The potential growth of the Belgian economy and its determinants

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Introduction

The potential growth path of the economy is at the centre of various fundamental economic questions. It arises, in particular, in connection with the conduct of monetary policy and the management of public finances. The growth potential combined with the trend in the population also determines the development of the level of prosperity in the economy. In recent years, renewed interest in this question has been kindled in the European economies by the dramatic advances in the new information and communication technologies (ICT) and their impact on productivity. The European debate on the Lisbon strategy also aims to strengthen growth potential, particularly in a context of population ageing.

Potential output is not recorded directly and therefore has to be estimated by indirect means. There are various assessment methods available for this purpose. The present analysis is based on the production function approach. This method, which is used in analyses of the same type conducted by institutions such as the EC, links the growth potential to three determinants, namely the labour and capital available in the economy and the efficiency with which those production factors are used; that efficiency depends partly on technological progress.

The study will focus primarily on the case of Belgium. However, an international dimension is essential in order to provide reference points. The first chapter discusses the potential growth of the Belgian economy and its determinants, assessed over the past two decades (1982-2004). That growth will be compared with the assessments for the various EU-15 countries, produced by the EC.

The growth path obtained by the production function approach can also be judged on the basis of the trends observed in the past in terms of the volume of labour and apparent labour productivity. The second chapter presents a comparison between the developments recorded in Belgium, and more generally in the EU-15 as a whole, and those seen in the United States. Knowledge of the determinants of productivity is still imperfect. Various studies suggest factors which could influence its development, but it is still difficult to assess their real influence. Among these factors, the development of ICT is often mentioned. Other elements, particularly concerning the quality of the production factors and certain more structural aspects of the economy, are liable to influence productivity. The second chapter considers Belgium's situation in regard to these factors.

1. Potential growth in Belgium and its determinants

Potential output can be defined as the level of output which is sustainable over time, i.e. without generating imbalances on the market in goods and services and on the labour market. It represents the supply capacity of an economy, taking account of the normal use of the available production factors, i.e. use which is compatible with stable inflation and a balanced trend in wages. Actual output may be higher than potential output, but can equally be lower, with fluctuations around the potential level being due to short-term divergences between supply and demand. These fluctuations give rise to what is known as the output gap. This gap is positive if the

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production factors are overused in order to cater for strong demand, a situation which is liable to lead to pressure on wages and prices; when the gap is negative, that indicates that the production factors are underused owing to a demand deficit. In a market economy, an output gap cannot persist in the long term, as the wage and price adjustment process restores equilibrium between supply and demand.

Since an economy's potential GDP cannot be measured directly, nor can it be quantified by compiling basic information as in the case of actual GDP, for example, it has to be estimated indirectly.

Various methods of estimating potential GDP have been developed[1]; they can be divided roughly into the following categories:

– *"statistical" methods*, which – in the case of the univariate methods – aim to extract the trend component of the actual GDP series (e.g. by calculating a linear trend or by applying a Hodrick-Prescott filter); in the case of a multivariate approach, they consider a number of series simultaneously (GDP, inflation, interest rates, real wages, etc.) but without establishing explicit links between the production factors and the level of output (e.g. SVAR models, models with non-observable components);

– *"structural" methods*, based on a production function in which the level of output is determined explicitly by the production factors used.

The range of methods developed over time reflects the difficulty of finding one which appears irrefutable, reliable and appropriate for all types of use. Many empirical studies propose the simultaneous use of different methods in order to determine an order of magnitude – rather than focusing on an exact estimate of potential output – and to permit an assessment of the robustness of the results. However, the use of multiple assessment methods entails the risk of arriving at an ambiguous result.

The analysis proposed in this article is based on the use of a production function in the context of what is called growth accounting. This method, which is widely used by international institutions, makes it possible to highlight the role of the various growth determinants, namely the supply of the production factors – labour and capital – and total factor productivity (TFP), i.e. the efficiency with which these factors are combined. By means of a somewhat simplified representation of the economy (cf. box and annex), this method permits an easy interpretation of past developments and offers the possibility of assessing the long term growth.

(1) For an overview of the various methods, see ECB (2000), De Masi (1997) and Guarda (2002).

Growth accounting

The most frequently used method of growth accounting is based on a production function in which the level of output (Y) is a function of three determinants: the quantity of labour (L), the capital stock (K) and total factor productivity (TFP).

$$Y = f(L, K, TFP)$$

The production function generally used for growth analysis is a Cobb-Douglas function. This type of function offers a simplified but relatively accurate representation of the supply relationships of industrialised economies and produces results which are easy to interpret. It conforms to all the assumptions made in the neo-classical approach to growth: decreasing marginal returns of the production factors L and K and constant economies of scale for these factors. It takes the following form:

$$Y = TFP \cdot L^{\alpha} \cdot K^{(1-\alpha)}$$

where α reflects the share – assumed to be constant – of the factor labour in the production process (approximated by the share of wages in total factor remuneration).

TFP provides an overall measure of the efficiency of the production process, taking account of the combined use of the production factors. Two countries using the same quantity of labour and the same stock of capital could achieve different levels of output depending on whether their organisation is more or less efficient. In short, TFP is sometimes treated as a measure of technical progress.

In terms of rates of change (indicated by an ° above the variables), the previous equation can be restated as follows:

$$\overset{\circ}{Y} = \overset{\circ}{TFP} + \alpha \,.\, \overset{\circ}{L} + (1 - \alpha) \,.\, \overset{\circ}{K}$$

In the empirical applications, the growth rate of TFP is calculated as a residual figure, being the difference between the output growth rate and the weighted growth rates of the quantities of production factors used:

$$\overset{\circ}{TFP} = \overset{\circ}{Y} - \alpha \,.\, \overset{\circ}{L} - (1 - \alpha) \,.\, \overset{\circ}{K}$$

Consequently, the estimate of the TFP growth rate is influenced by the way in which L and K are measured, and more specifically by the content attributed to these two determinants. The more accurately L and K are measured in terms of their potential contribution to output, the smaller the bias which may affect the measurement of TFP. Thus, the labour used is not taken simply as the number of persons working. The hours worked or the skills of the labour force can also be taken into account [1]. The same quantity of capital can also vary in its contribution to output according to the age of the machinery and its nature (traditional working tool or one geared more to the new technologies) [2]. TFP therefore reflects the influence on output of all the factors which are not captured by the respective measurements of L and K. Consequently, to permit international comparisons of TFP, it is necessary to ensure that the data used are as homogeneous as possible.

The method adopted by the Bank to estimate potential output is derived directly from the one used by the EC [3] and is based on the fundamental principles of growth accounting. The variables (L, K and TFP) which occur in the production function are constructed from actual observations. They then undergo smoothing to eliminate cyclical movements and short-term erratic fluctuations, and thus approximate as closely as possible to structural trends. The smoothing procedures using a Hodrick-Prescott (HP) filter are implemented with due regard for the medium-term forecasts produced for the Eurosystem projections, in order to attenuate the end-of-period bias inherent in this smoothing method.

In the approach adopted, potential output therefore depends on the "potential" levels of the determinants, identified in growth theory:

$$Y^{*} = TFP^{*} \,.\, L^{*\alpha} \,.\, K^{*(1-\alpha)}$$ where * refers to the potential levels.

The method used is presented in more detail in the annex.

(1) Labour quality reflects the effectiveness of the hours worked per category of personnel. Here, the factor labour has to be allocated to various classes of workers (generally taking account on the standard of education), weighted according to their remuneration, which is assumed to reflect the efficiency of the labour.

(2) A sophisticated measurement of capital's contribution to output is based on the concept of capital services. However, this measure, which aims to take account of the productive capacity of the various assets making up the capital stock, is demanding from a statistical point of view and is not very widespread as yet. For more details, readers may refer to the work of the OECD [notably Shreyer et al. (2003)].

(3) Denis et al. (2002).

1.1 Potential growth in Belgium

Considering that public sector activity and employment cannot exert any fundamental influence on the potential growth of the economy, the assessment method which has just been outlined was used to estimate the potential output of the private sector in Belgium. The development of public services is indeed dictated by determinants other than those which lead to long-term market equilibrium. However, the government has a key role to play in establishing a framework conducive to increased productivity throughout the whole economy.

Over the period 1982 to 2004, the potential output of the private sector grew at an annual average rate of 2.2 p.c. in Belgium. The largest contributions came from the development of TFP and the growth of the capital stock, each of these elements accounting for 1 percentage point. The contribution of the factor labour averaged just 0.2 percentage point over the period as a whole. Taking account of the value added of the public sector, potential GDP growth for the Belgian economy as a whole is estimated at 2.1 p.c.

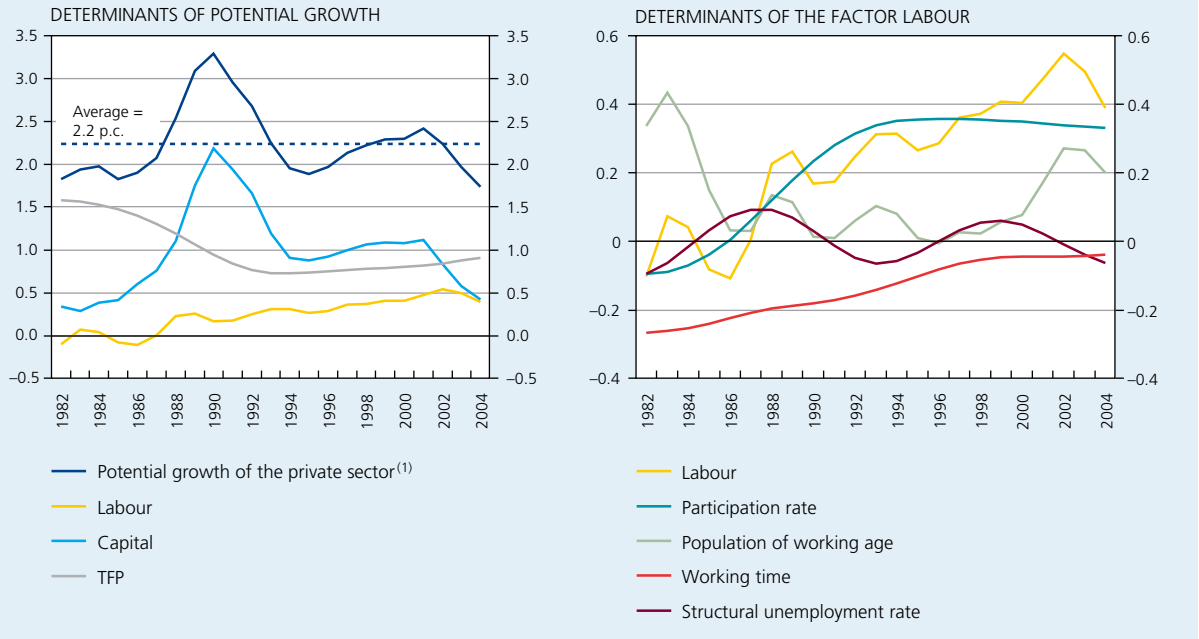
TABLE 1 POTENTIAL GROWTH IN BELGIUM: TENDENCIES

		Sub-periods	
	1982-2004	1982-1995	1996-2004
Potential growth of the private sector (1)	2.2	2.3	2.1
Labour (2)	0.2	0.1	0.4
Capital (2)	1.0	1.0	0.9
Total factor productivity (2)	1.0	1.1	0.8
p.m. Potential growth of the economy as a whole (1)	*2.1*	*2.1*	*2.1*

Source : NBB.
(1) Percentage change.
(2) Contributions to the potential GDP growth of the private sector.

The potential growth of the private sector increased at a fairly steady pace during this period, generally fluctuating within the range of 2 to 2.5 p.c. However, between 1989 and 1991 it grew by almost 3 p.c. as a result of exceptional expansion of the capital stock.

CHART 1 POTENTIAL GROWTH OF THE PRIVATE SECTOR IN BELGIUM AND ITS DETERMINANTS
(Contributions to the growth of the potential value added of the private sector, unless otherwise stated)



Source : NBB.
(1) Percentage change.

TABLE 2 COMPARISON OF ESTIMATES OF POTENTIAL GROWTH FOR BELGIUM

(Percentage change, economy as a whole)

		Sub-periods	
	1985-2004	1985-1995	1996-2004
EC	2.1	2.1	2.1
IMF	2.2	2.2	2.2
OECD	2.1	2.2	2.0
p.m. NBB	*2.2*	*2.3*	*2.1*

Yet the relatively stable growth rate of potential output masks substantial movements in the various determinants. The biggest changes were seen in the capital stock. Except for the boom which occurred around 1990, the capital stock experienced a period of weak growth in the first half of the 1980s and a marked slowdown after 2000. In all probability, these movements in the capital stock are partly cyclical. The contribution of TFP, the main engine of growth in the early 1980s, was halved, as TFP growth fell from 1.5 p.c. to around 0.7 p.c. in the mid 1990s. Subsequently, a slight upward trend was seen, with the growth rate rising towards 1 p.c. Finally, the contribution to private sector growth made by the volume of labour has tended to increase over the years, since it was practically zero at the start of the analysis period and has totalled around 0.5 percentage point in recent years.

The estimate of the potential volume of labour can in turn be broken down into various components. Thus, it seems that the pick-up in labour's contribution to growth can be attributed partly to an upward trend in the activity rate and partly to a deceleration in the trend towards shorter working hours. Apart from these two medium-term developments, labour's contribution to growth is also influenced by changes in the size of the population of working age. This component has been favourable in recent years, influenced not only by purely demographic factors but also by campaigns to regularise residents "without papers". Finally, the movement in the structural unemployment rate had a negligible impact on growth.

Despite differences between the assessment specifications and methods, the potential growth figure obtained here is of the same order of magnitude as that estimated for Belgium by other bodies, such as the EC, the IMF and the OECD. The divergences come to no more than 0.2 percentage point.

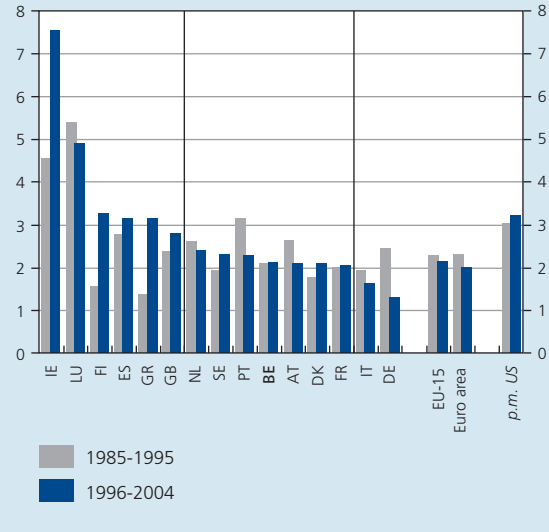
1.2 Comparison with the other EU-15 countries

On the basis of the EC estimates, obtained by using a harmonised method, the EU-15 countries may be divided into three groups according to their average potential growth since the mid 1990s. Belgium is among the group of countries where growth was close to the EU-15 average. The same is true of the Netherlands, Sweden, Portugal, Austria, Denmark and France, which recorded growth of potential GDP in the order of 2 p.c. While potential growth did not change substantially between 1985-1995 and 1996-2004 in Belgium, the Netherlands and France, it did slow down in Portugal and Austria, and gained momentum in Sweden and Denmark.

Another group of countries was notable for higher potential growth during the period 1996-2004. In Finland, Spain, Greece and the United Kingdom, the figure reached around 3 p.c., a growth rate comparable to that recorded in the United States. It was significantly higher in Luxembourg, and especially in Ireland where it exceeded 7 p.c. In this last country, potential growth was probably boosted by a "catching up" effect, owing to a strong rise in productivity in a context of market integration, substantial foreign investment and European subsidies, and the incentive for greater participation in the labour market.

CHART 2 POTENTIAL GROWTH IN THE EU-15 COUNTRIES

(Percentage change)



Sources: EC, OECD.

Finally, Italy and Germany feature relatively weak potential growth, averaging around 1.5 p.c. since 1996. In the case of the German economy, this figure represents a decline of more than 1 percentage point compared to the ten preceding years.

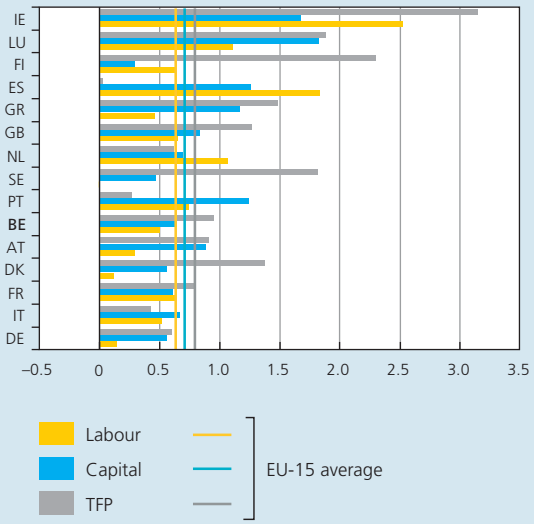
The wide dispersion of potential growth rates in the EU-15 countries during the period 1996-2004 reflects very divergent situations in terms of the contributions of the various factors. Thus, it seems that labour made a major contribution in Ireland and Spain. The substantial mobilisation of the factor labour in both these countries evidently led to excess growth totalling 1.9 and 1.2 percentage points respectively, in comparison with the EU-15 average. A number of elements contributed to this outcome. In Ireland, the expansion of the population of working age came to around 2 p.c. per annum, the activity rate increased by almost 6 percentage points between 1995 and 2004, while the structural unemployment rate declined by around 8 percentage points. In Spain, it was mainly the steep rise in the activity rate, totalling 9 percentage points, that accounted for the large growth contribution made by the factor labour, together with a fairly significant fall in the structural unemployment rate. Some surplus growth, albeit on a smaller scale, is also attributable to labour in Luxembourg and the Netherlands. Conversely, the contribution of the use of labour is relatively close to the average in Belgium, while in Germany, Denmark and Sweden, potential growth was impeded by a labour shortage. The population of working age remained static in the first two countries, and the participation rate – though high in relation to the other European countries – declined in Denmark and Sweden.

The strong expansion of the capital stock in Ireland and Luxembourg produced a contribution to potential growth totalling around 1.7-1.8 percentage points in these two countries, about 1 point above the EU-15 average. Spain, Portugal and Greece also performed well from this point of view. Conversely, in Finland the capital stock appeared to make a rather low contribution to potential growth. In Belgium, the figure was about average.

Finally, in Ireland and Luxembourg the contribution of TFP was also well above the average, adding excess growth of 2.4 and 1.1 percentage points respectively. The dramatic rise in GDP in these two countries over the past ten years was therefore generated in varying degrees by the three determinants: labour, capital and TFP. Finland and Sweden were also among the countries with the biggest rise in TFP. In Belgium, EC estimates put the figure at 1 p.c., which is slightly above the average of 0.8 p.c. recorded in the EU-15. Conversely, it was low or zero in Italy, Portugal and Spain.

CHART 3 DETERMINANTS OF POTENTIAL GROWTH IN THE EU-15 COUNTRIES OVER THE PERIOD 1996-2004

(Contributions to potential growth, percentage points)



Source: EC.

2. Growth strengths and weaknesses: Belgium's position in the EU-15 and in comparison with the United States

The first part of the analysis has shown the relative importance of labour, the capital stock and TFP in the movement in the economy's potential growth. Next, it is useful to identify the strengths or weaknesses on the basis of the results observed, as the lessons to be derived from that analysis could indicate possible areas for providing structural support for the economy's development.

In that connection, the main focus will be on the volume of labour and apparent labour productivity; these are directly measurable variables, so that it is easier to draw up a list of strengths and weaknesses for the Belgian economy. The box on the opposite page shows that the breakdown of growth between the volume of labour and apparent labour productivity is derived directly from the growth accounting approach, as apparent labour productivity is itself a function of TFP and the capital to labour ratio.

As mentioned in the first chapter, the US economy has relatively high potential growth. This chapter therefore proposes to assess the developments seen in Belgium not only in the light of those recorded on average in the EU-15 but also by comparison with the United States.

Over the past twenty years, the average annual growth rate of GDP in the United States has outpaced that of the EU-15 by around one percentage point, with figures of 3 p.c. and 2 p.c. respectively. The gap has actually widened somewhat over the years, as growth edged upwards in the United States while slowing down slightly in Europe. In Belgium, the GDP growth rate was close to that of the EU-15.

However, the reasons for this growth differential between the two continents have not remained the same since the mid 1980s: at first, growth in the United States was bolstered by a stronger rise in the volume of employment than in Europe, but later it was due to higher growth of labour productivity.

Analytical breakdown of growth

In an analytical approach, Y output can be broken down between the volume of labour used (L) and what is known as apparent labour productivity $(\frac{Y}{L})$.

$$Y = L \cdot \frac{Y}{L}$$

On the basis of the classic formula for the production function $Y = TFP \cdot L^{\alpha} \cdot K^{(1-\alpha)}$ and dividing both elements of this equation by L, it is evident that apparent labour productivity can be written:

$$\frac{Y}{L} = TFP \cdot \left(\frac{K}{L}\right)^{(1-\alpha)}$$

In terms of the rate of change:

$$\frac{\overset{\circ}{Y}}{L} = \overset{\circ}{TFP} + (1-\alpha) \cdot \frac{\overset{\circ}{K}}{L}$$

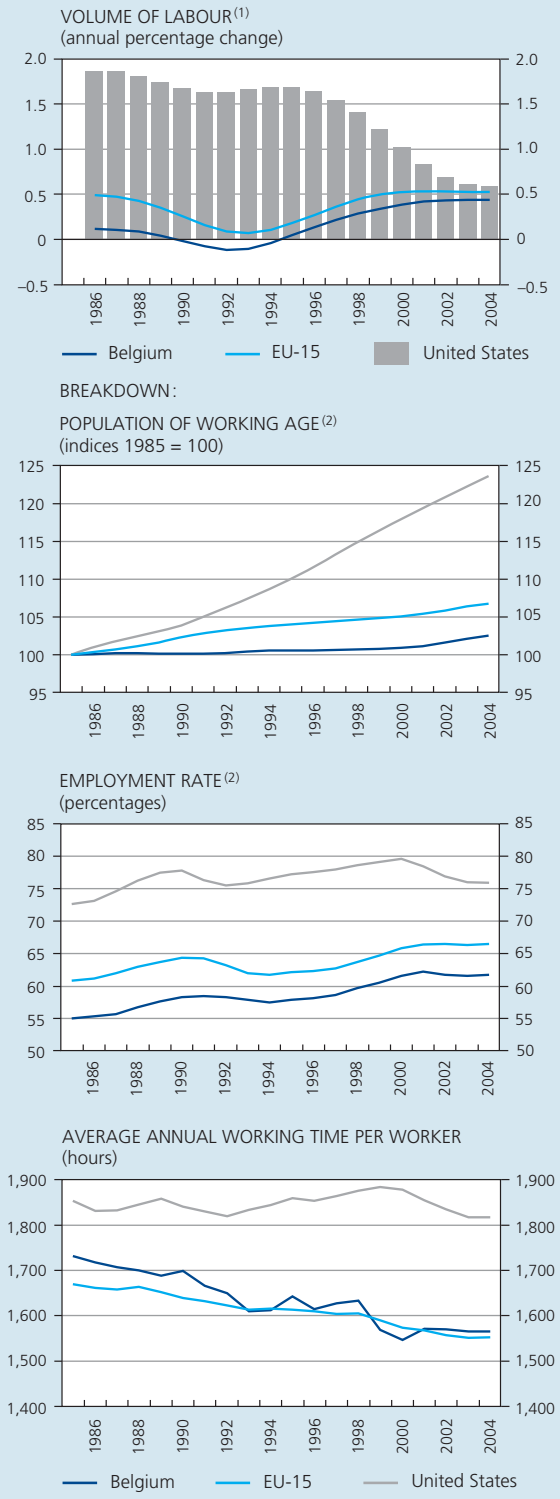
Apparent labour productivity is therefore determined by:
- TFP, as defined in the previous box, and
- the capital to labour ratio, also known as capital intensity (or capital deepening). An increase in the capital employed per unit of labour contributes to an increase in apparent labour productivity.

2.1 Volume of labour

For a long time, growth in the United States was underpinned by a strong rise in the volume of labour, which grew by an annual average of 1.7 p.c. until 1997. During this period, the number of hours worked showed only a modest increase in the EU-15, at 0.3 p.c. per annum, while the picture was even less favourable in Belgium where the volume of labour remained static. At the end of the 1990s, some convergence nevertheless occurred, as the rise in the volume of labour slowed down significantly in the United States while it accelerated slightly in Belgium, as it did in the EU-15 as a whole.

First, the faster average rise in the volume of labour in the United States was due to strong expansion of the population of working age. This increased by more than 1 p.c. per annum, whereas it stagnated in Belgium and grew by just 0.3 p.c. per annum on average in the fifteen EU countries. It was also reinforced by the movement in working time per person employed. In the United States, working time remained constant overall, but declined steadily in Belgium and in the EU as a whole, by around 0.5 p.c. per annum on average. The employment rate in Europe – i.e. the number of persons in work as a percentage of the population of working age – remained well below the United States figure, which peaked at around 80 p.c. in 2000, whereas it was only about 60 p.c. in Belgium, 4 percentage points below the EU-15 average.

CHART 4 VOLUME OF LABOUR: COMPARISON WITH THE EU-15 AND THE UNITED STATES



Sources: EC, GGDC, NBB calculations.

(1) Defined as the number of hours worked, series smoothed by means of a Hodrick-Prescott filter.

(2) Defined as the number of persons in work as a percentage of the population of working age.

(3) Population aged from 15 to 64 years.

The low participation rate is a well-known characteristic of the Belgian economy. A low level of participation in the labour market by certain age groups, particularly the older ones, relatively high labour costs which encourage the substitution of capital for labour, and a lack of both functional and geographical mobility are all factors which depress the volume of labour. Eliminating these barriers could stimulate future growth in the volume of labour, in a context where the population of working age is expected to expand more slowly, or even decline, over the coming decades.

While the employment rate in Europe and in Belgium was constantly below the US figure, it mirrored the upward trend in the United States between the mid 1980s and the year 2000. It subsequently remained steady in the first two cases, while a decline of almost 4 percentage points was seen in the United States, reflecting the "recovery without employment" which has typified the recent economic cycle in that country. The contraction of the employment rate on the American continent, combined with a decline in working time, which contrasts with the stable position recorded in the EU-15 and in Belgium in recent years, explains the comparable results recorded recently in terms of the volume of labour on the two continents.

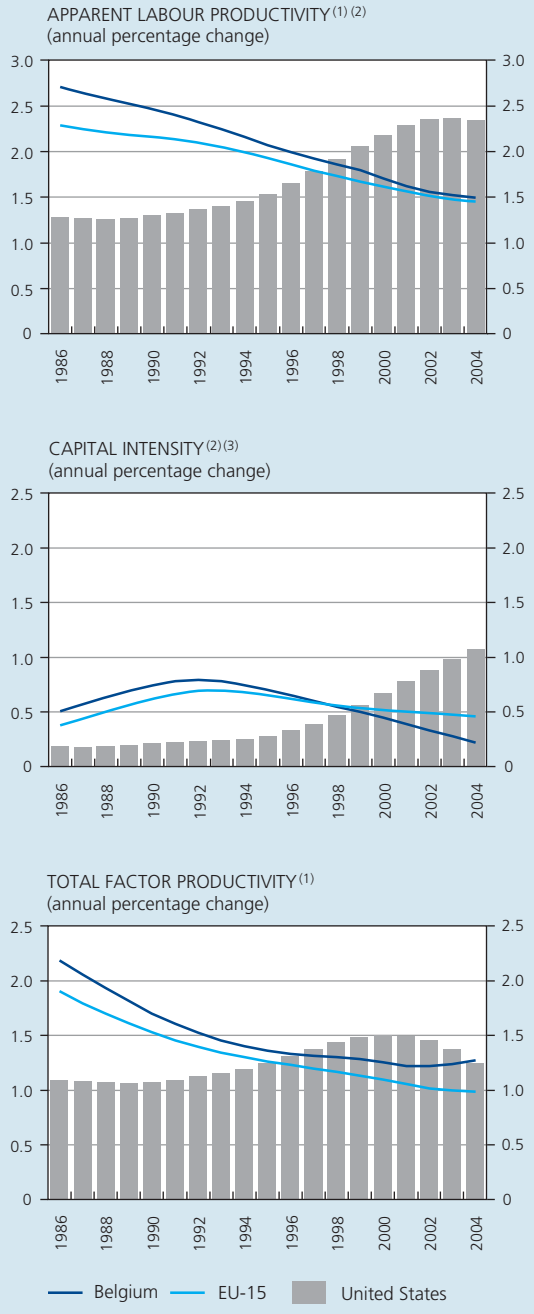
2.2 Apparent labour productivity

The convergence of performance in terms of the volume of labour in the United States, the EU-15 and Belgium was accompanied by a reversal of the relative figures for apparent labour productivity which enable the US economy to maintain its advantage in terms of economic growth.

Up to the mid 1990s, the European countries were ahead of the United States: apparent labour productivity, i.e. the volume of output per hour of work, was rising faster in the former countries. Belgium did even better with a rise in labour productivity which was above the European average. However, a persistent slowdown was seen in Europe, whereas American labour productivity speeded up considerably from the mid 1990s. In the past few years, this productivity has grown by around 2.3 p.c. in the United States, while in the EU-15 the increase came to only 1.5 p.c., the same as the rate of increase in Belgium.

This reversal of relative performance in terms of productivity is due to a more favourable picture in terms of both capital intensity and TFP in the United States. The increase in the capital available per worker had supported European growth up to the mid 1990s, but then slowed progressively while a fairly marked revival was seen on the

CHART 5 APPARENT LABOUR PRODUCTIVITY: COMPARISON WITH THE EU-15 AND THE UNITED STATES



Sources: EC, GGDC, NBB calculations.
(1) Defined as GDP per hour worked.
(2) Series smoothed by means of a Hodrick-Prescott filter.
(3) Also known as capital deepening; defined as the ratio between the net capital stock and the number of hours worked.

American continent. The employment and wage moderation policies pursued in Europe had the effect of increasing the relative cost of capital, and making the factor labour relatively less expensive. These policies, which aim to augment the employment content of growth, cause a fall in apparent labour productivity as a result of substitution between the two factors of production.

Relative developments in TFP are, by their nature, more fundamental. A very marked tendency towards deceleration of TFP is evident in Europe, and in Belgium, although the growth rate here has remained slightly above the EU-15 average and even tended to stabilise in recent years. Thus, the rise in TFP in Europe has dropped from 2 p.c. in the mid 1980s to around 1 p.c. at present. Conversely, in the United States the growth of TFP increased by half a percentage point, mainly as a result of an acceleration during the second half of the 1990s.

2.3 Factors which may influence labour productivity

The disappointing trend in apparent labour productivity in Europe, and above all in TFP, led to questions about the factors which might support the latter. There is plenty of literature on this subject, covering a broad spectrum of areas for action. Readers may refer to the study by Denis et al. (2004), which offers an interesting summary and attempts to quantify all the factors which may influence labour productivity.

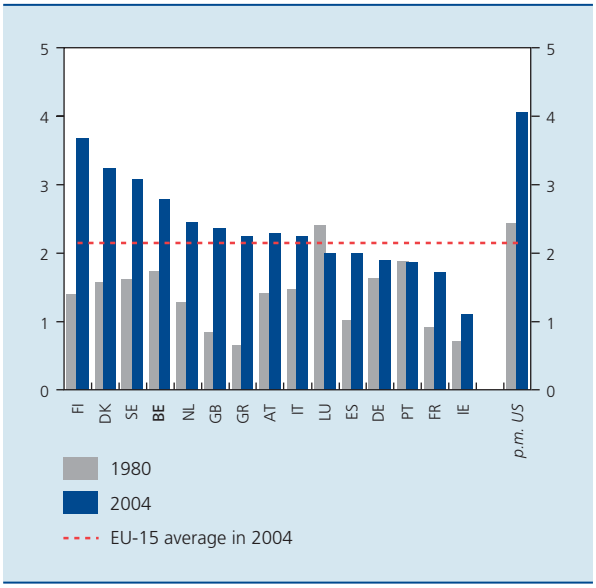
2.3.1 Influence of ICT

Numerous studies have highlighted the fact that the strong acceleration in apparent labour productivity in the United States from the mid 1990s was largely attributable to the role played by the new technologies, generally known as ICT (information and communication technology). ICT is often regarded as a veritable industrial revolution, leading to a rise in long-term growth potential which can improve the standard of living.

The development of ICT appears to have generated substantial productivity gains via the production channel. The branches producing ICT are in fact noted for rapid technological progress, so that their TFP tends to increase sharply, boosting productivity at the level of the economy so long as the ICT-producing industry is sufficiently large. That is the case, in particular, in the United States, and in Ireland and Finland in Europe.

CHART 6 ICT INVESTMENT IN THE EU-15 COUNTRIES

(Percentages of GDP, current prices)



Source : GGDC.

Moreover, the rise of the new technologies was accompanied by a fall in price coinciding with an improvement in the performance of ICT products (computers, microprocessors, etc.). This caused labour to be replaced by capital as the latter became less expensive. As a result, apparent labour productivity was augmented by a higher rate of capital intensity in ICT.

Finally, the spread of ICT throughout the economy has led to a rise in TFP in all ICT-user branches, as these technologies permit greater efficiency in the combined use of labour and capital. This was evident in the United States, where the branches investing most heavily in ICT, such as trade and financial services, have seen faster growth of TFP than other branches of activity. However, in order to be fully effective, the use of ICT has to be combined with additional investment in appropriate staff skills and organisational changes. The regulatory context, the climate of confidence and security, the availability of appropriate skills, the ability to modify the organisation and the capacity to innovate influence the degree to which firms can take advantage of the spread of ICT.

(1) The studies undertaken for several years now by the GGDC ("Groningen Growth & Development Centre") of Groningen University, particularly Professor Van Ark, relate to comparisons of the level of economic performance and growth differentials between countries. These studies are quite well-known, as this research centre has gained substantial experience on the subject and developed a large harmonised database. Both the OECD and the EC make frequent reference to it. Some of these studies, more specifically mentioned here, attempt to quantify the influence of ICT on growth in Europe, in comparison with the United States, on a basis which has been harmonised as far as possible. Data on ICT are not always available in official national sources, so that estimates and extrapolations are sometimes necessary. In Belgium's case, the GGDC based its work mainly on the calculations produced by the Federal Planning Bureau [Kegels et al. (2002)], which used a methodology largely compatible with that generally adopted in Van Ark's studies.

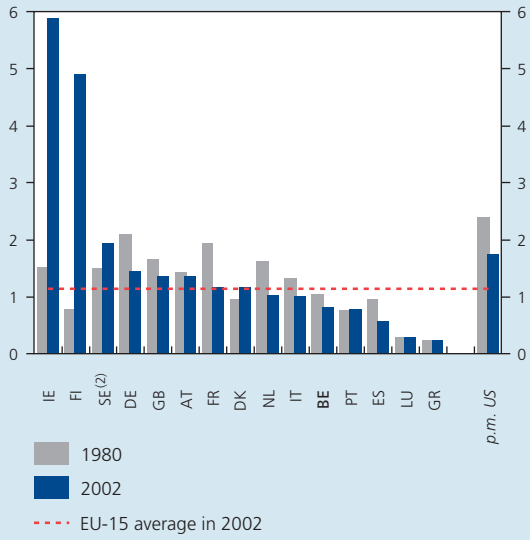
There have been many attempts to measure the influence of ICT on productivity, sometimes arriving at divergent conclusions. According to some studies, the influence of ICT on productivity is confined solely to the branches producing ICT. Other – more numerous – studies state that the influence is wider and is also exercised decisively, through the distribution channel, by the ICT-user branches, and particularly the service branches which are the main recipients of investment in ICT.

According to the data collected by the GGDC (1), it appears that Belgium was in fourth place in the EU-15 on the basis of the scale of ICT investment in 2004, which totalled 2.8 p.c. of GDP. Finland, Denmark and Sweden had higher investment rates than Belgium in this respect, while the United States was in an even more enviable position, with ICT investment exceeding 4 p.c. of GDP. Belgium thus has an ICT investment rate which is 0.6 percentage points above the European average, so that the spread of ICT in the Belgian economy appears to be a factor favourable to the relative growth of productivity.

Countries such as Finland and the United States are in a doubly favourable position, because not only the use of ICT is widespread, but also – in contrast to Belgium – manufacturing industry producing ICT holds

CHART 7 WEIGHT OF THE MANUFACTURING SECTOR PRODUCING ICT IN THE EU-15 COUNTRIES (1)

(Percentages of GDP, current prices)



Source : GGDC.

(1) By approximation, share of value added of branches 30 ("Manufacture of office machines and automatic data processing machines"), 32 ("Manufacture of radio, television and communication equipment") and 33 ("Manufacture of medical, precision and optical instruments, watches and clocks") in total value added.

(2) Figure for the year 2000.

an important place in the economy. Productivity growth is well above the average in ICT-producing industry. Thus, between 1995 and 2000 labour productivity increased by an annual average of around 15 and 25 p.c. respectively in this type of industry in Finland and the United States[1], contributing about one quarter of the total productivity growth of the economy as a whole. Ireland has also benefited from the notable presence of industries producing ICT, which are estimated to account for more than half of the general productivity growth in that country. Conversely, Irish investment in ICT appears to be the lowest in the EU, so that the Irish economy is gaining little from the influence of ICT on the productivity of the other branches of its economy.

In studies published in 2003, Van Ark et al. proposed a breakdown of the growth of hourly labour productivity over the period 1995-2001, in an attempt to quantify the possible influence of ICT on that figure. This breakdown is the most detailed conceivable, and although it does have its limits, it offers some interesting lessons. Thus, of the growth of almost 2 p.c. in hourly productivity in the United States, close on two-thirds (1.2 percentage points) appears to be due to the direct influence of ICT in the economy, namely both the contribution of capital intensity in ICT in all branches, and the contribution of the growth of TFP in the branches of industry producing the new technologies; this last contribution depends mainly on the weight of this type of industry in the country. In Europe on the other hand, the direct influence of ICT was more modest, totalling 0.7 percentage point and accounting for half of the hourly productivity growth. Ireland stands out as the direct influence of ICT led to hourly productivity growth in excess of 4 p.c., owing to the large contribution made by the manufacturing sector producing new technologies. Thus, ICT appears to account for almost 80 p.c. of that country's productivity growth. The direct influence of ICT was also substantial in Finland, Sweden and the United Kingdom. It was less marked in Belgium, where it totalled 0.8 percentage point, owing to the virtual absence of a manufacturing sector producing ICT. Capital intensity in ICT led to a rise in hourly productivity in Belgium of the same order of magnitude as that seen in the leading countries in this respect, and well above the average level in Europe.

Capital intensity excluding ICT did not make an atypical contribution to productivity growth in Belgium. In fact, its contribution seems to have been in line with the European average, at around 0.5 to 0.6 percentage point. In contrast, in branches other than manufacturing industry producing ICT, TFP increased strongly in Belgium during the period 1995-2001, and made a large contribution of 1 percentage point to the growth of hourly productivity in the economy. That was even more the case in Finland. This aspect of the productivity breakdown reflects a range

(1) Van Ark et al. (2002).

TABLE 3 BREAKDOWN OF THE GROWTH OF APPARENT LABOUR PRODUCTIVITY

(Contribution to growth of apparent labour productivity. unless otherwise stated; period 1995-2001)

	Effects directly linked to ICT				Other effects			*p.m. Growth of hourly productivity*
	Capital intensity in ICT products	TFP in ICT-producing industrial branches	Total		Capital intensity in non ICT products	TFP in branches other than ICT-producing industry[1]	Total	
	(a)	(b)	(a + b)	$\left(\frac{a+b}{e}\right)$	(c)	(d)	(c + d)	(e)
United States	0.7	0.4	1.2	(63 p.c.)	0.3	0.4	0.7	*1.9*
EU-14	0.4	0.3	0.7	(50 p.c.)	0.5	0.2	0.7	*1.4*
of which[2]:								
Ireland	0.7	3.6	4.2	(78 p.c.)	1.2	0.0	1.2	*5.5*
Finland	0.7	0.7	1.4	(45 p.c.)	–0.3	2.0	1.7	*3.0*
Sweden	0.8	0.6	1.4	(70 p.c.)	0.5	0.1	0.6	*1.9*
United Kingdom	0.6	0.4	1.0	(60 p.c.)	0.6	0.1	0.7	*1.7*
Belgium	0.7	0.1	0.8	(33 p.c.)	0.6	1.0	1.6	*2.4*

Source: Van Ark et al. (2003).

(1) TFP growth in branches other than ICT-producing industry reflects a whole range of factors. including the effect of the spread of ICT in those other branches. The ICT-related effects shown in columns (a) and (b) of the table therefore do not measure the total impact of ICT on productivity, but only the direct impact, excluding the diffusion effect.

(2) The five countries mentioned are those ranked highest on the basis of the total effects directly linked to ICT.

of explanatory factors which include the ICT diffusion effect, i.e. the possible influence of the integration of ICT on the TFP of the user branches.

2.3.2 Labour force skills

The development of a knowledge-based economy is one of the fundamental aims of the Lisbon strategy, designed to strengthen the competitiveness and dynamism of the European economy. A high standard of skills encourages the integration of innovations, and can attract foreign direct investment and stimulate the development of R&D and ICT. The quality of the labour force, which depends not only on the level of education but also on policies whereby training is continued throughout working life, is thus a factor which can stimulate economic growth.

The labour input measures generally used for the purpose of growth accounting analysis, namely the number of persons employed, or – preferably – the number of hours worked, do not take account of the quality of the labour force, so that the impact of this factor on productivity is reflected in the TFP measurement.

To our knowledge, there is no estimate of the influence of skills on TFP growth in the case of the Belgian economy. Nevertheless, some studies do propose an assessment for other countries, usually the biggest European countries.

Inklaar et al. (2003) thus propose an assessment of the influence of labour quality, approached via the level of education, on apparent productivity in the United States and in four European economies: Germany, France the Netherlands and the United Kingdom. This indicates that the productivity contribution of the improvement in labour quality is fairly similar in the United States and Europe, and that – in both cases – a slowdown in this contribution was recorded in the second half of the 1990s. Taking an average from 1995 to 2000, the improvement in the standard of education in the countries considered is estimated to have generated an annual increase in productivity totalling 0.2 percentage point. However, the results for the four European economies studied are quite divergent, as regards both the level of the contribution and whether it increased or decreased between the two sub-periods.

The estimate produced by the European Forecasting Network in 2004 is fairly similar where the US economy is concerned, and also shows a deceleration in the contribution of labour force skills to the growth of productivity in the second half of the 1990s. During that same period, the three European economies considered (Germany, France and the United Kingdom) appear to have a very slight advantage over the United States in this respect, although that difference cannot be regarded as significant. Moreover, the dispersion of the individual results appears to have diminished after 1995.

TABLE 4 LABOUR PRODUCTIVITY GROWTH ATTRIBUTABLE TO IMPROVEMENTS IN THE QUALITY OF THE LABOUR FORCE (1)

(Annual percentage change)

Estimation Inklaar et al.	1980-1995	1995-2000
United States	0.28	0.22
DE-FR-NL-GB	0.31 [0.08;0.50]	0.22 [0.05;0.41]
Estimate by EFN	**1982-1990**	**1990-1995**	**1995-2000**
United States	0.31	0.34	0.23
DE-FR-GB	n.	[0.14;0.95]	[0.28;0.35]
Estimate by Colecchia et al.	**1985-1990**	**1990-1995**	**1995-2001**
United States	0.46	0.55	0.36
DE-FR-IT-GB	[–0.49;0.95]	[0.21;1.64]	[0.42;0.59]

Sources: Colecchia et al. (2004), European Forecasting Network (2004), Inklaar et al. (2003).

(1) For each of the studies, the figures in brackets show the lowest and highest impact on growth among the European countries studied, for each period. They give some idea of the dispersion of the estimates. It is not necessarily the same country that records the lowest or highest impact on growth from one period to the next, or from one study to another.

A third estimate produced by Colecchia et al. (2004) takes account not only of the level of education but also of age and sex. It confirms the declining positive influence of labour quality on productivity during the second half of the 1990s. Here, too, there appears to be no significant difference in the results between the United States and the European countries where the most recent period is concerned. Conversely, there was much greater divergence before 1995.

While the estimated effects on productivity of the level of skills vary between countries and over time, so that it is difficult to extrapolate them directly to Belgium, the link between these two variables is undeniably positive.

In that connection, the share of value added represented by branches making intensive use of skilled workers is relatively high in Belgium (1), which could be an advantage for productivity growth. That share, around 59 p.c. in 1999,

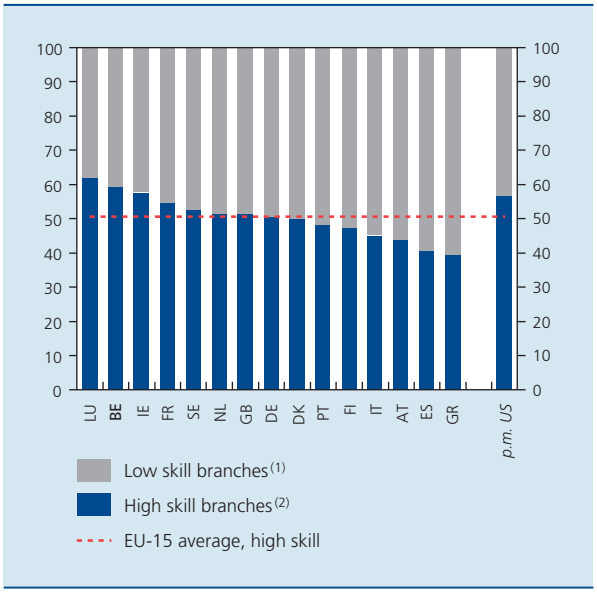
(1) According to estimates by O'Mahony and Van Ark (2003), who classify the branches into four categories: high-, higher-intermediate, lower-intermediate or low-skill intensive. This segmentation of the branches of activity according to the level of skill of the workers was effected on the basis of data for the United States and the United Kingdom, but seems transposable to European economies in general.

was higher than the European average (around 50 p.c.) and even slightly above the United States figure (57 p.c.). Some analysts argue that the spread of ICT is actually responsible for the replacement of unskilled labour with skilled labour, so that the relatively large share of branches employing highly skilled staff in Belgium could in that sense be another facet of the fairly widespread use of ICT in the Belgian economy. Moreover, the relatively high cost of unskilled labour in Belgium could also have restrained the development of branches of activity employing mainly low skilled workers.

One of the strengths of the US economy has been the availability of a skilled labour force, but also to have succeeded in creating employment for the least favoured categories, thus achieving a high employment rate, together with a sustained productivity growth. In the EU-15 countries, there seems to be no obvious link between the employment rate and growth of TFP. Some countries, such as Finland, Sweden, Denmark and the United Kingdom, appear to have succeeded, like the United States, in combining an above-average employment rate – which implies higher employment of less skilled workers – with substantial growth of TFP. Conversely, other economies such as Spain and Italy suffer from both a low employment rate and a meagre rise in productivity. Although there is no clear link here, it is possible that, in Belgium, the low employment rate – indicating under-employment of less skilled workers – is contributing to above-average growth of TFP.

CHART 8 BREAKDOWN OF VALUE ADDED ACCORDING TO THE DOMINANT SKILL LEVEL OF BRANCHES OF ACTIVITY IN THE EU-15 COUNTRIES

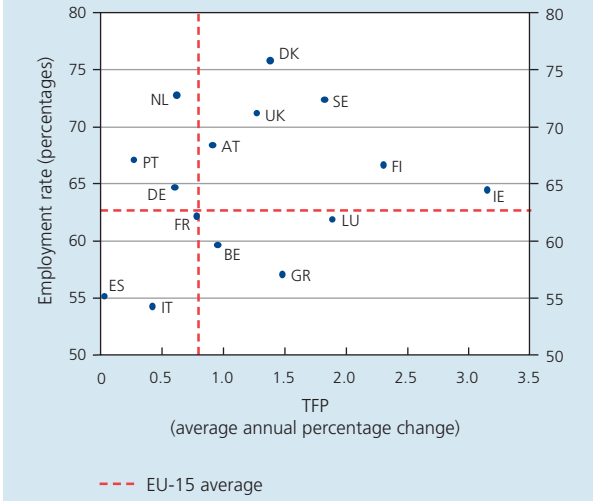
(Percentages of total value added in 1999)



Source : O'Mahony and Van Ark (2003).
(1) Branches of activity classed as low-skill- and low-intermediate skill intensive.
(2) Branches of activity classed as high-skill- and high-intermediate skill intensive.

CHART 9 TFP GROWTH AND EMPLOYMENT RATE IN THE EU-15

(Averages, 1996-2004)



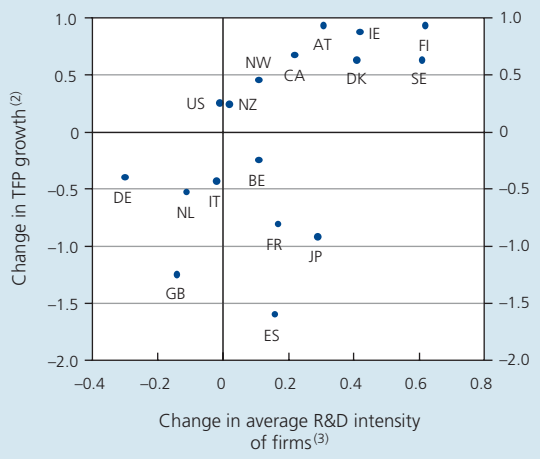
Source : EC.

2.3.3 Research and development

The economy's ability to innovate is also frequently cited as one of the key conditions for productivity growth. Recent OECD studies[1], which measure that ability in terms of the research and development (R&D) effort, have shown the positive influence which it exerts both directly – as a result of R&D activities conducted by firms, the government and universities – and indirectly, by permitting improved assimilation and exploitation of innovations and expertise developed in other countries (spillover effects). Thus, while domestic expenditure on R&D seems to have a smaller impact on the productivity of the smaller countries,[2] it nonetheless appears to be precisely the small countries that gain the greatest benefit from expenditure on R&D made abroad. Moreover, the highly R&D-intensive countries seem to be the ones where productivity gains the most from additional expenditure on R&D, at home and abroad, since they have a higher "absorption capacity". According to the study by Denis et al. (2004), it also appears that the effects on labour productivity of an increase in R&D expenditure as a

(1) cf. Guellec D. and B. Van Pottelsberghe de la Potterie (2001).
(2) cf. Coe and Helpman (1995).

CHART 10 TFP GROWTH AND R&D EXPENDITURE (1)



Source : OECD (2001).

(1) The statistical test reveals a significant link between the two variables : correlation coefficient of 0.57 and a Student's t of 2.65.

(2) Acceleration or deceleration of average annual TFP growth rate between the periods 1980-1990 and 1990-1999.

(3) Change in the average rate of expenditure on R&D by firms, expressed as a percentage of GDP between the periods 1980-1990 and 1990-1999.

percentage of GDP are much greater than the effects of an equivalent rise in the ratio of tangible investment expenditure. Thus, R&D expenditure seems to be far more "productive".

A strict causality between increased expenditure on R&D and productivity growth cannot be inferred. Other factors are at work, and it is highly probable that a whole range of conditions must be met before R&D investment can yield its full potential. Nonetheless, it is evident from an OECD study (2001) that the two countries where firms stepped up their R&D intensity the most between the 1980s and the 1990s – Sweden and Finland – are the ones which also saw the largest increase in TFP. Conversely, in Belgium the TFP growth rate dipped slightly, while there was a small increase in the R&D expenditure of firms as a percentage of GDP.

2.3.4 Other possible determinants

In addition to the above-mentioned factors, a set of elements which determine the economy's general working conditions also impact upon productivity, although to an extent which is hard to quantify.

Among these elements, the degree of (de)regulation might play a role in so far as it encourages competition within the national borders and beyond. Deregulation promotes the disappearance of the least profitable firms, stimulates foreign direct investment and supports investment, particularly in ICT. However, deregulation could have an adverse effect on R&D investment, which would be better served by an environment offering some degree of security, especially as regards legal certainty, providing protection for innovations.

The size of the product market, in terms of both the domestic market and foreign outlets, seems to exhibit a positive correlation with productivity growth, particularly if it offers scope for larger-scale marketing, essential to recoup the cost of R&D.

Finally, it seems that the existence of developed, dynamic stock markets is likely to be more conducive to the financing of innovation and R&D than a financial system based mainly on bank lending. The expansion of investment funding via venture capital also appears to be a favourable factor here.

3. Conclusion

The context of structurally weak economic growth and the adverse demographic outlook facing the European economies have kindled renewed interest in a proper understanding of the factors determining development. Numerous studies have been devoted to this subject in recent years. Their results form the background to the broad economic policy guidelines defined by the EU.

This article has tried to identify the main characteristics of potential GDP growth in Belgium, on the basis of observations over the past twenty years. The analysis was conducted in line with the growth accounting method. It is based on the use of an ajusted version of studies of the same type conducted on a harmonised basis by the EC, in order to make maximum use of the statistical information available regarding Belgium.

The estimate of the potential growth rate, and particularly the contribution of the various factors which determine it, are subject to a degree of statistical uncertainty for which allowance should be made. However, significant lessons can be drawn from the developments seen in Belgium since the beginning of the 1980s, especially as they are confirmed by other comparable studies and corroborated by external indicators.

Over the period from 1982 to 2004, the average annual growth of the potential output of the private sector came to 2.2 p.c. ; for the economy as a whole, GDP grew by an annual average in the order of 2.1 p.c. This places Belgium in the middle group of European countries,

in common with France and the Netherlands, for example. In the EU-15, there is wide divergence between the countries with the highest potential growth – from 5 to 7 p.c. in Luxembourg and Ireland – and those where it is particularly low, such as Italy and Germany, where it is now estimated at less than 1.5 p.c.

Among the three factors underlying potential growth, capital and total productivity have each contributed an average of almost 1 percentage point to annual growth in Belgium. The growth contribution of the factor labour has been less than 0.5 percentage point during the recent period. Since the mid 1990s, it has also been slightly lower than in the EU-15, owing to a less favourable movement in the employment rate and the population of working age. However, the volume of labour has shown signs of accelerating. On the other hand, in contrast to Europe, the rate of increase in the volume of labour has been decelerating since the mid 1990s in the United States, and is almost down to the European level.

Contrasting trends have also been seen as regards the growth of apparent labour productivity, with a rise of almost one percentage point in the United States and a downward trend in Europe. Belgium, too, has experienced a deceleration in growth, though in the past ten years that has been due mainly to lower capital intensity. After diminishing between 1985 and 1995, the growth of total factor productivity (TFP) – which in principle measures the overall productive capacity of the economy – stabilised at a level above the average TFP growth in Europe, and close to the United States figure. This relatively favourable result could be due to the fairly widespread use of ICT, as investment expenditure on this item is greater than in the majority of European countries. The high level of skills in the labour force is another factor supporting TFP, although its impact has not been quantified for Belgium.

In the face of the adverse trend in the population of working age forecast for the coming decades, it is necessary to continue and reinforce measures to support the volume of labour available in the economy, notably by encouraging increased participation in the labour market. Other levers could also be used in order to stimulate productivity progress. Despite the statistical uncertainty surrounding this type of estimate, empirical studies appear to indicate that expenditure on research and development and efforts to improve the quality of the labour force are the most productive. They are yet more effective if market forces offer appropriate incentives to the economic agents.

Annex

Details of the method used by the Bank to assess potential growth

The method of estimation adopted by the Bank is based on the use of a Cobb-Douglas production function. Potential output is a function of the "potential" level of the three determinants identified by growth theory, namely labour (L), capital (K) and total factor productivity (TFP):

$Y^* = TFP^* . L^{*\alpha} . K^{*(1-\alpha)}$ where * refers to the potential levels.

Although the empirical method of assessing Belgium's potential growth developed by the Bank is based largely on that used by the EC [1], it has nevertheless been adapted in several respects to take greater account of the specific characteristics of the economy or the availability of statistics:

- the production function is applied only to the private sector, as the public sector cannot exert any fundamental influence on the potential path of the economy via its own value added. The production function therefore takes account of the value added of the private sector only, plus labour in the private sector and the capital stock of firms. Up to now, the EC has used a production function for the economy as a whole;
- the data are processed on a quarterly basis, whereas the EC uses annual series only. Quarterly series present the advantage that the smoothing filters are finer, since they are based on a larger number of data. The aggregates are then annualised to ensure an easier readability of the results;
- in contrast to the approach used by the EC which, owing to the availability of statistics in certain countries, can only consider the number of persons in work, the volume of labour relates to the number of hours worked. This prevents the TFP figure from being distorted by changes in working time – whether they be due to the expansion of part-time working, changes in agreed working hours or short-term cyclical movements.

The determinants of the production function used by the Bank are calculated as follows:

- The factor labour (L) is expressed as a potential volume of hours of work in the private sector. It is obtained by taking the potential employment of the private sector, expressed in persons, and multiplying it by the average (smoothed) working time.
  Employment in terms of persons is calculated by eliminating from the overall population of working age:
  - persons who are inactive, taking account of a smoothed (in) activity rate;
  - the structural component of unemployment, considering that it cannot make any direct contribution to output, which is estimated by applying an HP filter to the observed unemployment rate [2];
  - smoothed public employment.
- The observed capital stock (K) is assumed to correspond to the potential capital stock (K*= K). This is a generally accepted assumption in this type of exercise, even though the use of the actual capital stock figure leads to a cyclical component in potential growth. In our method, we limit capital to the capital of firms only.
- Total factor productivity (TFP) is first deduced as a balance from the production function method, taking account of the actual levels of output in the private sector (GDP excluding public sector wages [3]) and the actual inputs (labour in the private sector and capital of the private sector). The potential level of TFP is then calculated by a smoothing process.

The estimated weighting coefficients of the production factors are as follows: 59 p.c. (= α) of the total remuneration of the factors is attributed to labour and the remaining 41 p.c. (= 1 – α) to capital; these are the average coefficients calculated over the period 1981-2003 [4].

(1) Denis et al. (2002).

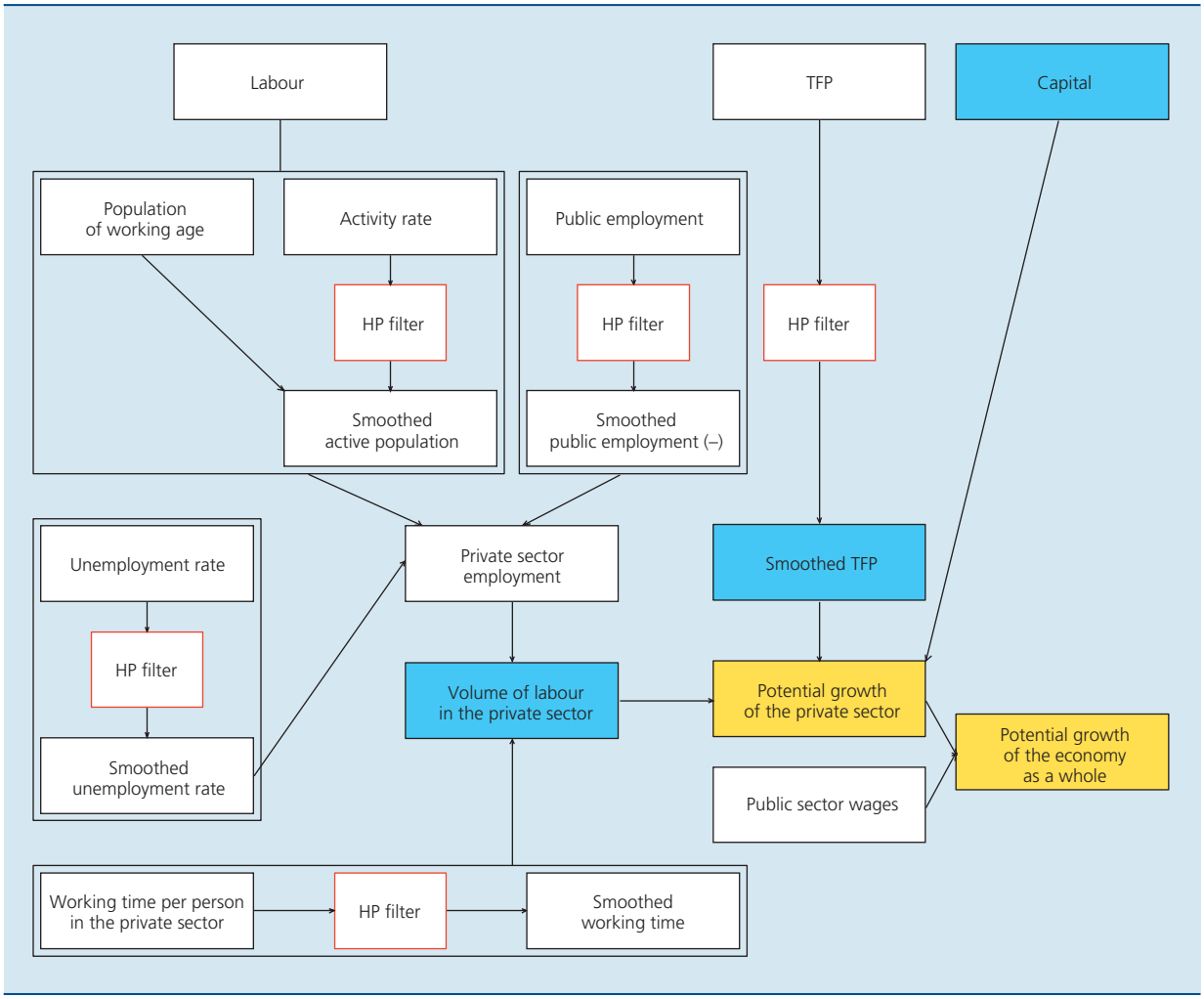
(2) The European Commission estimates a NAIRU (non-accelerating inflation rate of unemployment) by using a Kalman filter. The results thus obtained are very similar to those arrived at by using an HP filter. For simplicity, we have adopted the latter.

(3) As an approximation of value added in the public sector.

(4) A downward trend in the share of wages in the total factor remuneration is evident throughout the period, falling from 61-62 p.c. at the beginning of the 1980s to 56-57 p.c. at present. The coefficient α used here is lower than that, about 2/3, generally mentioned in the analyses, because the measure of potential growth adopted here relates to the private sector only, rather than the economy as a whole, and the value added of general government consists almost exclusively of remuneration of labour. The figure for the coefficient α which we obtain for the Belgian economy as a whole (private sector and public sector) is 64 p.c. on average for the period 1981-2003, which is close to the figure generally assessed.

By combining the estimate of potential labour, the capital stock and the estimate of potential TFP, we thus obtain the potential output of the private sector. The potential GDP of the economy as a whole is derived by adding public sector wages.

DIAGRAM OF THE METHOD USED BY THE NBB TO ASSESS THE POTENTIAL GROWTH OF THE BELGIAN ECONOMY



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