# NEW TECHNOLOGIES: THE NEED FOR STRUCTURAL REFORMS[1]

**By Focco W. Vijselaar and Neale O. Kennedy[2]**

Short summary

This contribution focuses on the macroeconomic impact of the information economy and the challenges it poses for the regulatory framework of the economy. There are three basic channels via which the new information and communication technologies, the so-called ICT, affect economic growth. The first is that of technical progress in the production of ICT, the second that of capital deepening and the third that of positive spill-over effects from the use of ICT. The two first-mentioned channels are clearly operative in the euro area. Still, there is as yet no sustained higher productivity growth discernible in the euro area economy as a whole. This points to the fact that, although progress has been made with structural reforms, the regulatory framework in the euro area is still inhibiting an optimal use of the new technologies.

[1] Prepared for the conference of the National Bank of Poland "*The Monetary Policy in the Environment of Structural Changes" Falenty*, 24-25 October 2002

[2] Respectively economist and principal economist, Euro Area Macroeconomic Developments Division, European Central Bank. The views expressed in this paper are those of the authors and do not necessarily reflect those of the European Central Bank.

## 1. Introduction

This contribution focuses on the macroeconomic impact of the information economy and the challenges it poses for the regulatory framework of the economy. Until 2001, many economists firmly believed in a beneficial impact of the new information and communication technologies on the macroeconomic performance of countries, the United States in particular. Since then, a slowdown in economic growth has cast doubt on at least some of the wilder claims of advocates of the "new economy", such as "the end of the business cycle". Nevertheless, many observers remain convinced of the beneficial impact of new technologies in the longer run. But, is there really a "new economy"? The answer probably depends on how you define "new economy", and on where you live. A narrow definition identifies the "new economy" with a significant acceleration in productivity related to innovations in information and communication technologies. If you use this narrow definition and if you live in the United States, the answer would probably be "yes".

What about the euro area? As the United States is the only major country in which an upsurge in productivity growth has been evident, the implicit answer to the above question with respect to the euro area would be "no".[3] However, our answer would be "it depends". Indeed, there was no acceleration of productivity in the euro area. Over the past decade as a whole, however, productivity growth in terms of GDP per hour worked has been higher in the euro area than in the United States. And a beneficial impact of new technologies is clearly discernible in the euro area as well. At the same time, we would argue that more structural reforms are needed before the euro area can enjoy the full potential of the new technologies.

This contribution is organised as follows. First, to set the stage, recent labour productivity developments in the euro area and the United States will be discussed. Second, the influence of new technologies on labour productivity developments in general and on those in the euro area in particular will be addressed. Third, the question

[3] Although in some smaller euro area countries, notably Austria, Greece, and Ireland, an increase in labour productivity growth has been apparent when comparing the period 1996-2001 with the first half of the 1990s.

what is the missing link for the euro area to achieve a state of sustained higher productivity growth will be explored further. And, fourth, the relevance of these issues for monetary policy will be shortly highlighted, before coming to a conclusion.

## 2. Productivity developments in the euro area and the United States

Growth of real GDP per capita has over the last decade on average been higher in the United States than in the euro area. Table 1 presents a decomposition of the growth of GDP per capita. Demographic changes in population (a), changes in labour force participation (b), and changes in the employment rate (c), account for differences between the growth of GDP per capita and of GDP per person employed. Likewise, changes in the number of average hours worked per person employed (d) explain the differences between the growth of GDP per person employed and of GDP per hour worked. The table thus highlights that the observed difference in GDP growth per capita between the United States and Europe is due to different developments in labour utilisation and not to a difference in growth of labour productivity.[4]

**Table 1 Annual growth in GDP and its components, 1991-2001**
(percentages and percentage points respectively)

| | GDP per capita | Working age population / total population (a) | Labour force participation rate (b) | Employment/ Labour force (c) | GDP per person employed | Average hours worked (d) | GDP per Hour Worked |
|---|---|---|---|---|---|---|---|
| **Euro area** | 1.7 | -0.1 | 0.5 | -0.1 | 1.4 | -0.6 | 2.0 |
| **United States** | 1.9 | 0.0 | 0.3 | 0.1 | 1.6 | -0.1 | 1.6 |

Source: own calculations based on data from the European Commission, National Accounts and OECD.
Note that figures may not add up due to rounding

Charts 1 and 2 below present developments in labour productivity and employment, both measured with total hours worked, in the euro area and the United States in a somewhat longer time perspective. Labour productivity is usually calculated either in terms of output per person employed or of output per hour worked. The latter measure is generally considered the more appropriate one since the development of output per person

[4] See also the article "New Technologies and Productivity Growth in the Euro Area" in the ECB Monthly Bulletin of July 2001.

employed is influenced also by the average annual number of hours worked per person. In the euro area a decline in the average annual hours worked per person occurred over the last twenty years - due to an increasing importance of part-time work and reductions in the official length of the working week - which was not matched by a similar development in the United States. The use of output per person employed would thus lead to a downward bias in productivity figures for the euro area in particular.

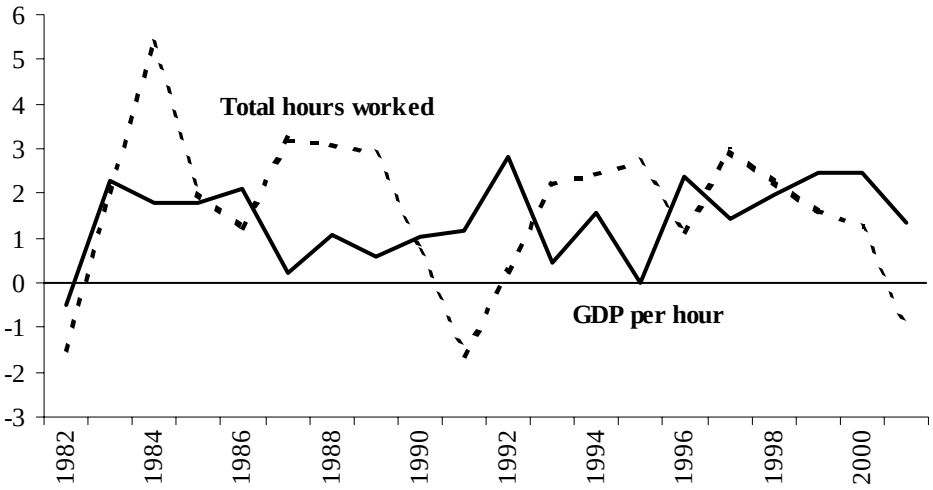
Chart 1 shows that average labour productivity growth in the US was relatively lacklustre in the period between the mid-1980s to the mid-1990s. Thereafter, in the period up to and including 2000, labour productivity accelerated again. While the rate of productivity growth attained in that latter period is in itself not without precedent, the acceleration has, in contrast to the past, been achieved with continued positive employment growth. The acceleration of labour productivity in the US has been accompanied by an increase in investment growth, to a large extent driven by strong ICT investment. This break with past experiences and the role of new technologies are generally seen as the distinctive features of the recent developments in US productivity growth.

It is still hotly debated whether the US productivity developments in the 1990s were of a structural or rather of a cyclical, non-sustainable nature.[5] No convincing conclusions could be reached yet, as it is quite difficult to separate trend and cyclical components, particularly when the data end in the middle of the cycle. The recession of 2001 led to a slowdown in productivity growth, although a sharp drop in growth of total hours worked held up productivity growth to some extent. Note, in this context, that a trade-off between employment and productivity growth is a traditional phenomenon in economies and was also apparent, for example, in the previous recession year in the United States, 1991. Productivity developments this year have been encouraging so far, but were again

[5] See, for example, for an optimistic view Oliner and Sichel (2002) "Information Technology and Productivity: Where Are We Now and Where Are We Going?" FEDS paper 2002-29, and for a more pessimistic view Gordon (2002) "Technology and Economic Performance in the American Economy", NBER Working Paper No.w8771.

achieved at the expense of growth in labour input. Thus, the jury is still out on the issue whether the productivity improvements of the late 1990s are structural or largely cyclical in nature.

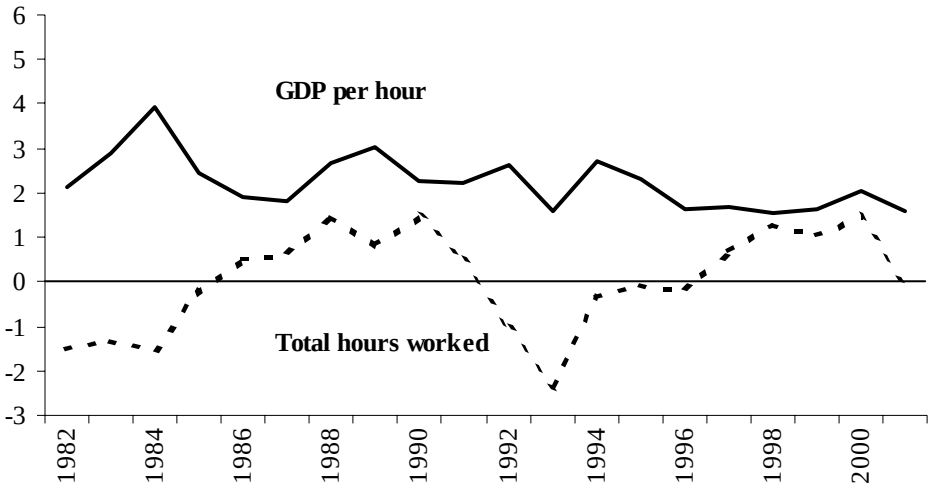
**Chart 1 Average labour productivity and growth of labour input; United States**
(percentage changes)




Source: own calculations based on data from National Accounts and OECD.

Chart 2 shows that developments in the euro area have been somewhat different from those in the United States. Average labour productivity has on average grown at a relatively high, though slightly downward trending, rate. In the recession periods of the first half of the 1980s and the first half of the 1990s, this relatively high rate of productivity growth has been accompanied by an adverse development in total hours worked. In the second half of the 1990s labour input has accelerated again. However, this has not been accompanied by a clear change in labour productivity developments.

**Chart 2 Average labour productivity and growth in labour input; euro area**
(percentage changes)




Source: own calculations based on data from National Accounts and OECD.

## 3. What influence do the new technologies have on productivity growth in the euro area?

There are three basic channels via which the new information and communication technologies, the so-called ICT, affect economic growth.[6] The first is that of technical progress in the production of ICT. This channel is clearly operative in the euro area. ICT-producing sectors have shown a remarkably high rate of productivity growth. In the second half of the 1990s, labour productivity in the ICT-producing manufacturing sector (measured as output per person employed due to lack of data on hours worked at the sectoral level) increased by about 15% per year, while that in the ICT-producing services sector grew by about 8%.[7] These rates of productivity growth are very high compared to the average rate of labour productivity growth in the economy as a whole, which amounted to only 1.3% per year in terms of GDP per person employed.

The second channel through which ICT affects productivity growth is capital deepening, associated with investment in ICT capital. Recent estimates made at the European

[6] See for example McGuckin and Van Ark (2001) "Making Most of the Information Age; Productivity and Structural Reform in the New Economy", Conference Board, New York.
[7] Vijselaar and Albers (2002) "New Technologies and Productivity Growth in the Euro Area", ECB Working Paper No. 122.

Central Bank (ECB) suggest that, even though the level of investment in ICT has been generally lower in the euro area than in the United States, the contribution of ICT capital accumulation to productivity growth has also clearly increased when comparing the first to the second half of the 1990s, following broadly the same pattern as in the United States.[8] Thus, the second channel through which ICT affects productivity is also active in the euro area.

A third channel would be via positive spill-over effects from the use of ICT on productivity growth, i.e. that ICT would be a so-called "general-purpose" technology in nature. This would go beyond the capital deepening effect, in that the spreading use of ICT would cause a more rapid increase in the overall efficiency of the economic process. However, in contrast to the first two channels mentioned, this third channel is not – as yet – clearly operative in the euro area. The evidence suggests that labour productivity in ICT-using sectors have not risen appreciably faster than in non-ICT-using sectors. And, on the basis of the data available, it has not been possible to detect any signs of an acceleration of total factor productivity (TFP) growth in the economy as a whole over the past decade. [9]

Thus, all in all, what is remarkable about the experience of the United States on the one hand and the euro area on the other, is that one important explanation for the acceleration in US productivity in the late 1990s – the proliferation of ICT – is also available in the euro area, but that an increase in productivity growth is only discernible on the other side of the Atlantic. Why then does the euro area not match the performance of the United States? The increase in ALP growth in the United States is in part also ascribed to an acceleration, from the first to the second half of the 1990s, of total factor productivity. By sharp contrast, TFP appears to have decelerated over this period in the euro area. TFP developments may thus explain most of the difference between labour productivity

[8] See op.cit. footnote 7.

[9] It has sometimes been argued that the official euro area statistics do not capture all quality improvements and therefore understate price declines in ICT goods and the volume growth of real GDP. However, as ECB calculations have shown, the sensitivity of euro area GDP growth to the use of alternative, more rapidly declining deflators of ICT was almost negligible in the 1990s (see box entitled "The sensitivity of euro area growth to the measurement of ICT prices" in the ECB Monthly Bulletin of September 2001). Thus, the "new economy" seems not to have arrived invisibly in Europe.

developments in the euro area and the United States, in particular that labour productivity decelerated in the euro area but accelerated in the United States. [10]

There are several possible explanations for the disparity in developments of TFP growth. For example, in a situation of increasing labour market flexibility associated with increasing employment also of relatively low-skilled and inexperienced people, the average quality of labour input will be lower than in a situation in which these people would not enter employment. Hence, the decrease in measured TFP growth in the euro area in the second half of the 1990s could also reflect the rise in employment of relatively low-skilled and inexperienced workers. Moreover, the acceleration of employment between the first and the second half of the 1990s was stronger in the euro area than in the United States, implying some bias in the differential in measured TFP growth in favour of the United States. Moreover, like labour productivity, total factor productivity is known to be highly pro-cyclical, and the cyclical expansion experienced in the United States in the second half of the 1990s was stronger than that in the euro area thus creating a bias in relative productivity developments in favour of the United States.

This notwithstanding, factors related to the new technologies seem to play a significant role as well. The sectoral composition of TFP and other structural factors which influence the use of technology could help explain at least part of the difference in TFP and, thereby, ALP growth. In particular, the ICT-producing manufacturing sector has shown a very strong acceleration in TFP, and this sector is substantially larger in the United States than in the euro area. Moreover, it is commonly believed that other business sectors in the United States are in a better position to exploit new technological opportunities due to its more flexible product, capital and labour markets. It could thus be argued that the process of innovation and adoption of existing technologies varies depending on the regulatory practices affecting the functioning of the economy.

[10] See also the box "Developments in euro area labour productivity" in the ECB Monthly Bulletin of August 2002.

## 4. What is the missing link for the euro area to achieve higher productivity growth?

In general terms, structural reforms will contribute to expanding the euro area's potential for non-inflationary growth and to reducing its high level of unemployment. At the same time, they will help to foster confidence among consumers and investors in long-term growth and employment opportunities in the euro area, thereby having a positive effect on spending and investment decisions in the short and medium term. The role of structural reforms against the background of the new technological possibilities can be assessed further by focussing on product, financial, and labour markets individually.

As regards **product market** regulations, the basic assessment of many observers is that the best policy for encouraging "new economy" developments is encouraging strong competition.[11] Strong competition not only brings static gains by forcing prices to converge to marginal costs. It will also yield dynamic gains as competition spurs technological innovation. Strong competition will lead to the emergence of best-practice firms, well-suited for globalised markets. In this context, there appears to be also some evidence that innovation is a self-enhancing process. In particular, an important factor for successful implementation of ICT capital in companies appears to be that companies already have experience with product and process innovation.[12] This reinforces the importance of having an economic environment conducive to innovation.

In euro area product markets, clear progress has been made over the last decade, in particular in the integration of goods markets and in regulatory reforms in network industries. These reforms contribute to increase competition in euro area product markets. Despite these encouraging developments, however, EU Member States have not (yet) agreed on a number of other important reform projects, such as the draft take-over

[11] See for empirical evidence on this point, for example, Gust and Marquez (2002) "International Comparisons of Productivity Growth: The Role of Information Technology and Regulatory Practices", International Finance Discussion Papers 2002-727.
[12] See Hempell (2002) "Does Experience Matter? Innovations and the Productivity of ICT in German Services", ZEW Discussion Paper No. 02-43.

Directive and an EU-wide patent. Furthermore, a decision on European Commission proposals to fully liberalise European electricity (and gas) markets has been postponed. Thus, despite the progress made, there remains ample scope for further product market reforms.

As regards **financial** markets, it has been pointed out that investment in the ICT sector has a 'high risk, high return' nature as, arguably, the ICT sector has a relatively large share of young, innovative firms. This suggests that equity finance is more appropriate than debt finance. A creditor would hardly benefit from a firm's upside potential, but is fully exposed to its downside risks. The return on equity, by contrast, is positively related to the firm's profitability, without an upper limit. This implies that young, innovative firms are not expected to comply with the so-called 'pecking-order' hypothesis, which states that debt is preferred over equity.[13] Rather, those firms need equity from so-called venture capitalists

A market-based financial system would then seem more accommodative to the financing needs of the innovative ICT firms than a bank-based system, which emphasises long-term relationships and debt financing, and the availability of venture capital may be considered vital. Indeed, the empirical evidence suggests that these factors may be important in explaining the difference in productivity dynamics between the United States and Europe in the second half of the 1990s, where the United States has a more market-oriented financial system and a well-developed venture capital market.[14] Against this background, the initiatives to stimulate financial market integration in the European Union, such as laid down in the Financial Services Action Plan and the Lamfalussy report, and, indeed, the advent of the euro itself can be seen as important steps to lower barriers for investment. These steps help to create easier access to international finance and thereby help enhancing an economic environment conducive to productivity growth.

[13] See, for example, Bank of England (2001) "The Financing of Technology-Based Small Firms", London.
[14] See, for example, Houben and Kakes (forthcoming) "ICT Innovation and Economic Performance: the Role of Financial Intermediation", Kyklos.

Also in the context of this session, let us focus more specifically on **labour market** regulations. As has been pointed out in a number of research papers, firms must be able to adjust their workforce in a flexible manner to benefit optimally from new technological possibilities.[15] High hiring and firing costs could then inhibit firms to adjust their production processes to fully exploit the latest technological possibilities. For instance, when technological change would be of a labour-saving nature, high hiring and firing costs are likely to reduce the benefits from implementing innovative techniques. In addition, it has been argued that as technological change is skill-biased, firms need to upskill their labour force in order to utilise the latest technology, which is in part done through job turnover. The empirical evidence indeed points to a negative impact of employment protection legislation on productivity growth when wages or internal training do not offset the adjustment costs associated with high firing costs.[16]

Thus, to be sure, this is not to argue that hiring and firing should be made as easy as possible. In fact, firms that can invest in the internal labour market and in that way are able to upskill the labour force, are also able to adjust to the new technologies. This, however, presupposes that investing in the labour force is a common device (a co-ordinated regime), as otherwise firms run the risk that trained workers are lured away by competitors. It also presupposes that there is an established worker-culture accepting life-long learning and responsibility in and for the job. In this context, for example, there is some empirical evidence that the concept of Lean Management (basically: flat hierarchical structures) helped firms to boost productivity as employees were more involved and efficiency in the decision making process was enhanced. However, the successful implementation of Lean Management presupposes that employees are open to changes and committed to their job. [17]

[15] See, for example, Brynjolfsson and Hitt (2000) "Beyond Computation: Information Technology, Organizational Transformation and Bussiness Practices", Journal of Economic Perspectives 14.
[16] See, for example, Scarpetta and Tressel (2002) "Productivity and Convergence in a Panel of OECD Industries: Do Regulations and Institutions Matter?", OECD Economics Department Working Paper 342.
[17] See, for example, Wolf and Zwick (2002) "Reassessing the Impact of High Performance Workplaces", ZEW Discussion Papers 02-07.

That the euro area labour market does not function satisfactorily in all respects may be illustrated by the fact that although the unemployment rate was still 8.0% in 2001, at the same time firms in euro area countries reported difficulties in recruiting workers. This coexistence of unsatisfied labour supply and demand suggests an insufficient ability of the euro area to match labour supply and demand.[18] There are again both static as well as dynamic efficiency gains to be achieved by a better matching of labour supply and demand. If labour markets become more flexible in such a way that the job matching process becomes more efficient, this should transitorily increase the potential growth rate of the euro area until a higher employment level is reached. In addition, one may conjecture that a more efficient matching process also leads to an easier adjustment of the economies' production structures towards the best-practice production processes.

Over the second half of the 1990s, euro area countries strengthened their efforts to promote structural reforms aimed at improving the functioning of labour markets. Since 1997, these reforms have been framed within the European Employment Strategy. However, contrary to product and financial market reforms, EU labour market reform is more strongly based on national initiatives. This implies that structural reforms have been uneven across countries. In particular, some euro area countries implemented reforms to increase work incentives by lowering the tax burden. Moreover, reforms of the benefit systems have been made in the right direction, but in most cases they have as yet not been sufficiently far-reaching. This is striking given the fact that the need for further reforms is more than evident from the existence of high and persistent levels of unemployment and low labour market participation in several euro area countries.

Overall, while euro area countries certainly have made some progress in implementing structural reforms, the advent of new technologies has made further structural reforms even more urgent. The regulatory burden becomes more of a binding constraint for adopting the optimal production processes in an environment of rapid technological advances, as arguably is the case with ICT capital.

[18] See also ECB (2002) "Labour Market Mismatches in Euro Area Countries", Frankfurt am Main.

## 5. Importance for monetary policy

What then is the relevance of all this for monetary policymakers? Structural reforms, and those related to the labour market in particular, are of considerable importance for monetary policy for various reasons. [19]

First, the functioning of markets affects the economic environment in which monetary policy is conducted. An inefficient allocation of goods, capital, and labour adversely affects the level of potential output and, in the short run, limits the pace at which an economy can grow without creating inflationary pressures. If markets were to become more flexible the economy could operate permanently or for an extended time period, at a higher rate of growth than in the past without, at the same time, generating an acceleration of inflation. This is also what people have mind when they refer to the "new economy" as raising the "speed limit".

Second, bottlenecks in the labour market resulting from matching inefficiencies might lead to general wage increases in excess of labour productivity growth, thus triggering inflationary pressures. In general, one may conjecture that more efficient matching processes should reduce the risk of upward pressure on wages and inflation resulting from cyclical upswings, reallocations in the economies' production structures and the expected demographic changes in the euro area.

Third, a greater matching efficiency of euro area labour markets accompanied by a higher degree of wage flexibility should speed up the adjustment of wages and prices to monetary policy actions and reduce the short-run effects of monetary policy on the real economy. This improved short-term inflation/growth trade-off would facilitate the conduct of the stability- oriented monetary policy of the European Central Bank.

[19] See also op.cit. footnote 17.

Fourth, efficiently functioning markets are of particular importance for countries participating in Economic and Monetary Union (EMU), because these countries are unable to use country-specific monetary and exchange rate policies to address asymmetric economic shocks.

In turn, the best contribution monetary policy can make to ensuring the appropriate framework conditions to foster innovation, is to pursue a continued stability- and growth oriented macroeconomic environment. This view is rooted in the fact, supported by decades of practical experience and empirical evidence, that the benefits of price stability for growth are substantial.[20] Without putting forward all the arguments, in particular, the maintenance of price stability helps to allocate resources efficiently both across uses and across time. Inflation causes economic agents to confuse transitory with permanent price changes, and therefore distorts their decision-making process. In evaluating investment opportunities, firms need to have confidence in the signals conveyed by relative price changes, and to discriminate between relative price adjustments and general changes in the overall price level. This process is facilitated in a situation of overall price stability. Price stability therefore improves the transparency of the relative price mechanism and can promote an adequate environment to increasing the growth potential of the euro area economy. Moreover, as experience has shown, stable prices minimise the inflation risk premium, thereby lowering long-term interest rates and helping to stimulate investment and growth.

## 6. Concluding remarks

All in all, there is evidence of an increased contribution of ICT to economic growth both in terms of production and investment in the second half of the 1990s. And, as indicated, progress has been made in the euro area with respect to structural reforms. Still, there is as yet no sustained higher productivity growth discernible in the euro area economy as a

[20] See, for example, Issing (2001) "Why Price Stability?" in Garcia Herrero et al. (eds.) "Why Price Stability?", proceedings of the first ECB Central Banking Conference.

whole. This points to the fact that, although progress has been made, the regulatory framework in the euro area is still inhibiting an optimal use of the new technologies. In this context, it is important to note that the regulatory burden becomes more of a binding constraint for adopting the optimal production processes in an environment of rapid technological advances, as arguably is the case with ICT capital.

It has been said time and again, but it remains a message necessary to reiterate: The introduction of new technology requires flexibility with regard to other factors, including labour, if production processes are to be reorganised most efficiently. If there are limits and restrictions to adjustment to the most profitable combination of productive factors, the levels of investment in the new technologies, and the extent of their implementation in production processes, will be adversely affected. Thus, there is no doubt that further structural reforms are needed to fully exploit the available potential.