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Labour productivity growth in Belgium
Long-term trend decline and possible actions

September 2015

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Abstract – The paper analyses the long-term trend of Belgian economic growth and the more recent evolution of labour productivity including the impact of the crisis. It identifies the causes of declining trend of productivity gains by analysing the structural changes in the economy and by applying the growth accounting methodology on industry-level data. Finally, possible policy actions are detailed which minimise the negative short term impact on aggregate demand while maximising the positive effect on labour productivity growth.

Abstract – Deze paper analyseert de langetermijntrend van de Belgische economische groei en de recentere evolutie van de arbeidsproductiviteit, waaronder de impact van de crisis. De oorzaken van de dalende trend van de productiviteitswinsten worden aangeduid door de structurele veranderingen in de economie te analyseren en de groeiverklarende methode toe te passen op sectorgegevens. Tot slot worden mogelijke beleidsmaatregelen uiteengezet die de negatieve kortetermijnimpact op de totale vraag beperken en de positieve impact op de groei van de arbeidsproductiviteit vergroten.

Abstract – Le papier analyse la tendance à long terme de la croissance économique belge et l'évolution récente de la productivité du travail en prenant en compte l'impact de la crise. Il identifie les causes de la baisse tendancielle des gains de productivité en analysant les changements structurels de l'économie et en appliquant la méthodologie de la comptabilité de la croissance à des données sectorielles. Enfin, il envisage les actions politiques possibles qui minimisent l'impact négatif sur la demande agrégée tout en maximisant l'effet positif sur la croissance de la productivité du travail.

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Executive summary

The recent great depression has reinforced the long-term trend of the decline in the growth rate of Belgian GDP per capita. This is a common feature of most advanced economies but the slowdown is more pronounced in Belgium than in the US resulting in a growing standard of living differential between the two countries. In Belgium, this decline is attributed to the decline of the labour productivity growth. The decomposition of GDP per capita growth since 1970 allows to shed light on the trade-off between labour utilisation and labour productivity growth present in Belgium over the period.

The analysis of labour productivity growth in comparison with the three neighbouring countries over the 2000-2013 period points to the TFP growth as the main cause of decline. The contribution to labour productivity growth of ICT capital deepening in Belgium is also lower than in Germany and in the Netherlands. The industry contribution shows that this relative productivity weakness is mainly explained by the negative contribution of non-market services over the whole period and by a more pronounced deterioration of market services after the crisis.

Analysing the reasons for the labour productivity growth slowdown allows to show that some are common to all advanced economies while others are more specific to the Belgian economy. The structural changes in activities in favour of services and in disfavour of manufacturing are common to most advanced countries. A Belgian specific feature is the weakness of ICT related activities, especially in manufacturing which reduces the TFP potential gains for the economy as a whole. Moreover, phenomena which have sustained productivity gains begin progressively to falter. This is the case for the rapid knowledge-based capital accumulation which is in Belgium relatively highly concentrated, the increase in the stock of high-skilled workers which has been for a long time a Belgian comparative advantage, and the fast development of the global value chains in which Belgium is already highly integrated.

In evaluating the policies which could be implemented in order to counteract the labour productivity growth declining trend, the macroeconomic and institutional context matters. Belgium belongs to a monetary union which suffers from a depressed economic situation with a policy mix limited by the zero lower bound and by the fiscal consolidation in many EU Member States. This leads to give the priority to three families of reforms: market functioning improvement and product market reform, investment in knowledge capital and innovation and improvement of infrastructure.

Concerning market functioning improvement, according to OECD indices, efforts can still be made in terms of business climate especially by reducing barriers to entrepreneurship and in terms of market functioning of telecoms, railways transport, retail trade and professional services.

To promote innovation, the accumulation of knowledge-based capital has to be enlarged in terms of industries and categories of enterprises involved. In addition, high skilled workers stock, especially in science and engineering, has to be at least maintained through the improvement of education and life-long learning systems. A more efficient resources allocation lowering skill mismatch also contributes to productivity gains.

Improving infrastructure after years of fiscal consolidation and disruptive effects of the recent crisis has also a positive impact on productivity growth. In Belgium, this mainly concerns energy and road and railways transport. In addition to public expenditure in maintenance and improvement of networks, public authorities have also to provide a clear and stable regulation, efficient procurement procedures and certainty of timing to encourage private sector investment.

Synthèse

La grande crise récente a renforcé la tendance de long terme au déclin du taux de croissance du PIB par tête belge. Cette tendance est une caractéristique commune à la plupart des économies avancées. Cependant, le ralentissement est plus prononcé en Belgique qu'aux États-Unis augmentant l'écart de niveaux de vie entre les deux pays. En Belgique, ce déclin est dû au déclin de la croissance de la productivité du travail. La décomposition de la croissance du PIB par tête depuis 1970 permet de mettre en lumière le trade-off entre l'évolution de l'utilisation du travail et la croissance de la productivité du travail présent en Belgique sur toute la période.

L'analyse de l'évolution de la productivité du travail en comparaison avec les trois pays voisins de 2000 à 2013 montre que la croissance de la PTF est la principale cause du déclin. La contribution à la croissance de la productivité de l'intensité capitalistique TIC en Belgique est aussi plus faible qu'en Allemagne et aux Pays-Bas. L'estimation des contributions des principaux secteurs à la croissance montre que la faiblesse relative de la productivité est principalement expliquée par la contribution négative des services non-marchands sur toute la période et par une détérioration plus marquée des services marchands après la crise.

Certaines raisons du ralentissement de la croissance sont communes à toutes les économies avancées mais d'autres sont propres à la Belgique. Les changements structurels des activités en faveur des services et au détriment de l'industrie manufacturière sont communs à la plupart des pays avancés. Une caractéristique spécifique à la Belgique est la faiblesse des activités liées aux TIC, en particulier dans l'industrie manufacturière, ce qui réduit les gains potentiels de PTF pour l'économie dans son ensemble. De plus, certains phénomènes qui ont soutenu les gains de productivité au cours des dernières décennies, commencent progressivement à s'essouffler. C'est le cas de l'accumulation rapide du capital basé sur la connaissance qui est, en Belgique, relativement fortement concentrée, de l'augmentation de la part des travailleurs hautement qualifiés qui a été pendant longtemps un avantage comparatif de la Belgique et du développement rapide des chaines de valeur globales dans lesquelles l'économie est déjà fortement intégrée.

L'évaluation des politiques susceptibles de contrecarrer le déclin tendanciel de la productivité doit tenir compte du contexte macroéconomique et institutionnel. La Belgique appartient à une union monétaire qui souffre d'une situation économique déprimée avec un policy mix limité par le plancher à zéro pour les taux d'intérêt et par la consolidation budgétaire à l'œuvre dans la plupart des États Membres. Cette situation conduit à privilégier trois familles de reformes : l'amélioration du fonctionnement des marchés et la réforme du marché des produits, l'investissement dans le capital basé sur la connaissance et l'innovation et l'amélioration des infrastructures.

Dans le cadre de l'amélioration du fonctionnement des marchés, selon les indicateurs de l'OCDE, des efforts doivent encore être consentis pour améliorer le climat des affaires, particulièrement pour réduire les barrières à l'entreprenariat et pour améliorer le fonctionnement du marché des télécoms, du transport ferroviaire, du commerce de détail et des professions réglementées.

Pour promouvoir l'innovation, l'accumulation du capital basé sur la connaissance doit être étendue en termes d'activités et de catégories d'entreprises impliquées. De plus, le stock de personnel qualifié, en particulier en sciences et ingénieur, doit être au minimum maintenu par l'amélioration des systèmes d'éducation et de formation tout au long de la vie. Un système d'allocation des ressources plus efficace permettant de diminuer l'inadéquation des qualifications contribue aussi aux gains de productivité.

Améliorer les infrastructures après des années de consolidation budgétaire et les effets dévastateurs de la récente crise a aussi un impact positif sur la croissance de la productivité. En Belgique, cette amélioration concerne l'énergie et le transport par route et par rail. En plus des dépenses publiques pour la maintenance et l'amélioration des réseaux, les autorités publiques doivent aussi garantir une réglementation claire et stable, des procédures de marchés publics efficaces et la certitude des échéances pour encourager l'investissement du secteur privé.

Synthese

De recente grote depressie heeft de dalende langetermijntrend van de groeivoet van het Belgisch bbp per hoofd versterkt. Dit is een gemeenschappelijk kenmerk van de meeste geavanceerde economieën, maar de vertraging is meer uitgesproken in België dan in de VS, waardoor er een groeiende kloof in de levensstandaard tussen de twee landen ontstaat. In België wordt die daling toegeschreven aan de daling van de arbeidsproductiviteit. De ontleding van de groei van het bbp per hoofd sinds 1970 maakt het mogelijk om licht te werpen op het evenwicht tussen de evolutie van de benutting van arbeidskrachten en de groei van de arbeidsproductiviteit in België over de gehele periode.

In de analyse van de groei van de arbeidsproductiviteit in vergelijking met de drie buurlanden over de periode 2000-2013 komt de TFP naar voren als de belangrijkste oorzaak van de daling. De bijdrage van de ICT-kapitaalintensiteitsvergroting is in België ook kleiner dan in Duitsland en Nederland. Uit de sectorbijdrage tot de groei blijkt dat de relatief zwakke productiviteit voornamelijk verklaard wordt door een negatieve bijdrage van de niet-marktdiensten over de gehele periode en door een meer uitgesproken achteruitgang van de marktdiensten na de crisis.

De analyse van de oorzaken van de vertraging van de groei van de arbeidsproductiviteit toont aan dat sommige oorzaken gemeenschappelijk zijn voor alle geavanceerde economieën, terwijl anderen specifiek zijn voor de Belgische economie. De structurele veranderingen in de activiteiten ten gunste van diensten en ten nadele van de verwerkende industrie zijn gemeenschappelijk voor de meeste geavanceerde landen. Een specifiek kenmerk van België zijn de zwakke ICT-gerelateerde activiteiten, met name in de verwerkende industrie, hetgeen de potentiële TFP-winsten vermindert voor de economie als geheel. Bovendien beginnen fenomenen die de laatste decennia productiviteitswinsten ondersteunden geleidelijk aan te wankelen. Dit geldt voor de snelle vergaring van kenniskapitaal, die in België redelijk hoog geconcentreerd is, de toename van het bestand hooggeschoolden, dat gedurende lange tijd een relatief voordeel vormde voor België, en de snelle ontwikkeling van de wereldwijde waardeketens waarin België reeds dieper geïntegreerd is.

De macro-economische en institutionele context spelen een belangrijke rol in de evaluatie van de beleidsmaatregelen die genomen kunnen worden om de dalende trend van de groei van de arbeidsproductiviteit een halt toe te roepen. België maakt deel uit van een monetaire unie die lijdt onder een economische depressie met een beleidsmix die beperkt wordt door een nul-ondergrens voor de rentetarieven en door het budgettaire saneringsbeleid in de EU-lidstaten. Dit leidt ertoe voorrang te geven aan drie soorten hervormingen: verbetering van de marktwerking en hervorming van de productmarkt, investeringen in kenniskapitaal en infrastructuurinnovatie en -verbetering.

Wat betreft de verbetering van de marktwerking, kunnen er volgens de OESO-indexen nog steeds inspanningen worden geleverd op het vlak van het ondernemingsklimaat, meer bepaald door de belemmeringen naar het ondernemerschap weg te nemen en op het vlak van de marktwerking van de sectoren telecom, spoorvervoer, detailhandel en professionele diensten.

Om innovatie te bevorderen moet de vergaring van kenniskapitaal uitgebreid worden naar meer sectoren en ondernemingscategorieën. Bovendien moet het bestand hooggeschoolden, met name in de wetenschap en de techniek, ten minste behouden worden door de onderwijssystemen en de systemen voor levenslang leren te verbeteren. Een efficiëntere toewijzing van middelen die de onaangepastheid van kwalificaties vermindert draagt ook bij tot productiviteitswinsten.

De verbetering van infrastructuur na jaren van begrotingsconsolidatie en na de verstorende effecten van de recente crisis heeft ook een positieve impact op de productiviteitsgroei. In België heeft dit voornamelijk betrekking op energie en het vervoer over de weg en per spoor. Naast overheidsinvesteringen in het onderhoud en de verbetering van netwerken, dient de overheid ook te voorzien in een heldere en stabiele wetgeving, doeltreffende aanbestedingsprocedures en zekere termijnen om investeringen in de privésector aan te moedigen.

1. Long term evolutions

1.1. Trend of GDP per capita growth

Growth of GDP per capita is one of the most frequently used indicators of economic performance, providing an easily understandable picture of the evolution of the standard of living. However, this indicator is far from offering a complete view of changes in the welfare of an economy. Its main short-comings are well known and include, among others, the lack of information on the inequality in income and wealth distribution, the use of non-renewable resources or the quality of life. Despite these limita-tions, GDP per capita is widely used in international comparisons as it is generally rapidly available for most industrialised countries.

The long term series allows light to be shed on the declining trend of GDP per capita growth over the last five decades. After an average annual growth of 4.3% in the sixties, the Belgian GDP per capita growth decreased to 3.1% in the seventies and to 1.9% in the eighties before stabilizing at 2.0% during the nineties. Since 2000, GDP per capita has been growing even more slowly at an average annual rate of 0.7%. The slowdown of the trend has been accelerated by the recent deep crisis. Over 2000-2007, the average annual growth rate of this indicator reached 1.5% against -0.3% over 2007-2013.

Graph 1   Real GDP per capita growth trend in Belgium
Annual growth rate in percent

Remark: HP filter (lambda = 100) to obtain the trend.
Source: Ameco, DG ECFIN.
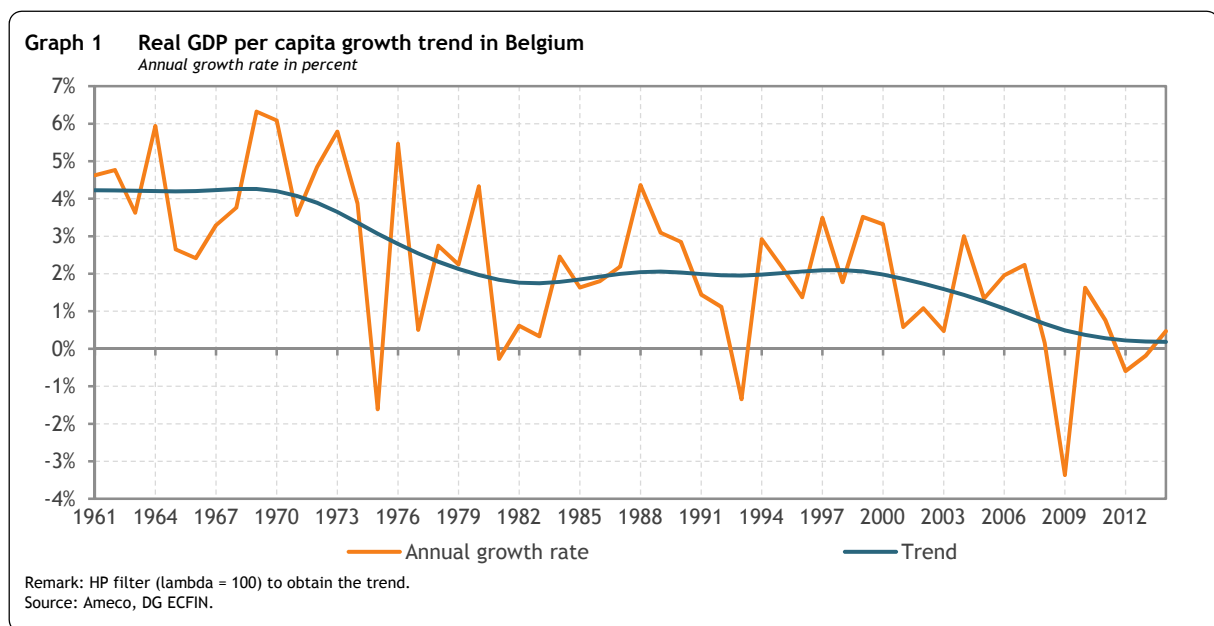
The decline in GDP per capita growth since the sixties is a common trend of the main industrialised countries and is also visible in the European Union (EU15) or in the US (Graph 2). Despite the declining trend, the GDP per capita growth in Belgium remained higher than the one in the European average and in the US during the sixties and the seventies. However, at the beginning of the eighties, this hier-archy changed and the growth rate of GDP per capita in the US became higher than the one observed in Belgium and in the EU15. This superiority holds for most of the remaining period and especially since the recent crisis.

Graph 2 **Comparison of real GDP per capita growth trend**
Annual growth rate in percent

Remark: HP filter (lambda = 100) to obtain the trend.
Source: Ameco, DG ECFIN.
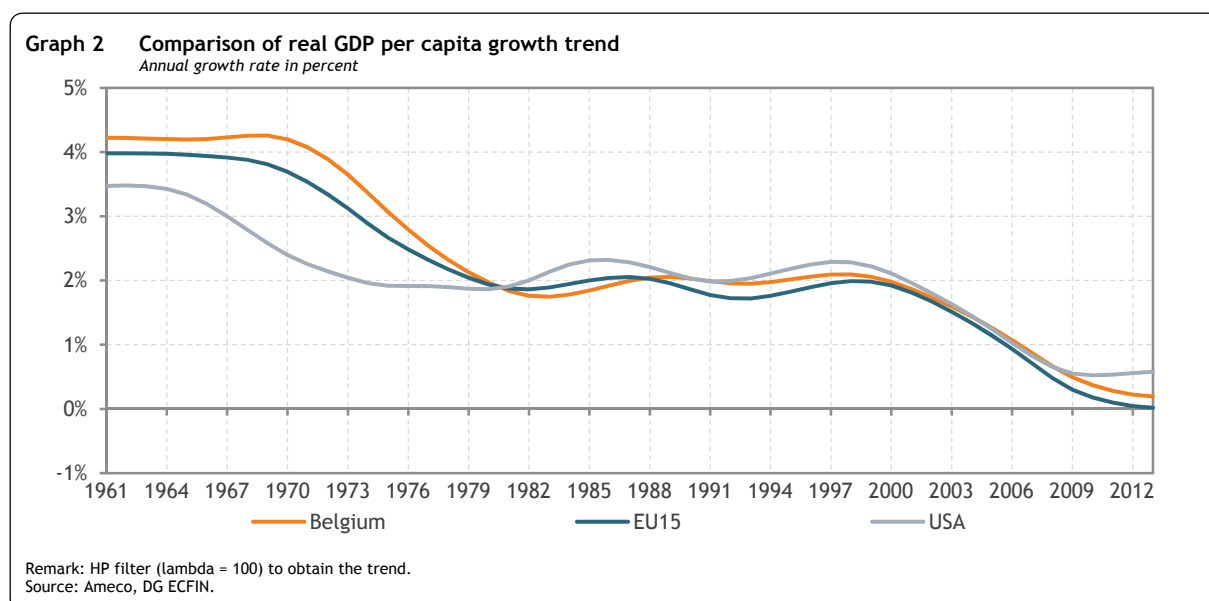
Table 1 **Comparison of real GDP, Population and real GDP per capita growth**
Annual average growth rate in percent

	Belgium	EU15	USA
1960-1970			
GDP	4.9	4.9	4.2
Population	0.6	0.8	1.3
GDP per capita	4.3	4.0	2.9
1970-1980			
GDP	3.4	3.1	3.2
Population	0.2	0.4	1.1
GDP per capita	3.1	2.6	2.1
1980-1990			
GDP	2.0	2.5	3.3
Population	0.1	0.3	0.9
GDP per capita	1.9	2.2	2.4
1990-2000			
GDP	2.2	2.5	3.4
Population	0.3	0.3	1.2
GDP per capita	2.0	1.7	2.2
2000-2013			
GDP	1.3	1.0	1.7
Population	0.6	0.5	0.9
GDP per capita	0.7	0.6	0.8

Source: Ameco, DG ECFIN, FPB.

A major difference between the EU15 and Belgium on the one hand, and the US on the other hand, is the evolution of the population (Graph 3). Over the period 1960-2013, the population in the EU15 grew at an average annual rate of 0.5% (0.4% in Belgium) while the American population expanded at an average annual rate of 1.1%. According to the long-term growth literature, the pace of population growth is one of the determinants of the GDP growth at steady state. This means that the average annual

growth rate of GDP in the US has to have been higher than the average annual growth rate of the European and Belgian GDP. Over the period 1960-2013, it was indeed the case: 3.1% for the US against 2.7% for the EU15 and for Belgium.

Graph 3   Comparison of population growth rate
Annual growth rate in percent

Source: Ameco, DG ECFIN and FPB.
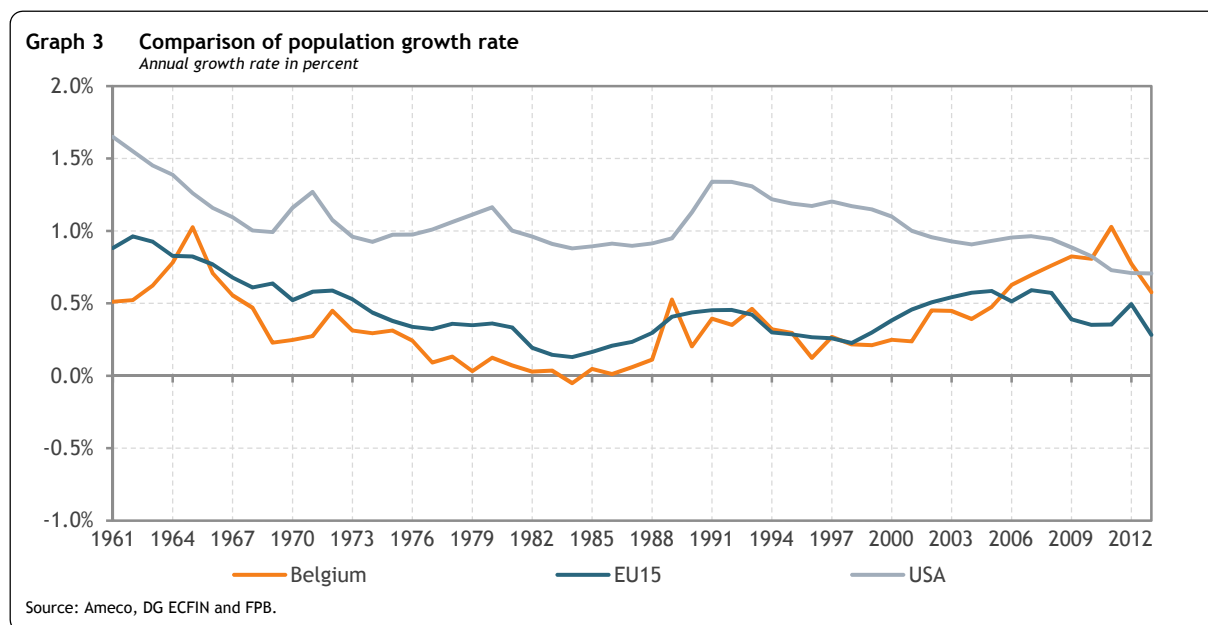
In order to assess the degree of convergence in standards of living across countries resulting from these different growth rates, it is useful to compare the levels of GDP per capita and their evolution. This kind of comparison requires the use of Purchasing Power Standard (PPS) which enables to express data in a common virtual currency taking into account the differences of the relative prices levels across countries[1].

Graph 4   Comparison of GDP per capita at 2010 prices and PPS
Left scale thousands of PPS and right scale in percent

Source: Ameco, DG ECFIN and Eurostat, PPS.
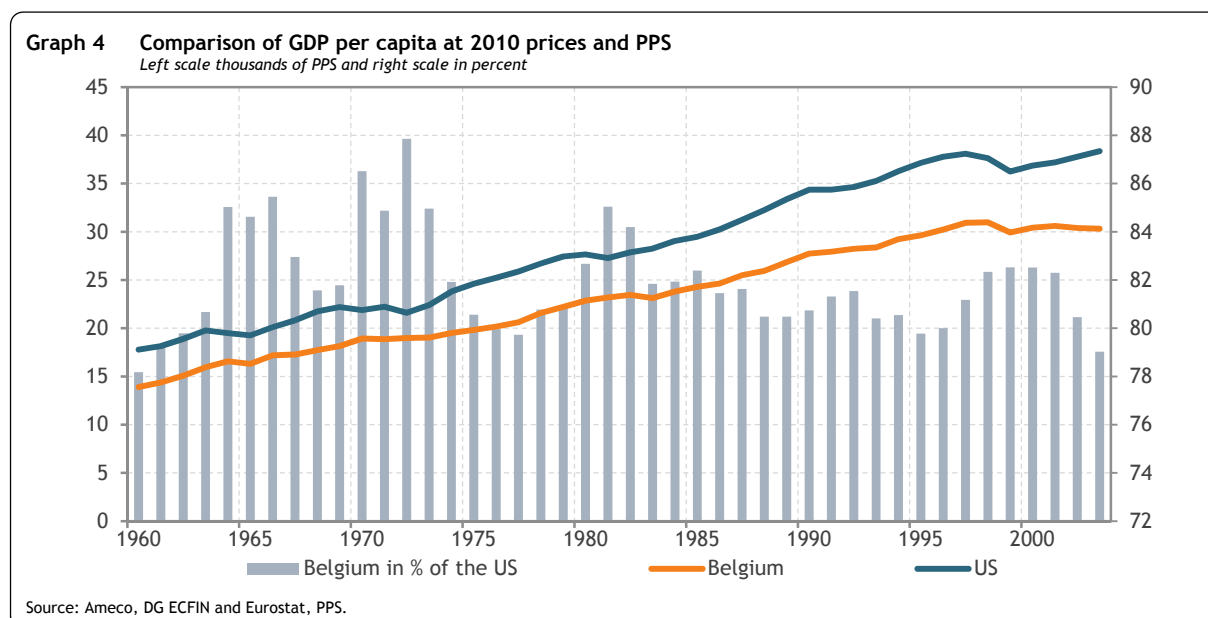
The convergence between the Belgian and the US levels of GDP per capita is not a constant process but occurs through cycles (Graph 4). However, the percentage of the American level reached by the Belgian

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[1]   Given the availability of data on PPS provided by Eurostat, this comparison is limited to Belgium and the US.

GDP per capita at the top of the cycle is on a declining trend indicating a growing standard of living differential between these two countries. Since 2000, the Belgian GDP per capita reached on average 81% of the American one.

1.2. Decomposition of GDP per capita growth

The evolution of the GDP per capita growth can be decomposed into the evolution of labour utilisation (the growth of hours worked per capita) and the evolution of labour productivity (the growth of GDP per hour worked). As hours worked per capita cannot increase indefinitely, labour productivity growth is, on the long run, the main driver of the increase in the standards of living. Over the period 1970-2013, this decomposition has been altered dramatically both in Belgium and in the US (Graph 5).

In Belgium, the decline of the GDP per capita growth is attributed to the decline of the labour productivity growth. The contribution of the labour utilisation to GDP per capita growth improved from a negative contribution during the seventies and the eighties to a slightly positive contribution since 2000. It appears from Graph 5 that a trade-off between labour utilisation and labour productivity growth seems to be present in Belgium over the period.

The same decomposition of GDP per capita growth provides the opposite picture for the US. The labour utilisation growth positively contributed to the GDP per capita growth during the three first decades before becoming negative over 2000-2013. However, this negative contribution of labour utilisation was not coupled with an acceleration of labour productivity growth during most recent years. Indications of a trade-off between labour utilisation and labour productivity growth are not visible in the US.

Graph 5   Decomposition of real GDP per capita growth: comparison Belgium and the United States
Average annual growth rate in percent

Source: Ameco, DG ECFIN.
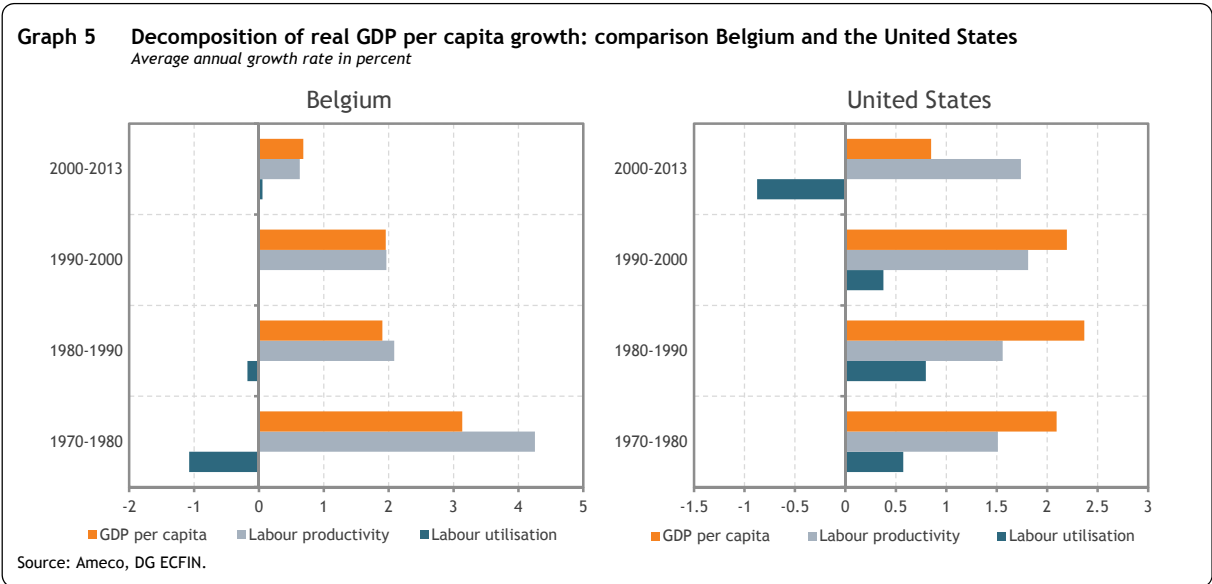
1.2.1. Labour utilisation

In Belgium, the number of hours worked per capita was on a relatively rapid declining trend from 1970 until the mid-eighties and again over 1990-1995. Since then, hours worked per capita has increased before stabilizing at the end of the period around 650 hours worked per capita.

In the US, the labour utilisation increased by successive waves from 1970 until 2000 when the number of annual hours worked per capita reached almost 900 hours. Since then, the trend is declining and the annual hours worked per capita reached 800 hours in 2013.

Graph 6   Labour utilisation in Belgium and in the US
Annual hours worked per capita

Source: Ameco, DG ECFIN.
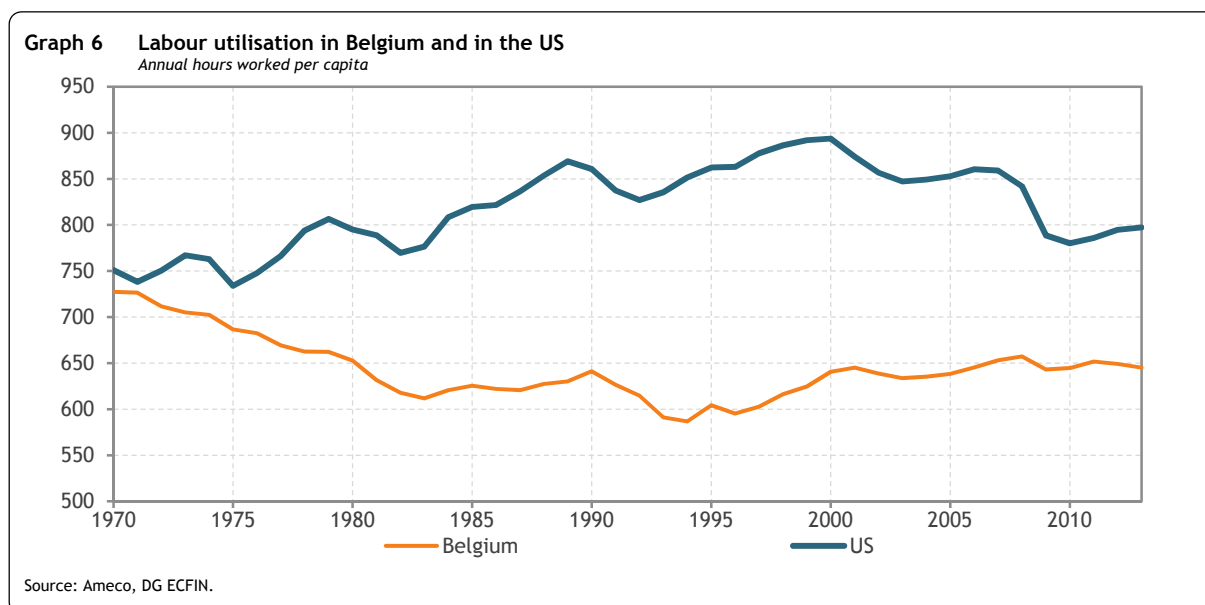
To better understand the evolution of labour utilisation, it is useful to decompose this indicator into more familiar elements. This has been done by considering the decomposition of labour utilisation into three components: firstly, annual hours worked per worker; secondly, the employment rate defined as the total number of workers divided by the working age population and, finally, the share of working age population in total population.

$$\frac{\text{Hours}}{\text{Population}} = \frac{\text{Hours}}{\text{Workers}} \times \frac{\text{Workers}}{\text{Working age population}} \times \frac{\text{Working age population}}{\text{Population}}$$

In Belgium, the decrease in labour utilisation at the beginning of the period was clearly linked to the decrease in the annual number of hours worked by worker in relation with reductions in contractually agreed working hours. From the mid-1970s and during the eighties, the decrease of the hours worked by workers is realised in a logic of sharing of work in a less favourable economic environment (Hendrickx and al., 1997). Since mid-nineties, the annual volume of labour per worker has stabilised, fluctuating between 1500 and 1600 hours. In the US, the decline in the annual hours worked by worker occurred later, from the end of the nineties until 2009. Since 2010, the volume of labour per worker stabilised slightly above 1700 hours.

Graph 7   Annual hours worked by worker in Belgium and in the US
Hours per worker per year

Source: Ameco, DG ECFIN.
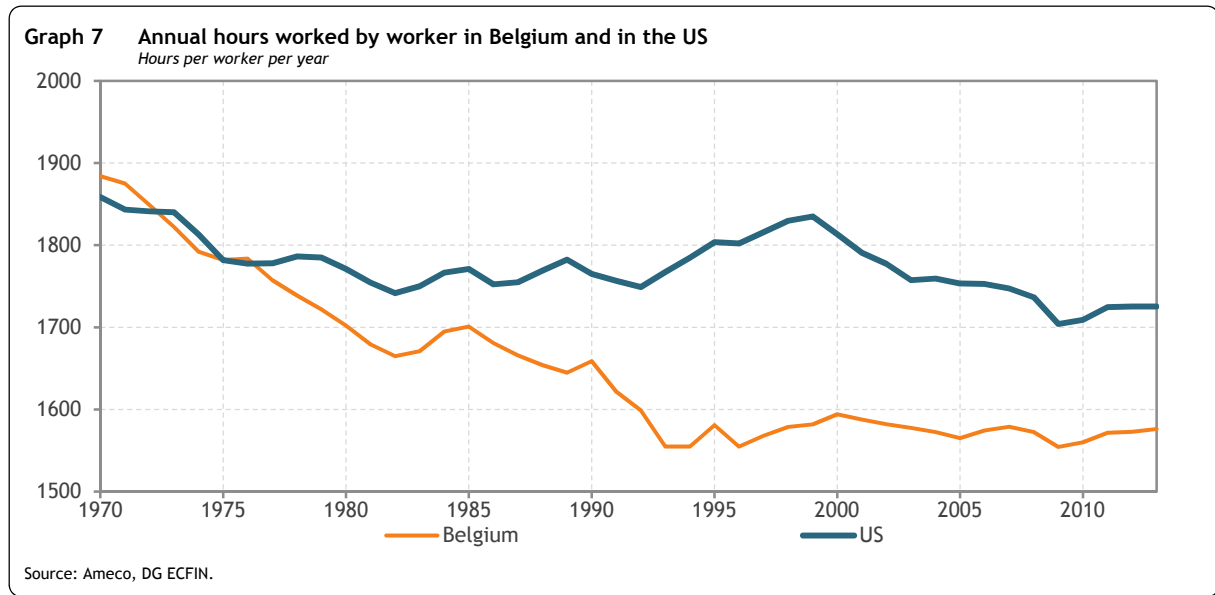
From the mid-seventies until the mid-eighties, the decline of employment rate also contributed to the decrease in labour utilisation in Belgium. This evolution was mainly due to the rapid increase in working age population, driven by the access to labour market of the baby boomers, which reached a peak in 1986 accounting for 67.4% of the total population. Since the mid-eighties, the employment rate has increased from 54.6% in 1985 to 62.6% in 2013. However, the Belgian performance is still far from the Lisbon employment rate objective[2]. The Belgian employment rate also remains below the American rate although the differential has narrowed in recent years.

Graph 8   Employment rate in Belgium and in the US
Workers on working age population (15-64) in percent

Source: Ameco, DG ECFIN.
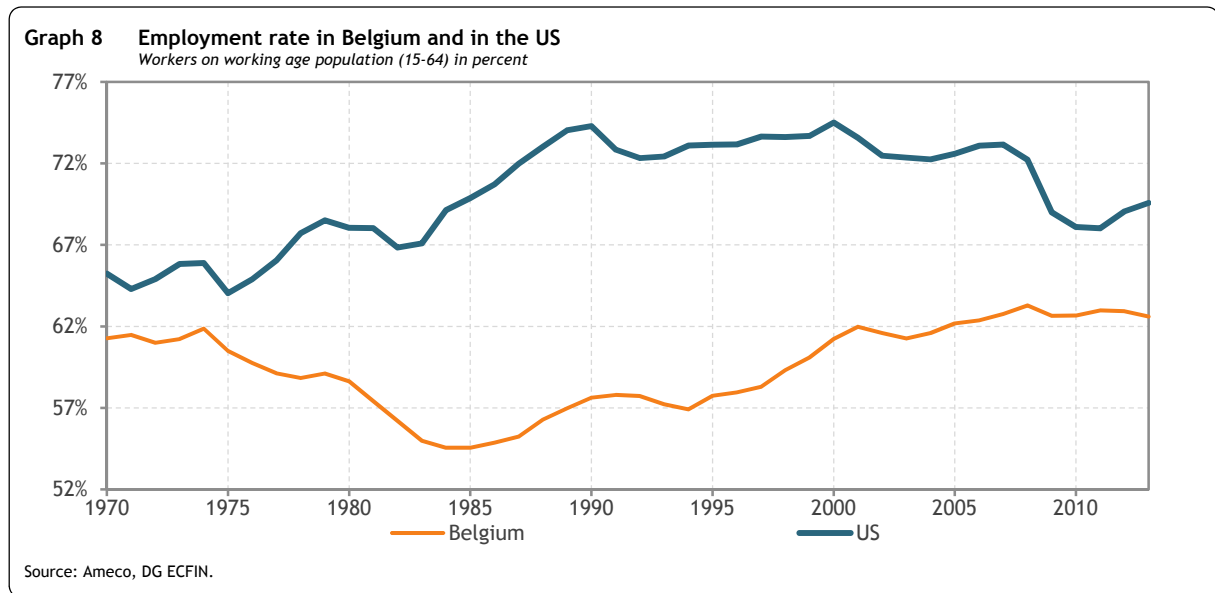
Between 1986 and 2004, the share of the working age population in the total Belgian population declined due to the rapid increase in the share of persons older than 64 in the total population. From 2004 to 2008, the relative importance of the working age population in the total population increased, from 65.6% to 66.1%, partly under the effect of immigrants. However, since then, the trend has reversed and, in 2013, the share of working age population in the total population reached 65.4%, slightly below the 2004 level.

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[2]   The employment rate objective, defined as workers on the population aged 20-64 in the Lisbon strategy, is 73.2% in 2020. In 2013, the Belgian employment rate was 67.2% according to the Commission's definition.

This recent trend is also observable in the US although the share of the working age population in the total population is higher than in Belgium since 1998.

Graph 9   Working age population on total population in Belgium in the US
Working age population (15-64) in percent of total population

Source: Ameco, DG ECFIN.
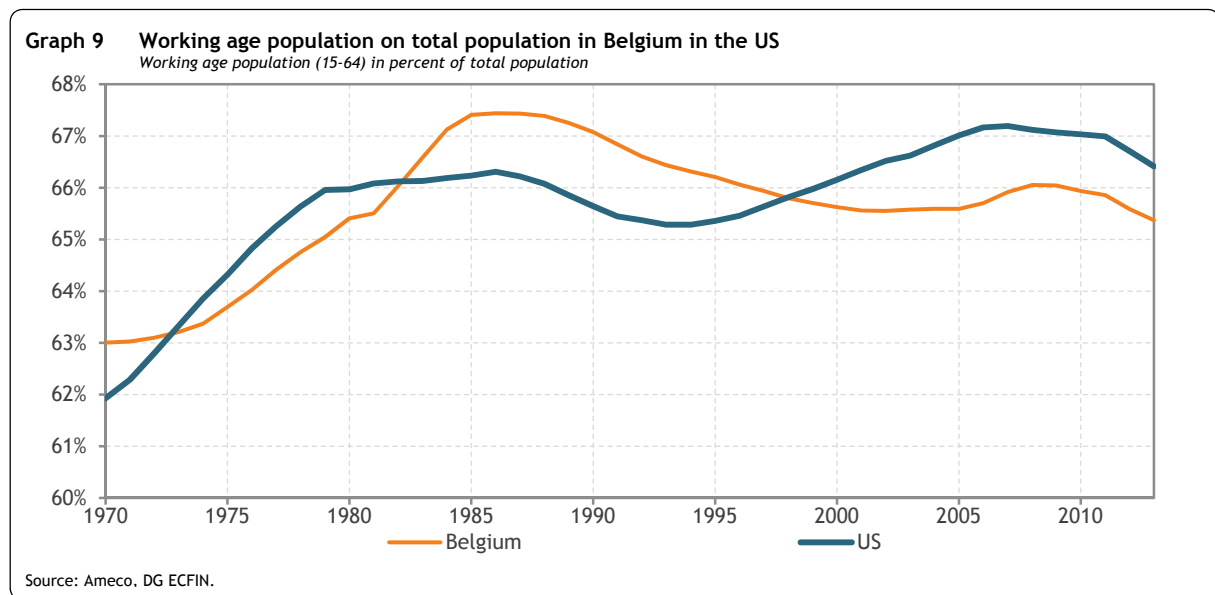
1.2.2.   Labour productivity growth

Over the whole period, labour productivity growth has been on a declining trend in Belgium. After an average annual growth rate of 4.3% during the seventies, labour productivity growth rate declined to 2.1% during the eighties and to 2.0% during the nineties. Over 2000-2013, the growth of labour productivity slowed even more at 0.6% on yearly average basis. Since the crisis, this growth rate has even turned to be negative, -0.1% over 2007-2013.

Graph 10   Labour productivity growth in Belgium
Real GDP per hour worked growth rate, in percent

Source: Ameco, DG ECFIN.
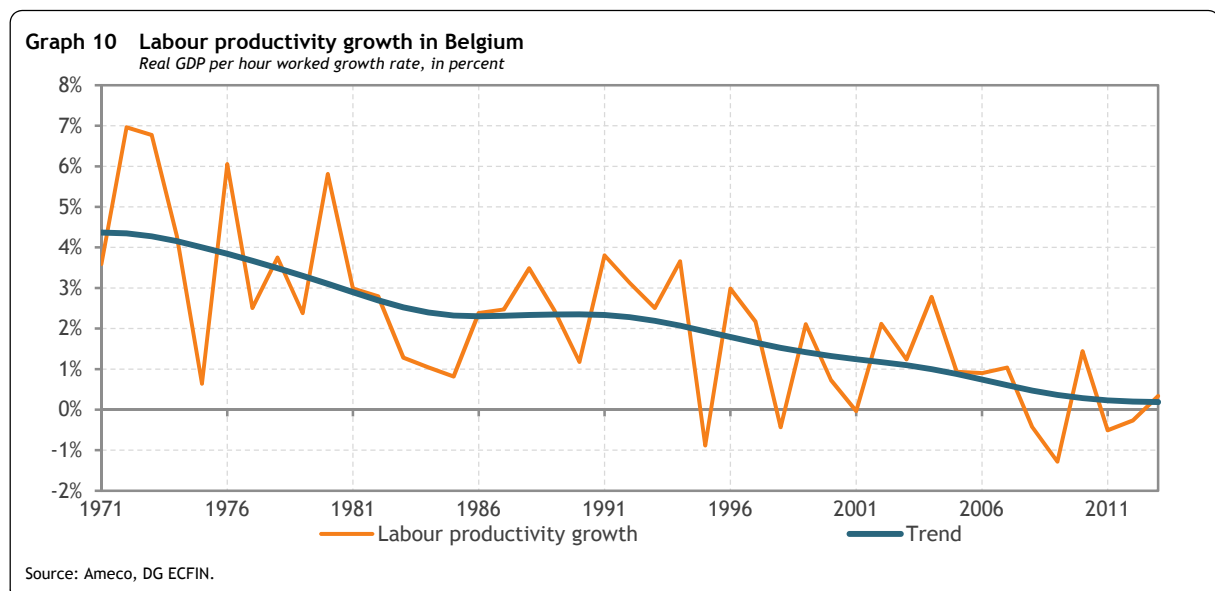
The trend of labour productivity growth in the US appears to be more stable, even if it has also declined since the beginning of 2000s. The average annual growth rate of labour productivity was 1.5% during

the seventies, 1.6% during the eighties and 1.8% during the nineties. Over 2000-2013, this rate reached 1.7%.

Graph 11   Comparison of labour productivity growth trend in Belgium and in the US
Real GDP per hour worked growth rate, in percent

Source: Ameco, DG ECFIN.
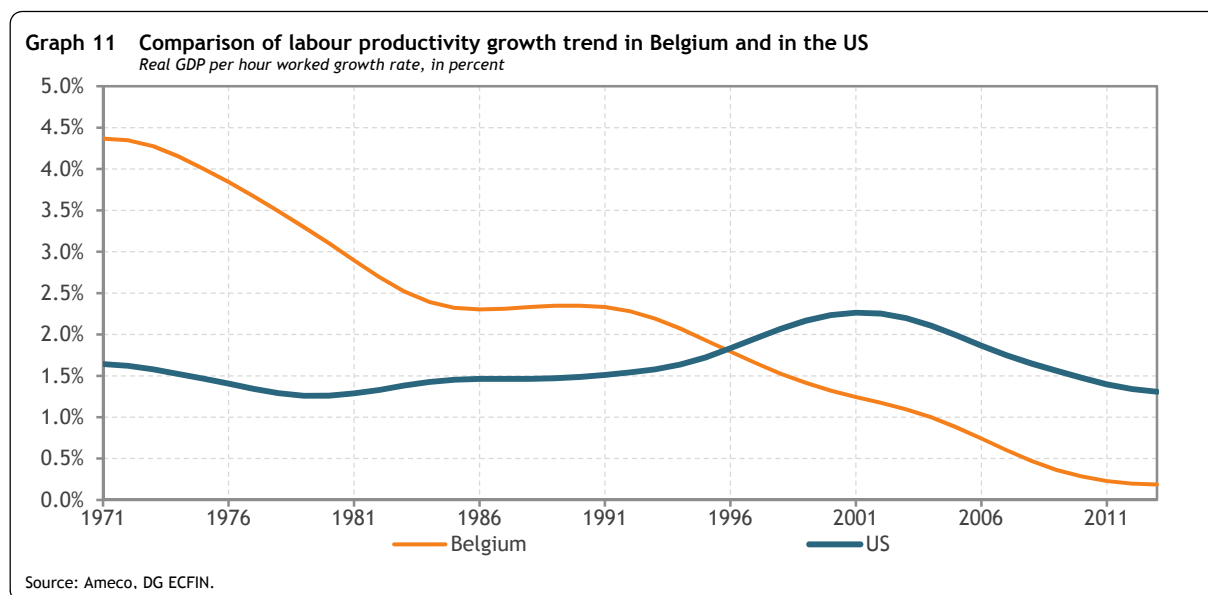
These differences in the patterns of growth have an impact on the relative level of labour productivity in Belgium in comparison to the US. In order to compare levels of labour productivity between the two countries, the GDP per hour worked is expressed in PPS.

The high level of the Belgian labour productivity is well known and the Belgian level was above the US from 1980 to 2009. However, since 2010, the US level of productivity overpassed the Belgian one and in 2013, the Belgian level was even 2% below the US level.

Graph 12   Comparison of labour productivity levels in Belgium and in the US at 2010 prices and PPS
Left scale thousands of PPS and right scale in percent

Source: Ameco, DG ECFIN.
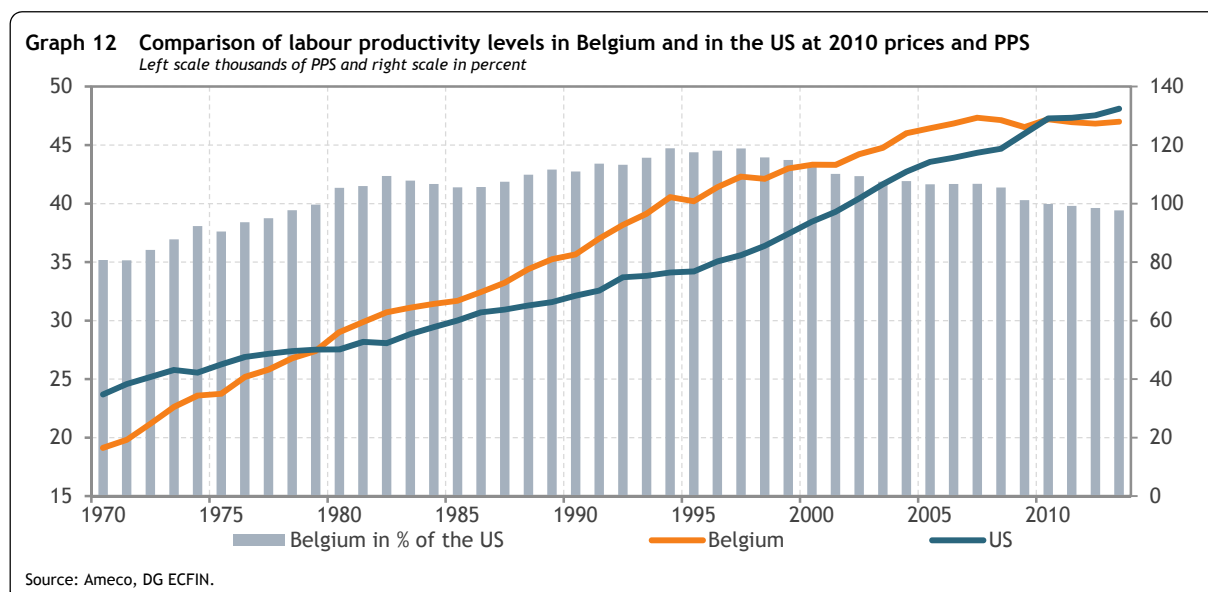
1.3. Conclusion

Over the last five decades, Belgium as most advanced economies has suffered from a declining trend of GDP per capita growth. The recent great depression has reinforced this slowdown. The decomposition of GDP per capita growth has also been profoundly altered between 1970 and 2013. In the seventies until the mid-nineties, the labour utilisation declined relatively rapidly as a consequence of the decrease in the working time per worker and of the employment rate. This decrease in employment rate was in turn due to the rapid increase in working age population until the mid-eighties. Since 1995, labour utilisation has progressively increased before stabilizing at the end of the period. Over the whole period, the growth of labour productivity was enough to compensate this evolution of labour utilisation allowing the increase in GDP per capita, however at a declining pace. The labour productivity growth trend is indeed decreasing. This decomposition of GDP per capita growth seems to indicate the presence of a trade-off between labour utilisation and labour productivity growth in Belgium even on the long run.

2. Recent evolutions of labour productivity growth

2.1. Total economy level

To better understand the reasons of the slowdown of the productivity growth in Belgium, this section provides a deeper analysis of the recent period 2000-2013.

Belgian evolutions are compared to those in the three neighbouring countries, Germany, France and the Netherlands, over two sub-periods, 2000-2007 and 2007-2013, which allows to analyse the impact of the crisis. In this section, labour productivity is defined as value added[3] per hour worked.

Over the whole period, labour productivity growth on an average annual basis was weaker in Belgium (0.7%) than in the Netherlands (0.9%), France (1.0%) and Germany (1.2%). The period 2007-2013 shows larger gaps compared to the period before the crisis. The average annual growth of labour productivity reached 1.3% in Belgium against 1.4% in France and in the Netherlands and 1.8% in Germany over the period 2000-2007. The average annual rate slowed to 0.0% in Belgium, 0.4% in the Netherlands, 0.5% in France and in Germany, over the period 2007-2013.

Graph 13   Labour productivity growth - Belgium, Netherlands, France and Germany
Real VA per hour worked, Total economy, 2000=100

Source: Eurostat.
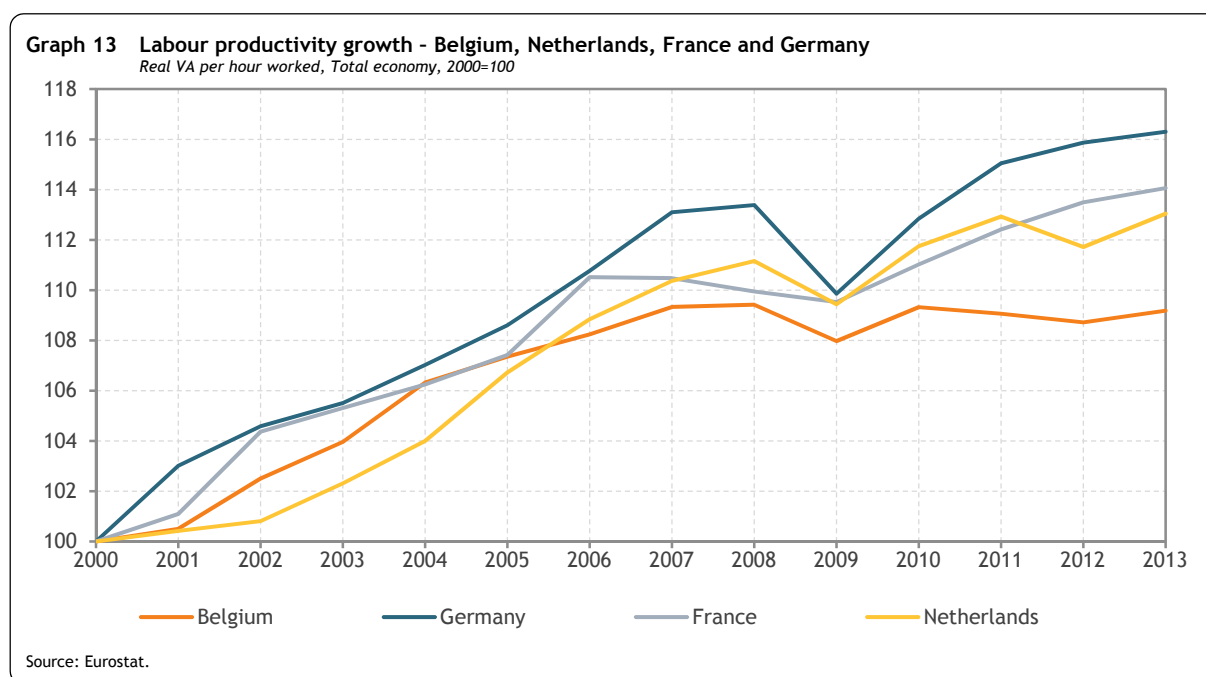
The weaker growth of labour productivity in Belgium compared to the three neighbouring countries has also impacted the relative levels of labour productivity. Since the beginning of the crisis, the gap between the three countries and Belgium has been strongly reduced.

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[3]   GDP is equal to gross value added plus net taxes on products. As net taxes on products are only available at whole economy level, gross value added is rather used to estimate productivity by industry.

Graph 14   Level of labour productivity - Belgium, Netherlands, France and Germany
Level of real VA at 2010 prices and PPS per hour worked, Total economy
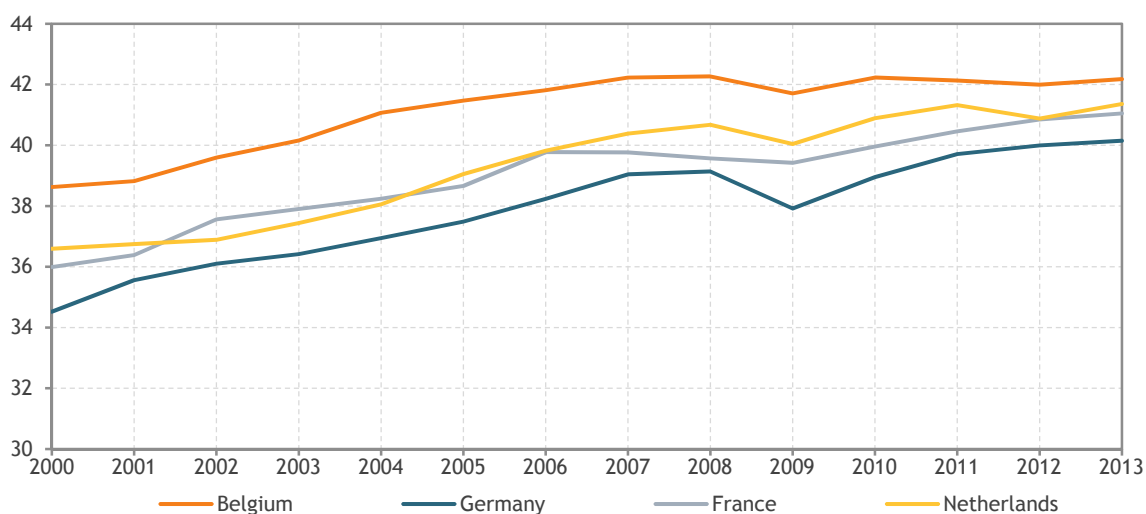
Source: Eurostat, FPB calculations.

2.1.1.   Decomposition of labour productivity growth

The growth accounting model allows to decompose the labour productivity growth into three components: capital deepening, labour composition effect and TFP.

The capital deepening (ratio K/L) covers the effect of an increase in labour productivity driven by increases in the quantity and/or quality of capital (K) for a constant amount of labour (L).

The labour composition effect measures the impact on labour productivity growth of changes in the characteristics (age, gender and skills) of workers over time.

TFP growth measures the evolution of the overall efficiency with which the production factors, i.e. labour and capital, are used together. TFP growth is generally considered as a measure of technological and organisational change, but due to its residual nature, it also includes measurements errors, the impact of changes in the returns to scale, the effects of the absence of perfect competition and the effect of the business cycle. Indeed, the growth accounting model is based on the implicit hypothesis of an utilisation of all production capacities. The variations in capacity utilisation are therefore included in TFP growth.

This section provides a comparison of the contributions to labour productivity growth[4] in Belgium and in the three neighbouring countries based on the database EUKLEMS. This database includes measures of economic growth, productivity, employment creation, capital formation and technological change at the industry level for most of European countries. The input measures correspond to the flow of services delivered by various categories of capital and labour. The data are available until 2009 for the three neighbouring countries and until 2013 for Belgium[5].

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[4]   These contributions are given in percentage point (pp).
[5]   Database for Belgium can be downloaded from www.plan.be and for the three neighbouring countries from www.euklems.net.

Belgian contributions are compared to the ones of the Netherlands, France and Germany over the period 2000-2009. Data for Belgium are also given for the period 2000-2013 to take into account more recent data (Table 2). The whole period hides totally different contributions between the two sub-periods, 2000-2007 and 2007-2013, that are then analysed.

The relative weakness of the productivity growth in Belgium is mainly explained by the relative weakness of TFP growth. Over 2000-2009, annual TFP growth in Belgium reached -0.19%, which is below TFP growth in the three other countries. Over the longer period 2000-2013, the negative contribution of TFP in Belgium was still visible but was less pronounced and reached -0.12 pp.

The contributions of ICT capital deepening and labour composition are also weaker in Belgium than in two other countries.

Belgium is however characterised by a high contribution of non-ICT capital deepening (0.65 pp in Belgium, 0.55 pp in Germany, 0.52 pp in France and 0.25 pp in the Netherlands over 2000-2009). A small part of this contribution is however explained by the capitalisation of R&D in the Belgium data based on ESA2010[6]. In Belgium, Germany and France, the non-ICT capital deepening contribution was higher than the ICT capital deepening contribution.

Table 2   Contributions to labour productivity growth in Belgium and in the neighbours, 2000-2009 (2013)
Total economy, percentage point contribution to average annual growth rate

	Belgium		Germany	France	NLDS
	2000-2013	2000-2009	2000-2009	2000-2009	2000-2009
Total	0.63	0.81	1.15	0.90	1.06
Labour composition	0.12	0.15	0.15	0.34	0.29
ICT capital deepening	0.17	0.20	0.30	0.18	0.27
Non-ICT capital deepening	0.47	0.65	0.55	0.52	0.25
TFP	-0.12	-0.19	0.15	-0.14	0.24

Source: EUKLEMS.

a. Before the crisis

The Graph 15 provides the contributions to labour productivity growth over the period 2000-2007. As over the longer period, the relative weakness of the productivity growth in Belgium is also mainly explained by the relative weakness of TFP growth. Annual average TFP growth in Belgium reached 0.26%, which is below TFP growth in the three other countries (0.97% in Germany, 0.39% in France and 0.74% in the Netherlands).

The contribution of capital deepening in Belgium reached 0.81 pp, slightly below the one in Germany (0.84 pp) and above the ones in France (0.64 pp) and in the Netherlands (0.53 pp). Compared with the other countries, Belgium is characterised by a high contribution of non-ICT capital deepening (0.60 pp

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[6]   Belgium data are estimated in the ESA2010, contrary to the data of the neighbouring countries based on the ESA95. This implies that the contribution of non-ICT capital in Belgium includes the evolution of R&D stock and consequently is overestimated with respect to the contribution of non-ICT capital in the neighbouring countries. However, previous Belgian data (in ESA95) have already shown a higher contribution of non-ICT capital than in France and in the Netherlands.

in Belgium, 0.53 pp in Germany, 0.45 pp in France and 0.23 pp in the Netherlands). As already mentioned[7], the capitalisation of R&D in the Belgium data explains a small part of this contribution. In Belgium, Germany and France, the non-ICT capital deepening contribution was higher than the ICT capital deepening contribution. The contribution of ICT capital deepening in Belgium (0.22 pp) was lower than in Germany and in the Netherlands (0.31 pp in both countries).

Graph 15   Contributions to labour productivity growth in Belgium and in the neighbours, 2000-2007
Total economy, percentage point contribution to average annual growth rate

Source: EUKLEMS.
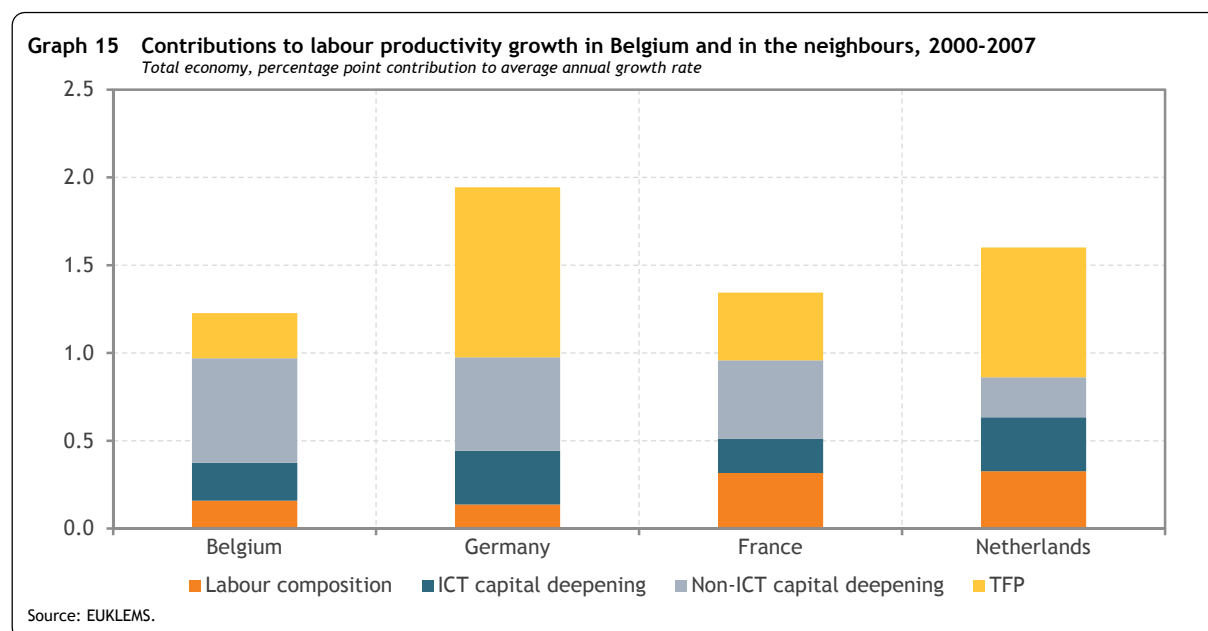
Compared with the other countries, a higher contribution of capital deepening (K/L) to labour productivity growth can come from a higher growth of the services delivered by the capital (K), or from a lower growth of the hours worked (L). Behind the high contribution of capital deepening in Belgium and in Germany are hidden different evolutions. Germany recorded a decrease in the hours worked (-0.31%) over the period 2000-2007. Belgium recorded an increase in the hours worked (0.75%) over the same period. The growth of the services delivered by capital is therefore largely higher in Belgium than in Germany.

Finally, the contribution of the labour composition reached 0.16 pp in Belgium, which is equivalent to the contribution of Germany but lower than in France and in the Netherlands. This contribution captures the reorientation of hours worked towards more productive workers.

b. The impacts of the crisis

Given the influence of business cycle on TFP evolution, the main impact of the crisis has been on TFP growth (Graph 16). The contribution to labour productivity growth of TFP has been strongly negative in the four countries, but it was in Germany that TFP was the most negative (-2.72 pp), followed by France (-1.98 pp) and by Belgium (-1.75 pp).

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[7]   See footnote 6.

Graph 16   Contributions to labour productivity growth in Belgium and in the neighbours, 2007-2009
Total economy, percentage point contribution to average annual growth rate

Source: EUKLEMS.
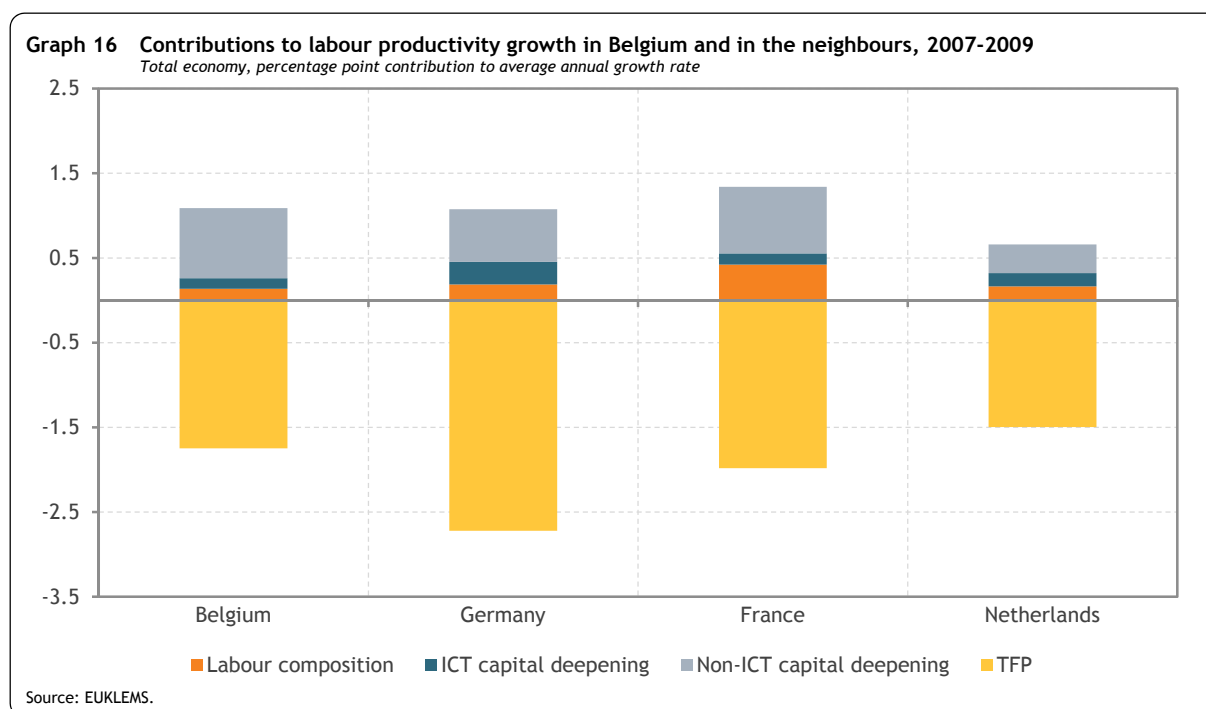
Compared with the previous period, the contribution of the non-ICT capital deepening increased in all countries while the contribution of ICT capital deepening slowed down in all of them. The decrease in hours worked in Germany and in France explains the evolution of the contribution of non-ICT capital deepening in these countries.

Over the period 2007-2009, Belgium recorded the highest contribution of capital deepening (0.95 pp, against 0.89 pp in Germany, 0.92 pp in France and 0.50 pp in the Netherlands).

The contribution of the labour composition was stable in Belgium (0.14 pp), close to the contributions in Germany and in the Netherlands and below the contribution in France.

By limiting the analysis to Belgium, the Graph 17 compares the contributions over the period 2007-2009 with the ones over the longer period 2007-2013.

Over 2007-2013, the negative contribution of TFP was less pronounced and reached -0.57 pp. The contribution of capital deepening decreased from 0.95 pp over 2007-2009 to 0.43 pp over 2007-2013. This evolution is explained by a further slowdown in the services delivered by capital while a renewal of the growth of hours worked was observed over the period 2009-2013. The contraction of the contribution of capital deepening was mainly observed in the non-ICT capital.

The contribution of the labour composition also decreased from 0.14 pp over 2007-2009 to 0.08 pp over 2007-2013.

Graph 17   Contributions to labour productivity growth in Belgium, 2007-2013
Total economy, percentage point contribution to average annual growth rate

Legend: ■ Labour composition   ■ ICT capital deepening   ■ Non-ICT capital deepening   ■ TFP
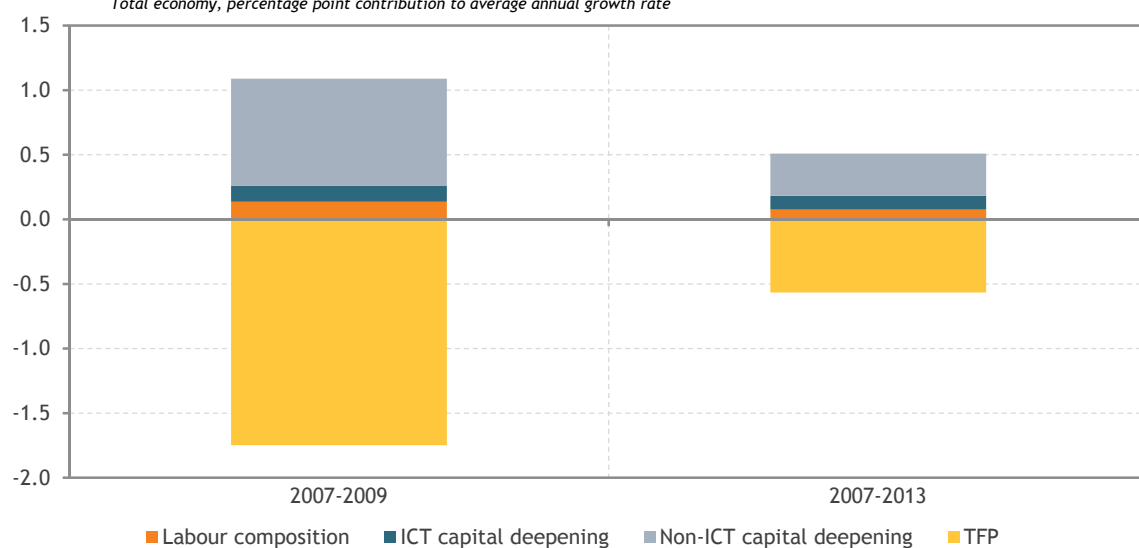
Source: EUKLEMS.

2.2. Industry level analysis

2.2.1. Structural changes in activities

In order to assess the broad structural changes which have occurred at the industry level in Belgium and in its three neighbouring countries, the analysis focuses on the evolution of the share in the volume of labour of the main categories of activities in these four countries[8].

Common patterns emerge from this analysis but divergences also. In all countries, the relative importance of manufacturing in terms of hours worked decreased over 2000-2013 and the relative importance of non-market services increased. Market service represented an increasing share of the volume of labour in Belgium, Germany and France but in the Netherlands, their relative importance slightly decreased.

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[8]   The NACE Rev2 codes of activities are given into brackets in the rest of the text. NACE Rev2 classification is available in Annex 1.

Table 3 Comparison of the relative importance of the main categories of activities, Belgium, Germany, France and the Netherlands
percent of hours worked in total hours worked

	Belgium	Germany	France	NLDS
2000				
Manufacturing	16.20	20.11	14.00	12.88
Market services	39.67	34.82	33.67	39.83
Non-market services	32.48	30.75	36.60	33.26
Others	11.65	14.32	15.72	14.04
2013				
Manufacturing	11.46	18.43	10.38	10.07
Market services	40.21	35.40	36.28	39.25
Non-market services	37.79	34.18	38.20	38.75
Others	10.55	12.00	15.13	11.94

Remark: Manufacturing corresponds to C in NACERev2, Market services include G to M without L, Non-market services include N to S and Others include A, B, L, D, E, F and T.
Source: Eurostat, National Accounts.

Over 2000-2013, in the manufacturing[9], textiles industry (CB) is the one which lost proportionally the most in terms of relative importance in volume of labour in the four countries. In Belgium, it was also the case for manufacture of computers and electronics (CI) and of motor vehicles (CL). In Germany, pharmaceutical industry (CF) and manufacture of machinery and equipment (CK) succeeded to increase their relative importance as it was also the case for pharmaceutical industry in Belgium while no manufacturing industry reached this achievement in France and in the Netherlands.

In 2013, in percent of total hours worked, the Belgian manufacturing was specialised in food industry (CA) (2.1%), metal industry (CH) (1.9%) and in rubber and plastic industry (CG) (1.1%) while German specialisation was in metal industry (CH) (2.9%), machinery and equipment (CK) (2.8%) and motor vehicles (CL) (2.3%) and the French and Dutch one in food industry (CA) (respectively 2.4% and 1.6%), other manufacturing (CM) (1.6% and 2.3%) and metal industry (CH) (1.5% in both countries).

Over 2000-2013, in market services, the same three industries increased their relative importance in total hours worked in Belgium, Germany and France: legal and accounting services (MA), computer programming (JC) and scientific research and development (MB). In the Netherlands, advertising and market research (MC) replaced scientific research and development (MB) in this top three. The largest proportional decline was also recorded by the same industries in Belgium and Germany: financial activities (KK), transport (HH) and telecommunications (JB). In the Netherlands, transport (HH) was replaced by publishing and broadcasting activities (JA) while in France, only one market service decreased in terms of share in total hours worked: telecommunications (JB).

In 2013, the market service representing the largest share of total hours worked was in the four countries trade industry (GG) (15.6% in the Netherlands, 13.8% in Germany, 13.7% in France and 13.0% in Belgium) followed in Belgium by legal and accounting activities (MA) (12.4% against 6.1% in the Netherlands and 4.9% in Germany) and by transport industry (HH) (5.3% in Belgium and in France against 5.1% in Germany and in the Netherlands). The third largest market service in France is accommodation and food industry (II) (4.6%) linked to the touristic interest of this country.

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[9] Hours worked by industry are given in Annex 2.

Over 2000-2013, in non-market services, the share of total hours worked increased in all services in Belgium while the three neighbouring countries recorded a decrease in the relative importance of public administration and defence (OO). The largest increase in relative importance of non-market services occurred in Belgium in residential care and social work (QB), in administrative support activities (NN) and in human health activities (QA). In France and in the Netherlands, administrative support activities (NN) were replaced by arts, entertainment and recreation (RR) in the top three while in Germany arts, entertainment and recreation (RR) replaced human health activities (QA).

In 2013, based on the share in total hours worked, the Belgian specialisation in non-market activities was in public administration and defence (OO) (9.7% against 8.6% in France, 6.2% in Germany and 6.0% in the Netherlands), in administrative support activities (NN) (7.3% against 9.8% in the Netherlands, 7.1% in France and 6.3% in Germany) and in education (PP) (6.4% against 5.4% in the Netherlands, 5.2% in Germany and 4.8% in France). Germany is more specialised in human health activities (QA) (6.8%) and France and the Netherlands in residential care activities and social work (QB) (respectively 6.7% and 7.3%).

2.2.2. Shift share analysis

Aggregate productivity is equal to a weighted average of industry productivity with the weights being determined by each industry's share in overall volume of labour[10]. Consequently, the change in total economy productivity growth rate over time is determined not only by the productivity growth rate of the individual industry but also by changes in the sectorial composition of hours worked. Shift-share analysis is the most commonly used algebraic method for decomposing total economy labour productivity growth rate into intra-industry productivity growth effect, structural change effect and interaction effect. The intra-industry effect (or within effect) equals the sum of productivity growth in the individual industries in the absence of structural change. If this effect is larger than aggregate productivity growth then the expectation would be that industries with higher productivity growth have decreased their share in total employment. The structural effect (or between effect) is equal to the contribution to overall productivity growth of a shift of employment resources from low to high productivity industries or conversely. This effect is indicative of the restructuring process occurring in an economy. The interaction effect (or dynamic effect) captures the dynamic component of structural change. It takes into account the variation of productivity with the variation of hours worked. The interaction effect is positive when the first two effects are complementary (productivity growth is positive (negative) in expanding (contracting) industries in terms of hours worked) and is negative when the first two effects are substitutes (productivity growth is positive (negative) in contracting (expanding) industries in terms of hours worked). In Europe, the sign of the interaction effect is usually negative because in the majority of industries, the productivity change and the labour input change have opposite signs. Formally this decomposition could be written as:

$$\frac{\Delta LPH}{LPH_{t-1}} = \sum_i \frac{\Delta LPH_i}{LPH_{i,t-1}} \frac{Y_{i,t-1}}{Y_{t-1}} + \sum_i \frac{LPH_{i,t-1}}{LPH_{t-1}} \left(\frac{L_{i,t}}{L_t} - \frac{L_{i,t-1}}{L_{t-1}} \right) + \sum_i \frac{1}{LPH_{t-1}} (\Delta LPH_i) \Delta \left(\frac{L_i}{L} \right) \tag{1}$$

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[10]   The value added of all industries are aggregated using a Törnqvist index. For calculating the contribution of each industry to aggregate labour productivity growth, the share of the industry in total nominal value added is used as weights.

In this equation, LPH is the labour productivity defined as value added in volume divided by hours worked, Y is the nominal value added, L is the number of hours worked, t is the time index and i is the industry index.

Even before the crisis, Belgium was characterized by a lower average annual growth rate of labour productivity than its neighbours. With the crisis, labour productivity growth declined in the four countries but became negative only in Belgium.

Over 2000-2013, in Belgium, the growth rate of labour productivity at industry level led to a within effect larger than the observed growth rate of labour productivity at aggregate level as in Germany and in the Netherlands. Therefore, the between effect was negative in Belgium as in Germany and in the Netherlands, the increase in hours worked occurring in industries with relatively lower level of productivity. This is coherent with the increase in hours worked in non-market services, usually with lower level of productivity and the decrease in hours worked in manufacturing with higher level of productivity. The Netherlands recorded the largest negative structural effect. At the opposite, France seems to have succeeded to increase hours worked in industries with higher level of productivity or to decrease the hours worked in industries with lower level of productivity. In the four countries, the interaction term is very low but negative, the within and between effect being rather substitutes than complementary.

Table 4   Shift share analysis, Belgium, Germany France and the Netherlands
Average annual growth rate in percent

	Belgium	Germany	France	NLDS
2000-2013				
Labour productivity	0.68	1.23	1.06	0.99
Within effect	0.74	1.31	1.03	1.22
Between effect	-0.06	-0.07	0.03	-0.23
Dynamic effect	-0.00	-0.01	-0.00	-0.00
2000-2007				
Labour productivity	1.28	1.77	1.43	1.59
Within effect	1.41	1.77	1.24	1.86
Between effect	-0.09	0.03	0.23	-0.21
Dynamic effect	-0.04	-0.03	-0.04	-0.06
2007-2013				
Labour productivity	-0.02	0.49	0.54	0.40
Within effect	-0.07	0.73	0.85	0.57
Between effect	0.07	-0.26	-0.26	-0.15
Dynamic effect	-0.02	0.01	-0.05	-0.02

Remark: within effect is estimated with weights based on share in nominal value added and sum with the discrepancy due to aggregation of value added in volume with Laspeyres index. Data for France and Germany are limited to 2000-2012 and for the Netherlands to 2001-2013.
Source: FPB based on Eurostat, National Accounts.

Since the crisis, the within effect has been reduced in the four countries but became negative only in Belgium. However, resources have been reallocated towards industries with relatively higher level of productivity in Belgium as shown by the between effect becoming positive. This was not the case in the three neighbouring countries where the between effect was clearly negative.

2.2.3. Industry contribution to aggregate labour productivity growth

Aggregate labour productivity growth can be considered as a weighted sum of industrial productivity growth rates. The contribution of an industry depends not only on its productivity but also the evolution of the industry's weights in total economy. Indeed, the contribution of each industry to aggregate labour productivity growth is computed as the ratio of the growth rate of real value added weighted by the industry's share in total nominal value added and the growth rate of hours worked weighted by the industry's share of hours worked.

During the period before the crisis, market services made the largest contribution to aggregate labour productivity growth in Belgium (0.81 pp) and in the Netherlands (0.94 pp). In Germany, the largest contribution came from the manufacturing industry (0.80 pp). In France, the contributions of these two sectors were equivalent (0.5 pp). The contribution of the manufacturing industry in Belgium (0.62 pp) was however higher than those in France and in the Netherlands.

It appears from Table 5 that the relative weakness of the productivity growth in Belgium is mainly explained by the negative contribution of the non-market services (-0.35 pp over 2000-2007). The contribution of non-market services is also negative in Germany and in the Netherlands, but to a lesser extent. The contribution of other industries is also slightly lower in Belgium than in the three neighbouring countries.

After the crisis, the contribution of the market services in Belgium has become negative (-0.20 pp), while it was positive in France and almost nil in Germany and in the Netherlands. The contribution of non-market services in Belgium remained negative (-0.24 pp), while it was positive in the three other countries.

The contribution of manufacturing industry declined in each country. The contribution of manufacturing industry in Belgium is equivalent to those in Germany and in the Netherlands and slightly below the one in France.

After the crisis, other industries made the largest contribution to aggregate labour productivity in Belgium (0.27 pp), in Germany (0.27 pp) and in the Netherlands (0.16 pp).

Table 5   Industry contribution to aggregate labour productivity growth - Belgium, Germany France and the Netherlands
Total economy, percentage point contribution to average annual growth rate

	Belgium	Germany	France	NLDS
2000-2013				
Total	0.68	1.17	1.06	0.99
Manufacturing	0.40	0.49	0.39	0.33
Market services	0.34	0.32	0.40	0.50
Non-market services	-0.30	0.00	0.11	-0.03
Others	0.24	0.37	0.16	0.20
2000-2007				
Total	1.28	1.77	1.43	1.59
Manufacturing	0.62	0.80	0.52	0.56
Market services	0.81	0.62	0.53	0.94
Non-market services	-0.35	-0.10	0.10	-0.15
Others	0.21	0.45	0.28	0.25
2007-2013				
Total	-0.02	0.47	0.54	0.40
Manufacturing	0.15	0.13	0.22	0.11
Market services	-0.20	-0.02	0.21	0.05
Non-market services	-0.24	0.11	0.13	0.08
Others	0.27	0.27	-0.01	0.16

Remarks: Manufacturing corresponds to C in NACERev2, Market services include G to M without L, Non-market services include N to S and Others include A, B, L, D, E, F and T. Due to data availability, data for France are limited to 2000-2012 and for the Netherlands to 2001-2013.
Source: FPB based on Eurostat, National Accounts.

Table 6 shows that labour productivity growth varies greatly between the main sectors[11].

Before the crisis, the manufacturing recorded the highest productivity growth in the four countries. The growth in Belgium was equivalent to the one observed in Germany (3.7%), slightly below France and below the Netherlands.

In the manufacturing, Belgium recorded the highest growth rates amongst the four countries in the (medium-) low-tech sectors: food industry (CA), textile industry (CB), wood, paper and reproduction industry (CC), coke and refined petroleum products (CD), and in pharmaceutical industry (CF) (same rates in Belgium and in Germany). Belgium recorded the lowest growth (or the strongest decrease) amongst the four countries in chemical industry (CE), in computer and electronic industry (CI) which knew a strong growth in the three neighbouring countries, and in other manufacturing (CM).

Before the crisis, market services, which is in Belgium the most important sector in terms of hours worked, recorded an annual average labour productivity growth of 2.2%. This growth is stronger than that observed in Germany and in France. Belgium recoded the highest growth rate amongst the four countries in accommodation and food activities (II) and in scientific and technical activities (MC). As in the manufacturing, the growth rate is the lowest amongst the four countries in the ICT related services telecommunication (JB). The growth rate in computer programming services (JC) is also lower than that in Germany and in France.

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[11]   Labour productivity growth by industry is given in Annex 2.

In the non-market services, the labour productivity decreased in Belgium and to a lesser extent in Germany, before the crisis. The sector regrouping the remaining industries (Others) knew a growth of 1% in Belgium, which is below the growth observed in the other countries.

Table 6   Labour productivity growth in the main activities - Belgium, Germany France and the Netherlands
Real VA per hour worked, average annual growth rate in percent

	Belgium	Germany	France	NLDS
2000-2013				
Total	0.68	1.17	1.02	0.99
Manufacturing	2.65	2.19	2.96	2.76
Market services	0.95	0.99	1.17	1.24
Non-market services	-0.52	0.20	0.52	0.27
Others	1.33	2.35	0.75	1.41
2000-2007				
Total	1.28	1.77	1.43	1.59
Manufacturing	3.68	3.71	3.91	4.37
Market services	2.20	1.92	1.58	2.38
Non-market services	-0.66	-0.10	0.55	0.04
Others	1.02	3.09	1.10	1.48
2007-2013				
Total	-0.02	0.47	0.53	0.40
Manufacturing	1.46	0.45	1.86	1.18
Market services	-0.50	-0.09	0.61	0.11
Non-market services	-0.35	0.55	0.47	0.49
Others	1.70	1.50	0.25	1.34

Remarks: Manufacturing corresponds to C in NACERev2, Market services include G to M without L, Non-market services include N to S and Others include A, B, L, D, E, F and T. Due to data availability, data for France (market and non-market services and others) are limited to 2000-2012 and for the Netherlands to 2001-2013.
Source: FPB based on Eurostat, National Accounts.

After the crisis, the growth observed in the manufacturing fell in all countries. Over 2007-2013, the growth in Belgium was above the ones in Germany and in the Netherlands. In three (medium-) low-tech sectors, Belgium improved its productivity growth compared with the previous period and recorded the highest rate amongst the four countries: food industry (CA), metal industry (CH), other manufacturing (CM). On the other hand, chemical industry (CE) and the ICT sector, computer, electronic and optical industry (CI), achieved lower performance in terms of productivity in Belgium than in the three other countries.

During the 2007-2013 period, Belgium recorded a decrease of its productivity in market and non-market services, which was not the case in the three neighbouring countries. Only Germany also recorded a decrease in market services, but to a lesser extent. In three industries, Belgium improved its productivity growth compared with the previous period and recorded the highest rate amongst the four countries: publishing and broadcasting activities (JA), financial activities (KK) and scientific research and development (MB). On the other hand, the ICT related services, telecommunications (JB) and IT and other information services (JC), achieved the lowest performance in terms of productivity amongst the four countries.

2.2.4. Decomposition of labour productivity growth in manufacturing and market services

Table 7 provides, from the database EUKLEMS, the contribution to labour productivity growth in the manufacturing and in the market services over the period 2000-2009 for the three neighbouring countries and 2000-2013 for Belgium. In comparison with the Table 2 on total economy, the contributions change considerably.

The contribution of annual average TFP growth was much more important in the manufacturing than at the level of the total economy, except in Germany. This is also the case in the market services in Belgium and in the Netherlands. In Manufacturing, TFP growth in Belgium increases when the period is extended to 2013.

In manufacturing and in market services, Belgium recorded a higher TFP growth than in two other neighbouring countries. As in the whole economy, Belgium is characterised by a higher contribution of non-ICT capital deepening than in the other countries. A part of this contribution is however explained by the capitalisation of R&D included in the Belgian data based on the new ESA2010[12].

The contributions of labour composition and of ICT capital deepening were weaker in Belgium than in two or three neighbouring countries.

Table 7   **Contributions to labour productivity growth in Belgium and in the neighbours, 2000-2009 (2013)**
Manufacturing and market services, percentage point contribution to average annual growth rate

	Belgium		Germany	France	NLDS
	2000-2013	2000-2009	2000-2009	2000-2009	2000-2009
Manufacturing					
Total	2.52	2.51	1.02	2.13	2.01
Labour composition	0.29	0.32	0.33	0.75	0.37
ICT capital deepening	0.15	0.17	0.21	0.26	0.21
Non-ICT capital deepening	1.08	1.44	0.50	0.77	0.46
TFP	1.00	0.57	-0.02	0.34	0.97
Market services					
Total	0.92	1.36	1.09	0.68	1.62
Labour composition	0.08	0.16	0.14	0.40	0.32
ICT capital deepening	0.28	0.31	0.54	0.27	0.37
Non-ICT capital deepening	0.43	0.66	0.42	0.40	0.11
TFP	0.12	0.22	-0.02	-0.39	0.82

Source: EUKLEMS.

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[12]   See footnote 6.

a. Before the crisis

The Graph 18 provides the contributions to labour productivity growth in the manufacturing over the period 2000-2007.

Graph 18   Contributions to labour productivity growth in Belgium and in the neighbours, 2000-2007
Manufacturing, percentage point contribution to average annual growth rate

Source: EUKLEMS.

The contribution of annual average TFP growth is much more important in the manufacturing than in the total economy in the four countries. Germany still recorded the highest TFP growth (3.36%). TFP growth in Belgium reached 1.81%, which is slightly above France (1.67%) and below the two other countries.

In the manufacturing[13], Belgium recorded the highest TFP growth rates amongst the four countries in the (medium-) low-tech sectors: food industry (CA), textile industry (CB), wood, paper and printing and reproduction industry (CC), and coke and refined petroleum products (CD). In Belgium, the industries, computer and electronic industry (CI) and electrical equipment (CJ), recorded a negative TFP growth, while in France and in Germany, these industries recorded a strong TFP growth[14].

In the four countries, the non-ICT capital deepening contribution was higher than the ICT capital deepening contribution. The contribution of non-ICT capital deepening was very high in Belgium (1.23 pp) compared with the three neighbouring countries. The contribution of ICT capital deepening in Belgium (0.15 pp) was below these observed in the neighbouring countries.

Finally, the contribution of the labour composition reached 0.32 pp in Belgium, which was above the contribution in Germany but below the ones in France and in the Netherlands.

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[13]   TFP growth by industry is given in Annex 2.
[14]   In the EUKLEMS database (other countries than Belgium), these two sectors are presented together.

In the market services, Belgium recorded a higher average annual TFP growth (0.81%) than Germany (0.33%) and France (0.25%). As in the manufacturing, the contribution of non-ICT capital was particularly high in Belgium (0.73 pp) compared with the three other countries. However, the contribution of ICT capital deepening, was lower than these in Germany and in the Netherlands. The contribution of the labour composition was also below two countries.

Graph 19 Contributions to labour productivity growth in Belgium and in the neighbours, 2000-2007
Market services, percentage point contribution to average annual growth rate

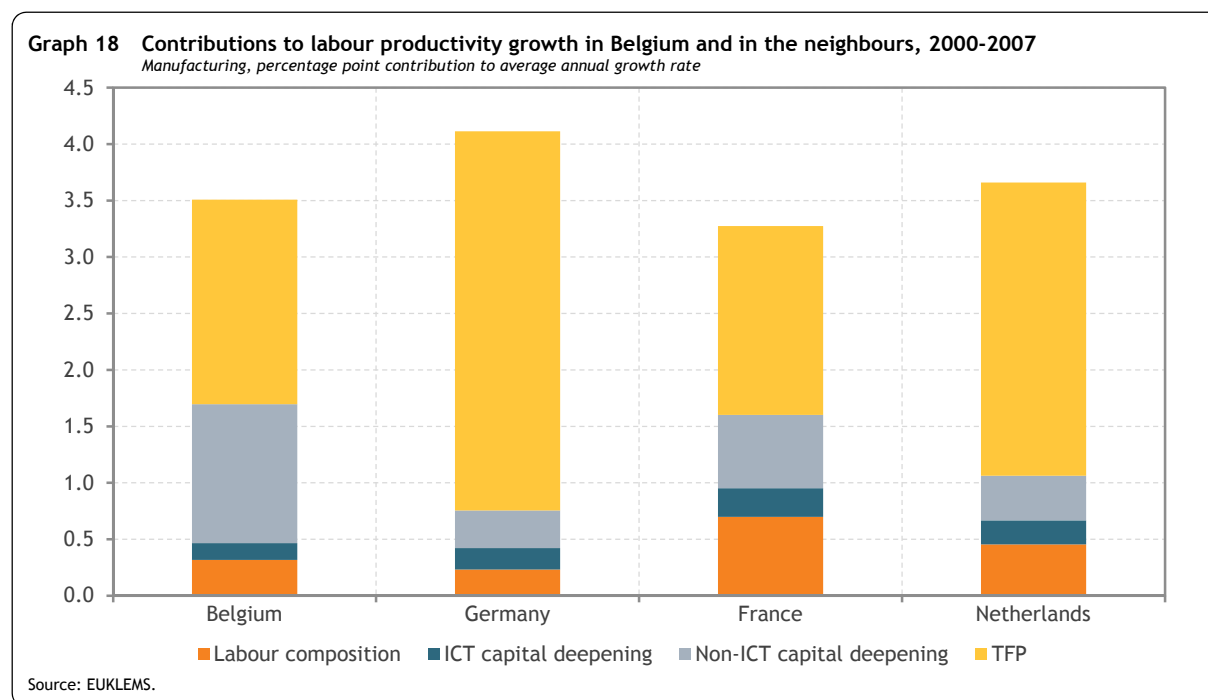Remark: Market services include G to M without L for Belgium. For the other countries, sector N is also included.
Source: EUKLEMS.
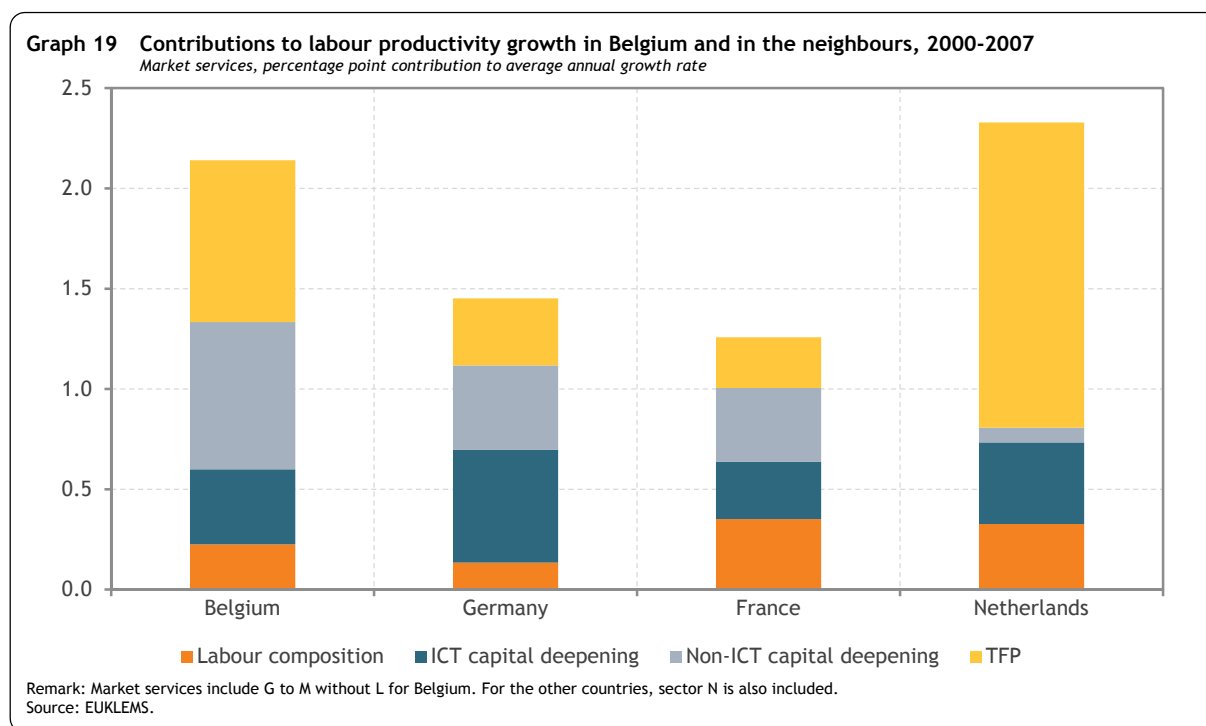
In the market services[15], Belgium recorded the highest TFP growth rates amongst the four countries in accommodation and food service (II). In Belgium, publishing, audio-visual and broadcasting activities (JA) and computer programming services (JC) recorded negative TFP growth which was below TFP growth in the three other countries. The TFP growth in telecommunications (JB) in Belgium was also below the strong TFP growth observed in France and in the Netherlands, but slightly above TFP growth in Germany.

b. The impacts of the crisis

As observed in total economy, the main impact of the crisis in the manufacturing concerned TFP growth. The contribution of TFP to labour productivity growth was strongly negative in the four countries over 2007-2009, but it was in Germany that TFP was the most negative (-11.83 pp), followed by the Netherlands (-4.73 pp), by France (-4.31 pp) and finally by Belgium (-3.79 pp).

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[15] In EUKLEMS database (other countries than Belgium), the sectors MA, MB, MC and NN are together in the single sector Professional, scientific, technical, administrative and support service activities (NACE MM-NN). Consequently, sector N is also included in the market services for the three neighbouring countries, while market services include G to M without L for Belgium. In Belgium, sector N includes the subsidised service voucher system and cannot be included in the market services.

Graph 20 Contributions to labour productivity growth in Belgium and in the neighbours, 2007-2009
Manufacturing, percentage point contribution to average annual growth rate
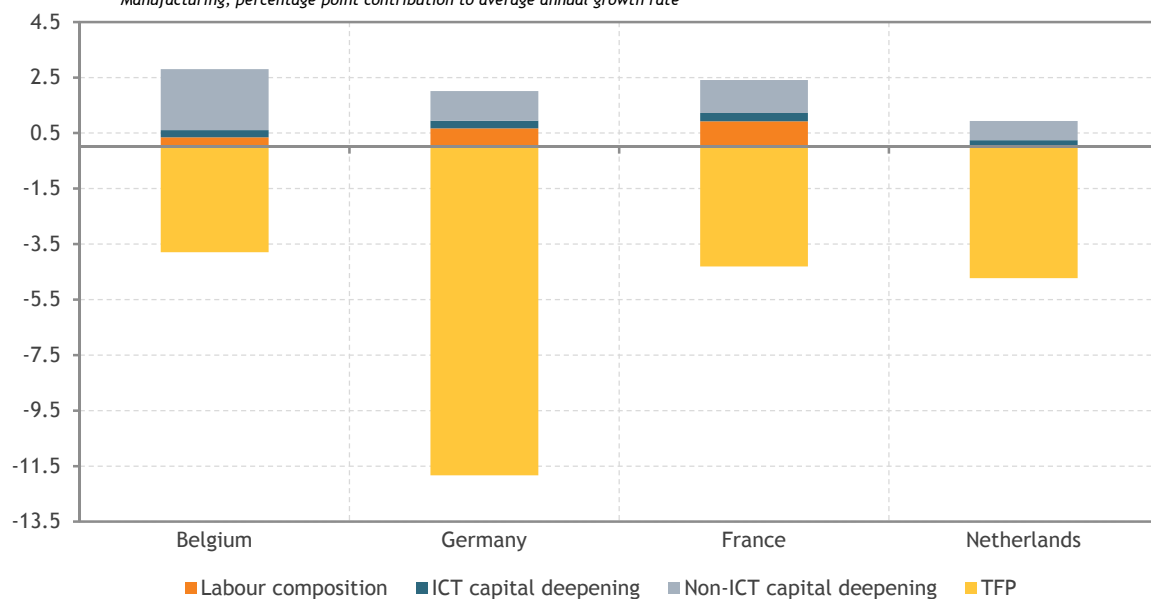
Source: EUKLEMS.

Compared with the previous period, the contribution of ICT and non-ICT capital deepening increased in the four countries, except in the Netherlands where the ICT capital deepening slightly decreased. The strong contraction of hours worked in the manufacturing explains in part this evolution. The contribution of non-ICT capital deepening in Belgium remained largely higher than those of the other countries.

The contribution of the labour composition was stable in Belgium (0.3 pp), below the contribution in Germany and in France.

By limiting the analysis to Belgium, the Graph 21 compares the contributions over the period 2007-2009 with the ones over the longer period 2007-2013.

Graph 21 Contributions to labour productivity growth in Belgium, 2007-2013
Manufacturing, percentage point contribution to average annual growth rate
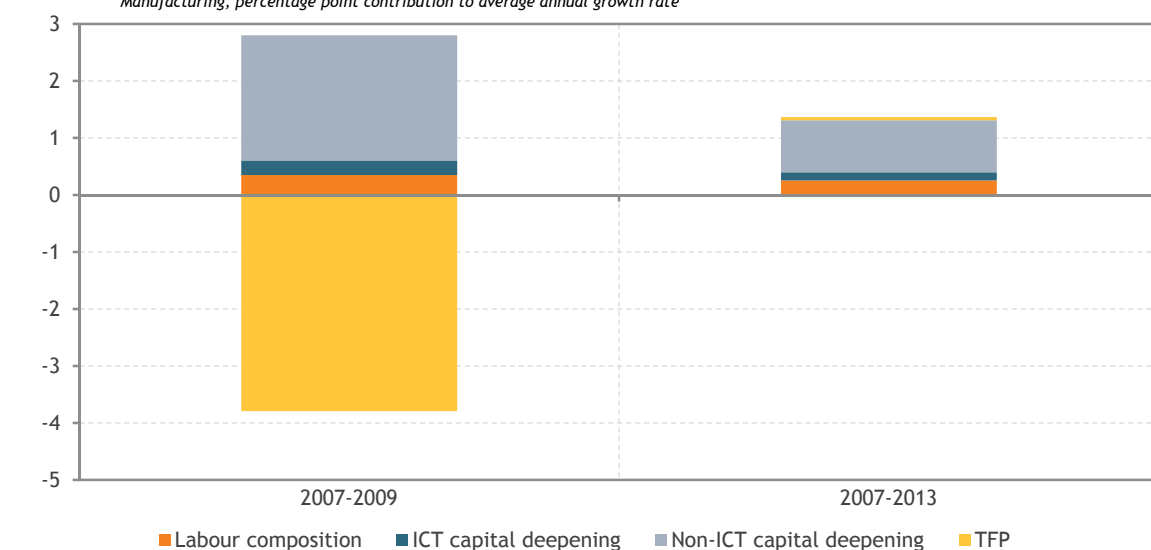
Source: EUKLEMS.

The contribution of TFP became slightly positive (0.06 pp). The contribution of capital deepening decreased from 2.45 pp over 2007-2009 to 1.06 pp over 2007-2013. This evolution is explained by a slowdown in the services delivered by capital, and by the less pronounced decline of hours worked over the period 2009-2013.

The contribution of the labour composition also decreased from 0.35 pp over 2007-2009 to 0.25 pp over 2007-2013.

As observed in total economy, the main impact of the crisis in services also concerned TFP growth. The contribution of TFP to labour productivity growth was negative in the four countries.

Compared with the previous period, the contribution of ICT capital deepening decreased in all countries. The contribution of non-ICT capital deepening also decreased in Belgium, while this contribution increased in France and in the Netherlands and remained stable in Germany. A slowdown of the growth of the services delivered by the ICT and non-ICT capital is observed in all countries.

The contribution of the labour composition became slightly negative in Belgium (-0.05 pp), while this contribution was positive in the other countries. This negative contribution captures the reorientation of hours worked towards less productive workers.

Graph 22 Contributions to labour productivity growth in Belgium and in the neighbours, 2007-2009
Market services, percentage point contribution to average annual growth rate

Remark: Market services include G to M without L for Belgium. For the other countries, sector N is also included.
Source: EUKLEMS.

By limiting the analysis to Belgium, the Graph 23 compares the contributions over the period 2007-2009 with the ones over the longer period 2007-2013.

The negative contribution of TFP was less pronounced over the period 2007-2013. The contribution of non-ICT capital deepening decreased from 0.39 pp over 2007-2009 to 0.08 pp over 2007-2013. This evolution is explained by a further slowdown in the services delivered by capital. The contribution of ICT capital deepening increased slightly.

The contribution of the labour composition effect remained negative.

Graph 23   Contributions to labour productivity growth in Belgium, 2007-2013
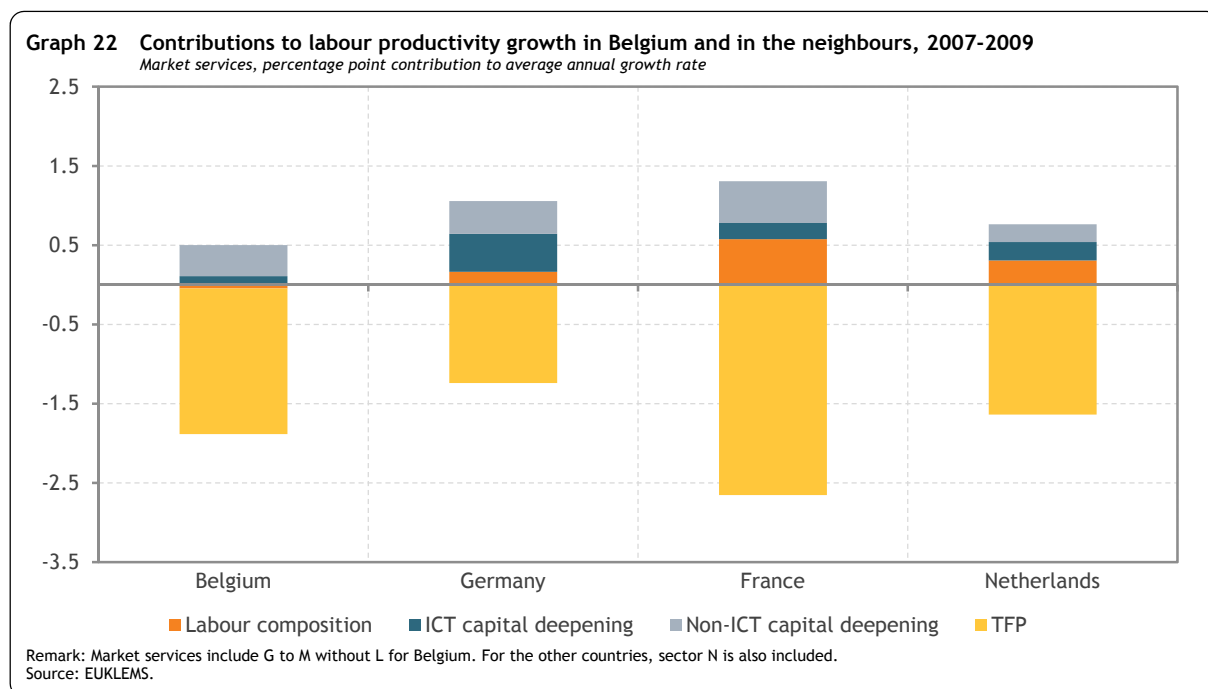*Market services, percentage point contribution to average annual growth rate*

Legend: ■ Labour composition   ■ ICT capital deepening   ■ Non-ICT capital deepening   ■ TFP

Remark: Market services include G to M without L for Belgium. For the other countries, sector N is also included.
Source: EUKLEMS.
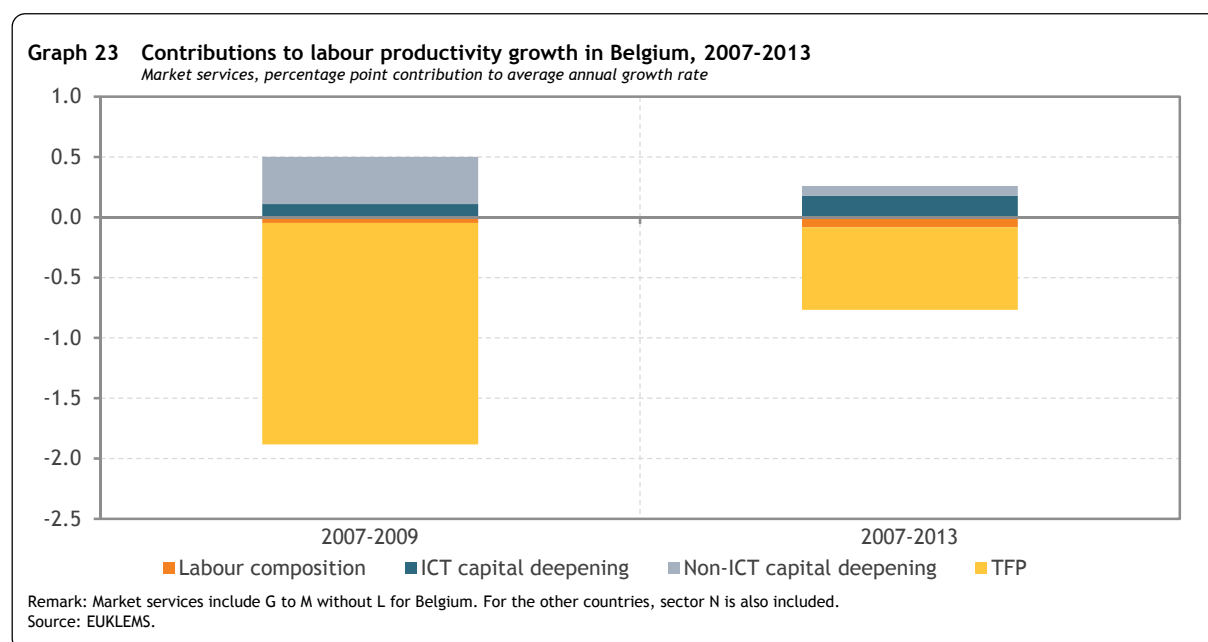
2.3. Conclusion

The analysis of the recent trend, 2000-2013, in labour productivity growth in Belgium in comparison with the three neighbouring countries points to the TFP growth as the main cause of decline. The contribution of ICT capital deepening in Belgium is also lower than in Germany and in the Netherlands. At industry level, structural changes appear to be common to the four countries, the decrease in the relative importance of the manufacturing in terms of hours worked and the increase in the relative importance of non-market services. Market services increase also their relative importance in Belgium, in Germany and in France but not in the Netherlands.

The shift share analysis shows that over 2000-2013, the labour productivity growth at industry level led to a within effect larger than the observed growth rate at aggregate level and a negative between or structural effect as the increase (decrease) in hours worked occurred in industries with relatively lower (higher) level of productivity. These evolutions are also visible in Germany and in the Netherlands and are consistent with the increase in the relative importance of non-market services and the decrease of the manufacturing.

The industry contribution to labour productivity growth shows that the relative weakness of the productivity growth in Belgium is mainly explained by the negative contribution of non-market services over 2000-2013. This negative contribution is in turn explained by a decrease of productivity of this sector over the whole period. The contribution of market services is also slightly lower in Belgium than in the neighbouring countries due to a more pronounced deterioration of productivity growth of these activities after the crisis.

The decomposition of labour productivity growth reveals, before the crisis, a TFP growth lower in Belgium than that in the Netherlands and in Germany in the manufacturing and lower than that in the

Netherlands in the market services. After the crisis, the contribution of TFP to labour productivity growth has become negative in the four countries. Over the whole period, the contribution of ICT capital deepening in Belgium is weaker than in the neighbouring countries.

3. Productivity trend

3.1. Reasons of decline

Is the declining trend of the Belgian labour productivity a fatality? In order to reply to this question, it is useful to identify a set of issues that are relevant for understanding productivity performance.

The slowdown of the productivity trend is partly linked to the structural changes identified in the previous section. The increasing importance of services, and in particular of non-market services, in the economy contributes to explain the decreasing trend of the average productivity growth as these activities have a slower growth rate and a lower level of productivity than the manufacturing of which relative importance decreases. In addition, inside the manufacturing, the activities that recorded the highest productivity growth rate, due to impressive contribution of TFP, over the last decades are ICT industries (Van Ark et al., 2003). In Belgium, the relative importance both in terms of value added and in terms of hours worked of ICT producers has decreased since 1970. Computer, electronic and optical manufacturing represented 1.2% of total value added and 1.6% of total hours worked in 1970 and only 0.5% of total value added and 0.3% of total hours worked in 2013. The increase in the relative importance of services in the economy will continue in the future in line with the ageing population (Braconier et al., 2014).

At industry level, the Belgian leadership has been eroded during the most recent decades. If several Belgian industries, especially in the manufacturing, were at the worldwide technological frontier during the eighties and the nineties, this is less and less the case (Biatour et al., 2011). Belgian industries appear to have difficulties to remain among the major innovative leaders especially in the group of fast growing industries which includes ICT producers, telecoms, machinery and life sciences. In the digital technologies industries, this could be explained by the winner-takes-all dynamics which allow technological leaders to increase productivity gap with laggards (Brynjolfsson and McAfee, 2011).

More generally, three channels of transmission of ICT on TFP growth are depicted by the literature: 1) the TFP growth in ICT-producing sectors themselves, 2) the growing share of these industries in the economy and 3) the productivity improvement in ICT-using industries such as high-tech manufacturing and some services. In Belgium, the two first channels are weak given the limited number of ICT-producing firms on the territory. The third channel is not automatically present as ICT investment require intangible investments and production process reorganisation to generate productivity gains (Brynjolfsson et al., 2002). The intangible investments are part of the knowledge-based capital (KBC) which includes Computerised information, Innovative property and Economic competencies (Corrado et al, 2014). As this KBC is often only partially excludable giving rise to knowledge spillovers, the productivity slowdown since 2000 could be partly explained by the decline of the pace of KBC accumulation for some authors (Fernald, 2014 and Goodridge et al., 2013).

One of the main assets of KBC is R&D investment. In Belgium, business R&D expenditures are concentrated in a limited number of industries and in a limited number of enterprises, generally large multinationals. This means that KBC is mainly accumulated by already near the frontier enterprises and that

the rest of the firms have not yet accumulated enough KBC to fully benefit from productivity enhancing ICT investments.

The slowdown in KBC accumulation may be also related to the decline in business start-ups given the key role of entrants in the formation of new ideas. Using micro-data, Andrews and Criscuolo (2015) show that an increase in the share of young firms (i.e. firms younger than 6 years) relative to the base category (i.e. firms 12 years and older) is associated with higher MFP growth and this effect is largely driven by the start-up category (i.e. firms younger than 3 years). There are not yet empirical results for Belgium on the role of start-ups in the productivity growth as Mutliprod project[16] is still at the beginning. However the DynEmp results suggest that not all small businesses are net job creators, showing that only young businesses – predominantly small – create a disproportionate number of jobs, confirming recent evidence for the United States. The findings point to a decline in start-up rates over the past decade across all countries considered, which gives cause for concern, given their strong contribution to job creation (Criscuolo et al., 2014).

The slowdown of productivity growth can also be linked to the slowdown of the rate of increase in the stock of high skilled workers. Over the past 50 years, the stock of highly educated workers has considerably risen due to the change of the composition of the labour force in favour of highly educated workers and the massive influx of women into the labour market. Several factors explain the increased demand for a more highly-qualified workforce: the globalisation and the intensification of the international trade, the development of global value chains, the modification of the industry structure of the economy, the introduction of new technologies, in particular ICT, in the production process and in the labour organisation, the development of ever more complex goods and production processes (European Commission, 2008 and Hertveldt et al., 2012). According to the forecasts of the European Centre for the Development of Vocational Training (Cedefop), between now and 2025, most job opportunities in the EU will require high-level qualifications (Cedefop, 2015). This evolution is associated with the development of an economy based on knowledge and innovation defined by the Europe 2020 Strategy. While average levels of educational attainment will continue to rise in the next decades, the rate of increase in the stock of human capital is expected to slow (Braconier et al., 2014).

Another factor that may explain the slowdown of productivity growth is the slowdown of the international fragmentation of the production process. The participation of countries to global value chains (GVCs) has been increasing steadily since the mid-1990s. The growth of GVCs has been notably enabled by technological advances, such as the development of ICT that decrease trade, transport and coordination costs and by trade liberalisation of goods and services. This process slowed down these last years due to the physical limit to the fragmentation of a product or a task (OECD, 2015c).

The participation to GVCs can stimulate productivity through various mechanisms, such as a greater competition that reduces the cost of intermediate inputs and that incites firms to follow new technological developments to maintain their productivity and cost advantages, the access to a wide range of foreign inputs that incorporates more productive technologies, the exposure to good practices in the

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[16] Multiprod and DynEmp are two OECD projects based on micro-data. More information available at http://www.oecd.org/sti/dynemp.htm.

other stages of the chain or to frontier technologies that may enhance the capacity absorption or the formation of organisational and managerial capital (Bloom et al., 2012) (knowledge spillovers), the specialisation of firms in specific activities and stages for which they are more productive.

Important differences exist in the participation of countries in GVCs. The degree of participation to GVCs depends on specific national features such as the size and the structure of the economy, the openness to trade, the geographic localisation…Governments can also play a significant role with diverse policies that promote the capacity of firms to enhance their competitiveness, attract investment, and insert themselves into GVCs.

In OECD (2015c), the participation to GVCs of OECD countries is measured on the basis of the database OECD-WTO Trade in Value-Added (TiVA). The participation corresponds to the sum of the share of imported inputs in exports of a country (upstream) and the share of the country's exports used as intermediate inputs in the exports of the other countries (downstream). Comparing 2005 (the last available data before the crisis) with 1995, the index shows increases in almost all OECD countries. In 2005, Belgium reached the 6th position, before the neighbouring countries (the Netherlands: 11th, Germany: 20th and France: 23rd position). Using cross-country industry-level for 15 OECD countries and 20 industries over the period 1984-2007, OECD (2015c) shows, from an empirical estimation based on Aghion and Howitt (1998), that GVC participation seems to have both a direct effect (participation in GVCs enhances productivity) and an interactive effect with frontier growth (higher GVC participation is associated with higher technology transfer from the productivity leader of the industry).

3.2. Productivity growth enhancing policies

Recent studies have shown that economic impact of structural reforms is not independent from the macroeconomic and institutional context in which the reforms occur (Caldera Sanchez et alii, 2015 and Vogel, 2014). Belgium belongs to a monetary union which suffers from a depressed economic situation with a policy mix limited by the zero lower bound and the Stability and Growth Pact. This leads to promote reforms which have no negative impact, even on the short run, on demand and/or which give back rooms of manoeuvre to the fiscal policy.

From the extensive literature on the quantitative assessment of reforms mainly alimented by the European Commission (European Semester), the OECD (Going for growth) or IMF (G20 growth initiative), three main families of reforms appear to be able to boost productivity growth while minimising the short term negative impact on the economic activity: market functioning improvement and product market reform, investment in knowledge capital and innovation and improvement of infrastructure. These reforms are analysed in the Belgian context.

a. Market functioning improvement and product market reform

Empirical works such as Dabla-Norris et alii (2015) suggest that higher regulated services sector is associated with lower TFP, this negative relationship being more severe the closer the industry is to the technological frontier. Moreover, given the importance of intermediary consumption of services by the

Belgian exporters, improvement of market functioning and increase in competition pressures have also positive impacts on the external competitiveness of the country.

The impact of enhancing competition regulatory reforms on productivity can materialise through different channels. Increase competition leads to a decrease in mark-ups and rents of incumbents, facilitating firms exit and new firms entrance, improving resources allocation inside the economy (Caldera et al., 2015). This reduction in prices gives a purchasing power gains for users and diffuses in the economy through intermediary consumption of enterprises (Roos, 2015 and Cette, 2015). This decrease in prices could also be coupled with the concretisation of latent demand (Caldera et al., 2015 and Roos, 2015). However, the reduction of rents is also associated with reduction of cash-flows of incumbents and income reduction for a few households benefiting from rent distribution (Roos, 2015) which can reduce somewhat the positive impact of the reform on the growth. The increase in competition could also accelerate the speed at which innovative effort and incorporation of new technologies occur (OECD, 2015c) and the production process is reorganised (Dhyne et al., 2014). However, the link between competition and innovation is non-linear and could even follow an inverted-U pattern (Aghion et al., 2005).

The models show usually progressive positive impact of reforms with maximum effect being reached between years 5 and 10 (Varga and 't Veld, 2014 and Cette, 2015).

In Belgium where indexation of wages covers a large part of the economy, the positive impact of a reform leading to lower consumer price index (CPI) growth could also be larger in the short term given the direct impact on labour costs evolution.

Improvement of market functioning and market reform mainly concern services in Belgium given the already high degree of international competition in the manufacturing. However, even manufacturing could benefit from a better business climate and lower barriers to entrepreneurship.

The OECD has developed a synthetic indicator of product market regulation (PMR) covering three main aspects of the business environment, namely state control, barriers to entrepreneurship and barriers to trade and investment[17]. In Belgium as in the three neighbouring countries, this indicator improved between 1998 and 2013. However the relative position of Belgium has not changed: before France but after Germany and the Netherlands, one of the least regulated European countries. In terms of indicator components, the relative position of Belgium improved concerning barriers to trade and investment (in 2013, Belgium was close to the Netherlands), remained constant in terms of state control but deteriorated in terms of barriers to entrepreneurship, with in 2013, the least favourable index among the countries of comparison. Administrative burdens on start-ups and, to a lesser extent, regulatory protection of the incumbents are the two aspects for which the relative Belgian position was the weakest in 2013.

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[17] This indicator is only an imperfect measure of the straightness of the regulation. It is mainly based on the presence of a selected set of legal constraints. As such it only takes into account the level of regulation but nor the coverage of these regulations nor the compliance to these regulations. For an illustration of the drawbacks of this kind of index in labour field, see Aleksynska, 2015.

Graph 24   Product Market Regulation (PMR) index, Belgium and the 3 neighbouring countries, 1998 and 2013
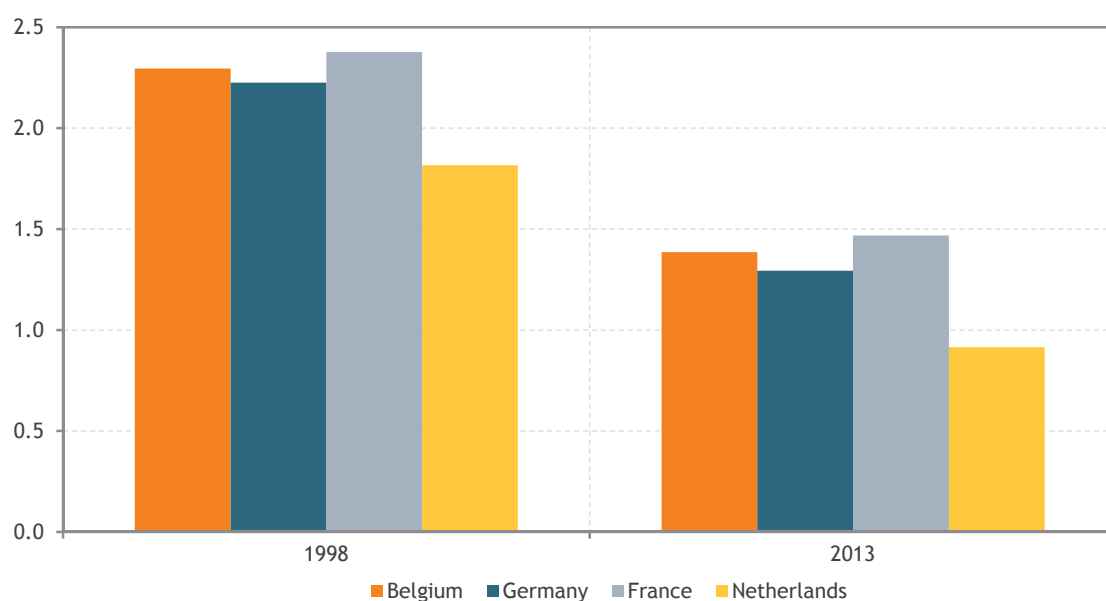
Source: OECD.

OECD has also developed indicators of regulation in non-manufacturing sectors (NMR). These indicators measure regulation at the sector level and cover seven network sectors (telecoms, electricity, gas, post, rail, air passenger transport, and road freight) and five services sectors (retail distribution, accounting services, legal services, engineering services, and architectural services). The seven indicators of regulation in network sectors are aggregated into one indicator of regulation in energy, transport and communications (ETCR). The four indicators of regulation in accounting, legal, engineering and architectural services are aggregated into one indicator of regulation in professional services.

Graph 25   Regulation in network sectors (ETCR) index, Belgium and the 3 neighbouring countries, 1998 and 2013
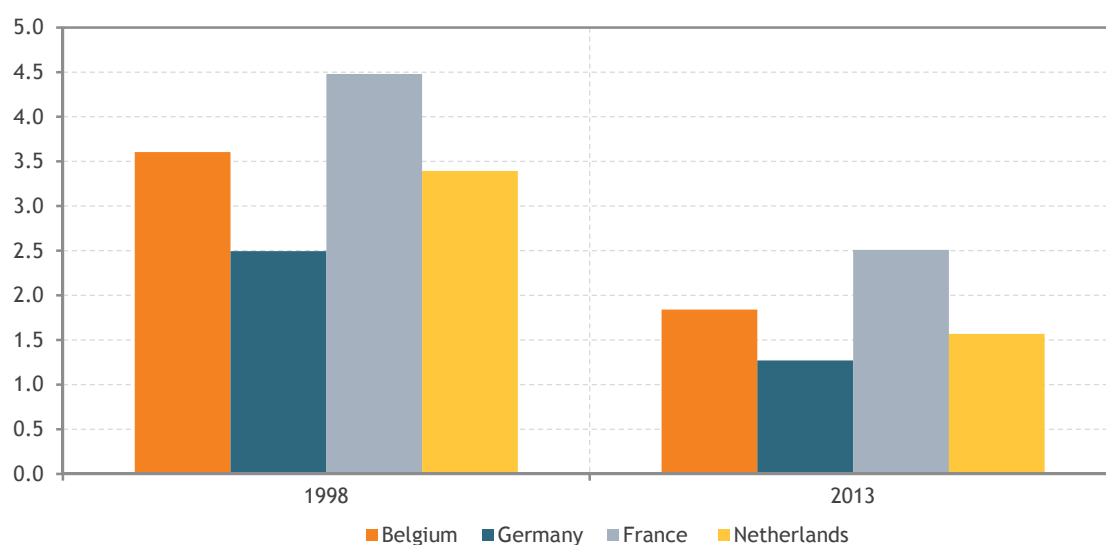
Source: OECD.

Over 1998-2013, the ETCR indicator improved in the four countries without change in their relative position: the least regulated country remains Germany and the most regulated country is France. In

2013, the relative position of Belgium is the least favourable in telecoms and in transport by rail in comparison with the three neighbouring countries.

When looking at regulation in retail trade and professional services (accounting, legal, architect and engineer), an improvement of the Belgian regulatory framework over 1998-2013 is also visible. However, in retail trade, the Belgian position remains the weakest of the comparison while the Belgian relative position is better in professional services. However, in this sector, only a very slight improvement of the indicator has been recorded since 1998 contrary to what has been observed in Germany.

Graph 26 Retail trade and professional services regulation indices, Belgium and the 3 neighbouring countries, 1998 and 2013

Source: OECD.
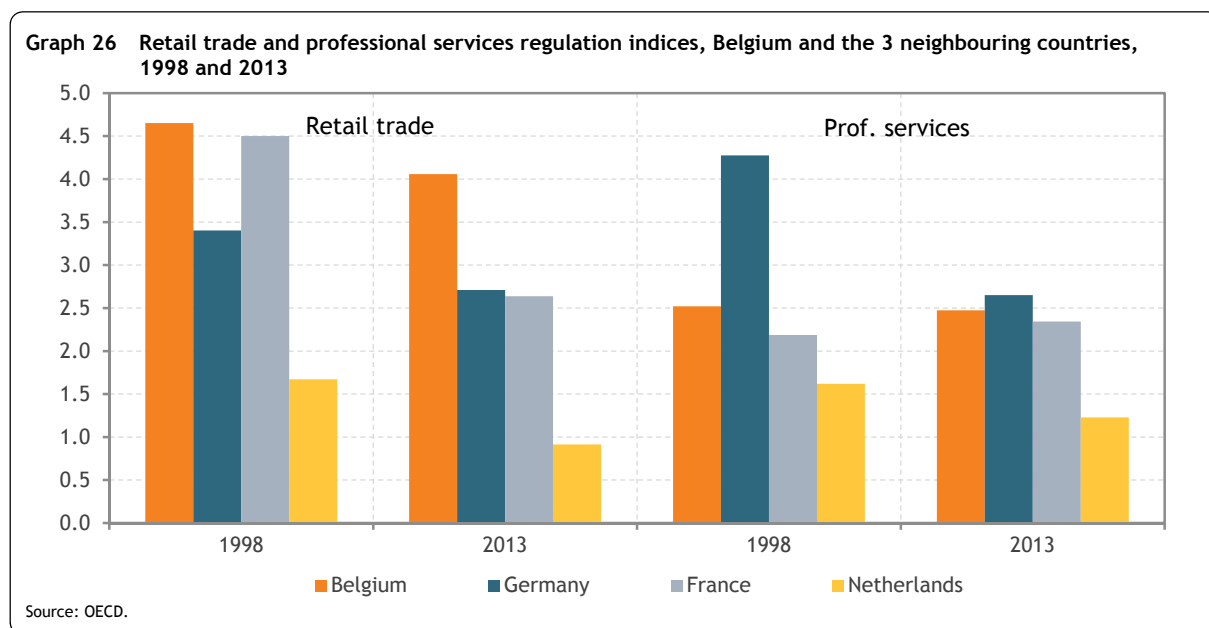
b. Accumulation of knowledge-based capital: intangible and human capital

In Schumpeterian inspired models such as Aghion and Howitt (1998), the economic growth is driven by innovation resulting from intangible investments like R&D, training…motivated by the expected monopoly rents of successful innovators.

These intangible investments, constitutive of what is called the knowledge-based capital (KBC), present two important characteristics. First, as previously mentioned and unlike physical capital, investments in many intangible assets generate knowledge that can benefit to agents who have not paid for it. Due to the existence of these positive knowledge spillovers, investments in innovative activities by private enterprises tend to be suboptimal and justify an important role for the state as co-investor in the knowledge economy (Aghion and Akcigit, 2015). Second, once created, some forms of KBC can be duplicated at no cost and can be used simultaneously by many users, creating increasing returns to scale in production. These scale economies can be reinforced by positive network externalities and justify a role of the state to ensure that competition is maintained (OECD, 2013b). Moreover, investments in KBC play an important role in the diffusion of ideas from the global frontier firms to domestic firms by facilitating the absorption of new technologies (OECD 2015c).

Three main categories of intangible assets are usually measured: Computerised information which include software and databases, Innovative property covering R&D, design, mineral exploration, financial innovation and artistic originals and Economic competencies including advertising, marketing research, own-account organisational capital and training (Corrado et al., 2012).

Between 1995 and 2010, the intangible investment intensity increased in Belgium and in the three neighbouring countries. In 2010, this intensity was the highest in Belgium reaching 8.5%. Economic competencies was the largest intangible category in the four countries, followed by innovative property for which Germany presented the highest intensity.

Graph 27   Intangible investment intensity, Belgium and the 3 neighbouring countries, 1995 and 2010
In percent of GDP

Source: INTAN-INVEST.NET and Eurostat.
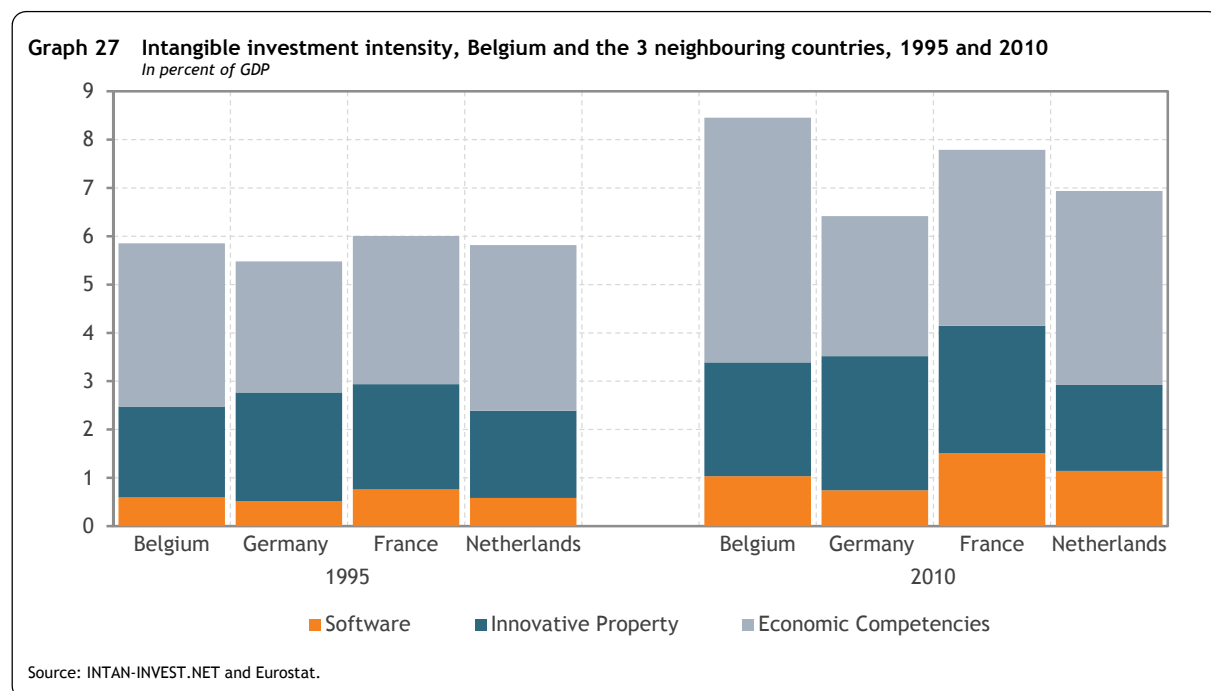
This global measure of KBC provides no information about the distribution of intangible investments across industries and firms and its efficient use to sustain TFP growth. Risks exist that TFP enhancing effects of these investments are concentrated into a limited number of high-tech industries and into some large enterprises[18]. Econometric results (Biatour et al. 2011) show that this is the case in Belgium for an important component of KBC, namely R&D stock. The impact of R&D accumulated inside the industry (intra-industry) or R&D accumulated by other domestic or foreign industries (inter-industry) on TFP is more pronounced for manufacturing than for other industries (services, construction and utilities). When a breakdown of manufacturing industries by R&D intensity is considered, for high-tech industries, there is robust evidence of a positive impact of domestic and foreign intra-industry and domestic inter-industry R&D stocks. For medium-tech industries, domestic and foreign inter-industry R&D stocks and foreign knowledge spillovers have a positive impact on TFP. However, domestic knowledge spillovers appear to be negative which might be an indication of the negative effect of domestic competitors' R&D activities. No significant positive impact of R&D stocks for low-tech industries is found. These results seem to indicate that Belgian industries which are already R&D intensive have

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[18]   Based on Belfirst database, in 2010, 50% of all Belgian enterprises of the private sector has no intangible assets in their balance sheet and 25% of all enterprises concentrated 98% of all intangible assets.

more incentives to accumulate KBC than other industries. This also means that public support to innovative activities could be excessively concentrated on a limited number of enterprises leading to a decrease in its effectiveness as the same enterprises cumulate different tax and direct public incentives (Dumont, 2015).

As underlined by OECD (2015c) experimental development and applied research have represented the largest share of research expenditure of businesses (BERD) across OECD countries. Recent evidence indicate that the share of basic research by American large companies has actually fallen over time (Arora et al, 2015). In Belgium, the share of basic research in BERD has also decreased over recent years, from 9.7% in 2005 to 7.0% in 2011. This evolution could be potentially damageable as basic research results in significantly larger knowledge spillovers than applied research.

The existence of a positive correlation between intangible investments and the efficiency of resources reallocation process (Andrews and Cingarro, 2012) implies that stricter regulations on product or labour market which raised reallocation costs could also eventually lower productivity growth.

Investments in KBC, such as brands, basic R&D, design and the complex integration of software with organisational structures and in innovation also allow to upgrade to higher-value segments of global value chains. Higher value added activities in GVCs are often observed in segments of the value chain intensive in high-skilled workers and KBC investments. (OECD, 2013a). In Belgium, given the high average level of the human capital and the cost of labour, the challenge concerning the GVCs will be the development of technological means and a recognised expertise to attract or retain the most technical and value-added-intensive stages of the production chain (Duprez and Dresse, 2013). Investments in KBC are a driver for innovation and allow to produce sophisticated and hard-to-imitate products and services that ensure the participation to GVC.

As underlined by OECD (2013b), human capital is the main engine of KBC production and with the increasing use of intangible assets in the economy, the supply of skill labour is a challenge for advanced economies. Belgium is characterized by a population with a high percentage of tertiary education graduates, slightly higher than the percentage observed in the neighbouring countries. However, this relative advantage is eroding as other countries have rapidly increased the access of young generation to the tertiary education.

Graph 28 **Young population (30-34 years) with tertiary education, Belgium and the 3 neighbouring countries, 2000 and 2013**
In percent of total population aged 30-34 years
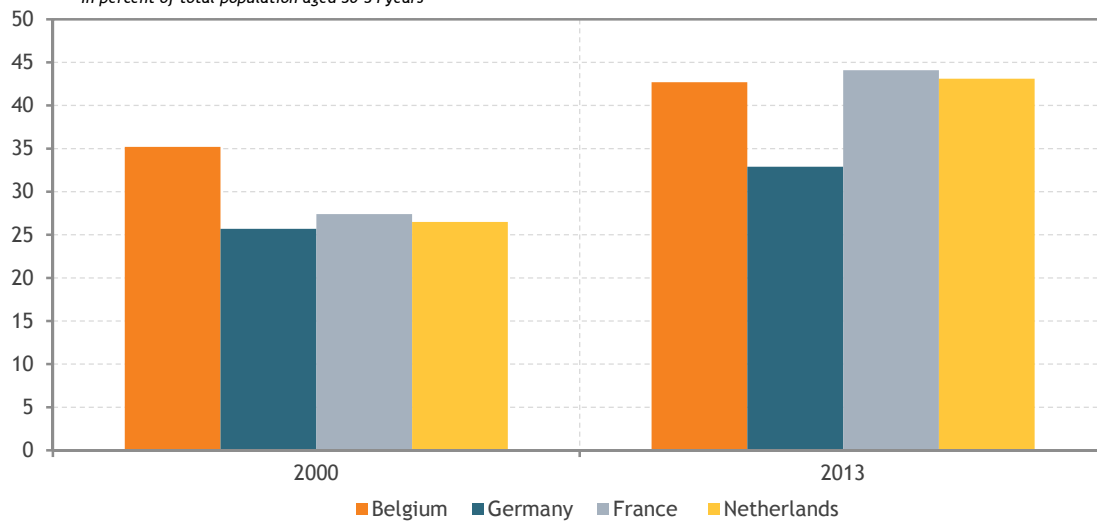
Source: Eurostat.

The orientation of the tertiary education also matters and science and technologies are of particular importance in the context of innovative and knowledge-based economies. In Belgium, the share of new science and engineering graduates is largely lower than the EU average, than those in France and in Germany. This result is particularly worrying because a declining trend is observed over the last 10 years. With the ageing of the population, new tertiary graduates will play a critical role to maintain the available stock of high skilled workers.

Graph 29 **Science and engineering new graduates, Belgium and the 3 neighbouring countries, 2000 and 2011**
In percent of total new tertiary education graduates
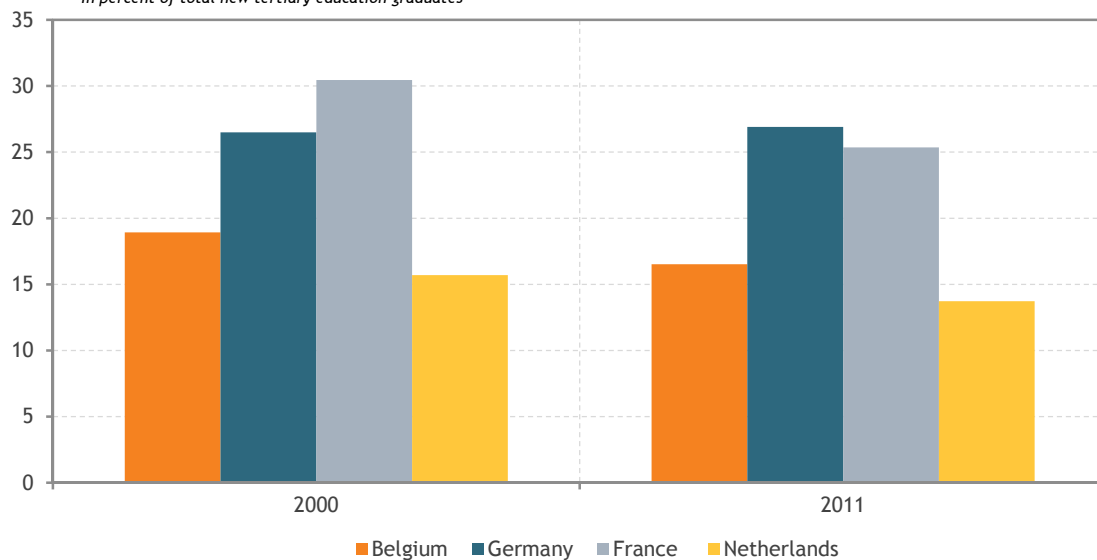
Source: Eurostat.

Given this rising demand for highly-educated workers, it is important for economies to efficiently allocate their existing stock of human capital. According to the OECD Survey of Adult Skills (PIAAC), about one-fourth of the workers in OECD countries report a mismatch between their existing skills and those

required for their job (OECD, 2015c). This mismatch can affect labour productivity growth via two channels: a lower (or stronger) productivity in the enterprise and a less efficient distribution of the workforce across enterprises. There is significant variation across countries and industries in the level of mismatch. In Belgium, OECD calculated a percentage of workers with skill mismatch slightly below 20%, a percentage close to the percentages in France and in the Netherlands, and lower than in Germany. This percentage placed Belgium at the third position out of 22 OECD countries covered by the analysis. According to the same study, the simulated productivity gains to allocative efficiency from lowering skill mismatch to the best practice would reach 3% in Belgium, against about 6% in Germany. OECD (2015c) suggests a range of policies to reduce skill mismatch: reducing the stringency of product market regulation, of employment protection legislation and of bankruptcy legislation that penalises excessively business failure, reducing barriers to mobility in housing markets, encouraging better managerial quality and increasing participation in lifelong learning.

To preserve the quality of tertiary education, it is also important to maintain the quality of secondary education. The Programme for International Student Assessment (PISA) (OECD, 2013c) shows that, among the 34 OECD countries (2012 results), Belgium performed, in 2012, above the OECD average in each of mathematics, reading and science (15-year-olds students). Belgian mean performance in mathematics has however declined since 2003. There has been no significant change in reading or science. There is significant variations in the results between the Belgian regions and between students due to their socio-economic environment. Variations explained by the socio-economic background of the students are higher in Belgium than in the OECD average. Immigrant students in Belgium obtained in 2012 results below non-immigrant students, after taking account of the socio-economic background of students. This difference is significantly higher than the OECD average but has significantly improved since 2003.

In a context of rapid technological change, lifelong learning allows developing and adapting the skills of human resources throughout life and is therefore also part of the response to skills shortages. In Belgium, the participation rate to the lifelong learning is largely below the ones in the neighbouring countries and on average in Europe. In addition, no improvement was observed the last 10 years. The reform of the law on private sector training efforts, the support of private-public partnership in education and a better monitoring of skills shortages could be promising paths of actions.

c. Improvement of infrastructure

The improvements of infrastructure can have a positive impact on productivity that goes beyond the effect of increases in the industry-specific capital stocks. This is a result of economies of scale, the existence of network externalities and competition-enhancing mechanisms (Dabla-Norris et al., 2015). This concerns in particular energy, transport and telecoms infrastructures[19] as they form an essential input for the production of industries which is complementary to other inputs including labour and capital. They also play a major role in the implementation of the EU's internal market influencing the degree of competition in these industries. Four transmission channels of infrastructure investment increase could be identified: (1) a decrease in production costs increasing competitiveness, (2) an increase in capital stock increasing productivity growth, (3) an increase in aggregate demand by increasing construction

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[19]   Water is also a network utility but this industry is more relevant for households than for enterprises.

expenditures and, (4) an increase in investments in other industries by providing positive signals (European Commission 2014). Empirical studies seem to indicate that the relationship between infrastructure and growth is positive but non-linear: the relationship may change with the level of infrastructure (Sutherland et al., 2009).

Part of these improvements take the form of investments. Investments in infrastructure cover maintenance expenditures and building-up of new assets. These investments in new assets are usually associated with large fixed costs making the decision irreversible and increasing the risks for the investors[20]. Given the presence of market failures such as externalities and natural monopolies, the use of the infrastructure is conditioned by the government intervention and the regulation put in place in terms of access conditions, market structure and prices determination. The market size is also influenced by the possibility of interconnection with other national networks. The use of network infrastructure is also often submitted to congestion. This congestion raises the cost for users and reduces individuals' utility. In this case, the benefit of investment in infrastructure could be large (Sutherland et al., 2009).

Past infrastructure spending in many OECD countries including the United States have been insufficient to compensate for capital depreciation and to maintain the quality of the infrastructure (OECD, 2015b). This evolution is mainly due to fiscal consolidation[21] partly based on the decrease in public investment and to the impact of the great depression on private investment. Additional capital expenditures in transport and in energy are also expected to respond to the environmental challenges and to move towards a low carbon economy[22].

In Belgium, if the telecoms have recorded a fast increase in the volume of the net stock of capital since 1995, this is not the case of energy and transport infrastructure (Bogaert and Kegels, 2012). Given the fiscal constraints, the infrastructure owned by the public sector has suffered from insufficient maintenance spending and the ageing of networks. This is clearly the case of road and railways network. The situation in energy is different as the owners of the infrastructure (production, transport and distribution) are mainly private enterprises. However, government decisions are still important as they influence incentives of private investors. This was, for instance, the case with the decision of phasing-out nuclear power in electricity market.

In addition to the quantitative assessment, the quality of infrastructure is also an important dimension. This quality is one of the 12 pillars of the global competitiveness index published by the World Economic Forum. In its 2014-2015 release, Belgium occupied the 18th rank out of 144 countries for the overall infrastructure quality index, which is also its ranking for the general competitiveness index. However, the Belgian ranking was lower for two components of this index: the quality of roads with the 27th position and the mobile telephony coverage with the 73th position.

The need for boosting infrastructure investment has been recognised by the European Commission. In the implementation of the Stability and Growth Pact (SGP), infrastructure expenditures are considered

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[20]   One of the main important risks is the infrastructure lock-ins caused by the non-optimal technology choice.
[21]   OECD (2015b) estimates that on average, 1% of GDP in consolidation has been associated with a 0.3% of GDP cut in public investment.
[22]   Estimates for Belgium of these needs in three scenarios with different levels of ambition in the field of energy efficiency and renewable energy development are presented in Devogelaer and Gusbin, 2015.

as growth-enhancing expenditures and are considered as expenditures to be preserved in the fiscal consolidation of Member States. The main objective of the Juncker Plan is to encourage both private and public investment, especially in infrastructures in telecoms, energy and transport by the creation of a new European Fund for Strategic Investment (EFSI) and the identification of 2000 potential projects in key areas. Moreover, the plan appeals for the creation of an investment-friendly environment by the removal of regulatory and financial barriers to investment and the development of private investment in line with government investment. Member States can also encourage private sector investment in infrastructure by providing clear and stable regulation, efficient procurement procedures and certainty of timing. More than financial support investors look at these fundamental conditions when deciding in which project to invest (OECD, 2014).

3.3. Conclusion

Analysing the reasons of the decline in the trend of labour productivity growth allows to show that some are common to all advanced economies while others are more specific to the Belgian economy. The structural changes of the advanced economies in favour of services with lower productivity level or lower productivity growth as gone in hand with income increase and ageing population. A specific feature of the Belgian economy in this respect is the weakness of ICT related activities, especially in manufacturing which reduce the TFP potential gains. In most advanced economies, phenomena which have sustained productivity gains begin progressively to falter. This is the case for knowledge-based capital accumulation particularly important to sustain TFP growth. In Belgium, this capital accumulation is relatively high but concentrated in some high-tech industries and in some large multi-national enterprises. The slowdown in the rate of increase in the stock of high skilled workers is also a common feature of advanced economies. Belgium is characterized by a population with a high percentage of tertiary education graduates. However, this relative advantage is eroding as other countries have rapidly increased the access of young generation to the tertiary education. Another factor that may explain the slowdown of productivity growth is the slowdown of the international fragmentation of the production process. The participation of countries to global value chains (GVCs) has been increasing steadily since the mid 1990's. This process has slow downed these last years due to the physical limit to the fragmentation of a product or a task.

In evaluating the policies which could be implemented in order to counteract the labour productivity growth declining trend, the macroeconomic and institutional context matters. Belgium belongs to a monetary union which suffers from a depressed economic situation with a policy mix limited by the zero lower bound and the Stability and Growth Pact. This leads to give the priority to three families of reforms: market functioning improvement and product market reform, investment in knowledge capital and innovation and improvement of infrastructure.

Concerning market functioning improvement, according to OECD indices, efforts can still be made in terms of business climate especially by reducing barriers to entrepreneurship and in terms of market functioning of telecoms, railways transport, retail trade and professional services.

To promote innovation, the accumulation of knowledge-based capital has to be enlarged in terms of industries and categories of enterprises involved. In addition, high skilled workers stock, especially in

science and engineering, has to be at least maintained through the improvement of education and life-long learning systems. A more efficient resources allocation lowering skill mismatch also contributes to productivity gains.

Improving infrastructure after years of fiscal consolidation and disruptive effects of the recent crisis has also a positive impact on productivity growth. In Belgium, this mainly concerns energy and road and railways transport. In addition to public expenditure in maintenance and improvement of networks, public authorities have also to provide a clear and stable regulation, efficient procurement procedures and certainty of timing to encourage private sector investment.

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Annex

Annex 1: Nace Rev2 classification (A38)

Code	Description
AA	Agriculture, forestry and fishing
BB	Mining and quarrying
CA	Manufacture of food products; beverages and tobacco products
CB	Manufacture of textiles, wearing apparel, leather and related products
CC	Manufacture of wood, paper, printing and reproduction
CD	Manufacture of coke and refined petroleum products
CE	Manufacture of chemicals and chemical products
CF	Manufacture of basic pharmaceutical products and pharmaceutical preparations
CG	Manufacture of rubber and plastic products and other non-metallic mineral products
CH	Manufacture of basic metals and fabricated metal products, except machinery and equipment
CI	Manufacture of computer, electronic and optical products
CJ	Manufacture of electrical equipment
CK	Manufacture of machinery and equipment n.e.c.
CL	Manufacture of motor vehicles, trailers, semi-trailers and of other transport equipment
CM	Manufacture of furniture; jewellery, musical instruments, toys; repair and installation of machinery and equipment
DD	Electricity, gas, steam and air conditioning supply
EE	Water supply; sewerage, waste management and remediation activities
FF	Construction
GG	Wholesale and retail trade; repair of motor vehicles and motorcycles
HH	Transportation and storage
II	Accommodation and food service activities
JA	Publishing, motion picture, video, television programme production; sound recording, programming and broadcasting activities
JB	Telecommunications
JC	Computer programming, consultancy, and information service activities
KK	Financial and insurance activities
LL	Real estate activities
MA	Legal and accounting activities; activities of head offices; management consultancy activities; architectural and engineering activities; technical testing and analysis
MB	Scientific research and development
MC	Advertising and market research; other professional, scientific and technical activities; veterinary activities
NN	Administrative and support service activities
OO	Public administration and defence; compulsory social security
PP	Education
QA	Human health activities
QB	Residential care activities and social work activities without accommodation
RR	Arts, entertainment and recreation
SS	Other service activities
TT	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use
UU	Activities of extraterritorial organisations and bodies

Annex 2: Detailed tables (A38) of the industry level analysis

Hours worked by industry (percent of total hours worked)

	Belgium		Germany		France		Netherlands	
	2000	2013	2000	2012	2000	2013	2000	2013
AA	2.56	1.98	2.57	1.94	5.59	3.94	3.78	2.95
BB	0.09	0.06	0.32	0.17	0.11	0.07	0.15	0.13
CA	2.44	2.06	2.33	2.23	2.60	2.39	1.91	1.57
CB	1.28	0.54	0.66	0.38	1.00	0.41	0.39	0.22
CC	1.38	0.97	1.52	1.13	1.17	0.78	1.34	0.74
CD	0.12	0.11	0.06	0.05	0.04	0.03	0.08	0.07
CE	1.40	0.99	1.01	0.89	0.54	0.43	0.73	0.59
CF	0.47	0.55	0.29	0.30	0.18	0.16	0.24	0.17
CG	1.47	1.07	1.94	1.71	1.44	1.01	0.97	0.72
CH	2.81	1.89	3.01	2.88	2.01	1.54	1.83	1.47
CI	0.57	0.29	0.89	0.83	0.54	0.32	0.48	0.35
CJ	0.63	0.37	1.38	1.28	0.46	0.31	0.41	0.27
CK	0.96	0.78	2.74	2.81	0.86	0.62	1.17	1.07
CL	1.69	0.92	2.58	2.31	1.06	0.74	0.67	0.52
CM	0.98	0.91	1.71	1.64	2.12	1.62	2.65	2.31
DD	0.49	0.46	0.70	0.66	0.50	0.47	0.32	0.32
EE	0.48	0.58	0.67	0.66	0.50	0.60	0.42	0.47
FF	6.24	6.20	8.18	6.83	6.74	7.82	8.47	7.03
GG	14.58	13.04	14.91	13.81	13.14	13.72	16.20	15.55
HH	6.46	5.30	5.01	5.10	5.14	5.25	5.49	5.09
II	3.46	3.05	3.90	3.92	3.99	4.56	3.53	3.60
JA	0.58	0.51	0.80	0.77	0.76	0.77	0.93	0.72
JB	0.74	0.63	0.61	0.35	0.50	0.44	0.79	0.41
JC	0.93	1.31	1.31	1.94	1.45	1.76	1.84	2.43
KK	3.45	2.72	3.52	3.09	2.70	2.88	3.67	3.05
LL	0.46	0.55	1.03	0.96	1.31	1.30	0.87	0.88
MA	8.43	12.43	3.60	4.93	3.64	4.29	5.44	6.11
MB	0.17	0.22	0.36	0.46	1.44	1.64	0.42	0.43
MC	0.86	1.00	0.82	1.04	0.91	0.97	1.52	1.87
NN	5.40	7.34	4.45	6.25	6.54	7.12	9.07	9.77
OO	9.48	9.71	7.29	6.21	9.82	8.64	6.11	5.97
PP	5.69	6.43	4.54	5.18	4.82	4.79	4.80	5.36
QA	5.36	6.19	5.96	6.77	5.95	6.73	4.15	5.91
QB	3.23	4.65	3.83	4.84	5.63	6.68	5.47	7.29
RR	0.85	0.94	1.34	1.56	1.45	1.82	1.51	1.99
SS	2.48	2.54	3.33	3.36	2.39	2.42	2.15	2.44
TT	1.33	0.71	0.84	0.76	0.97	0.93	0.03	0.15

Source: Eurostat.

Labour productivity growth (percent)

	Belgium		Germany		France		Netherlands	
	2000-2007	2007-2013	2000-2007	2007-2012	2000-2007	2007-2012	2001-2007	2007-2013
AA	0.26	3.82	4.95	-1.91	2.67	3.08	4.12	1.65
BB	3.99	4.48	1.57	2.24	-0.53	-3.66	2.01	-1.17
CA	4.37	4.42	-0.62	-0.05	2.16	0.75	3.81	0.14
CB	6.42	1.94	4.05	1.02	5.72	3.16	4.12	1.90
CC	4.63	1.25	2.40	2.63	2.74	5.42	4.46	2.75
CD	12.87	7.22	-4.33	-13.62	6.60	-18.70	2.16	8.57
CE	0.45	-2.78	3.41	-0.89	1.94	1.33	7.21	-0.77
CF	7.26	-0.22	7.30	1.09	4.97	5.24	3.95	4.11
CG	3.85	2.74	3.70	0.51	5.13	2.11	4.89	-0.54
CH	2.28	3.38	1.67	0.05	1.76	1.65	3.64	1.56
CI	-0.54	0.69	12.57	5.13	9.19	10.12	12.28	6.98
CJ	1.00	-1.48	0.51	0.52	1.19	-2.09	3.05	1.31
CK	3.11	-1.15	2.45	-2.33	4.99	1.54	3.89	2.19
CL	4.79	-0.60	5.98	3.31	2.40	2.49	5.31	-4.08
CM	-3.20	1.61	4.03	-1.21	3.78	1.59	-0.07	0.85
DD	1.16	-2.74	1.51	2.33	2.21	-5.36	5.26	-1.44
EE	-2.82	1.12	-0.35	2.27	0.89	-1.56	-0.12	-0.46
FF	3.12	0.47	-0.39	1.21	-0.50	-2.56	1.07	-1.49
GG	3.47	-0.32	4.37	-1.37	0.93	-0.32	3.13	0.60
HH	1.44	0.84	3.68	0.61	1.39	0.52	2.50	0.71
II	2.87	-2.30	-0.34	-0.46	-0.56	-0.32	-1.75	-2.86
JA	-0.44	2.45	0.52	1.06	2.28	0.31	3.27	-2.88
JB	5.94	0.69	6.33	12.29	10.02	6.70	14.43	2.91
JC	1.85	-1.64	3.91	4.65	2.48	0.93	1.76	-0.18
KK	2.40	2.85	-2.30	0.67	1.17	2.68	4.53	2.38
LL	-0.38	-1.78	2.48	2.17	-0.18	2.70	-0.82	2.74
MA	0.96	-2.08	-1.25	-3.17	2.12	-0.45	-1.23	-0.02
MB	-0.31	3.74	-0.71	-0.75	-1.32	1.26	1.59	-1.48
MC	4.19	-2.45	-5.20	-1.70	0.92	2.21	0.07	-2.89
NN	-1.16	-2.39	-1.13	-0.91	-0.54	-1.14	-0.45	-0.47
OO	0.50	1.02	1.23	2.45	1.57	1.92	1.85	1.02
PP	-0.63	-0.33	-1.68	-1.06	-0.60	0.37	-1.17	0.10
QA	-2.56	-0.44	0.78	2.55	0.65	1.41	0.83	2.31
QB	0.16	-1.04	0.80	1.11	1.53	0.35	0.85	1.26
RR	-2.43	0.10	-1.41	0.39	1.95	0.15	-0.53	-2.19
SS	1.71	0.43	-0.10	-0.13	1.83	-0.70	-1.29	-1.54
TT	-0.33	-0.21	-0.29	2.10	1.40	0.57	1.68	1.05

Source: Eurostat.

TFP contribution to labour productivity growth (in percentage point) - Belgium

	2000-2007	2007-2009	2007-2013
Manufacturing	1.81	-3.79	0.06
CA	3.25	2.87	4.08
CB	4.89	-2.03	0.87
CC	3.22	-1.37	0.75
CD	11.17	-30.01	5.58
CE	-1.81	-9.46	-3.26
CF	3.40	3.25	-2.26
CG	2.67	-2.82	1.78
CH	1.67	-4.11	2.14
CI	-1.63	-16.47	-0.37
CJ	-0.58	-1.51	-1.95
CK	1.94	-9.99	-2.17
CL	3.33	-4.21	-1.89
CM	-3.85	0.21	1.67
Market services	0.81	-1.84	-0.68
GG	1.69	-2.43	-1.16
HH	0.15	-2.16	0.28
II	1.83	-5.27	-2.74
JA	-2.57	0.32	-0.83
JB	3.81	0.57	-0.88
JC	-0.38	-4.86	-1.87
KK	0.43	1.36	2.70
MA	-0.57	-2.55	-2.39
MB	-1.09	20.42	2.87
MC	3.20	-7.81	-1.75

Source: EUKLEMS.

TFP contribution to labour productivity growth (in percentage point) – Germany, France, Netherlands

	Germany		France		Netherlands	
	2000-2007	2007-2009	2000-2007	2007-2009	2000-2007	2007-2009
Manufacturing	3.36	-11.83	1.67	-4.31	2.60	-4.73
CA	-0.05	-9.50	0.53	-3.48	2.41	-0.65
CB	3.42	-7.26	3.19	-6.09	2.98	-5.04
CC	1.39	-1.16	1.16	4.44	1.84	-1.63
CD	-6.17	-15.37	1.40	-50.03	4.13	-0.94
CE-CF	5.12	-5.63	1.56	-1.81	5.70	-3.87
CG	3.51	-8.70	3.07	-4.27	2.56	-6.04
CH	1.82	-13.62	0.34	-1.43	2.69	-4.36
CI-CJ	6.67	-6.69	4.72	-5.15	-3.67	-5.96
CK	1.93	-18.92	3.30	-11.52	2.93	-13.44
CL	5.32	-20.55	-1.46	-11.90	4.87	-19.62
CM	3.93	-8.56	2.83	-1.80	1.48	-3.28
Market services	0.33	-1.24	0.25	-2.65	1.52	-1.64
GG	2.77	2.11	0.25	-2.24	2.79	-3.06
HH	1.83	-2.62	0.13	-4.79	1.65	-3.30
II	0.23	-0.22	-0.58	-1.00	-1.56	-4.03
JA	-0.64	6.32	1.29	-6.09	1.37	-1.74
JB	2.62	10.89	8.20	-0.51	9.09	1.29
JC	1.48	5.69	1.89	-1.73	-0.23	-3.31
KK	-1.38	0.58	0.11	-0.85	2.82	3.26
MM-NN	-2.03	-7.61	-0.99	-3.26	-1.27	-1.72

Source: EUKLEMS.