

Has the reorganisation of global production radically changed demand for labour ?

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Introduction

The organisation of global production has undergone profound changes in recent decades. Technological progress has revolutionised creation, production and distribution methods, and even customer relations. Technology has become widespread in all sectors of the economy, and has really taken off via the use of robots, digitalisation, computerisation and developments in information and communication.

Coupled with the decline in transport costs, these technological developments have also helped to open up the production chains by facilitating the transfer of data and providing greater scope for supervision. Nowadays, the creation of a final product is based on intermediate components or services originating from different locations, sometimes in distant countries. In this new form of organisation, production units are no longer geared to making final products for consumers, but each unit represents a link in a production chain which is often complex and fragmented. As a result, the emerging countries – especially in East Asia – have assumed a bigger role in the global market production chains, particularly in the industrial segment.

These changes have had an impact on economic activity and employment, and repercussions on industry and market services. In addition, the composition of demand for labour has changed radically in the past fifteen years. Demand for highly-skilled jobs has risen to the detriment of medium-skilled occupations. Low-skilled jobs have been less affected. Viewed from the angle of the occupations pursued, demand for labour has therefore polarised (see also Goos *et al.*, 2014, Michaels *et al.*, 2014 and Eurofound, 2013).

This article describes the reorganisation of production chains and the polarisation of employment, and examines the link between the two during the recent period⁽¹⁾. The article does not consider wages or the impact of technology on low-qualified workers since these aspects have already been studied (see in particular Goux and Maurin, 2000 and Revenga, 1992). But it uses new ways of measuring the fragmentation of production which appear relevant for explaining the polarisation of demand for labour.

The article is in two parts. The first chapter describes the global production chains. The major changes that have influenced their organisation are discussed in section 1.1. Section 1.2 focuses on Belgian market production chains, analysing the contributions of the production factors of the main economic regions. The second chapter looks at developments in demand for labour. Section 2.1 takes a look at employment in Belgium and the EU15. Since the level of education is not the most appropriate angle for analysing demand for labour, section 2.2 gives a breakdown by type of occupation. Section 2.3 describes the

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(1) This article uses data from various sources. The period for which data are available varies from one source to another. The period analysed runs from 2000 to the latest available year.

polarisation of demand for labour in Belgium and elsewhere in Europe. Section 2.4 presents the econometric results of the regressions linking globalisation, technological progress and the polarisation of demand for labour. This article ends with a conclusion.

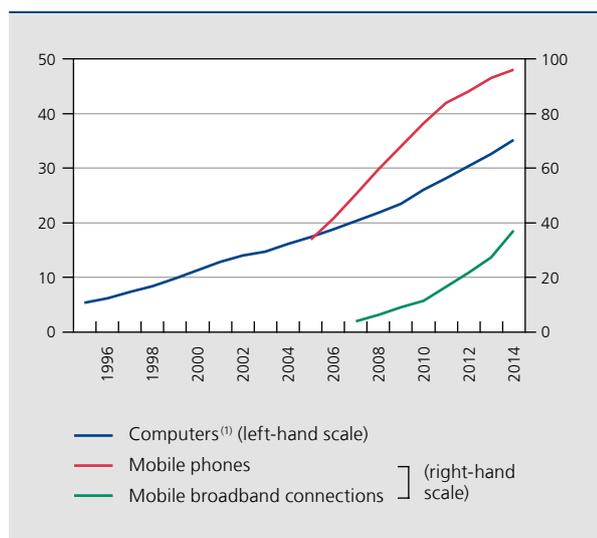
1. Production chains

1.1 Technological progress and globalisation of production chains

The history of information and communication technology (ICT) features a series of revolutionary developments, such as the telegraph, the telephone, television and computers. The past fifteen years have also brought a rapid succession of innovations, with the advent of mobile phones, the internet, digitalisation, high definition, etc. These innovations have become widespread in the economy, in both the market sector and the non-market sector, bringing changes in organisation, production and distribution methods, and in the channels for reaching customers, etc.

Although the figures available internationally are often fragmented, the development of ICT has been accompanied by an increase in the corresponding capital stock. In Belgium, the net volume of IT and telecommunications equipment expanded by 133 % between 1995 and 2013.

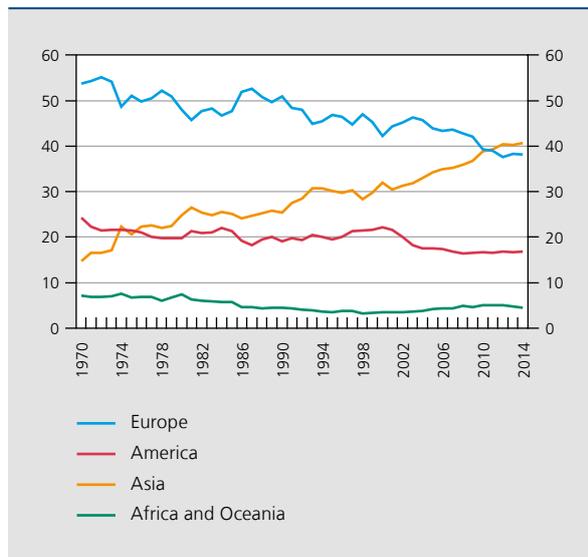
CHART 1 GLOBAL SPREAD OF ICT
(per 100 inhabitants)



Sources: IMD, ITU.

(1) Average for a selection of 44 countries worldwide. See the World Competitiveness Center (IMD) for more details.

CHART 2 SHARE IN GLOBAL EXPORTS OF GOODS
(in % of the world total)



Source: UNCTAD.

For comparison, the intangible capital which consists of R&D, software and other intellectual property grew by 102 % over the same period, while other productive assets such as buildings (excluding housing), civil engineering works, transport equipment and other machinery and equipment recorded only 19 % growth.

By facilitating the transfer of information, the ICT revolution has also been one of the factors leading to the opening up of production chains, thus contributing to their international fragmentation. The creation of a final product now requires numerous inputs, often coming from different firms which, in some cases, are located in distant countries. In those circumstances, production units no longer manufacture a final product for the consumer, but form just one link in a fragmented production chain. Companies, and particularly multinationals, have taken advantage of this situation to locate some elements of their production in countries offering a more flexible regime in terms of taxes and social and environmental legislation, plus an abundant supply of relatively cheap labour. R. Baldwin⁽¹⁾ summed it up by saying "ICT made it possible, wage differences made it profitable".

The expansion of ICT is not the only factor enabling the emerging countries, and especially the Asian economies, to gradually become the biggest manufacturers in the

(1) See WTO (2013).

world. Another reason lies in the political choice made by some countries, notably China, to develop their industry, particularly the export sectors. In so doing, these countries maintained an extremely high investment ratio, exceeding 40 % since 2009, whereas that ratio remained steady at around 20 % in the EU15 and the new EU Member States. Overall, in the past 15 years, Asia's share in global exports of goods – which are constantly increasing – has grown by more than 10 percentage points to reach 40 % in 2012.

1.2 Belgian production chains

The emerging countries' participation in the global economy has intensified, driven mainly by the East Asian countries. On the basis of the OECD's Inter-Country Input-Output (ICIO) data⁽¹⁾, the share of the emerging economies in global GDP increased from 23.4 % in 2000 to 39.6 % in 2011⁽²⁾. However, that figure takes account of total value added, i.e. including that involved in the creation of non-market services which are, by nature, less subject to globalisation. By using global input-output matrices, the analysis can focus on the chains for the creation of market goods and services, i.e. those where the final product offered for sale is commercial⁽³⁾. In these chains, the contribution of each branch including any contribution from the non-market sector can be measured by its value added, regardless of the production stages incorporating the components or intermediate services. As a supplement to the national accounts, which enable the total contribution of each branch to be deduced from the breakdown of value added by branch of activity, it is thus possible to separate the contribution of the different branches of activity to the market production chains by means of global input-output matrices.

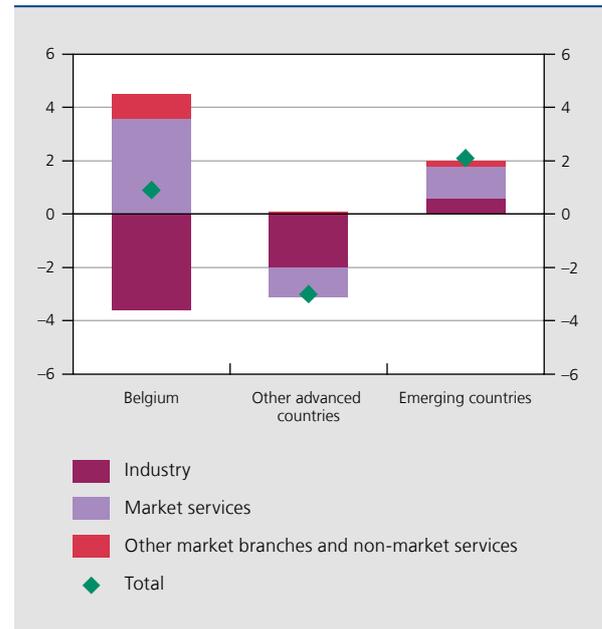
In the global market production chains, the share of the emerging countries grew from 24.9 % in 2000 to 43.3 % in 2011. Their market consumption at current prices practically quadrupled, whereas the increase for the advanced countries came to only 60 %. The new demand potential in the emerging countries is an opportunity for all producing countries, including the advanced economies.

(1) See www.oecd.org for more information on this database.

(2) The available data on global value chains (ICIO, WIOD) concern only a limited number of countries. In this article, which is based largely on those data, the countries are divided into two groups. The group of advanced countries includes the EU15, Norway, Switzerland, the United States, Canada, Australia, New Zealand, Japan and South Korea. All other countries, including the "rest of the world" in the value chain data banks, belong to the "emerging countries" group. The latest available year in the ICIO database is 2011.

(3) See Timmer *et al.* (2014) for a description of the calculation method. By convention, the market branches of activity comprise agriculture, industry, construction, trade, transport, accommodation and food service activities, information and communication, financial services and real estate activities, professional, technical and scientific activities, and administrative and support service activities (sections A to N of the NACE 2008 nomenclature). The non-market branches of activity are public administration, education, health and social work, the arts, entertainment and other service activities (sections O to S of NACE 2008).

CHART 3 CONTRIBUTIONS TO BELGIAN MARKET CHAINS
(change between 2000 and 2011, in percentage points)



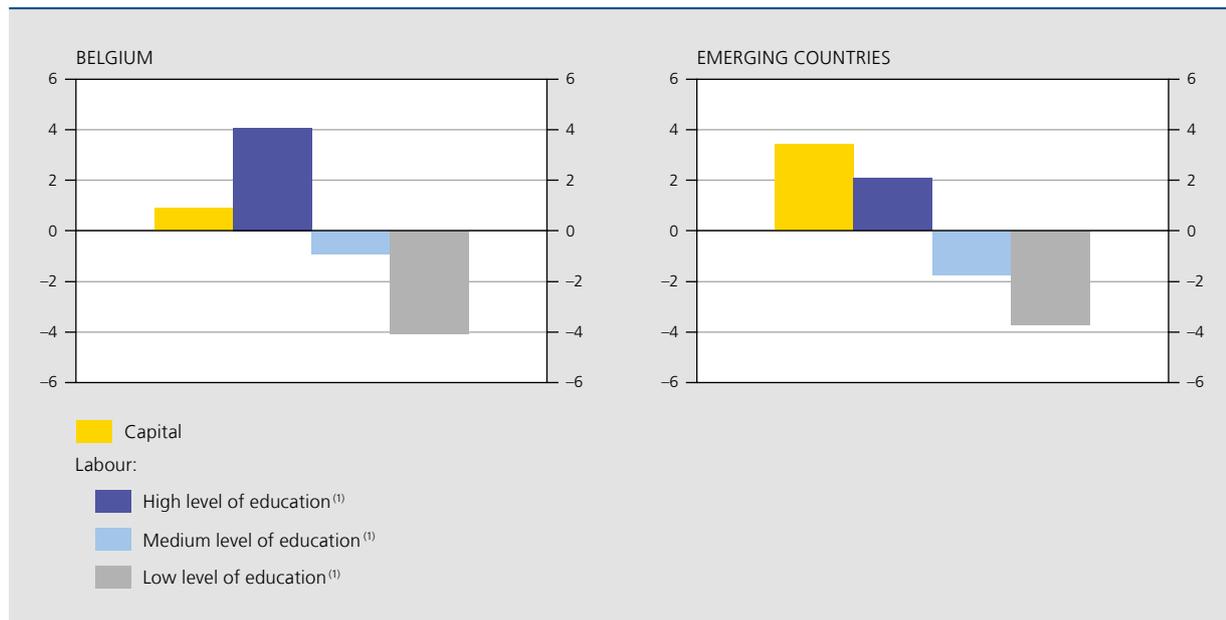
Source: NBB calculations based on the ICIO data (OECD).

However, by expanding their production capacities, the emerging countries are also competing with advanced countries for creating value and jobs. In Belgium, the share of final consumption of market products imported direct from emerging countries rose from 3.9 % in 2000 to 4.8 % in 2011.

In addition, Belgian production processes used more components from the emerging countries as inputs. The contribution of the emerging countries, particularly China, India and Russia, in Belgian market chains in fact expanded from 5.7 % in 2000 to 7.8 % in 2011. That was not at the expense of components from Belgium but affected those from other advanced countries, whose contribution thus declined by 3 percentage points to 20.2 % in 2011. In this group of countries, it was mainly France, the United Kingdom, the United States and Japan that lost market shares. Belgian firms, which generated 72 % of Belgian market output in 2011, actually increased their contribution by 0.9 percentage point over that period.

In Belgium, the main branches of activity have not all followed the same pattern. By way of illustration, the market chains can be sub-divided into industrial product chains and chains producing market services. For each of these chains, it is also possible to calculate the contributions of the different branches of activity, including

CHART 4 SHARES OF PRODUCTION FACTORS IN THE RESPECTIVE CONTRIBUTIONS TO BELGIAN MARKET CHAINS
(change between 2000 and 2008, in percentage points)



Source : NBB calculations based on the WIOD.
(1) See the annex for more details on the breakdown by level of education.

those of industry, market services and non-market services. The contribution of Belgian industry has declined, as has the contribution of industry in the other advanced countries, especially in the industrial product chains. In Belgium, this de-industrialisation was accompanied by wider outsourcing of services by industrial firms, which thus made greater use of trading firms or those specialising in business services in order to produce their goods. In the chains producing market services, the Belgian market services branches also stepped up their contribution, even though it was already high, at almost 82 %.

At this stage, it may be worth going into more detail on the two segments that have gained market share in Belgian market output, namely the Belgian segment and that of the emerging countries. In the WIOD database⁽¹⁾, a breakdown of remuneration per production factor is available up to 2008⁽²⁾. The remuneration of labour is also broken down by the level of education⁽³⁾. This shows that the remuneration of low-qualified workers declined in relative terms between 2000 and 2008. In the Belgian segment, the contribution of the low-qualified has fallen primarily in favour of the highly qualified. In the emerging countries

segment, that fall has also – and primarily – favoured capital even though the original share of capital was greater than in the Belgian segment.

It therefore seems that the market share of the Belgian industrial segment contracted mainly in favour of capital in the emerging countries, as the latter have specialised in the initial links in industrial production, such as extraction, which are capital-intensive by nature. There are two comments to be made here. First, demographic or socio-economic factors may play a role in the relatively small share of wages in the emerging countries, and therefore in the large share of capital remuneration. Also, some of the capital there may be owned by firms in advanced countries. However, it is difficult to put a figure to the scale of that at present, since no data are available on the financing of value chains.

2. Changes in demand for labour

2.1 Employment trends since 2000

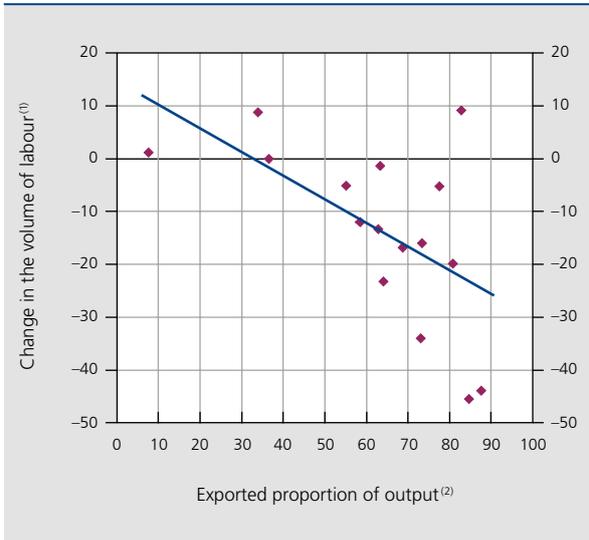
The great forces affecting the organisation of global production chains have also had implications for employment. The loss of market shares for European industry was accompanied by a decline in the volume of labour in industry

(1) See Timmer *et al.* (2015) for more information on this database.
(2) See Timmer *et al.* (2014) for a detailed analysis of these data.
(3) As we shall see, a breakdown by occupational category would be preferable. However, that is not available in the WIOD. See the annex for more details.

CHART 5

CHANGE IN THE VOLUME OF LABOUR AND EXPORTS OF BELGIAN INDUSTRY

(each diamond represents one of the 16 industrial branches of activity in the A38 classification)



Source: NBB calculations based on EU KLEMS data and Dhyne and Duprez (2015).

(1) Between 2000 and 2012, in millions of hours.

(2) Proportion of output exported directly or indirectly (via another branch of activity), average over the period 2002-2012.

in all the EU15 countries, though the impact was greater for some (Portugal, Denmark, the United Kingdom) and smaller for others (Luxembourg, Germany, Austria). The new Member States also had to contend with this gradual

de-industrialisation: in their case, the contribution of industry to the increase in the total volume of hours worked between 2000 and 2014 was -2.4 percentage points, compared to -3.7 percentage points for the EU15.

In Belgium, the industrial branches of activity that felt the biggest impact were the ones featuring the highest degree of globalisation. For the 16 industrial branches in the A38 classification of the NACE 2008 nomenclature, the correlation between the proportion of output exported and the movement in the volume of labour between 2000 and 2012 is clearly negative. In contrast, that correlation is zero and non-significant for market services.

In contrast to industry, market services recorded an increase in the volume of labour, although in Belgium that is due partly to the government measures concerning service vouchers⁽¹⁾. The growth of employment in market services occurred in all European countries. Between 2000 and 2014, the contribution of market services to the expansion of the volume of labour came to 4.8 percentage points in the EU15.

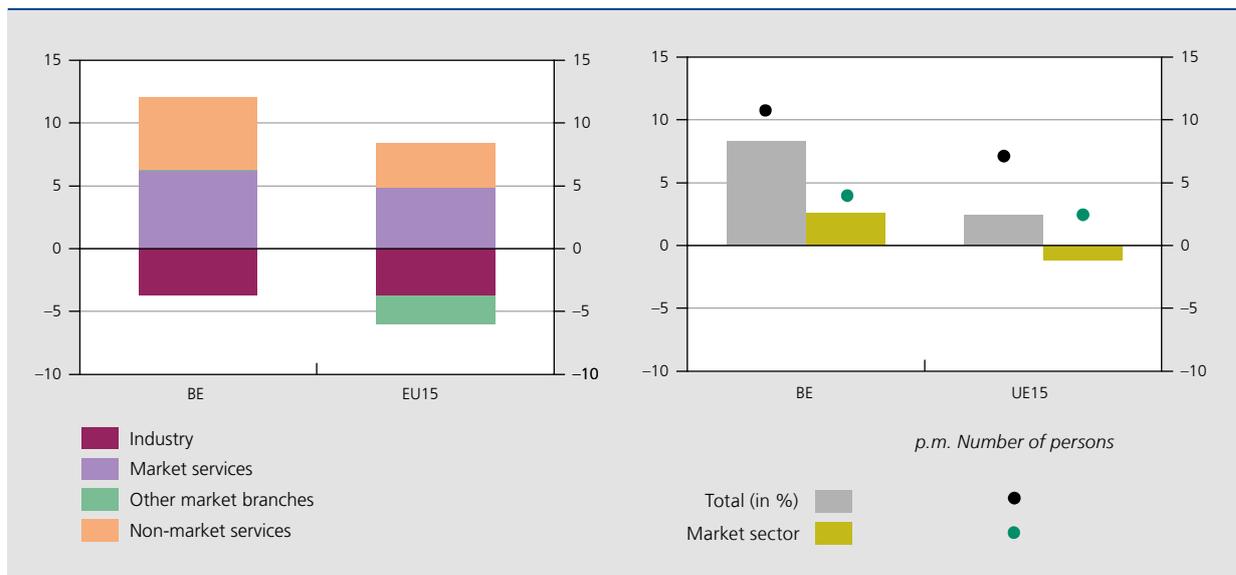
In Belgium, employment in the other market branches, namely agriculture and construction, was unaffected, in contrast to other European countries such as Portugal, Greece, Spain and Ireland. Largely as a result of the economic crisis, the market sector in all European countries

(1) See NBB (2015).

CHART 6

CHANGES IN THE VOLUME OF LABOUR OVER THE PERIOD 2000-2014

(contribution to the total change; percentage points, unless otherwise stated)



Source: EC (national accounts).

therefore posted relatively weak growth, or even negative growth in most countries. However, the total volume of labour increased overall, thanks to the positive contribution from the non-market sector.

The change in the volume of labour is the best way of measuring the influence of economic activity on the labour market. However, in the absence of data on the number of hours worked, the analysis in the rest of this chapter is based on employment in terms of the number of persons. The trend in the number of persons in work over the period 2000-2014 is clearly more positive than the trend in the volume of hours worked. Indeed, a reduction in average working time per person was recorded, to a greater or lesser degree, in all EU Member States and in the various branches of activity. Different working regimes, particularly part-time working, became more widespread during that period, since they offer more flexibility for both employers and workers⁽¹⁾. On average, the number of hours worked declined even more sharply in the EU15 than in Belgium. The number of people working in the market sector therefore also increased in the EU15. During the period considered, the total number of persons in work was up by almost 11 % in Belgium and around 7 % in the EU15.

2.2 How to assess demand for labour

In the previous chapter, the production factor “labour” was broken down according to the level of education, the only detail available in the WIOD database. However, that breakdown which – as explained in the annex – is based on the highest diploma or certificate gained is not a good indicator of demand for labour. It is strongly influenced by the structure of the available labour supply (the labour force) whose average level of education has risen in recent decades. If the labour supply is abundant, employers may tend to fill vacancies with people who are in fact over-qualified for the job, thus driving out the less qualified. In addition, the highest diploma gained does not provide any information on what the person in question has done since completing his or her education, so that this breakdown is particularly problematic in the case of people who left school quite some time ago. This dissonance may operate in either direction. For instance, during their career, people gain experience, enabling them to perform more complex tasks than their diploma would indicate. Conversely, a period of prolonged inactivity may imply that certain abilities are lost. In the context of “working longer”, it is also possible that older workers reaching the end of their career step down and take on a less demanding job. All these factors can affect the share of

the various levels of education in total employment, so that this breakdown does not give an accurate picture of demand for labour, in which employers wish to recruit people with specific skills for certain jobs.

A breakdown of employment by type of job performed gives a better idea of demand for labour, because the actual content of the job indicates precisely the activities for which jobs are created. Moreover, the various effects mentioned above which distort the breakdown of employment by level of education do not apply if employment is broken down by job level. As stated in the annex, the results of the labour force survey (LFS) provide that information. By analogy with the sub-division commonly used for the level of education, a breakdown into three groups – namely highly-skilled, medium-skilled and low-skilled jobs – is used here⁽²⁾. Low-skilled jobs are elementary occupations such as cleaners, refuse collectors, etc. Medium-skilled jobs include clerical workers and service staff, sales workers, handicraft workers and plant and machine operators. Finally, highly-skilled jobs concern managers, for instance, and intellectual, scientific and artistic occupations⁽³⁾.

The breakdown of employment according to the job level presents a significantly different picture from the breakdown according to the level of education. While low-qualified workers accounted for around 19 % of employment in Belgium in 2013⁽⁴⁾, the proportion of low-skilled jobs was much lower, namely 10 %. Conversely, the proportion of medium-skilled and highly-skilled jobs (around 45 % each) exceeded the proportion of groups of workers with the corresponding level of education (40 % and 41 % respectively). Similar shifts in the respective proportions are also seen elsewhere in the EU15. Furthermore, the impression that employment in Belgium is more highly qualified, on average (in 2013, 41 % of workers held a higher education diploma, compared to 33 % in the EU15) disappears almost entirely if the job level is considered. At this fairly aggregated level, demand for labour in Belgium is therefore very comparable to that in other EU15 countries.

Comparison of the data relating to educational attainment and jobs performed also reveals that, in other EU15 countries, greater “upward mobility” is necessary to meet the demand for labour. In those countries more so than in

(1) For an in-depth analysis of the trend in working time, see *Conseil supérieur de l'emploi* (2015).

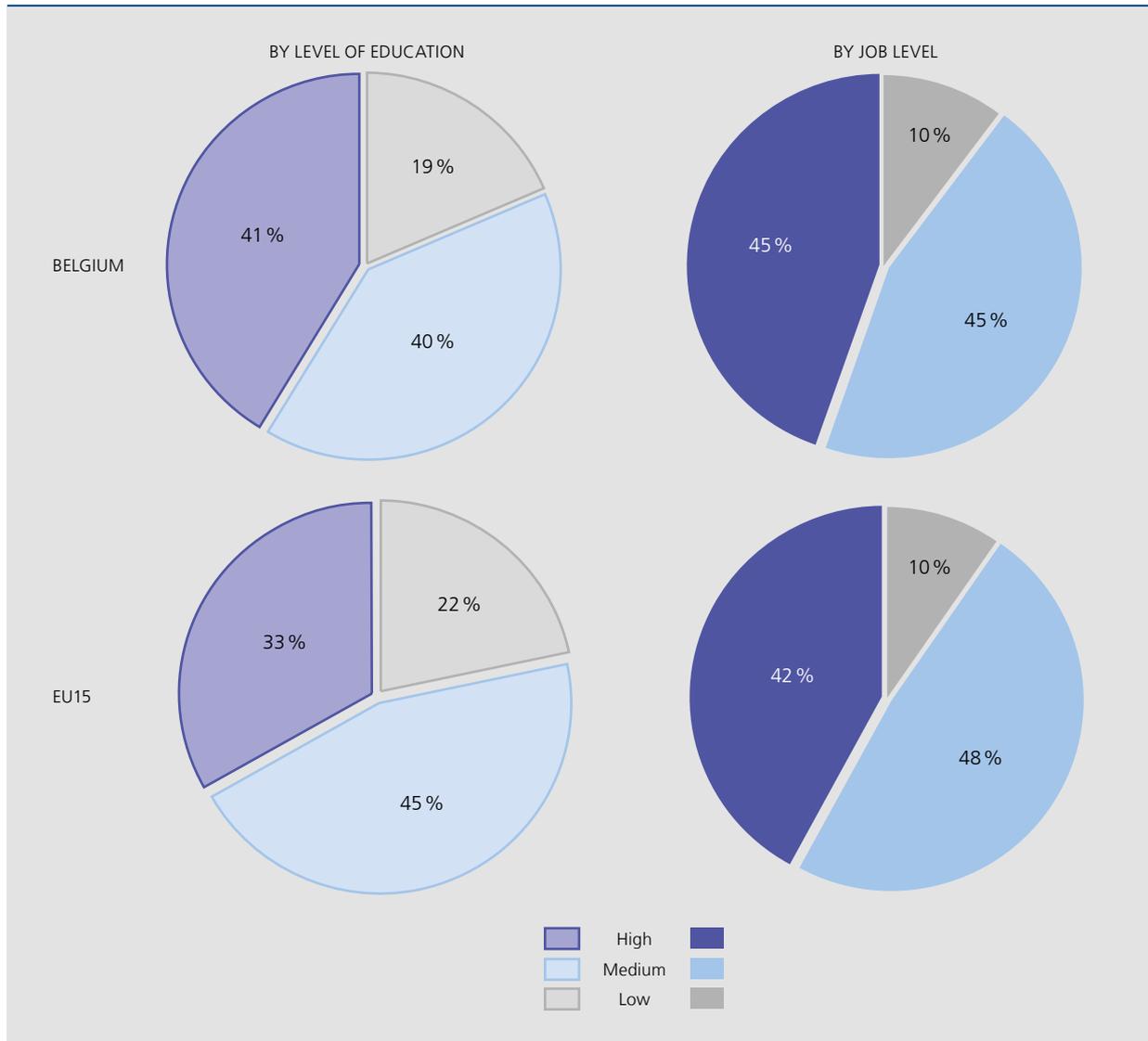
(2) The definition of the skill levels used here is described in detail in ILO (2012).

(3) In the breakdown used in this article, military occupations were disregarded because for that category the ISCO 88 classification did not permit any breakdown according to the various skill levels. The annex presents a more detailed illustration of the ISCO 08 classification at 2-digit level.

(4) This is the latest year for which the LFS microdata are available.

CHART 7

EMPLOYMENT IN 2013 ACCORDING TO LEVEL OF EDUCATION AND JOB LEVEL



Source: EC (LFS).

Belgium, less-qualified workers have to do a more highly-skilled job. In the EU15, a larger proportion of medium-qualified workers are employed in highly-skilled jobs, while a larger proportion of low-qualified workers take on medium-skilled or highly-skilled jobs. However, the fact that there is less need for upward mobility in Belgium does not permit the conclusion that there is less qualification mismatch on the labour market. For that, it would be necessary to conduct a more detailed analysis of the skills sought and the skills available on the labour market⁽¹⁾.

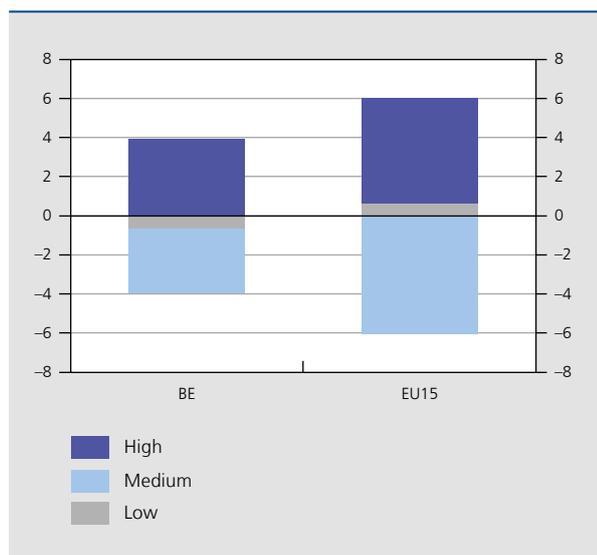
(1) A simple comparison is not enough, for two reasons. First, as already mentioned, the highest level of educational attainment does not indicate the worker's current skills. Also, the breakdown used, which is based on three groups of jobs, is too aggregated to permit meaningful conclusions regarding the degree of qualification mismatch.

2.3 Polarisation of employment

As mentioned in section 2.1, the number of people in work has clearly risen since 2000. In Belgium, employment has grown in each job category. But that rise has not been uniform. The expansion was most pronounced in the case of highly-skilled jobs. Next come the low-skilled jobs and finally the medium-skilled jobs. The same ranking applied in the EU15, but there employment in medium-skilled jobs actually declined over that period. As a result of these divergences, the proportion of medium-skilled jobs in total employment declined considerably in the period 2000-2013. In Belgium, that fall amounted to 3.3 percentage points; it was even more marked in the EU15, where it came to 6 percentage points. Conversely, there has been a clear

CHART 8 EMPLOYMENT BY JOB LEVEL DURING THE PERIOD 2000-2013

(shares in the total, changes in percentage points)



Source : EC (LFS).

rise in the proportion of highly-skilled jobs, up by 3.9 and 5.4 percentage points respectively, while the proportion of low-skilled jobs has been fairly stable. Employment has therefore polarised during this period⁽¹⁾. That polarisation was even more marked in the EU15 than in Belgium.

No polarisation of employment appears from the breakdown by level of education, where it is mainly the proportion of low-qualified people that has contracted sharply. This development is greatly influenced by the structure of the labour supply, confirming the importance of assessing demand for labour on the basis of the results by job level.

However, when viewed from the angle of the job level, the polarisation is universal, as indicated by table 1. It was already in progress during the sub-period 2000-2008 which preceded the crisis, and clearly continued during the sub-period 2008-2013, both in Belgium⁽³⁾ and on average in the EU15. It is therefore not connected with the crisis but is a structural trend. It is also worth examining whether the polarisation of employment concerns the

(1) The finding of employment polarisation is nothing new. Previous international studies often described the phenomenon by distinguishing between jobs according to the duties entailed and/or the wage level (see, for example, Goos *et al.*, 2014) and established a link with other explanatory factors such as jobless recovery or the theory of routine-biased technological change; see below in this article). Other criteria were also used to break down employment, such as the level of educational attainment and job quality (see, for example, Eurofound, 2013). However, in the case of these criteria, employment polarisation is not always found.

(2) Owing to specific developments in industry (see below), the polarisation of employment in Belgium during the pre-crisis period is not entirely clear from the figures.

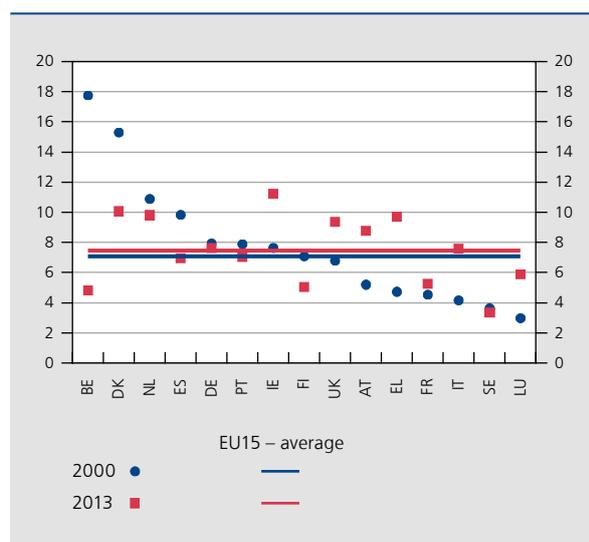
economy as a whole or principally certain branches of activity. This analysis shows that, although the changes vary in scale, the phenomenon is very obvious in both the market sector and the non-market sector, in Belgium and in the EU15. It is therefore not confined to the market sector, which is more exposed to the impact of globalisation. In the market sector, there is a clear polarisation in market services and in the “other market branches”.

In Belgian industry, there does not, at first sight, appear to be any polarisation: the proportion of low-skilled jobs has declined considerably in favour of highly-skilled jobs, but also medium-skilled jobs, albeit to a lesser extent. However, appearances are deceptive. During the period 2000-2013, and primarily before the crisis, the structure of employment in Belgian industry changed radically: in 2000, low-skilled jobs still accounted for around 18% of industrial employment, by far the highest proportion in all the EU15 countries. The decline in that category was therefore much steeper in Belgium than in the other countries. As a result of the restructuring carried out during the period considered, that proportion stood at around 5% in 2013, the lowest figure in the EU15 except for Sweden. A movement on such a scale dominates all the other changes in the structure of employment. Consequently, the pressure on medium-skilled jobs – which is likewise prevalent in Belgium industry – is not immediately apparent.

In the EU15, on average, the share of low-skilled jobs in total industrial employment was virtually stable in

CHART 9 SHARE OF LOW-SKILLED JOBS IN INDUSTRY IN THE EU15

(in % of total industrial employment)



Source : EC (LFS).

TABLE 1 EMPLOYMENT BY JOB LEVEL DURING THE PERIOD 2000-2013: BREAKDOWN BY SUB-PERIOD AND BY BRANCH OF ACTIVITY
(shares in the total, changes in percentage points)

	Belgium			EU15		
	Low-skilled jobs	Medium-skilled jobs	Highly-skilled jobs	Low-skilled jobs	Medium-skilled jobs	Highly-skilled jobs
By sub-period						
Before the crisis (2000-2008)	-1.6	-1.4	3.1	1.1	-4.9	3.8
Since the crisis (2008-2013)	1.0	-1.9	0.9	-0.4	-1.1	1.6
By branch of activity						
Market sector	-1.0	-2.3	3.3	1.0	-6.3	5.3
Industry	-12.9	4.3	8.6	0.4	-9.0	8.7
Market services	4.4	-4.6	0.2	1.6	-3.2	1.6
Other market branches	-0.1	-4.1	4.2	-0.8	-5.6	6.4
Non-market services	-0.2	-3.6	3.8	-0.4	-3.0	3.4

Source: EC (LFS).

the period 2000-2013, as the sometimes considerable changes in the various countries largely balanced each other out. Thus, in contrast to what happened in Belgium, the change in the employment structure was not dominated by an adjustment concerning low-skilled jobs, which makes the polarisation of employment very obvious.

The detailed LFS data on jobs performed⁽¹⁾ offer a more specific idea of the kind of jobs that have either

suffered or benefited from this change in demand for labour. In the case of highly-skilled jobs, there has, for example, been an increase in the number of IT specialists, engineers and architects, accountants and financial specialists; that is clearly linked to developments in ICT. There has also been an increase in senior nursing staff and midwives, highlighting the growing importance of medical services.

In regard to medium-skilled jobs, a decline is apparent, for example, among administrative staff and workers in the printing, textiles and metallurgy sectors. In addition, while the number of specialist secretaries (classified as highly-skilled jobs) is increasing, the opposite applies to typists (an operational function and therefore classified as medium-skilled). In many cases, these are jobs consisting mainly of routine tasks which are fairly easy to automate or which can be readily relocated to foreign countries where labour is cheaper. This chimes with the theory of routine-biased technological change as a factor accounting for the evident polarisation (see, for example, Goos *et al.*, 2014).

In the case of low-skilled jobs, there has been a rise in the number of domestic helpers and cleaners. In Belgium, that can be attributed to the jobs created via the service voucher scheme. However, an increase is also apparent elsewhere in the EU. These are jobs which, logically, are

TABLE 2 EMPLOYMENT DURING THE PERIOD 2000-2013: JOBS GREATLY AFFECTED

Highly-skilled jobs. Increases in, for example:

- IT specialists
- Engineers, architects
- Senior nursing staff and midwives
- Accountants and financial specialists
- Specialist secretaries

Medium-skilled jobs. Decreases in, for example:

- Typists
- Administrative staff
- Skilled trades in metallurgy and the textiles industry
- Printing trades

Low-skilled jobs. Increase in, for example:

- Domestic helpers

Source: EC (LFS).

(1) However, this analysis is hampered by the switch in 2011 to the new "ISCO-08" nomenclature (see annex). The LFS data are insufficiently detailed to check the changes in all jobs over time. That is why only the main trends are mentioned, which are generally evident both in Belgium and on average in the EU15.

more difficult if not impossible to automate or to outsource to other countries.

However, the general picture of employment polarisation does not apply to all occupations within the three job levels. For example, the number of hairdressers and beauticians is not declining, in contrast to other medium-skilled jobs. Like activities such as domestic help and cleaning (low-skilled jobs), these are personal services involving an interaction between the service provider and the customer. The polarisation seen is therefore not grounds for concluding that all medium-skilled jobs are under threat or that all low-skilled jobs will be spared. The exact range of tasks inherent in the various occupations varies considerably, so that globalisation or technological progress will affect these jobs to different degrees.

Another point is that the changes in demand for specific occupations are having some impact on the composition of employment according to other criteria, such as sex, age, level of education or even origin. In practice, some jobs are done mainly by people presenting a particular profile. For instance, there are traditionally “female occupations” and “jobs for young people”, or highly-skilled jobs reserved almost exclusively for graduates. The breakdown of employment according to these criteria is therefore determined to some extent by the available labour supply. Since this article focuses on demand for labour, that analysis is beyond the scope of the subject studied.

2.4 Links between globalisation, technological progress and polarisation

The polarisation of demand for labour evident in most European countries seems to indicate that forces are at work on a large scale. An econometric analysis was conducted to test that assumption and establish whether the polarisation is linked to globalisation and technological progress. Compared to previous studies on polarisation (see, for instance, Goos *et al.*, 2014, Michaels *et al.*, 2014, and van den Berge and ter Weel, 2015), the originality of the regressions presented here is that they incorporate, alongside the traditional export and import data, new indicators of globalisation, namely measures of the length of global production chains and the position within those chains.

In practice, the analysis was based on the annual data for the period 2000-2010 of a division into ten market branches of activity for the nine EU15 countries available in EU KLEMS⁽¹⁾. The shares of the three job levels in total

TABLE 3 CHARACTERISTICS OF THE BRANCHES OF ACTIVITY AND SHARE OF JOB LEVELS⁽¹⁾

	Highly-skilled jobs	Medium-skilled jobs	Low-skilled jobs ⁽²⁾
Length of the production chains	0.030 *** (0.005)	-0.048 *** (0.000)	0.017 ***
Relative position in the production chains	0.324 ** (0.015)	-0.655 *** (0.000)	0.331 ***
Imports	-0.127 (0.234)	-0.157 (0.164)	0.284 ***
Exports	0.108 ** (0.009)	-0.096 ** (0.027)	-0.012
High-tech capital	0.019 *** (0.000)	-0.024 *** (0.000)	0.004
Fixed effect branch/country	yes	yes	
Observations	920	920	
R ²	0.95	0.94	

Source: NBB calculations based on EC data (LFS), EU KLEMS and WIOD.

- (1) Coefficients estimated by SURE regression. The p-values are indicated in brackets. *** means significant at the 1% threshold, ** significant at the 5% threshold, and * significant at the 10% threshold. Each job level is expressed as a share of the total. The length of the production chains, in the data ranging between 1.9 and 5.6, measures the average number of branches of activity successively involved in the chains in which the branch of activity participates. The relative position indicates whether a branch of activity tends to specialise in the initial phases of production (value close to 0) or in the final phases (value close to 1). Direct imports and exports are expressed in shares of output. The volume of high-tech capital is expressed as an index 2005 = 1.
- (2) Since the sum of the shares of the various categories is equal to 1, the coefficient of this category is equal to the inverse of the sum of the coefficients of the other two categories. The significance test concerns the sum of the other two coefficients.

employment in each market branch⁽²⁾ were compared with various indicators relating to ICT and the globalisation of production chains. In regard to ICT, the analysis included a measure of the volume growth of high-tech capital. This variable, obtained from the EU KLEMS database, shows developments concerning computer hardware, telecommunications equipment, and software. Various indicators relating to globalisation were also included. The measures of the length of production chains and relative position within those chains, based on Antràs *et al.* (2012), proposed by Dhyne and Duprez (2015), and calculated on the basis of the WIOD data, present a picture for each branch of activity. The length of the production chains gives the average number of branches

- (1) See O'Mahony and Timmer (2009) for details concerning the EU KLEMS data. The countries are: Germany, Austria, Belgium, Spain, France, Italy, Finland, the Netherlands and the United Kingdom. The branches of activity are: agriculture, mining and quarrying, manufacturing industry, electricity, gas and water supply, construction, trade, transport; hotels and restaurants, real estate and business services, financial activities.
- (2) Although they are not reported here, the regression results are fairly similar if the analysis is conducted for the economy as a whole, i.e. with the addition of the following four branches of activity: public administration, education, health and social work, and other service activities.

of activity successively involved in the production chains in which each branch participates⁽³⁾. The relative position within the production chains indicates whether a branch of activity tends to specialise in the initial phases of production (value close to 0) or, conversely, in the final segment that delivers the final product (value close to 1). To take account of the degree of internationalisation of the branches of activity, direct imports and exports – expressed as the share of their total output – are also included. Finally, the regressions included a fixed effect for each branch of activity in each country. Those fixed effects neutralise the specific characteristics of each branch of activity in each country.

It should be noted that, since the sum of the shares of the three job levels must always be equal to 100, any changes in those shares must always cancel one another out. Therefore, if the regressions have been carried out for two job levels, the coefficients of the third can be calculated automatically. The share of low-skilled jobs was chosen arbitrarily as the residual variable. Its share therefore moves in the opposite direction to the total changes in the other two categories.

Although the regressions cannot tell us anything about the causality of the mutual relationships, they do offer an indication of the complementarity between the reorganisation of global production and the change in the shares of the various job levels. As indicated in table 3, which presents the overall results, a lengthening of the production chains is accompanied by an increase in the shares of highly-skilled and low-skilled jobs and a decline in the share of medium-skilled jobs. This three-fold relationship confirms the link between globalisation and the polarisation of demand for labour. That polarisation is more pronounced the closer the branch of activity to the final consumer. The polarisation of labour is therefore associated with the fragmentation of value chains and a position at a later stage of production. Furthermore, an increase in imports coincides with a rise in the share of low-skilled jobs. Similarly, an increase in exports and high-tech capital is accompanied by growth in the share of highly-skilled jobs to the detriment of medium-skilled jobs. Internationalisation and high-tech capital therefore seem to complement highly-skilled and low-skilled occupations, whereas they replace medium-skilled jobs.

Apart from the variables taken into account, other factors may also be at work. An examination of the correlation between the residuals shows that a shock having a

positive impact on the share of a particular job level always has a negative impact on both the other shares. That is not really surprising since the share of a job level can only increase at the expense of at least one of the other two shares. It is nevertheless interesting that the negative impact is greater for the medium-skilled jobs. Technically, by conducting the regressions simultaneously, it was possible to compare the residuals two by two. In the case of the regression for medium-skilled jobs, the correlation of the residuals is -0.85 with those of highly-skilled jobs and -0.36 with those of low-skilled jobs. For comparison, the correlation of the residuals between highly-skilled and low-skilled jobs is only -0.19 . This means that, apart from the indicators relating to ICT and globalisation included in the regressions, other variables seem to accentuate the polarisation of demand for labour.

Conclusion

In recent decades, the economy has undergone radical changes at global level. In all sectors, technological progress has revolutionised creation, production and distribution methods and altered relationships with consumers. It has also helped to open up production chains and contributed to the growth of the emerging economies. Backed by a high investment rate, some Asian countries have assumed their place in market production and have gradually become the world's biggest manufacturers. Those countries have therefore gained market shares in the market production chains of the advanced countries, including those in Belgium. This progress has benefited the remuneration of capital in the emerging countries and, to a lesser extent, that of highly qualified workers, but has not increased the remuneration of low-qualified workers.

The European labour market has also experienced fundamental change. Against the backdrop of de-industrialisation and a rising number of jobs in market and non-market services, demand for labour has radically changed. The level of education of the workforce is not the best approach to assessing that change. Breaking down employment according to job level, offering an idea of the job content, is a better way of conducting that analysis.

In Belgium as in other EU15 countries, medium-skilled jobs have been under pressure, mainly in favour of highly-skilled occupations, while demand for low-skilled jobs has been fairly stable. During the period 2000-2013, the share of medium-skilled jobs declined by 3.3 percentage points in Belgium and 6 percentage points on average in the EU15. Conversely, the share of highly-skilled jobs increased by 3.9 and 5.4 percentage points respectively.

(1) Intra-branch trade is taken into account. In that respect, the length indicates the average number of firms successively involved in the production chains.

We can therefore say that demand for labour has polarised. This structural trend, which was already evident before the crisis, is widespread in all the main branches of activity.

The econometric analysis conducted for this article shows that all these developments are linked. The polarisation of demand for labour in the market branches has been accompanied by a fragmentation of production chains and growth of high-tech capital. These radical changes have been to the detriment of medium-skilled jobs such as typists, administrative staff and those in metallurgy, textiles and printing trades. It is the most repetitive jobs that have been hardest hit, some having become obsolete while others belong to production segments which have been relocated to emerging countries. Conversely, low-skilled jobs have been less affected, particularly if they are non-routine and involve interaction between the service provider and the customer, such as domestic services. Highly-skilled jobs, notably those closely linked to information and communication technology, such as IT specialists, engineers, specialist secretaries, etc. have likewise seen an increase in demand. Jobs within each category have not all been affected in the same way, since the impact depends on the exact range of tasks inherent in the various occupations. There have been wide divergences in the changes affecting each specific job, and that will doubtless continue to be the case in the future.

However, the rise of the East Asian economies and technological progress are not the sole determinants of demand for labour. Other factors may influence the polarisation of employment. For instance, labour market institutions play a role. In that connection, an active labour market policy and fiscal/parafiscal measures support low-skilled employment. Measures such as Belgium's service vouchers are a good example. In addition, greater prosperity, the feminisation of the labour supply, and population ageing can contribute to growing demand for personal or health services. That also favours the interactive or non-routine occupations.

Finally, it is worth pointing out that the available data used for our analysis do not tell us anything about the impact of the recent developments on demand for labour. It seems that the fragmentation of the production chains has ceased since 2010 (see Al-Haschimi *et al.*, 2015 and Dhyne and Duprez, 2015). The latest data also indicate that investment is slowing down in the emerging economies, particularly in China. Conversely, there is nothing to indicate that technological progress is losing momentum (see OECD, 2015). Firms will therefore need to continue adjusting to a constantly changing world. While technological progress and globalisation present a major challenge, they also open up immense prospects in terms of economic development and employment, especially for firms which assume their full role in the value creation chains and exploit potential demand, including that in the emerging countries.

Annex

Statistics on employment by level of education and job level

The labour market data used in this article were derived mainly from the labour force survey (LFS). That survey is harmonised at European level by Eurostat and therefore provides mutually comparable results for the various countries. Those results are broken down according to various criteria. The groups of variables used in this article are not always available on the Eurostat website, so that microdata made available by Eurostat were used; those microdata currently relate to a period up to and including 2013.

The LFS breakdown according to **level of education** is based on the ISCED classification (International Standard Classification of Education), drawn up by UNESCO. That classification permits an international comparison. Since 1998, the "ISCED 97" classification has been used. In this – highly-detailed – classification, it is usual to distinguish between three main groups:

- *low-qualified* persons are those who have not gained a certificate of secondary education,
- *medium-qualified persons* are those who have gained a certificate of secondary education but no higher education diploma,
- *highly-qualified persons* are those with a higher education diploma.

The breakdown of employment by **job level** is based on the ISCO classification (International Standard Classification of Occupations) drawn up by the ILO (International Labour Office). This classification can also be used to produce internationally comparable statistics. Up to and including 2010, the LFS used the "ISCO 88" version; the version used since 2011, known as "ISCO 08", has undergone major changes. Conversion between the two versions is only possible at a highly-detailed level (namely at the 5-digit level), whereas the relevant LFS data are only available at the 3-digit level, hampering comparisons over time at the detailed level. However, by analogy with the sub-divisions according to the level of education, this article has generally used a breakdown which distinguishes between three main groups for which the ILO has produced a conversion table, and which can therefore be followed over time.

By way of illustration, the "ISCO 08" classification at the 2-digit level is given below (source: DGS).

Highly-skilled jobs (ILO skill levels 3 and 4) include:

- 11 Chief executives, senior officials and legislators
- 12 Administrative and commercial managers
- 13 Production and specialised services managers
- 14 Hospitality, retail and other services managers
- 21 Science and engineering professionals
- 22 Health professionals
- 23 Teaching professionals
- 24 Business and administration professionals
- 25 Information and communications technology professionals
- 26 Legal, social and cultural professionals
- 31 Science and engineering associate professionals
- 32 Health associate professionals
- 33 Business and administration associate professionals
- 34 Legal, social, cultural and related associate professionals
- 35 Information and communications technicians

Medium-skilled jobs (skill level 2) include:

- 41 General and keyboard clerks
- 42 Customer services clerks
- 43 Numerical and material recording clerks
- 44 Other clerical support workers
- 51 Personal service workers
- 52 Sales workers
- 53 Personal care workers
- 54 Protective services workers
- 61 Market-oriented skilled agricultural workers
- 62 Market-oriented skilled forestry, fishery and hunting workers
- 63 Subsistence farmers, fishers, hunters and gatherers
- 71 Building and related trades workers, excluding electricians
- 72 Metal, machinery and related trades workers
- 73 Handicraft and printing workers
- 74 Electrical and electronic trades workers
- 75 Food processing, wood working, garment and other craft and related trades workers
- 81 Stationary plant and machine operators
- 82 Assemblers
- 83 Drivers and mobile plant operators

Low-skilled jobs (skill level 1) include:

- 91 Cleaners and helpers
- 92 Agricultural, forestry and fishery labourers
- 93 Labourers in mining, construction, manufacturing and transport
- 94 Food preparation assistants
- 95 Street and related sales and service workers
- 96 Refuse workers and other elementary workers

Armed forces occupations (group 0) were disregarded.

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