureau of Economic Research, June 2013.

4 C.M. Reinhart, K.S. Rogoff: This Time is Different – Eight Centuries of Financial Folly, Princeton 2010, Princeton University Press; International Monetary Fund: Fiscal Monitor, April 2016; E. Stockhammer, R. Wildauer: Debt-driven growth? Wealth, distribution and demand in OECD countries, in: Cambridge Journal of Economics, Vol. 40, No. 6, November 2015.

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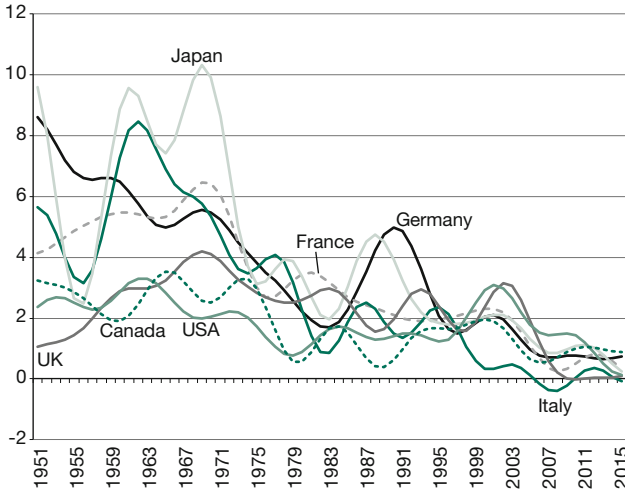
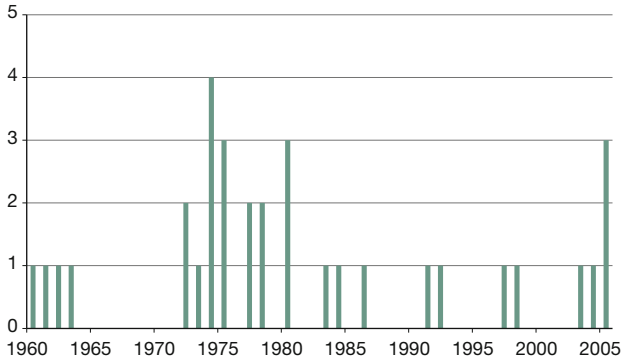
Figure 1
Labour productivity trends in the G7
in %



Source: The Conference Board Total Economy Database: Output, Labor and Productivity, 1950-2015. We calculated trends using the asymmetric version of the Christiano-Fitzgerald band pass filter under the assumption that the original series are integrated of order 1. See L.J. Christian, T.J. Fitzgerald: The Band Pass Filter, in: International Economic Review, Vol. 44, No. 2, 2003, pp. 435-465.

Figure 2
Number of structural breaks in the labour productivity trends of major industrialised countries



Source: The Conference Board Total Economy Database: Output, Labor and Productivity, 1950-2015.

debtors lose access to credit markets or at least have to pay very high mark-ups on interest rates.

This paper addresses the topic of an overall long-term slowdown in labour productivity for a panel of 25 countries in the following manner. First, we look at productivity shifts and trends based on structural break tests and modern filtering techniques. The productivity slowdown is revealed in almost all countries we investigate. We confirm that a falling trend is a global phenomenon by using principal component analysis. However, a certain degree of heterogeneity prevails. Some countries, such as South Korea and the US, perform somewhat better than the large EU member states or Japan. Second, we deepen the analysis by decomposing labour productivity growth into changes in hours worked and GDP growth for each country and repeating the analysis for both individual series. At first glance, the falling trend coincides with falling GDP growth rates but not with trends in hours worked. Third, we use dynamic models to test for Granger causality in the trends and find that there is overwhelming evidence that a slow GDP growth trend causes the subsequent productivity trend. In particular, we can identify reasonable clustering for the growth trends of EU member states, but the individual country differences are very small. Countries with particularly strong economic relations with Germany and Austria or the Nordic countries cluster more towards a joint common trend. Despite this, we conclude that the productivity slowdown is a global phenomenon and should therefore be tackled at the international level.

A closer look at productivity trends

While Figure 1 points towards a downward trend in labour productivity in the major industrialised economies, this section is dedicated to a deeper diagnosis of the phenomenon. Firstly, we test whether the downward trend has been consistently present since the 1950s or whether it has happened in shifts. For that, we use structural break tests and compare the results across countries. The tests are conducted on the constant term in the regression model proposed by Robert Gordon more than a decade ago.[5] Figure 2 reports all the significant structural breaks we were able to detect in our sample.[6] We use the sequential breakpoint test developed by Jushan Bai and Pierre Perron, which allows for multiple breakpoints in the sample.[7] While structural breaks seem to have occurred across the whole sample,[8] two of the five decades seem

5 R.J. Gordon: Exploding productivity growth: context, causes, and implications, Brookings Papers on Economic Activity 2003, No. 2, pp. 207-298.

6 Our sample consists of 25 industrialised countries: Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, Canada, United States, Japan and South Korea. The sample is based on annual data for labour productivity. Growth rates are available for the years 1951 to 2015.

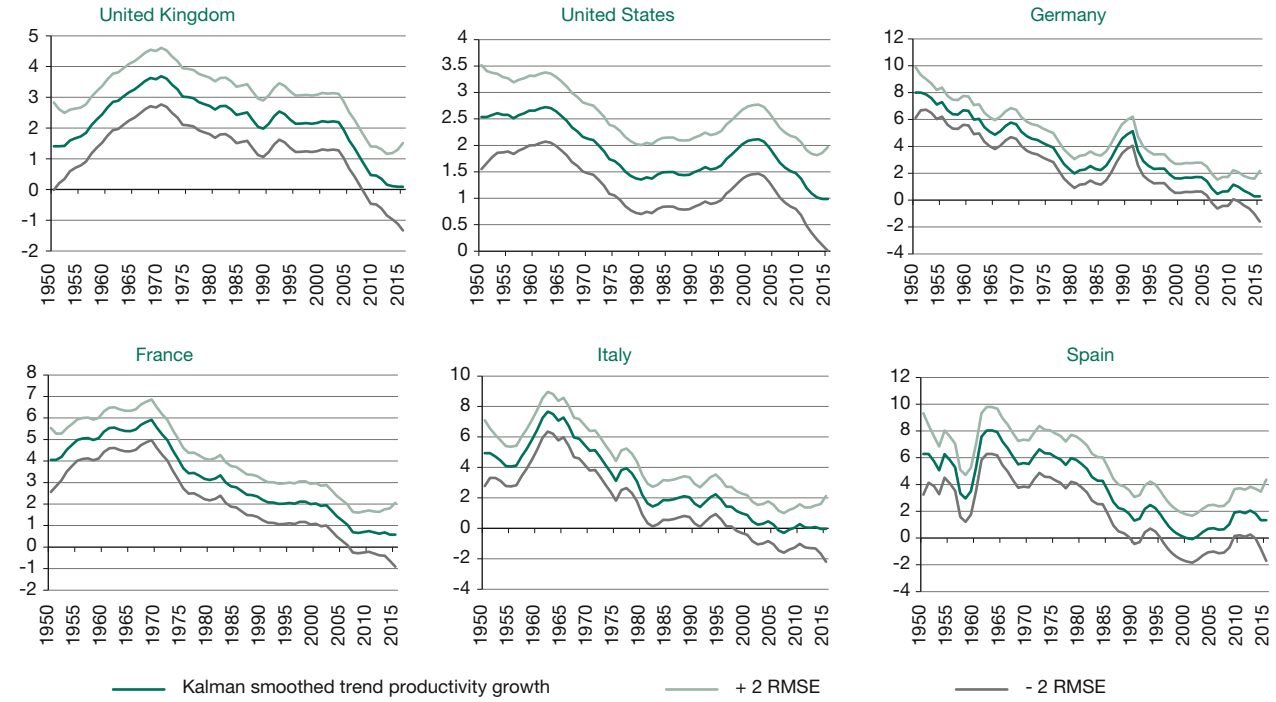
7 See J. Bai, P. Perron: Computation and Analysis of Multiple Structural Change Models, in: Journal of Applied Econometrics, Vol. 6, 2003, pp. 72-78. For more information on the methods used throughout this article, please see G. Erber: Labor Productivity Slowdown in the Developed Economies, DEP (Socioeconomics) Discussion Papers Macroeconomics and Finance Series, No. 201604, 2016.

8 The sample is trimmed at the upper and lower 15% in the test setting.

Figure 3

Kalman filter estimated trends and estimated shifts of the constant in the Gordon model of labour productivity growth, 1950-2015

in %



Source: Authors' calculations based on data from The Conference Board Total Economy Database: Output, Labor and Productivity, 1950-2015.

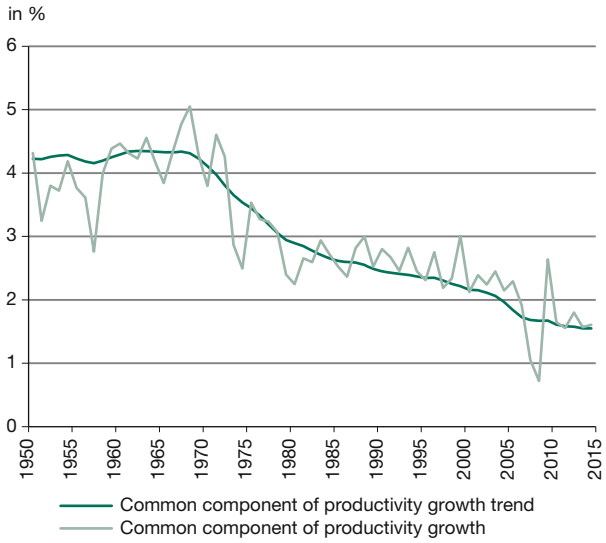
to stand out. The 1970s count a total number of 14 breaks, which means that more than half of the countries in the sample experienced a breakpoint at that time. The other period of note is the decade from 1995 to 2005, where we found seven break points. The 1970s seem to have been a period in which countries across the entire industrialised world experienced a (downward) shift in productivity growth: 4 out of the 14 countries are non-EU (Canada, Japan, Turkey and the United States). The countries going through shifts in the last ten years of the sample, however, are all EU countries. Strikingly, some of the EU countries that went through structural breaks in the near past had already experienced breaks in the 1970s or early 1980s – namely Finland, France, Germany and Norway.

The analysis of productivity growth evolution can also be conducted using estimated trend series of labour productivity. Figure 3 presents the results of the filtering approach, which is based on the same baseline regression as the structural break tests.[9] The series represent movements of labour productivity which are not due to the business cycle and can be interpreted as underlying or medium-term structural trends. Again, there seems to be a difference between the US and the EU time series: all of the EU countries experienced a shift in labour productivity, which had led their trend growth series close to zero. In fact, zero growth is included in the confidence intervals in the five biggest EU economies, while productivity growth seems to remain positive in the US. The other major difference between the US and continental Europe in particular is that even though the trend is unambiguously moving downward everywhere, it is much steeper in Europe than in the US. In the 2000s, the downward trend has again become more visible across countries, with Spain being the exception. In fact, in Spain the trend growth rate of labour productivity actually seems to have recovered some. One likely explanation for this is the "shedding" of the labour force that has taken place in Spain since the financial crisis, where massive numbers of the most unproductive workers have been laid off.

The results point toward some major differences and similarities between the countries we investigated. So far, we have seen that all countries – explored separately – seem to have a downward trend with differing start and end-

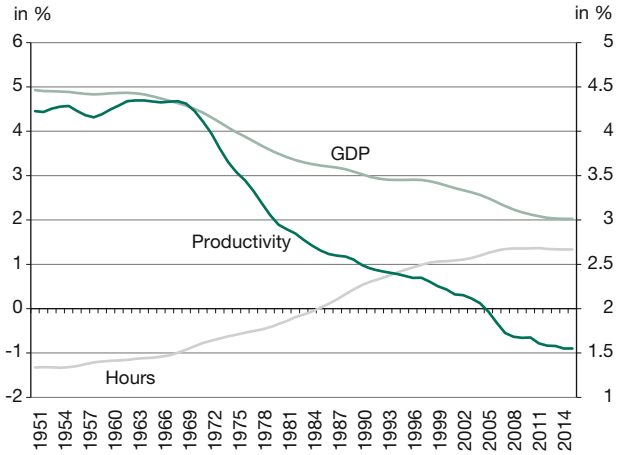
9 The filtered series are obtained by smoothing out the business cycle component of the labour productivity series using the Kalman filter. The resulting series are the time varying constants of the regression as in R.J. Gordon: Exploding . . . , op. cit.

Figure 4
Common component of productivity growth



Source: Authors' calculations based on data from The Conference Board Total Economy Database: Output, Labor and Productivity, 1950-2015.

Figure 5
Common components of growth trends for GDP, productivity and hours worked



Note: Productivity is measured on the right-hand scale and the other series on the left-hand scale.

Source: Authors' calculations based on data from The Conference Board Total Economy Database: Output, Labor and Productivity, 1950-2015.

points and differing slopes. We are now interested in the question of whether the trends of these countries share a common component. Figure 4 depicts such a common component, which is the result of a factor analysis on the raw and the trend series, as determined in the last section. It turns out that there is a common downward trend, which explains large parts of the trends of most individual countries: the first common factor explains more than 50% of the series' variance in 21 of the 25 countries.[10] However, this is only true for the trend series. The raw series are highly driven by asymmetric business cycles across countries. The common component in Figure 4 also confirms the conclusions drawn above, namely that the slowdown did not start until the 1970s, it became less pronounced in the 1990s and it accelerated around the financial crisis.

As labour productivity is the ratio of GDP to some measure of labour input (hours worked, in our case), the investigation of the individual series might give hints as to the potential causes of the labour productivity downturn and the differences across countries. As both GDP and hours worked are highly dependent on the business cycle, it again makes sense to use filtered series. Figure 5 displays the same common productivity trend component series as Figure 4, but now the corresponding series are added for hours worked and GDP. The common component of hours worked has a positive trend, while the other two series have (very similar) downward trends. It is also true that, being derived from the factor analysis transformations, these common component growth rates do not add up (not even approximately), while the basic series for any country are consistent. The reason why the picture is so confusing is that the one factor solution for growth in hours worked does not seem to be very helpful: in 14 of our 25 countries, the factor explains less than half of the variance in hours worked. In the case of GDP, on the contrary, 22 out of 25 series are well explained – it accounts for more than half of the variance – by one factor.

In this section, we have seen that many industrialised countries share a downward trend in labour productivity. For essentially every country studied, this trend started in the 1970s, when structural breaks can be identified in more than half of the countries. In the last 20 years, another structural break seems to have occurred in some European countries. With productivity growth being nearly zero, the situation seems to be worse in many EU countries than in the US. As the GDP trend series are very similar across countries, we suspect this series to be the driving force behind the downward trend. The fact that no such systematic relationship exists with regards to growth in hours worked might be a hint that cross-country differences in this series might also explain differences in the productivity growth series.

10 For details refer to G. Erber et al., op. cit.

Table 1
Results of the Toda-Yamamoto Granger non-causality test for GDP and productivity growth

Excluded series	χ^2 statistic	P-value
Common component of productivity growth	2.82	0.42
Common component of GDP growth	9.69	0.02

Source: Authors' calculations based on data from The Conference Board Total Economy Database: Output, Labor and Productivity, 1950-2015.

What drives the slowdown, and are we all alike?

Causality analysis is a delicate topic in economics. In the context of time series, however, there are established tools to investigate causal relationships given the exogenous timeline. To this end, we estimate bivariate vector autoregressive (VAR) models of the common components of GDP and productivity growth. This allows us to formally test for Granger (non-)causality. As we are dealing with, by definition, trending series, these are likely to be non-stationary. Therefore, we use a method appropriate for such cases.[11] Table 1 summarises the Granger test result from the bivariate model of the common components of trend GDP and trend productivity growth.

The null hypothesis of "non-causality" cannot be rejected for the direction running from productivity to GDP, but we would reject "non-causality" at the usual significance levels for the direction running from GDP to productivity growth. The common downward trend in productivity growth is therefore likely to be "caused" (or influenced) by the downward trend in GDP growth – and not vice versa.

What about country differences? To explore that, we used a cluster analysis of productivity growth to shed light on the issue of how much countries differ with respect to their productivity growth over time.[12]

Regarding productivity growth, we find three aspects worth mentioning. First, differences in general are very small, as all countries have many similarities. With the exception of Turkey and Cyprus – each with strong catching-up growth effects over the sample periods – all countries are very similar. Identified subgroups to a large extent confirm the findings of the well-known "varieties of capitalism" approach: Anglo-Saxon countries are clustered together, Scandinavian countries are close to each other and continental European countries form two groups – one consisting of catching-up (periphery) countries and one of the established (core) countries of the EU. Strikingly, however, the differences between groups are very small. A quite similar picture appears for productivity growth trends.

To sum up the investigative part, all countries face a downward trend in productivity, and the common trend follows a similar decline in the GDP growth trend. There are, however, country groups which are different with respect to the speed of the decline in productivity growth due to catch-up growth effects at the beginning of the sample. The differences across countries, however, are small.

Remedies

Our study shows that there is a long-run joint downward trend in productivity and growth, with the causality of this trend originating from growth to productivity. Underlying causes could be manifold – ranging from hysteresis effects on labour and capital markets[13] to slow innovation dynamics in stagnating economies.[14] The remedies, however, are straightforward. We need stronger demand to lift growth and create room for creative destruction.

First, strong collective action is needed to lift growth rates in Europe and all other regions in the world. This in turn calls for a collaborative approach that could make the overall impact more effective. An example was the collective stimulus programme agreed to at the G20 summit in Pittsburgh in 2009, which was essential to deal with the global financial and economic crisis. If all developed countries could agree to pull in the same direction for fostering an overall growth agenda, perhaps the current and real risk of protectionism could be contained. However, if each country attempts to pursue its own separate agenda, the best response for any single country is to proceed with protectionism, stifling the possibility of spillover growth effects in the global econ-

11 H.Y. Toda, T. Yamamoto: Statistical inference in vector autoregressions with possibly integrated processes, in: Journal of Econometrics, Vol. 66, Nos. 1-2, 1995, pp. 225-250.

12 We used Ward linkages as a clustering method and the squared Euclidean L2 as a distance measure. We excluded South Korea and Malta as outliers. More information is available on request.

13 E. Klär, U. Fritsche: Mehr Beschäftigung durch weitere Arbeitsmarktreformen?, in: Wirtschaftsdienst, Vol. 88, No. 7, 2008, pp. 451-460; E. Klär: Kapitalakkumulation, Gesamtnachfrage, Arbeitsmarktinstitutionen und Beschäftigung in pfadabhängigen Volkswirtschaften. Neue neoklassische Synthese und postkeynesianische Kritik, Marburg 2013, Metropolis.

14 P. Aghion, P. Howitt: Appropriate Growth Policy: A Unifying Framework, in: Journal of the European Economic Association, Vol. 4, Nos. 2-3, 2006, pp. 269-314.

omy. The current agenda pushed by Donald Trump is exactly this, as he has promised to put America first. In a global interconnected world, this could become self-defeating.

Second, a new age of protectionism and "beggar-thy-neighbour" policies could further harm growth with still more negative consequences. Even if globalisation has not worked to improve everyone's living standards, a process of de-globalisation would have devastating economic effects.

Third, global governance needs to be strengthened. In particular, the globally dominant economic countries should accept their responsibility to strengthen the structure of global governance in order to support inclusive global growth. This would require strengthening and further developing the international institutions as effective global governance bodies.

Fourth, growth policies have to strike a balance between demand- and supply-side measures. A one-sided demand pull policy of higher public deficit spending would be incomplete and would only have short-term impacts if the supply-side measures were not simultaneously implemented. The structural impediments constricting the growth potential of the global economy could then not be released to ignite a sustainable long-term recovery of productivity growth.

Fifth, supply-side growth-enhancing measures often require careful and painstaking regulatory reforms. This takes time, and strong policy action is necessary to push them through the legal process and implement them effectively. Often this cumbersome process fails, resulting in negative impacts on the sustainability of growth.

Sixth, investments in infrastructure where they are urgently needed may be one crucial element for a supply-side policy. But they are just one element and by no means a silver bullet towards a long-term higher productivity growth path. In particular, a narrow definition of public infrastructure that concentrates on roads and bridges is highly insufficient.

Seventh, to realise the potential of higher growth, multiple bottlenecks in the production and innovation system must be addressed. This includes bureaucratic inertia and a lack of innovation-friendly regulatory frameworks, among other things. Deregulation is not the solution. There will always be a need to balance the effects of innovation between the winners and losers of innovation to strike a fair deal. This can only be accomplished by active innovation management. Free markets, due to unbalanced market power, tend to produce unfair results where the powerful dominate the weaker market participants. In the short run this might work, but it will ultimately backfire, as the rising resistance against such outcomes has become visible in the populist movements against globalisation.

Eighth, growth has to balance ecological and environmental constraints. Without taking care of these exogenous limits for sustainable growth, the implicit costs such as climate change, pollution, exhaustion of natural resources, etc. will become visible sooner rather than later. These effects are costly to correct – as China is now discovering after a long period of high growth that did not pay much attention to environmental concerns.

Ninth, the financial system has to be adjusted to effectively support long-term growth driven by innovation. Access to financing should be given to those with entrepreneurial spirits, such as start-ups, to realise their business plans. Innovators often get stranded due to lack of access to financing. However, effective risk management is needed in this area, which is still in short supply.

Tenth, the heterogeneity still prevailing among countries gives ample room for country-specific growth policies at the national level. Naturally, a common international framework needs to be complemented by domestic policy to address the specific shortcomings in each individual country. There is no common standard one can take off the shelf and implement.

Conclusion

All this makes it understandable why productivity growth has slowed down. Omissions over the past decades have reduced the growth potential of the developed economies step-by-step. Short-term upticks due to general purpose technologies like the internet economy (particularly in the US) run into rising obstacles such as internet security issues and inefficiencies arising from information overload. These combine to prevent customers from making optimal use of the potential positive productivity growth associated with them, thus limiting our ability to use this technology to access a higher growth path.

Summing up, we believe that there is a chance to engineer a turnaround in productivity growth, but a cumbersome road must be travelled in order to return to a higher growth path. One-sided approaches tend to result in failure in the end. One has to face these challenges to reform the whole production and innovation system.