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EMPLOYMENT RESEARCH



## Mid-term skills supply and demand forecast

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# Overview of 2015/16 Projections

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## **Preface and Acknowledgements**

This report summarises the latest results from the Cedefop *Skillsnet* project on Forecasting skill supply and demand in Europe to 2030. This is part of an ongoing *Framework Agreement* which extends over 4 years. This report documents work carried out in Years 3 and 4 (2015/16).

The researchers are grateful to Cedefop for this financial support. The Framework Agreement relates to open invitation to tender No: AO/RPA/AZU-VKVET/skill-forecast/003/12).

The results are the outcome of a team effort. The author is grateful to all of the team, especially Terry Ward and Robert Stehrer of Alphametrics and the Country Group Experts for their contributions. Thanks are also due to the various experts from individual countries who have taken time to review and comment on the emerging findings.

Finally, thanks are due to Peter Millar and Luke Bosworth who undertook much of the technical analysis required to process the European LFS data, and the linking of this with the results from the macroeconomic model.

Rob Wilson (Project team leader)

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## **Glossary**

AM - Alphametrics  
CE - Cambridge Econometrics  
CGEM - Computable General Equilibrium Model  
CGEs - Country Group Experts  
CM - Computable model  
DTI - Danish Technological Institute  
EPC - Education Policy Centre  
ERC - Economix Research & Consulting, Munich  
FGB - Fondazione Giacomo Brodolini, Roma  
ICEs - Individual Country Experts  
IER - Institute for Employment Research  
IHS - Institute for Advanced Studies, Vienna  
NTF - National Training Foundation, Prague  
ROA - Research Centre for Education and the Labour Market, Maastricht  
VA - Visionary Analytics, Vilnius  
VA – Value Added (projects)  
3S -  
GFC Global Financial Crisis  
ROA Research Centre for Education and the Labour Market, Maastricht  
E3ME Multi-sectoral macroeconomic model  
EDMOD Model to produce occupational projections  
RDMOD Model to produce projections of replacement demands  
QUALMOD model to produce qualification projections

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## Executive Summary

### *Methodological and related developments*

This document presents a summary of the latest projections of skill supply and demand in Europe up to 2030. Skills are measured by occupation and by qualification. The projections present a consistent picture of likely trends across the whole of Europe, providing results for all member states plus Norway, Switzerland and Iceland.<sup>1</sup>

They build upon improved data, and are based on updated and improved models and systems. A key innovation has been the shift to using the latest ISCO08 classification for occupations and in particular developing and presenting a full set of results at the 2-digit level.

The projections are based on revised demographic and macroeconomic scenarios, which take into account the latest available information from Eurostat and DG ECFIN. The E3ME multi-sectoral macroeconomic model has been used to produce new projections by industry and for the economically active labour force.

E3ME and all the other modules have been updated to make use of NACE revision 2 data, as well as the new ISCO08 information on occupational employment from the European LFS. Other data and all models have been updated and recalibrated.

The current set of projections has been updated in line with Europop 2013, the short-term economic projections have also been updated to match the latest data available in the AMECO database and the long-run economic projections have been updated to match the Aging Population Report 2015 GDP growth assumptions, which are in line with the Europop 2013 projections.

The skills supply projections are now produced using the stock-flow approach where possible.<sup>2</sup> Despite all these changes the results presented here suggest a very similar story to that developed in earlier projections.

The projection period has also been extended up to 2030, although the reporting here focuses on the period up to 2015.

### *Key results*

*Labour supply:* The European labour force is expected to continue to expand, although the rate of growth will slow towards 2020. Then it will stabilise, although a slight decline is expected beyond 2025. This path is explained by an increase in the size of the oldest cohorts and a decrease in the youngest age groups in the population. The increase in labour supply is caused by gradually increasing rates of participation for many groups, particularly among older workers. However, the slowing rate of growth is driven by demographic trends, in particular an ageing population that puts more individuals beyond traditional retirement ages. This results in the overall rate of labour market participation declining slightly. In this context, it

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<sup>1</sup> Some indicative results are also produced for Turkey and the Former Yugoslavian Republic of Macedonia (FYROM)).

<sup>2</sup> Due to data limitations this has not been possible for Croatia, Malta, Switzerland, FYROM and Turkey.

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can be expected that changes in the legislation which is currently in force will happen in order to discourage trends towards earlier retirement. In some countries (most notably Germany) the demographic decline is much more pronounced and the overall size of the labour force is projected to decline.

*Employment:* The projections of employment take the expected developments in labour supply into account, as well as the continuing slow recovery from recession. European employment levels are projected to rise from 2013 onwards. This is dependent on economic and political developments. For the E31 countries, it is expected that employment will exhibit an average 0.2% increase per annum over the forecast period. This is expected to become increasingly constricted by the available labour force from which to draw workers in a number of countries (notably in Germany)..

*Unemployment:* Unemployment is expected to decline through time in many countries, most notably Germany, Austria and Switzerland, and Scandinavia. However, in a number of countries the unemployment rate is projected to remain above pre-crisis levels; this point is particularly relevant in the case of Southern Europe where labour markets have been hardest hit by the economic crisis. The rates of change vary quite substantially between the different European countries, with southern Europe having the most persistently high unemployment rates. For Europe as a whole unemployment rates are projected to have returned to their 2008 levels by 2030.

*Macroeconomic uncertainties:* The rate of recovery from the 2011 European sovereign debt crisis is still an important source of uncertainty for the current set of projections. In particular, there is considerable uncertainty in terms of development of countries which high unemployment rates in the near future. The potential impacts of such macroeconomic uncertainties on the labour market projections will be reported in sensitivity analyses to be completed after the November workshop. Other outstanding questions remain whether austerity policies can eventually restore Eurozone stability and the longer term impacts of international migratory movements.

*Sectoral change:* The current set of projections captures a transition of the European economy towards a new model where the service sector will be the main economic driver. This trend was already evident in previous projections. In contrast, a strong decline in the primary sector and manufacturing is expected. Significant further structural change is projected especially for transition countries. The changing sectoral employment structures will reinforce (skill biased) technological change and trends towards increasing globalisation. The latter are expected to continue to have significant impacts on sectoral employment structure (and therefore on the demands for different types of skills). The projections show a relentless shift from primary and manufacturing activities towards knowledge based and other consumer services.

*Skill Supply:* The supply of people with formal qualifications is also projected to continue to rise. Substantial increases in the numbers qualified at intermediate and high levels are projected over the medium term as individuals and governments attempt to meet the uncertainty caused by the changes identified above by investing in skills. Although the slow recovery from recession and continuing uncertainty about future job prospects may cause some to question whether investing in education remains a good idea, most young people have few alternatives.



*Skill demands:* The analysis suggests that structural change at the sectoral level will be reinforced by changes within sectors which affect the way goods and services are produced and delivered (notably the effects of skill biased technological change). These will combine to produce a general increase in the demand for skills (as measured by both occupation and qualification) over the medium to longer term. This will have important implications for continuing indications of some polarization in the jobs available, with significant growth in employment in some less skilled areas especially in the service sector. These jobs are often poorly paid with negative implications for issues of exclusion and job quality.

These changing patterns of demand are common across most countries. They are driven by similar factors: demography; globalisation; international competition and technological change: Together these drivers are leading significant shifts in employment from primary and manufacturing towards services. Technological change and related factors are also driving changing occupational and qualification patterns within industries in similar directions in most countries. There are some notable differences between different parts of Europe, depending upon the stage of economic development, and different industrial structures, but there is an ongoing process of convergence, as newer member states are expected to converge towards output and productivity paths of older Member States.

*Replacement needs:* The importance of replacement demands is also emphasised. As older workers retire from the economically active workforce they will need to be replaced. Even in areas where employment levels are projected to decline quite rapidly, this results in substantial numbers of projected job openings. Recruitment into such areas (industries and occupations) will remain particularly problematic. This is especially of concern in some areas of manufacturing and related activities which may be the engines of future growth.

*Imbalances and mismatches:* The results again highlight tensions between demand and supply trends. Some well-qualified individuals may need to take up jobs that have typically not required such high formal qualifications in the past. There is likely to be a need for policy interventions to stimulate the growth in demand for high skill jobs, and to maximise the utilization of individual's skills.

The historical patterns of employment by qualification reflect the growth in supply of people who have acquired formal qualifications. This will also be a feature of the future. The projected numbers make a distinction between constrained and unconstrained estimates of demand. The constrained estimates are based on allocating the projected numbers of those economically active and in employment to the jobs projected to be available. This assumes that the better qualified will continue to have lower probabilities of unemployment than those less well qualified.

## 1. Introduction

### *Background and Objectives*

This document presents the latest set of detailed labour market projections produced as part of the Cedefop *Skillsnet* project on *Mid-term skills supply and demand forecast*. It provides detailed and consistent projections of skill supply and demand across Europe. These include a revised macro and sectoral assessment and updated demographic projections based on the latest Cambridge Econometrics analysis using their E3ME macroeconomic model, and use of the latest data from the Eurostat Labour Force Survey (ELFS). The latter has been used to build a stock-flow model for generating the skills supply projections and models of demand, focussed around the new ISCO08 method of classifying occupations.

For ease of comparison, the layout of the document takes a very similar form to previous reports. However, it is important to note that the occupational results are no longer directly comparable with older results based on use of the old ISCO88 categories. While these may look similar to the new ones there are many significant differences, as explained in detail in Stehrer *et al.* (2015). The present document provides a summary and overview of all the main results.<sup>3</sup> It is supported by a series of technical papers which provide further details of data sources, methods and assumptions.<sup>4</sup>

The results draw upon the most up to date information available, including new and improved data generated in the present project as described in the other technical papers. Based on these data, updated models and systems have been used to assess the prospects for the coming decade, taking into account all the latest available information. These update the earlier projections using ISCO08 occupations produced in 2013.<sup>5</sup> This set of baseline projections incorporates the latest population projections from Eurostat as well as the latest short-term macro projections produced by DG ECFIN. Together these capture the pattern of recovery from the recession.

The overall aim of the project is to build upon, and further develop, the system for producing regular, detailed and consistent projections of skill demand and supply for the whole of Europe. It is part of broader *Framework Programme* described in **Box 1**. **Box 2** summarises the rationale for this type of work. In brief, it provides a pan-European perspective, presenting a consistent overview across all member countries of the European Union (EU) plus some others countries. The work uses common data sets (especially the ELFS data) and common methods, models and assumptions. It is not intended to be a substitute for national projections but to complement them. It provides a consistent context within which the more detailed national analyses can be compared.

### *Responding to comments from national experts*

As in previous years, the input from the national experts is a key part of the process for making the projections. The feedback allows the projections to include a detailed knowledge of national factors that may be missing from the historical data or baseline economic projections.

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<sup>3</sup> The work has been undertaken by a large consortium led by the Warwick Institute for Employment Research. The core team members also include Alphametrics (AM), Cambridge Econometrics (CE) Economix Research & Consulting, Munich (ERC) and the Research Centre for Education and the Labour Market, Maastricht (ROA).

<sup>4</sup> See especially Stehrer and Ward (2015), Künn-Nelen and Sijbers (2015), Wilson *et al.* (2015a), Kriechel (2015) and Wilson *et al.* (2015b).

<sup>5</sup> Wilson *et al.* (2013).

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In 2013 a new set of country experts was appointed by Cedefop to help with this process and revised procedures for obtaining feedback have been developed. Draft baseline projections were circulated for comment in the early summer and the results have been adjusted to take into account the comments of the national experts. The current (2<sup>nd</sup>) round of results is being circulated for comment at the November Skillsnet Workshop.

The current results have benefitted from scrutiny by, and comments from, a large number of individual country experts (ICEs) who are members of *Skillsnet*.<sup>6</sup> These have been facilitated and coordinated by four “country group experts”. (CGEs) Detailed feedback has been received following extensive email exchanges between the team and the ICEs and CGEs.<sup>7</sup> The authors are grateful to all these experts for taking the time to examine and comment on the detailed results. Further discussion of the results will take place at the *Skillsnet* workshop to be held in Thessaloniki in November 2015, and in subsequent further exchanges.

By presenting such results for expert scrutiny, at expert workshops, and other events it is hoped to improve the quality of the results, as well as the overall approach to anticipating changing skill needs at a pan-European level.

The exact procedure depends on the nature of these comments, which are often quite varied. Wilson *et al.* (2013) describe in some detail how the team have responded to the various comments received in general terms. These include detailed feedback on the labour supply and sectoral employment projections as well as more detailed comments on the occupational and qualification projections. In many cases these comments related to inadequacies of the historical data. Where possible (and relevant) amendments have been incorporated into the revised results.

### *General approach*

**Boxes 3-6** explain briefly how the projections have been produced. Further details are also given in Wilson *et al.* (2013), Kriechel (2015) and Wilson (2013). Together these provide a detailed explanation of the methodology, data sources and methods.

A key innovation in 2013 was the switch to the new ISCO08 system for classifying occupations. It is clear from the analysis conducted by Stehrer *et al.* (2015) that the new classification is still being bedded in. At present it is therefore difficult to discern trends in occupational structure from discontinuities caused by the move to the new classification system. Details of how the database has been developed are given in Stehrer *et al.* (2013 and 2015).

Section 2 sets out the main findings, highlighting the key messages for policy makers and others. In addition to the summary results reported here, a set of Excel workbooks has been produced containing the detailed data for each country. These are available to *Skillsnet* members on request (for further details see Wilson (2013). The detailed results will also be made available via the new Cedefop *Skillswatch* website once they are finalised.<sup>8</sup> (Cedefop to check and update link). They represent the most comprehensive and consistent set of skill demand and supply projections available for the whole of Europe.

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<sup>6</sup> *Skillsnet* is a network of people from across Europe with an interest in skill demand and supply, organised by Cedefop. For details see: <http://www.cedefop.europa.eu/EN/about-cedefop/networks/skillsnet/index.aspx>

<sup>7</sup> The Country Group Experts are Emilio Colombo, Simonas Gausas, Tim Grebe and Vilius Stanciauskas.

<sup>8</sup> Cedefop *Skillswatch* website: <http://www.cedefop.europa.eu/EN/about-cedefop/projects/forecasting-skill-demand-and-supply/skills-forecasts.aspx>

**Box 1: The Cedefop *Framework Programme* on Anticipating Skill Needs**

The Programme is designed to build capacity and improve the capability to anticipate changing skill needs across Europe. It aims to improve understanding of the main drivers of change. The need to improve Labour Market Information and Intelligence (LMII) at a detailed level to guide decision making is crucial. This can help to identify possible new jobs for Europe, as well as highlighting those under threat from structural change.

A multifaceted approach is used, involving both quantitative and qualitative approaches, especially when developing scenarios. However the main focus is on the development of quantitative projections, based on econometric analysis, using well established models and techniques.

Such quantitative projections should not be seen as deterministic nor prescriptive. Structural changes, and their implications for changing skill needs, cannot be mechanistically predicted. Neither qualitative scenarios nor quantitative projections should be seen as precise predictions. They are more about preparation for what might come. The programme is intended to help to move Europe towards a world class infrastructure for anticipation of changing skill needs, building on existing strengths, networks and capacity by:

- Identifying and helping to fill gaps, and deal with problems, in basic data;
- Improving model building and technical capability;
- Developing capacity and capability across Europe;
- Strengthening and developing networks;
- Improving strategic thinking and policy making relating to skills at a European level.

The general objective is to develop a robust system for producing medium-term forecasts of skill needs (demand and supply), at a pan-European level, based initially on readily available, comparative data, and then to carry out and disseminate such forecasts on a regular basis.

There are some very real concerns about data quality. The existing Eurostat data remain weak in some areas, especially on detailed trends in skill demand within sectors and some other aspects of skill, as well as lack of consistency both over time and across countries. The project has helped to identify where the main problems are, and begin to develop a more consistent and robust database.

Additional related research activities included in the first year's programme have included: the development and application of approaches to understanding the interaction between demand for and supply of skills, and to improve understanding of the nature of skills imbalances and mismatches; exploration of links between technology, performance and skills; and implications for aspects of skills other than occupation and qualifications.

Extensive previous reviews (see for example Wilson *et al.* (2004), confirm that best practice in quantitative skills forecasting demands a multi-sectoral macro model. The demand for labour is derived from the demand for goods and services, and so to understand the changing demand for skills a model of the changing demands for good and services is needed. Similarly the supply of skills needs to be seen in the broader context of demographic and socio-economic change that a macroeconomic model can provide. The *Conceptual Framework* developed for this project provides such a foundation. This is described in detail in Wilson *et al.* (2015). The latter includes a detailed description of the macroeconomic model E3ME.

The *Conceptual Framework* developed here, based around the E3ME macroeconomic model, provides a sound foundation, but there is a long way to go compared to best practice elsewhere in the world. The aim is to exploit the existing modular structure of the *Conceptual Framework*, and to make changes in such a manner that can be applied consistently at a pan-European level.

### **Box 2: Rationale for skills forecasting**

The rationale for forecasting the demand for and supply of skills is now well established and is written into various policy statements such as Council resolution on *News Skills for New Jobs*, and the revised integrated guidelines for employment for 2008-10). Such projections, it is argued, can help inform active labour market policies to retrain the unemployed or reintegrate individuals who are economically inactive, as well as improving the information available to guide the decision of those making investments in human capital.

The rationale for producing regular and detailed qualitative projections includes:

- filling existing information deficits and preventing future labour market imbalances;
- informing various actors on future labour market needs, as an aid to their choices and decision-making in this arena;
- supporting policy-making at national and European level in the field of employment and social protection, lifelong learning, guidance and counselling and migration;
- answering key questions:
  - in which sectors will employment be growing?
  - which occupations will be in demand?
  - for which qualifications will demand increase or decrease?
  - what about replacement needs?
  - how will this compare with supply?

It is important to emphasise the significance of such projections in informing individuals and helping to make labour markets function better. This is becoming increasingly important given the rising levels of migration flows between countries. Labour mobility between European countries is, if anything, likely to increase further. International labour mobility can help resolve labour market bottlenecks and deal with surpluses. Information on future skill needs in Europe can help, therefore, orientate and guide individuals about future developments and opportunities.

Of course it is not possible to predict the future precisely, but the need to make strategic plans and choices which can influence and shape the future path taken by the economy and labour market is widely accepted. Such plans need to be guided by robust labour market information and intelligence (LMII), including a forward looking element. This needs to be based on regular, systematic and quantitative approaches to forecasting and scenario development. Skills are a key part of the infrastructure of the economy. The choices made by policymakers, enterprises and individuals on investment in education and skills together help to determine the path the economy takes. These individual choices also need to be guided by good LMII.

A range of approaches to assessing future skill needs is required. These need to encompass both quantitative and qualitative methods and serve a range of audiences. The latter also includes: education and training providers, other stakeholders, social partners, sectoral organisations, practitioners and analysts. The results are aimed at all these audiences, across all the countries of the EU (plus some associated members).

It is important to recognise what such forecasts can and cannot do. They can help to inform labour market participants and help labour markets work better. They cannot provide precise implications to guide investment decisions, (mechanistic “manpower” planning).

### **Box 3: General methodological approach**

The project focuses upon skills as measured by occupations and qualifications, using comparable data available across all countries. A general conceptual framework and modular approach has been developed. The method has involved encouraging systematic dialogue and discussion with individual country experts.

The demand side (skill needs) focuses upon employment (jobs). The supply side focuses on available skills – the numbers of people economically active and, in particular, the qualifications they hold. By comparing the two it is possible to infer something about possible imbalances. In reality, of course both employment and the economically active labour force are the results of both demand and supply factors. However, this is a useful heuristic device that is widely used in most national discussion of these issues.

The methods used to produce the projections are quantitative, econometric and statistical modelling, using time series data. Boxes 4-6 below provide more detail on the treatment of skills supply demand and mismatches and imbalances. Wilson (2013) provides a brief overview of the main elements of the macroeconomic model used and how these links in to the other elements. A modular approach is used. The advantages of this approach are that it aids independent development and improvement of the different parts of the system.

The project has involved the development of consistent databases and related tools in order to produce a comprehensive and consistent set of skill projections for all countries in the EU (plus Norway and Switzerland). It adopts common data, methods and models for all countries. The database draws primarily on Eurostat sources, including: demographic data, national accounts (NA), and the LFS.

Together the demand and supply databases, and the related models and modules, constitute a conceptual framework for analysis of future developments in skills demand and supply across Europe. Full details of the methodology are given in various technical reports that have been produced as part of the project. These are documented in Wilson *et al.* (2015).

Such pan-European projections are not intended to be a substitute for what is already being done nationally, but rather to complement them. They provide a broad and consistent overview for the whole of Europe. They provide a consistent context within which the more detailed national analyses can be compared.

The use of common models and assumptions does not always allow incorporation of local data and knowledge about detailed policy and other factors that may affect skills supply and demand. They should be supplemented by other country specific and qualitative information before reaching firm conclusions. They should be seen as just one of a number of important building blocks in developing a consistent pan-European view of current and possible future developments in this area.

The results provide an important contribution to the debate about the changing pattern of skills demand and supply in Europe. In principle, the projections of future supply allow a comparison with likely future demands. In practice, such comparisons are fraught with difficulty. The report explores some of these issues and draws out some implications of the results for the balances of the demand for and supply of skills over the longer term.

## 2. Baseline Macroeconomic Projections

### 2.1 Introduction

This section presents the new baseline projections that have been produced. The section follows the same structure as the corresponding section in the 2013 report.<sup>9</sup> Results for Turkey and FYROM are on a provisional basis and are therefore presented only in Appendix A, with the exception of Figures 2.2 and 2.5 which also report results for these two economies.

This set of baseline projections has been updated in line with Europop 2013. The short-term economic projections have also been updated to match DG Ecfín's AMECO database, published on 5th of May 2015. The long-run economic projections have been updated to match the Aging Population Report 2015<sup>10</sup> GDP growth assumptions, which are in line with the Europop 2013 projections. The overall methodology used including the exogenous inputs to the model are described in more detail in the report on methodology (Wilson, *et al.* (2013)).

The new projections cover the whole of Europe, including results for some candidate countries. They have been carried out in a consistent fashion across all the 28 members of the EU (EU28) plus Iceland, Norway and Switzerland (EU28+3). Results for Turkey and the Former Yugoslavian Republic of Macedonia (FYROM) are still on a provisional basis and are therefore not included in the totals presented here. For comparability with earlier results some tables and figures just focus on the EU27 (excluding Croatia) + Norway and Switzerland (EU+27).

### 2.2 Aggregate employment

Figure 2.1 displays the evolution of the annual rate of growth of employment over the period 2000-2030. This figure reports the data included in the E3ME baseline for the EU28 plus Norway, Switzerland and Iceland (hereafter E31). A modest recovery of employment growth is forecasted in the medium term, after which employment growth is projected to stabilise at around 0.2% pa over the period 2020-2030.

Moving onto the discussion of results for individual countries, Table 2.1 presents the employment growth rates in each country over the period 2003-2030. Although the 2013 report identified an overall decrease in employment over the period 2003-13 in the case of 6 countries, the new set of projections show this phenomenon only in two economies, i.e. Hungary and Romania. In general terms, employment growth from 2013 onwards is the expected trend for all the countries with the exception of Germany, Estonia, Latvia and Romania.

Focusing on the post-crisis period, a negative effect on employment is the general trend observed in the vast majority of the countries. Employment is expected to

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<sup>9</sup> Rob Wilson, Rachel Beaven and Eva Alexandri (2013) *Overview of Updated Projections, Year 1*.

<sup>10</sup>

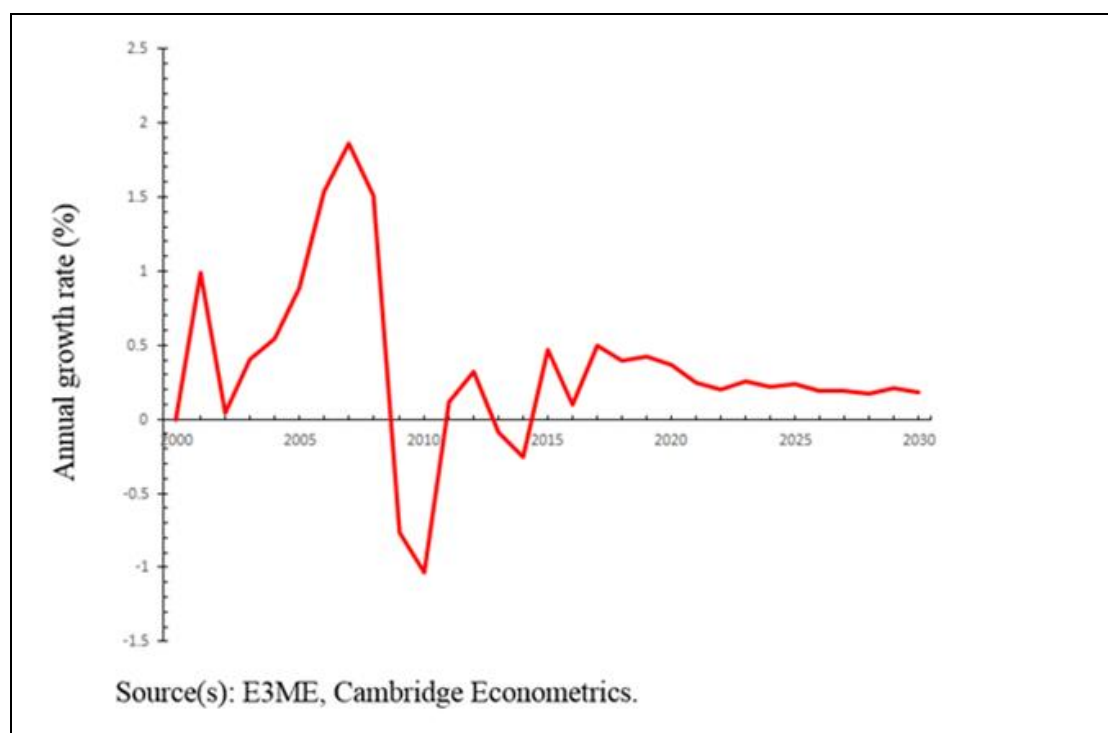
[http://ec.europa.eu/economy\\_finance/publications/european\\_economy/2014/pdf/ee8\\_en.pdf](http://ec.europa.eu/economy_finance/publications/european_economy/2014/pdf/ee8_en.pdf)

recover over the forecast period, but this growth is likely to be dampened by demographic trends and a much slower growth in labour force. In general terms, the expected growth in 2020-30 will be weaker than it was in the pre-crisis period. As advanced in previous reports, employment is expected to decline over the period 2020-30, as a result of the strong ageing process that the German population will face in the coming years. This finding needs to be interpreted in a context where rising participation rates and net migration will not be sufficient to reverse the mentioned declining trend.

Drawing attention to the historical period, the strong job destruction which took place in countries such as Greece, Ireland, Latvia, Lithuania and Spain is captured by the average rate of growth over the period 2010-2015. Falling employment until 2020 is projected also in the case of Germany, Estonia and Romania.. As reported in Table 2.1 three economies have been less affected by the economic downturn and exhibited positive employment growth in 2010-2015, i.e. Luxembourg, Malta and Switzerland.

In general terms, growth is expected to be slightly lower in 2025-30 than in the previous period, i.e. 2020-25. The current set of projections suggests that the strongest growth of employment towards the end of the period is expected to occur in Ireland, Iceland, Cyprus and Belgium; while employment in Germany, Estonia, Latvia Poland and Romania is expected to decline slightly.

**Figure 2.1: Baseline Employment, EU28 plus Norway, Switzerland and Iceland**





**Table 2.2: Baseline Employment by Country (Average Annual Growth Rate)**

<b>BASELINE EMPLOYMENT BY COUNTRY (AVERAGE ANNUAL GROWTH RATE)</b>				
	<b>2010-15</b>	<b>2015-20</b>	<b>2020-25</b>	<b>2025-30</b>
Belgium	0.5	0.8	1.0	0.8
Denmark	-0.1	0.6	0.6	0.5
Germany	0.9	-0.2	-0.2	-0.2
Greece	-4.1	0.5	0.4	0.3
Spain	-2.1	0.4	0.2	0.3
France	0.4	1.0	0.3	0.4
Ireland	0.0	1.5	1.3	1.3
Italy	-0.2	0.5	0.4	0.3
Luxembourg	2.2	1.3	0.9	0.6
Netherlands	-0.1	0.6	0.3	0.1
Austria	1.1	0.3	0.3	0.2
Portugal	-2.0	0.1	0.4	0.5
Finland	0.2	0.6	0.4	0.5
Sweden	1.1	0.5	0.6	0.5
UK	1.0	0.4	0.5	0.4
Czech Rep.	0.4	0.3	0.2	0.1
Estonia	2.3	-0.4	-0.4	-0.6
Cyprus	-2.0	1.9	1.1	1.0
Latvia	1.3	0.0	-0.3	-0.1
Lithuania	0.7	0.3	0.0	0.0
Hungary	0.3	0.0	0.2	0.4
Malta	2.4	0.1	0.1	0.1
Poland	0.1	0.4	0.0	-0.3
Slovenia	-1.2	0.2	0.0	0.0
Slovakia	0.4	0.8	0.7	0.6
Bulgaria	-1.6	0.1	-0.4	0.0
Romania	0.1	-0.2	-0.3	-0.2
Norway	1.5		0.7	0.6
Switzerland	1.6	0.3	0.4	0.2
Iceland	1.0	0.2	1.2	1.1
Croatia	1.0	0.4	0.7	0.4
EU28 + 3	0.1	0.4	0.2	0.2

Source(s): E3ME, Cambridge Econometrics.

### 2.3 Sectoral Employment

Table 2.2 reports the total average annual growth in employment across the E31 countries for ten broad sectors. These results illustrate a decline in employment in primary industries and basic manufacturing. Tertiary sectors such as business services or distribution and retail are expected to be the main drivers of employment growth over 2015-30, although the pace of growth slows down after 2020. As advanced in the previous report, the identified trends are the reflection of a transition of the European economy towards a more service-based economy.

Austerity measures implemented by European governments are expected to result in slower but, overall, positive employment growth in the public sector over 2015-30, with most of the growth attributed to employment in health services. This is the result of the ageing process that the European population is expected to face in the coming decades.

Further consideration needs to be given to the construction sector. After the intense process of adjustment which followed the crash of several European housing markets in 2008-09, positive growth in the sector can be expected after 2020. Two main reasons justify this trend: i) the cyclical recovery of the sector due to the replacement of the old stock of dwellings; and ii) the increase in construction activities to provide the required infrastructure, investment in which was deferred during the crisis.

**Table 2.2: Baseline Employment by Broad Industry (average growth rate)**

<b>BASELINE EMPLOYMENT BY BROAD INDUSTRY (AVERAGE ANNUAL GROWTH RATE)</b>			
<b>Broad industry</b>	<b>2010-15</b>	<b>2015-20</b>	<b>2020-30</b>
Primary sector & utilities	-1.8	-1.6	-1.2
Manufacturing	-1.0	-0.3	-0.4
Construction	-0.1	-0.2	0.5
Distribution & transport	0.6	0.5	0.1
Business & other services	2.0	1.1	0.8
Non-market services	1.0	0.4	0.2

Note(s): Figures are for EU28 + Norway, Switzerland and Iceland.  
Source(s): E3ME, Cambridge Econometrics.

*At the detailed level*

The average annual growth rate in the baseline projection of employment for each of the 42 sectors under consideration is reported in Table 2.3.<sup>11, 12</sup>

The analysis of the projected employment trends at sectoral level has revealed that only a few sectors are expected to grow over the period 2015-30 (highlighted in bold in Table 2.3).

The growth areas are all services sectors, except for a few parts of manufacturing such as of 'Rubber and plastics', 'Mechanical engineering' and 'Motor vehicles'. Growth is particularly notable in the case of 'Computing services', 'Professional services' and 'Other business services', which are expected to register around 1% annual rate of growth from 2020 onwards. Despite the positive growth which is expected in these sectors over the forecast period, most of them showed a sharp decline in employment in the pre-crisis period. In the case of 'Air transport' and 'Communications' this decline trend is observed since 2003. In contrast, a downward trend is projected for the vast majority of primary and basic manufacturing sectors. The mentioned decline in employment would be particularly relevant in the case of 'Coal' and 'Electrical engineering' and 'Textiles, Clothing & Leather'.

Figure 2.2 provides a graphical representation of the average rate of growth of employment over the period 2013-2030. The greater concentration of dark grey and black squares at the bottom of the figure illustrates the increasing importance of services sectors across the European economy. The greater concentration of white squares at the top of Figure 2.2 is consistent with the decline in employment in primary and basic manufacturing sectors which has been mentioned above.

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<sup>11</sup>The 42-sector classification which is used for the purpose of this report is the result of the aggregation of the 69 sectors that are currently included in the E3ME model.

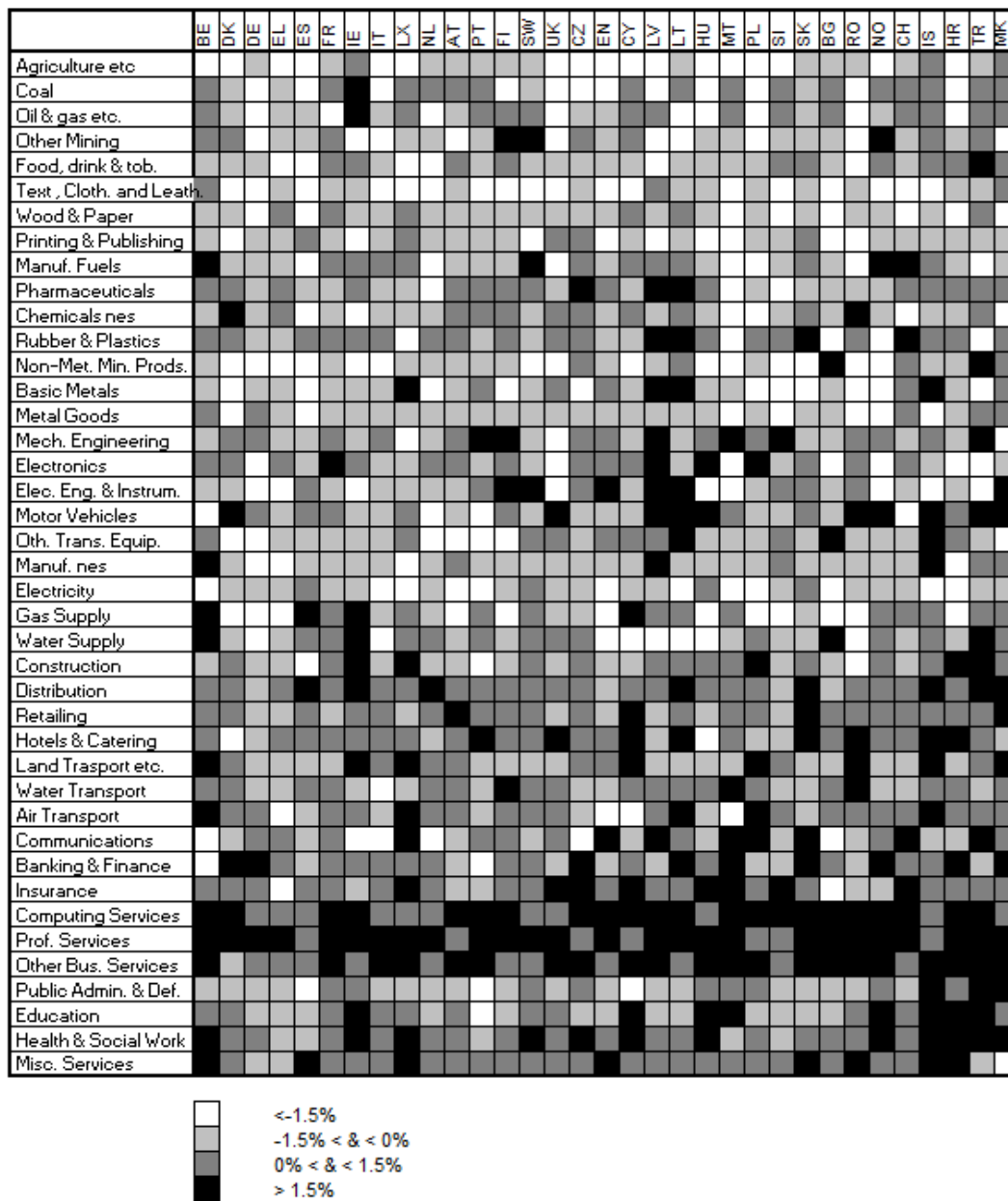
<sup>12</sup> The figures reported in Table 2.3 refers to the E31 countries.

**Table 2.3: Baseline Employment by Sector (Average Annual Growth Rate)**

<b>BASELINE EMPLOYMENT BY SECTOR (AVERAGE ANNUAL GROWTH RATE)</b>				
	<b>2010-15</b>	<b>2015-20</b>	<b>2020-25</b>	<b>2025-30</b>
Agriculture	-1.5	-1.8	-1.4	-1.2
Coal	-1.6	-2.2	-2.4	-2.1
Oil & Gas	1.4	-1.7	-1.8	-1.7
Other Mining	0.7	-1.1	-1.4	-1.4
Food, Drink & Tobacco	-0.4	-0.2	-0.2	-0.3
Textiles, Clothing & Leather	-1.4	-1.2	-1.4	-1.3
Wood & Paper	-0.5	-0.5	-0.7	-0.7
Printing & Publishing	-1.4	-0.1	-0.5	-0.7
Manufactured Fuels	-0.6	0.7	0.2	-0.1
Pharmaceuticals	0.2	-0.1	-0.1	-0.4
Chemicals nes	-0.7	-0.3	-0.2	-0.4
<b>Rubber &amp; Plastics</b>	<b>0.4</b>	<b>0.2</b>	<b>0.3</b>	<b>0.4</b>
Non-Metallic Mineral Prods	-2.3	-1.9	-1.1	-0.3
Basic Metals	-0.5	-1.8	-1.2	-0.8
Metal Goods	-0.8	-0.4	-0.4	-0.4
<b>Mechanical Engineering</b>	<b>1.2</b>	<b>0.0</b>	<b>0.1</b>	<b>0.1</b>
Electronics	-0.1	0.0	0.0	-0.1
Electrical Eng. & Instments	1.3	-0.2	-0.9	-2.0
<b>Motor Vehicles</b>	<b>0.9</b>	<b>0.5</b>	<b>0.3</b>	<b>0.3</b>
Other Transport Equipment	-0.5	-0.8	-0.3	-0.3
Manufacturing nes	-0.5	-0.3	-0.5	-0.5
Electricity	-0.8	-0.6	-0.8	-0.6
Gas Supply	-2.2	-1.3	-1.6	-1.4
Water Supply	2.2	-0.5	-0.8	-0.3
<b>Construction</b>	<b>-2.4</b>	<b>-0.2</b>	<b>0.4</b>	<b>0.6</b>
<b>Distribution</b>	<b>0.1</b>	<b>1.0</b>	<b>0.2</b>	<b>0.3</b>
<b>Retailing</b>	<b>0.1</b>	<b>0.2</b>	<b>0.3</b>	<b>0.0</b>
<b>Hotels &amp; Catering</b>	<b>1.0</b>	<b>0.6</b>	<b>0.5</b>	<b>0.3</b>
Land Transport	0.3	0.1	-0.1	0.0
Water Transport	0.5	-0.6	0.0	0.1
<b>Air Transport</b>	<b>-0.1</b>	<b>0.7</b>	<b>0.5</b>	<b>0.7</b>
<b>Communications</b>	<b>-0.6</b>	<b>0.2</b>	<b>0.2</b>	<b>0.4</b>
<b>Banking &amp; Finance</b>	<b>-0.2</b>	<b>1.1</b>	<b>0.5</b>	<b>0.3</b>
<b>Insurance</b>	<b>0.6</b>	<b>0.2</b>	<b>0.6</b>	<b>0.6</b>
<b>Computing Services</b>	<b>2.8</b>	<b>1.1</b>	<b>1.0</b>	<b>0.9</b>
<b>Professional Services</b>	<b>2.0</b>	<b>1.9</b>	<b>1.2</b>	<b>0.9</b>
<b>Other Business Services</b>	<b>2.1</b>	<b>1.4</b>	<b>1.1</b>	<b>0.9</b>
Public Admin & Defence	-0.8	-0.3	-0.5	-0.2
<b>Education</b>	<b>0.0</b>	<b>0.2</b>	<b>0.0</b>	<b>0.0</b>
<b>Health &amp; Social Work</b>	<b>0.9</b>	<b>0.9</b>	<b>0.6</b>	<b>0.5</b>
<b>Miscellaneous Services</b>	<b>0.6</b>	<b>0.7</b>	<b>0.7</b>	<b>0.5</b>
<b>Unallocated</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>

Source(s): E3ME, Cambridge Econometrics.

**Figure 2.2: Baseline Employment – Average Annual Growth Rate 2013-30**



Source(s): E3ME, Cambridge Econometrics.

Figures 2.3 and 2.4 show the total average annual growth in employment across the EU 28+3 countries for ten broad sectors. The projections suggest further employment losses in primary industries and in basic manufacturing. It is the tertiary sectors (especially business services and to a lesser extent distribution and retailing) which continue to be the drivers of overall employment growth over the period 2013-2025. However, the rate of growth is expected to slow (especially for the former). This demonstrates the on-going trends towards a more knowledge based, service economy in Europe.

Employment growth in the public sector is expected to remain positive overall (mostly due to employment in health services). However, employment growth rates are also projected to slow over the period 2013-2025 as a result of the austerity measures implemented by most European governments.

More detailed results for the 42 sectors covered in the analysis are presented in the Country Workbooks. These suggest that only a few of the sectors that experienced employment growth up to 2008 will see this continue to 2025. These are almost all service sectors. In contrast, most primary and basic manufacturing sectors are expected to see continuing declines in employment.

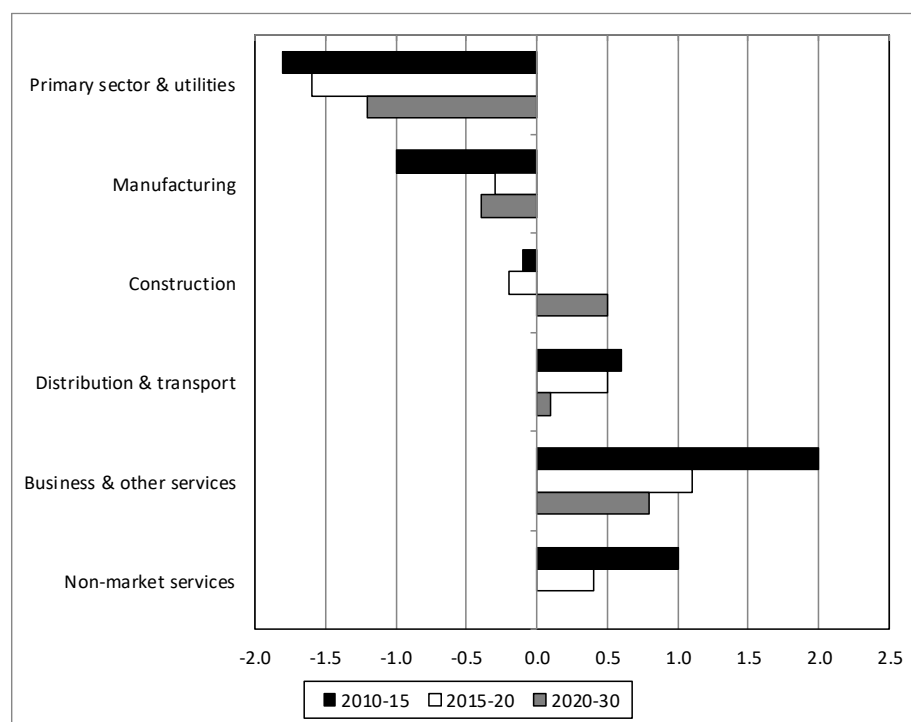
In general, the projections are consistent with previous trends, with most countries experiencing weak or negative employment growth within the primary industries and manufacturing areas and stronger growth in services. The results also illustrate that, towards the end of the forecast period, professional services and other business services are expected to see the strongest levels of employment growth. Growth within these two sectors is likely to be shared across almost all countries. While this growth in professional and other business services is fairly strong across most countries, other sectors see much more significant variations in patterns of employment growth and decline between countries.

**Figure 2.3: Past and future sectoral employment change (EU28+3)**

<b>BASELINE EMPLOYMENT BY BROAD INDUSTRY (AVERAGE ANNUAL GROWTH RATE)</b>			
<b>Broad industry</b>	<b>2010-15</b>	<b>2015-20</b>	<b>2020-30</b>
Primary sector & utilities	-1.8	-1.6	-1.2
Manufacturing	-1.0	-0.3	-0.4
Construction	-0.1	-0.2	0.5
Distribution & transport	0.6	0.5	0.1
Business & other services	2.0	1.1	0.8
Non-market services	1.0	0.4	0.2

Note(s): Figures are for EU28+Norway, Switzerland and Iceland  
Source(s): E3ME, Cambridge Econometrics.

**Figure 2.4: Past and likely future sectoral employment change (EU28+3)**



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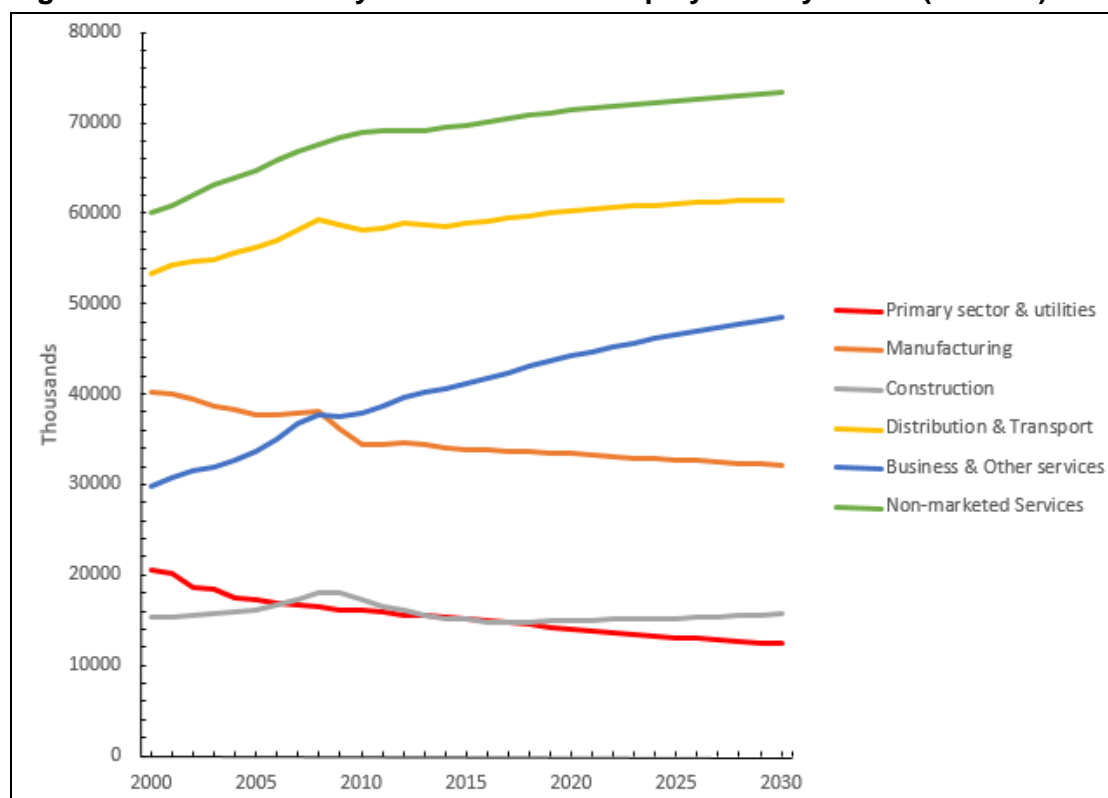
Note: Changes in numbers in employment.  
Source: IER estimates based on E3ME.

## Forecasting skill supply and demand in Europe: Overview of 2015/16 Projections

The sectoral projections are set in a historical context in Figures 2.5-2.8. Longer term trends are generally projected to continue. The most notable break in trend relates to non-marketed services. Employment in government and administration as well as other public services has been especially hard hit by the austerity measures. Its previously strong upward employment trend has become almost flat and this is expected to continue for the foreseeable future. Some growth in areas such as health and education is offset by job losses in other areas of public employment. Job losses are also expected to continue in the primary sector (especially agriculture) and traditional manufacturing industries where such trends have been evident for many years in most countries. There are a few exceptions to these general trends where inward investment has helped to offset longer term technological and other factors, but these are unusual. The main employment increases are projected in services, especially in knowledge intensive areas

Around 8 million additional jobs are projected between 2010 and 2030 in the EU28+3. A loss of around 7 million jobs is expected in the primary sector and manufacturing, with job losses in agriculture in some of the new member states a key component. Distribution, transport, hotels and catering together are projected to see substantial employment growth over the same period (about 3 million), while non-marketed services are expected to increase by around 2 million. Business and miscellaneous services are expected to see the brightest outlook, with around 12 million additional extra jobs emerging between 2010 and 2030.

**Figure 2.5: Past and likely future trends in employment by sector (EU28+3)**

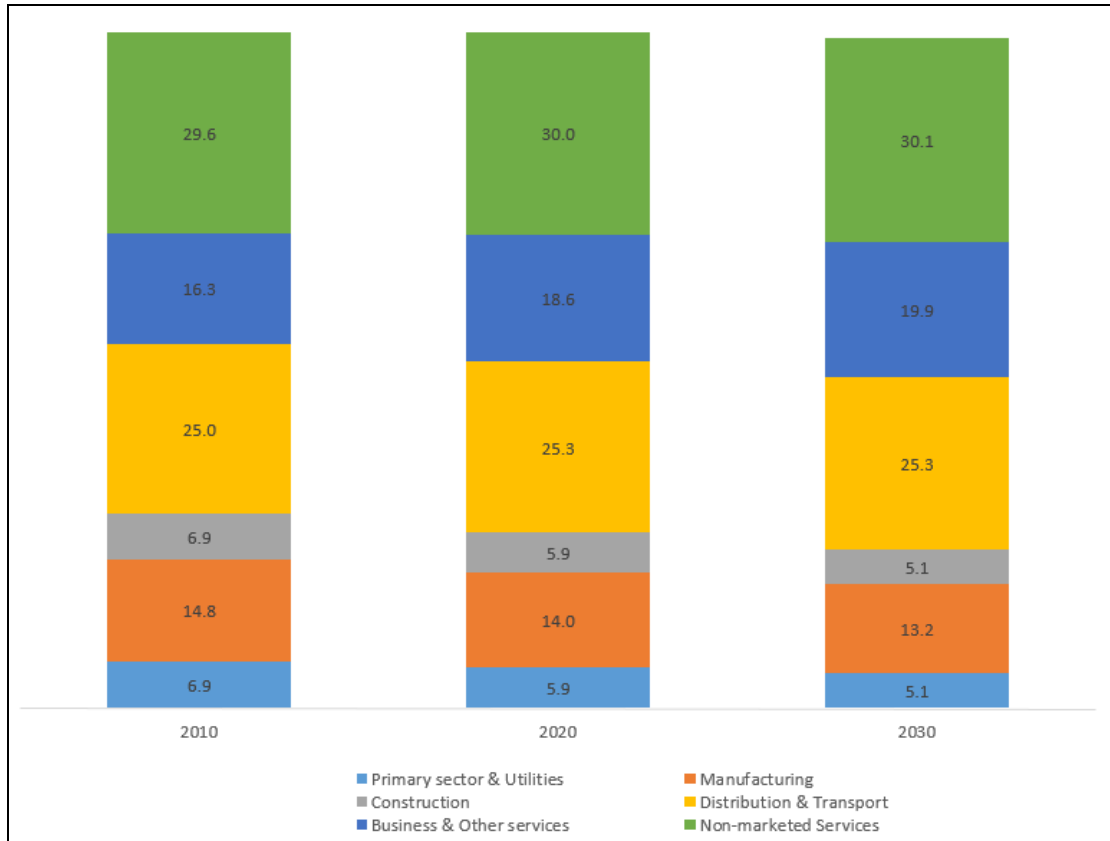


Note: Numbers in employment (National Accounts based estimates).

Source: CE estimates based on E3ME.



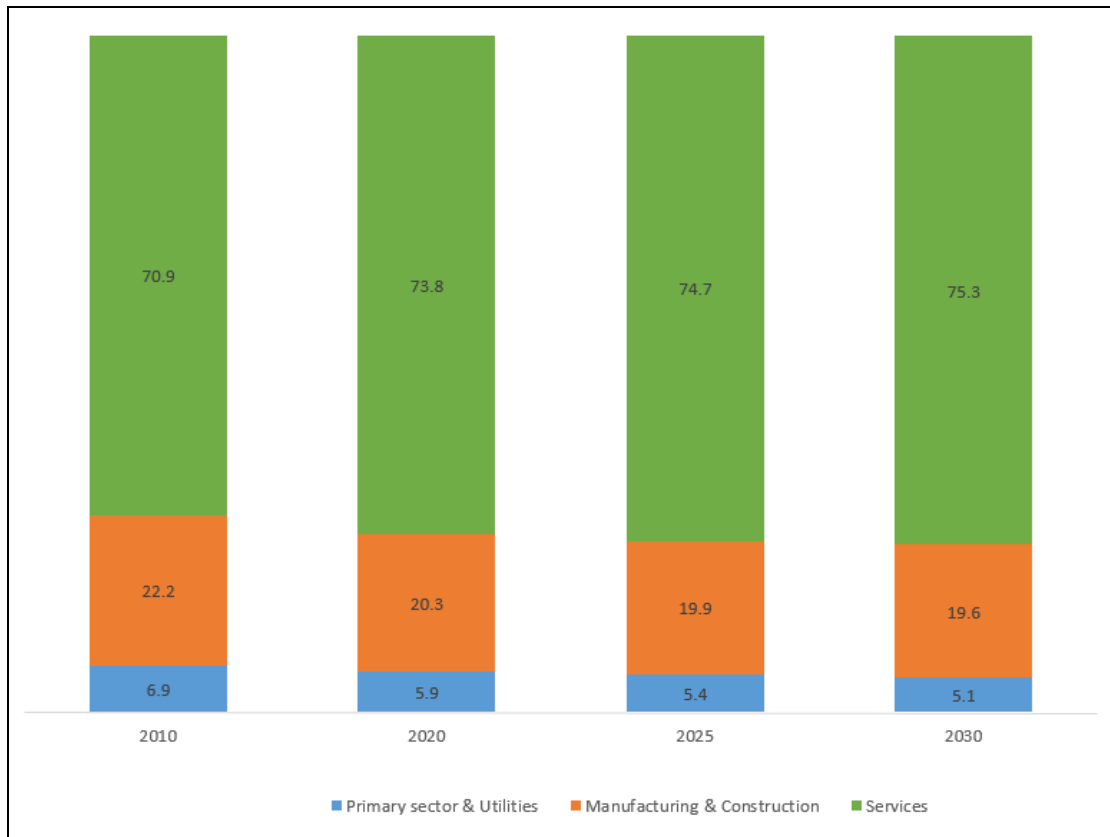
**Figure 2.6: Past and likely future sectoral employment structure, 6 broad sectors (EU28+3)**



Note: Numbers in employment (National Accounts based estimates).

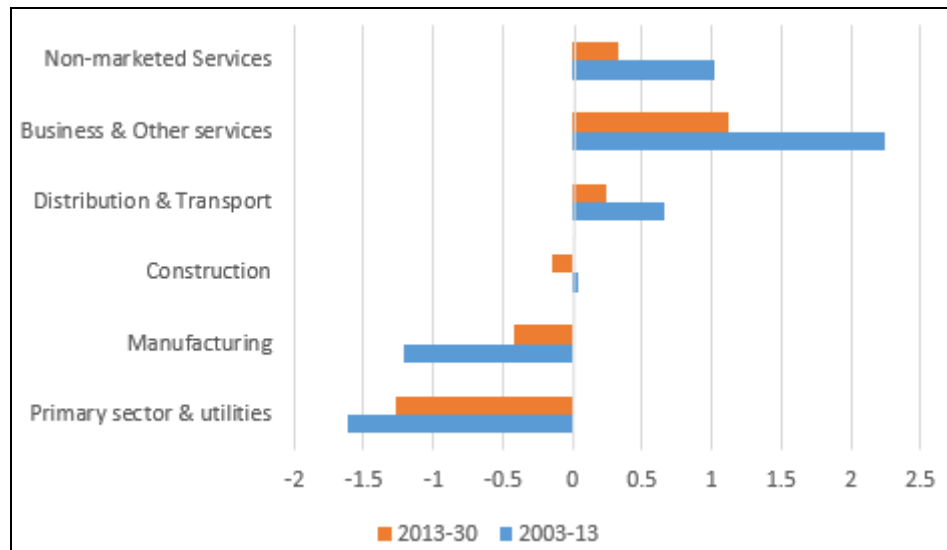
Source: CE estimates based on E3ME.

**Figure 2.7: Past and likely future sectoral employment structure three broad sectors (EU28+3)**



Note: Numbers in employment (National Accounts based estimates).  
Source: CE estimates based on E3ME.

**Figure 2.8: Past and likely future sectoral employment change (EU28+3)**



Note(s): Numbers in employment (National Accounts based estimates). Average rates of growth in (%) are shown in the chart.

Source: CE estimates based on E3ME.

## 2.4 Aggregate labour supply

Figure 2.9 shows the projected path for the labour force in the E31 economies. In particular, the labour force is expected to show an upward trend following the modest economic growth after the crisis. This path stabilises from 2020 onwards although a decline in the labour force will take place towards 2030. The increase in the labour force in the aftermath of the economic crisis is partly explained by an increase in participation of the oldest cohorts due to changes in the regulation to extend working life, and the unsustainable path of public pension systems shown in countries such as Spain. A declining labour force emphasises the necessity of public interventions to encourage participation in the labour market.

**Figure 2.9: Baseline Labour Force, EU28 Plus Norway, Switzerland and Iceland**

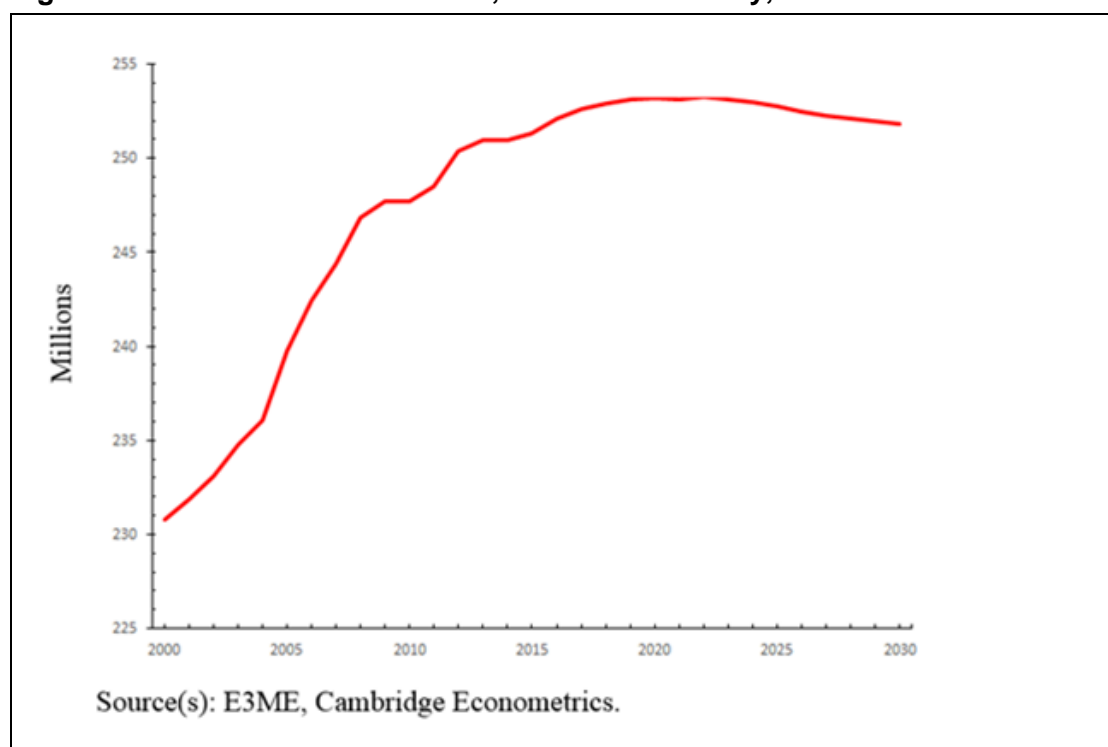


Table 2.4 summarises the projected trend of working-age population, the average participation rate and the corresponding labour supply for each of the countries under consideration. In the baseline projection, labour supply in the E31 countries is expected to increase by 1% between 2013 and 2030.

The figures reported in Table 2.4 point out an increase in the working age population over the period 2013-30 in the case of 19 of the economies under consideration. The strongest increases in the working-age population are expected in the case of Luxembourg, Norway, Switzerland and Iceland. This increase in the working-age population will lead to an increase in the labour supply in the mentioned countries. Other economies where labour supply will also increase substantially are Belgium and Sweden. In some countries, such as Latvia, Lithuania and Bulgaria, the projected fall in working-age population will be large so that, despite a projected rise in activity rates, the labour supply will shrink. At European scale, a 3.8% increase in the working-age population will lead to a 1% increase in the labour supply.

**Table 2.4: Summary Country Results, 2030 compared to 2013**

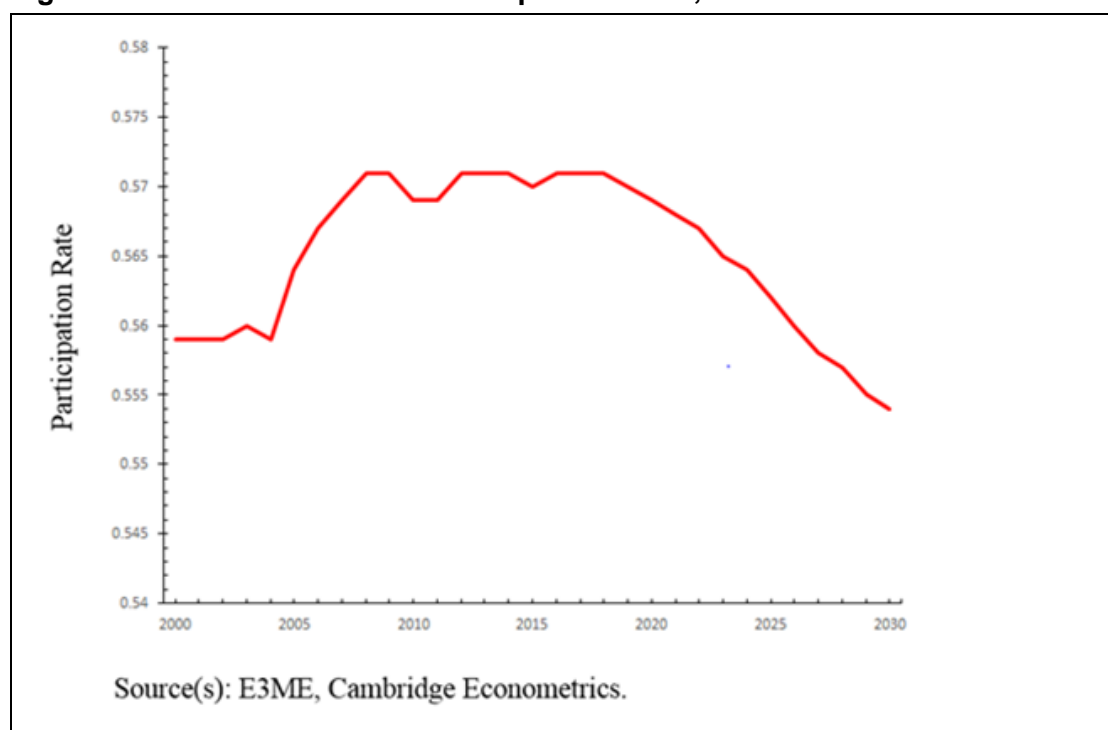
<b>SUMMARY COUNTRY RESULTS, 2030 COMPARED TO 2013</b>				
	<b>Population (15+), %</b>	<b>Average Participation Rate, pp</b>	<b>Labour Supply, %</b>	<b>Labour Supply, 000s</b>
Belgium	15.6	-3.0	9.1	443.2
Denmark	9.6	1.1	11.5	333.1
Germany	-2.3	-1.4	-4.5	-1915.0
Greece	-6.8	-0.3	-7.4	-361.6
Spain	-1.2	-3.1	-6.4	-1511.2
France	9.0	-1.2	6.5	1862.3
Ireland	4.4	-5.2	-4.7	-101.0
Italy	8.9	-1.9	4.7	1213.8
Luxembourg	48.1	-6.5	31.4	78.1
Netherlands	6.9	-2.5	2.7	241.3
Austria	10.2	-2.9	5.0	218.9
Portugal	-3.7	-2.1	-7.0	-377.9
Finland	8.7	-2.9	3.5	94.2
Sweden	14.1	-3.9	7.1	357.7
UK	10.6	-2.9	5.3	1700.1
Czech Rep.	2.5	-1.6	-0.3	-16.5
Estonia	-8.0	-0.4	-8.5	-58.2
Cyprus	8.1	-3.1	2.6	11.5
Latvia	-20.0	4.9	-13.4	-138.0
Lithuania	-26.6	3.9	-21.6	-318.0
Hungary	-2.4	1.8	1.1	48.6
Malta	8.5	-1.8	4.6	8.2
Poland	-1.0	0.1	-0.8	-147.3
Slovenia	1.9	-4.4	-5.9	-59.5
Slovakia	1.2	-0.9	-0.3	-7.9
Bulgaria	-11.6	5.4	-2.6	-88.2
Romania	-5.6	1.6	-3.0	-292.9
Norway	28.0	-2.4	23.4	623.9
Switzerland	19.2	-4.6	11.2	515.5
Iceland	16.3	-3.2	11.1	19.8
Croatia	-3.6	2.3	0.9	15.6
EU28 + 3	3.8	-1.6	1.0	2392.8

Source(s): E3ME, Cambridge Econometrics.

The overall increase in the absolute levels of labour supply show in Table 2.4 are therefore due to the lower participation rates being more than offset by an increase in the working-age population. The decline in the participation rate does not particularly reflect changes in the willingness of any particular age group to seek employment (for most age groups this willingness actually increases, as shown below); rather it is related to changes in the relative sizes of the labour groups.

Figure 2.10 illustrates the baseline projection for average labour participation rates in the E31 countries from 2000 onwards. The figure clearly shows a steady decline in the average participation rate (which here includes people over 65) over the period 2012-2030, coming down by 1.5 pp from a peak of 57% in 2012. Although some countries (e.g. Latvia, Lithuania) present substantial increases in average participation rates between 2012 and 2030, a decrease could be expected for the vast majority of the countries under scrutiny.

**Figure 2.10: Baseline Labour Participation Rates, E31 Countries**



For a better understanding of the projected dynamics in the case of each demographic group, Table 2.5 provides a detailed breakdown of the results by gender and age group. The results show that the population in younger age groups is expected to fall substantially while population in the older age groups will rise. This results in an ageing population, as both birth rates and death rates decline, and more people enter into groups with lower participation rates. The participation rates among the older age groups are, however, expected to increase (albeit from a low base) as general health and fitness improvements make people more able to work at a greater age (and retirement ages rise and there is greater pressure to continue working to top up pensions). Increases in the participation rate are observed particularly in the 55-64 age groups.

**Table 2.5: Summary Results by Labour Group, 2030 compared to 2013**

<b>SUMMARY RESULTS BY LABOUR GROUP, 2030 COMPARED TO 2013</b>				
<b>Labour Group</b>	<b>Population, %</b>	<b>Average Participation Rate, pp</b>	<b>Labour Supply, %</b>	<b>Labour Supply, 000s</b>
Male 15-19	-1.3	1.5	5.3	173.7
Male 20-24	-6.4	4.4	0.0	1.0
Male 25-29	-9.8	-0.2	-10.1	-1492.6
Male 30-34	-11.7	1.6	-10.2	-1678.1
Male 35-39	-9.7	1.2	-8.4	-1441.5
Male 40-44	-12.2	1.7	-10.6	-1912.3
Male 44-49	-10.4	3.7	-6.7	-1179.4
Male 50-54	-3.0	4.8	2.3	369.6
Male 55-59	7.9	8.8	20.3	2575.7
Male 60-64	17.4	8.3	39.7	2639.3
Male 65+	44.1	2.0	82.2	2431.2
Female 15-19	-0.8	1.4	6.4	178.3
Female 20-24	-7.5	2.0	-4.2	-372.3
Female 25-29	-12.7	6.3	-5.5	-697.1
Female 30-34	-15.1	4.4	-10.4	-1422.2
Female 35-39	-12.2	5.9	-5.7	-820.3
Female 40-44	-12.9	6.3	-6.1	-949.5
Female 45-49	-10.1	6.0	-3.3	-511.1
Female 50-54	-4.0	6.9	4.8	672.2
Female 55-59	5.4	8.3	19.7	2089.0
Female 60-64	13.8	6.5	40.2	1838.0
Female 65+	32.6	0.5	53.9	977.2
Total 15-19	-1.0	1.5	5.8	352.0
Total 20-24	-6.9	3.3	-1.9	-371.2
Total 25-29	-11.3	3.0	-8.0	-2189.7
Total 30-34	-13.4	3.1	-10.3	-3100.2
Total 35-39	-10.9	3.6	-7.2	-2261.8
Total 40-44	-12.6	4.0	-8.5	-2861.8
Total 45-49	-10.2	4.9	-5.1	-1690.6
Total 50-54	-3.5	5.9	3.5	1041.8
Total 55-59	6.6	8.7	20.0	4664.7
Total 60-64	15.5	7.5	39.9	4477.3
Total 65+	37.4	1.3	71.5	3408.4
Note(s): Figures show change in population, labour market participation rates and resulting labour supply in 2030 compared to 2013 for the EU28+3 countries.				
Source(s): E3ME, Cambridge Econometrics.				

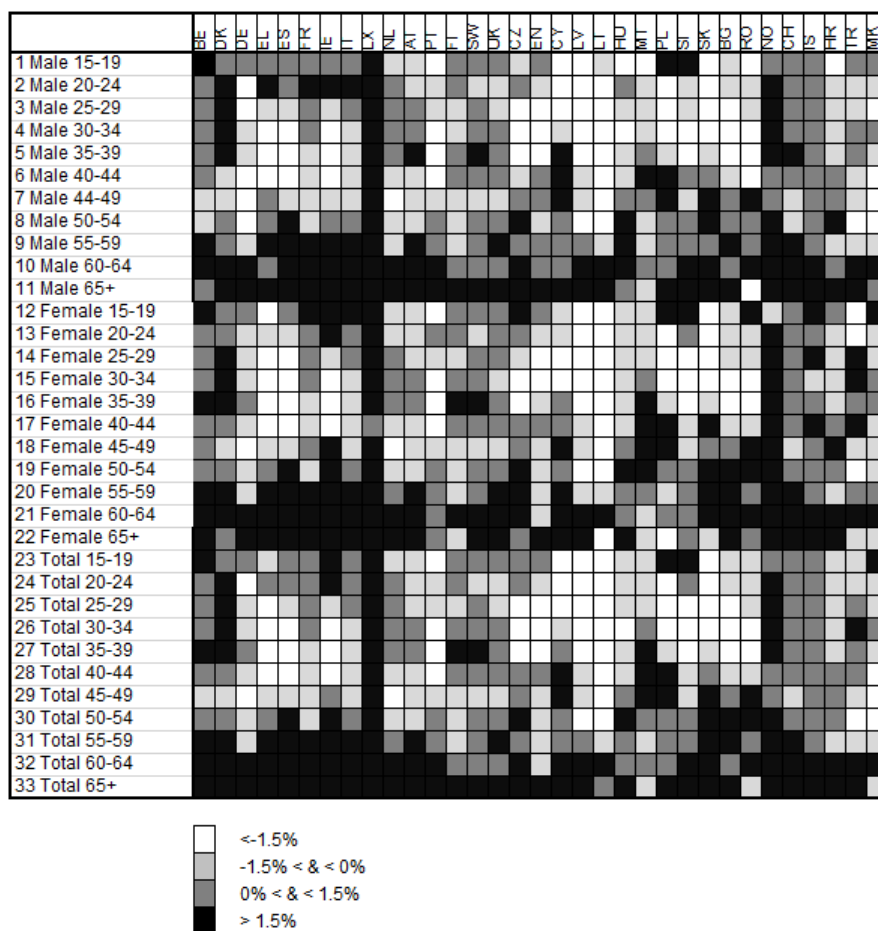
## Forecasting skill supply and demand in Europe: Overview of 2015/16 Projections

However, the increases in participation rates among the older age groups do not offset the large decreases in the population (and, in some cases, participation rates) of the younger groups. Participation rates of younger people are also declining due to the increasing trend to remain in education past the compulsory stage, as access to education and training becomes easier, and the labour market becomes more competitive. This results in a decline of the participation rates for the youngest age group.

For males, an age group that is expected to make a substantial contribution to the increase in labour supply is 60-64 (2.6m), while for female the main contribution is expected to take place in the group aged 55-59 (2.1m). This is followed closely by the 55-59 age group (2.6m) for male and the 60-64 group in the case of female (1.8m). The age group 65+ is also expected to see an increase in labour supply (of around 2.4m for males and 1m for females).

In terms of labour supply rates for all the demographic groups, Table 2.5 shows clearly the general pattern of increased participation among older age groups alongside the decrease among younger age groups. Nevertheless, there are important differences among the patterns that can be identified in each country. Figure 2.5 provides an overview of those differences. However, Figure 2.11 shows that the patterns can vary between countries. To make the point, we refer to the case of Romania, Malta and FYROM which contradicts the general trend by exhibiting a decrease in the average labour supply within older age groups.

**Figure 2.11: Baseline Labour Supply – Average Annual Growth Rate 2013-30**



Source(s): E3ME, Cambridge Econometrics.



## Forecasting skill supply and demand in Europe: Overview of 2015/16 Projections

Table 2.6 and Table 2.7 provide a summary, broken down by gender, and distinguishing population and labour force numbers. In the baseline projection, labour supply in Europe is expected to increase fairly steadily between 2013 and 2025. There is a strong upward trend in the labour force following recovery from the crisis. This is primarily driven by increases in population numbers. Part of the increase in labour supply over the period is likely to come from older age groups increasing their participation in the labour force due to expected upwards changes in official retirement ages, and the concerns surrounding pension schemes. Many governments are calling for people to defer retirement ages. In practice, and on average, many people are still choosing to take some of the benefits of economic growth in the longer term in the form of leisure rather than income. Government policies to raise employment and participation rates may have more impact for workers between the ages of 25 and 55.

**Table 2.6: Supply Trends, Stocks: Population (EU28+3, aged 15+)**

	2005	2010	2015	2020	2025
<b>Levels (000s)</b>					
Males	204,937	210,376	213,367	215,911	218,794
Females	219,923	224,965	227,197	228,947	231,218
Males and females	424,859	435,342	440,564	444,858	450,012
<b>Shares (per cent)</b>	<b>2005</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>2025</b>
Males	48.2	48.3	48.4	48.5	48.6
Females	51.8	51.7	51.6	51.5	51.4
Males and females	100.0	100.0	100.0	100.0	100.0
<b>Growth (% per annum)</b>	<b>2005-2010</b>	<b>2005-2015</b>	<b>2015-2020</b>	<b>2020-2025</b>	<b>2015-2025</b>
Males	0.5	0.4	0.2	0.3	0.3
Females	0.5	0.3	0.2	0.2	0.2
Males and females	0.5	0.4	0.2	0.2	0.2
<b>Change (000s)</b>	<b>2005-2010</b>	<b>2005-2015</b>	<b>2015-2020</b>	<b>2020-2025</b>	<b>2015-2025</b>
Males	5,440	8,430	2,544	2,883	5,427
Females	5,043	7,274	1,750	2,272	4,022
Males and females	10,482	15,704	4,294	5,154	9,448

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2013\data\Workbooks\Xcountry\Eur31SupplyResults.BaseC.xlsm

Note: Numbers in the population aged 15+.  
Source: CE estimates based on E3ME.

Figure 2.4 above shows that overall labour market participation rates have levelled out and are expected to decline to 2025. Although there are pressures for some older people to increase their participation in the formal labour market, many younger people are choosing to stay on in education. Many older labour market participants have also been forced to withdraw from the labour market in the face of very poor job prospects. Despite this, overall numbers in the labour force are projected to rise slightly (see Table 2.7).

## Forecasting skill supply and demand in Europe: Overview of 2015/16 Projections

**Table 2.7: Supply Trends, Labour Force (EU28+3, aged 15+)**

	2005	2010	2015	2020	2025
<b>Levels (000s)</b>					
Males	132,604	135,307	136,110	136,863	136,775
Females	107,130	112,391	115,215	116,311	116,005
Males and females	239,734	247,698	251,325	253,174	252,780
<b>Shares (per cent)</b>					
Males	55.3	54.6	54.2	54.1	54.1
Females	44.7	45.4	45.8	45.9	45.9
Males and females	100.0	100.0	100.0	100.0	100.0
<b>Growth (% per annum)</b>					
Males	2005-2010	2005-2015	2015-2020	2020-2025	2015-2025
	0.4	0.3	0.1	0.0	0.0
Females	1.0	0.7	0.2	-0.1	0.1
Males and females	0.7	0.5	0.1	0.0	0.1
<b>Change (000s)</b>					
Males	2005-2010	2005-2015	2015-2020	2020-2025	2015-2025
	2,703	3,506	753	-88	665
Females	5,261	8,085	1,096	-307	789
Males and females	7,964	11,591	1,849	-395	1,455
<b>Activity Rate</b>					
Males	2005-2010	2005-2015	2015-2020	2020-2025	2015-2025
	64.7	64.7	63.8	63.4	62.5
Females	48.7	48.7	50.7	50.8	50.2
Males and females	56.4	56.4	57.0	56.9	56.2

Note: Activity Rate is the proportion of the population aged 15 and above that is in the Labour Force.

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2013\data\Workbooks\Xcountry\Eur31SupplyResults.BaseC.xlsm

Note: Numbers in the economically active labour force aged 15+.  
Source: CE estimates based on E3ME.

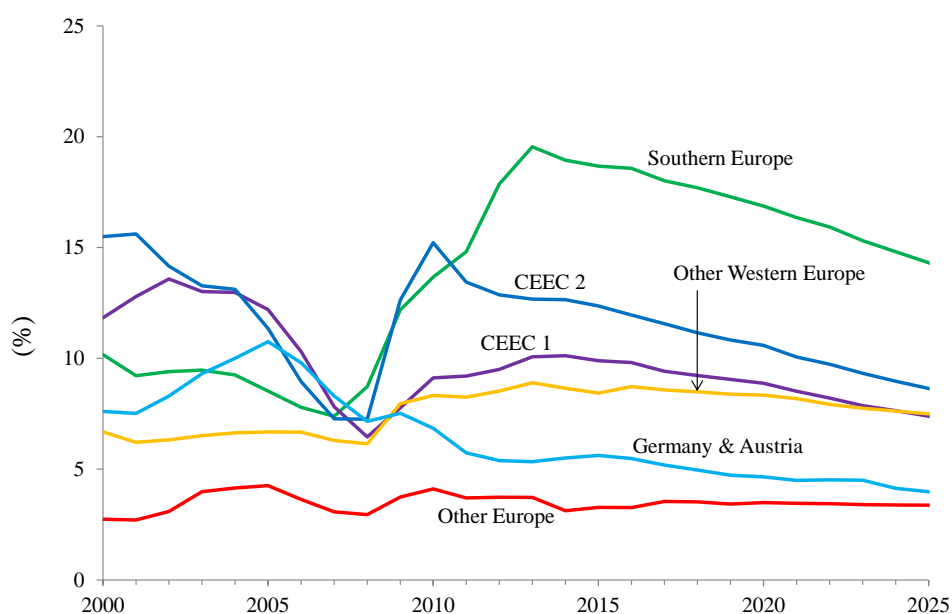
## 2.5 Imbalances between labour supply and demand

In order to analyse the existence of imbalances between labour supply and demand, we concentrate on the evolution of the unemployment rate.<sup>13</sup> Figure 2.12 illustrates the expected unemployment rates that accompany the baseline projections of labour supply and demand. The figure reports the unemployment rate over the period 2000-2030 by 6 broad European regions. An increase is observed in all regions in 2009, following the financial and economic crisis, though the groups containing Germany and Austria and Other Europe quickly returns to its long-term downward trend. The fact that Other Western Europe and CEEC regions peaked in 2011 can be interpreted as a lagged response to the economic downturn. Many countries are forecasted not to return to pre-crisis unemployment levels. This point is particularly relevant in the case of Southern Europe where labour markets have been strongly hit by the economic crisis.

Such imbalances are expected to decrease towards the end of the period across all region groups, as shown in Figure 2.12.

**Figure 2.12: Baseline Unemployment Rate within EU Regions (2000-30)**

BASELINE UNEMPLOYMENT RATE WITHIN EU REGIONS (2000-30)



Note(s): Southern Europe is Greece, Portugal, Malta, Italy, Spain ; CEEC 1 is Bulgaria, Croatia, Hungary, Poland, Czech Rep. And Romania CEEC 2 is Estonia, Latvia, Lithuania, Slovenia and Slovakia; Other Western Europe is Belgium, France, Ireland, Denmark, UK, the Netherlands, Finland and Sweden; and Other Europe is Luxembourg, Norway, Switzerland & Iceland.

Source(s): E3ME, Cambridge Econometrics.

<sup>13</sup> The unemployment rate is defined as the imbalance between labour supply and demand in % terms.

## 2.6 Comparing results with the previous forecast

This section presents a comparison of the results of the new baseline projections (February 2016) with the results of the previous forecasts delivered in October 2015, December 2014, October 2013, November 2012 and 2011, September 2010 and November 2009.

Iceland was not included in the 2009 and 2010 projections and is therefore not included in the comparison either. Croatia was only added to the forecast in 2012 and therefore is not included in this analysis. For consistency, the results represent the sum of 29 European countries (EU27 plus Norway and Switzerland).

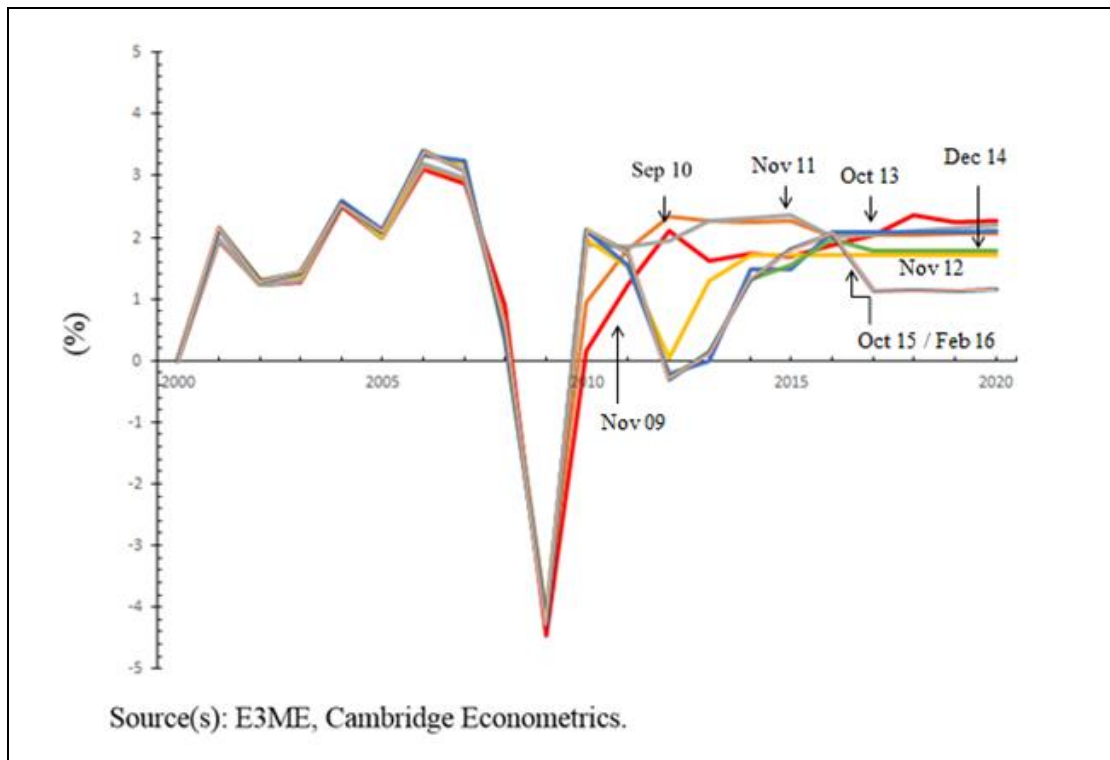
### *Changes to data*

The new projections include historical data to 2014. E3ME's time-series data were substantially revised in 2012 to make use of the new NACE Rev 2 classification.

### *Key results*

Figure 2.13 compares the projected growth rates in GDP, an exogenous input to the modelling exercise. There are two clear differences in these growth rates, when compared to previous forecasts. GDP growth for 2012 is negative for Europe as a whole, compared to a previous forecast of no growth, and there is a longer recovery time. Long-term trends are, however, similar. We may also note that the new projections rely on a lower GDP growth after 2017, as assumed in the Aging Population Report 2015.

**Figure 2.13: Baseline GDP Growth, EU27 plus Norway and Switzerland**

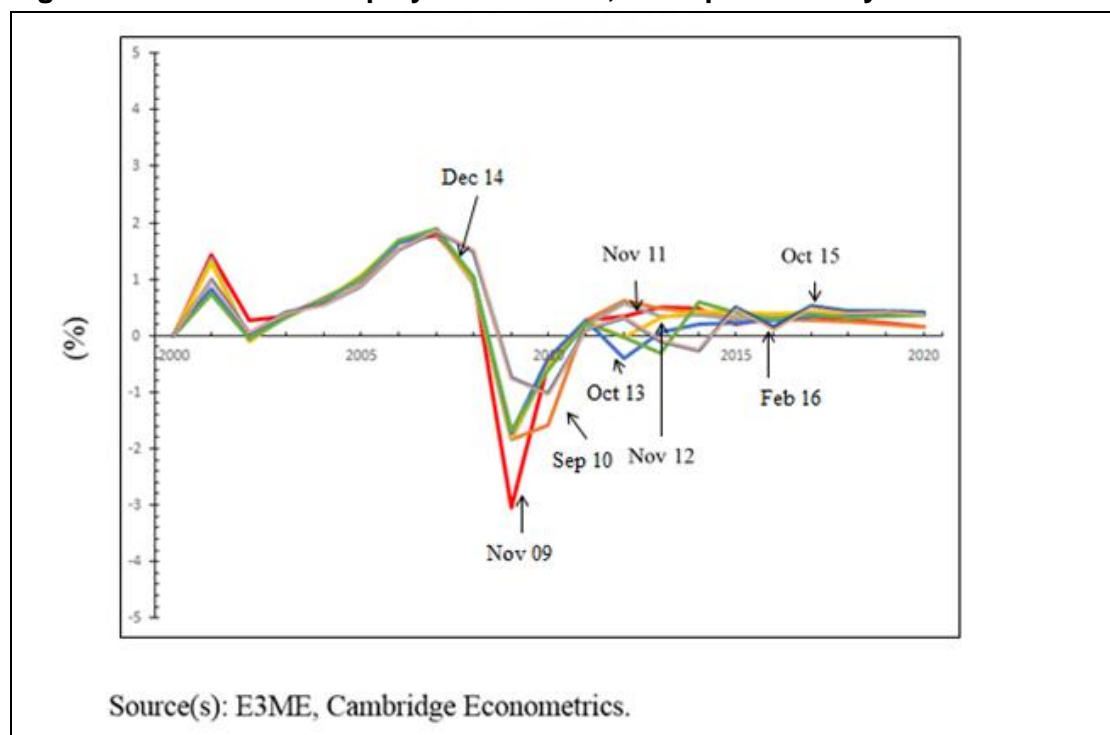


### *Employment*

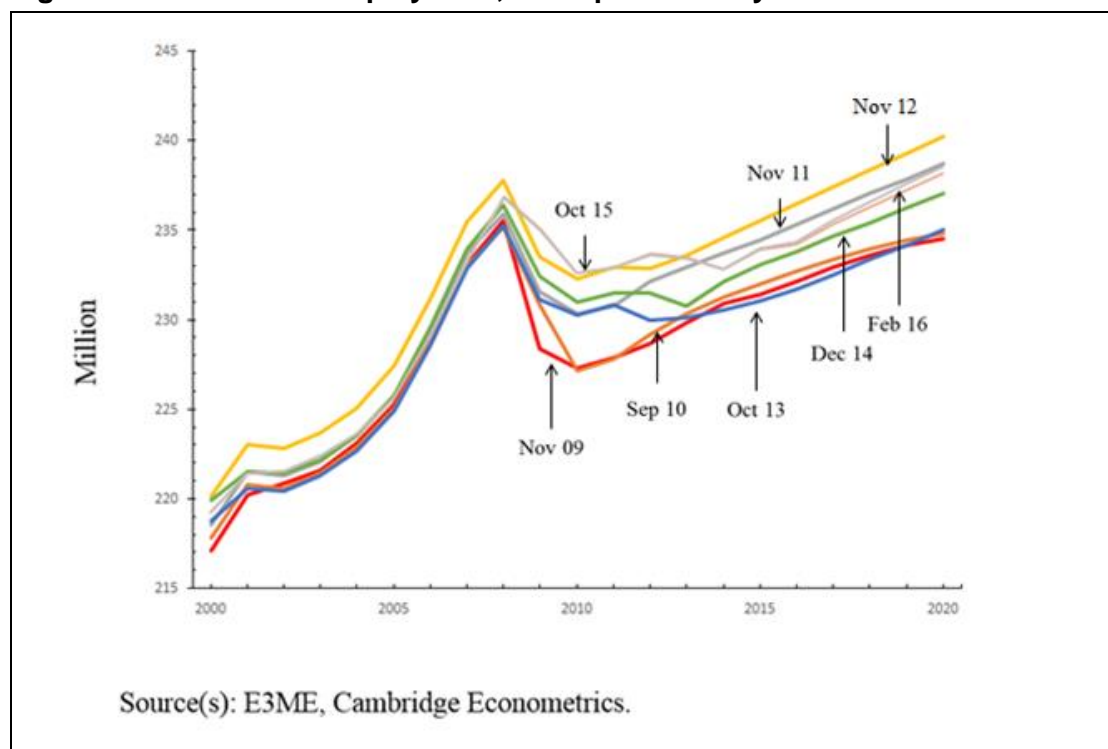
Figures 2.14 and 2.15 present the different projections for employment growth and absolute employment levels respectively. The key differences in the most recent result are that employment growth in 2012 is negative and recovery is more drawn out; this reflects the revised view for GDP growth. The new set of projections show a decline in employment in 2019 which is the reflection of a lower GDP growth from 2017 onwards. This decline is evident in both Figures 2.14 and 2.15.

As advanced in the previous report, there has been an upward revision to employment levels in the historical data and this also affects the projections as well. This is due to a revision of Eurostat data for UK sub-sectors. It is important to note that the Eurostat published number for total employment in the UK does not match the sum of the sub-sectors. It was decided to use the sum of sub-sectors as the actual value of total employment in the UK.

**Figure 2.14: Baseline Employment Growth, EU27 plus Norway and Switzerland**



**Figure 2.15: Baseline Employment, EU27 plus Norway and Switzerland**

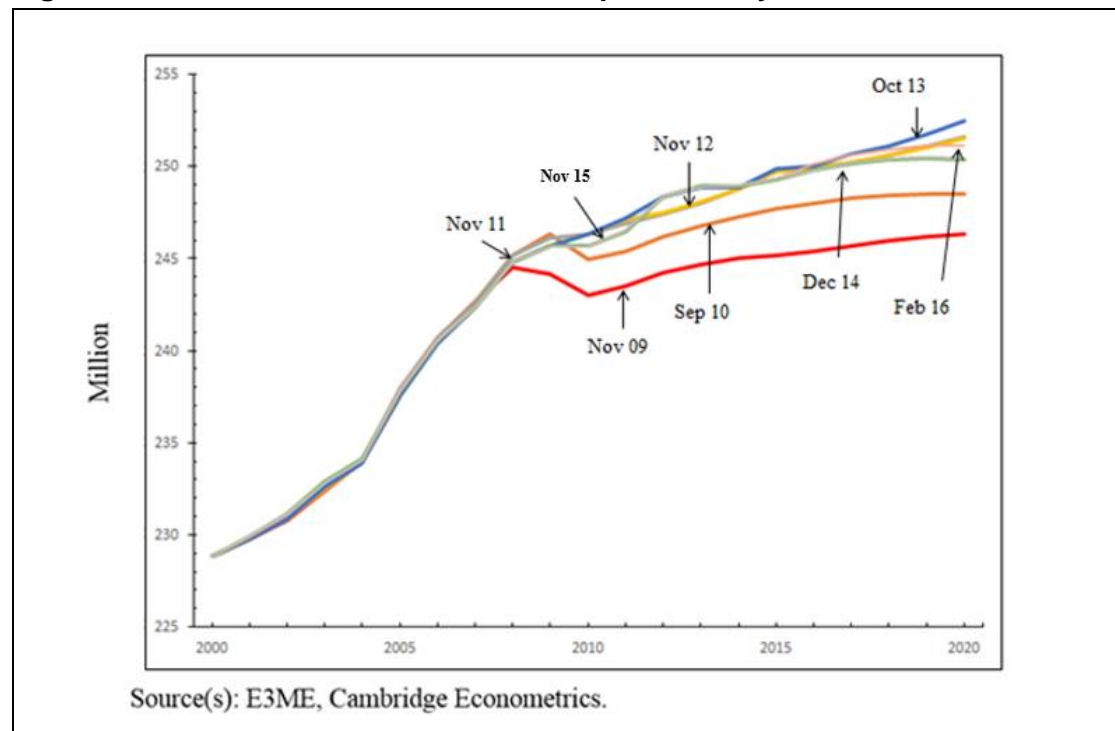


### *Labour supply*

There is a consistent pattern for the E3ME labour force projections to be revised upwards over time, as shown in Figure 2.16. A justification for this fact is that the recession did not result in a decline in labour supply which was expected in previous forecasts. As discussed above, labour supply is expected to grow as a result of rising participation rates in older age groups (55-59, 60-64 and 65+) in some countries (e.g. Germany and France) caused by rising statutory retirement rates and, concerns the sustainability of public pensions.

Overall, the expected trend for labour supply is similar to the one described by the set of projections presented in December 2014. However, labour supply is slightly lower than projected in November 2015.

**Figure 2.16: Baseline Labour Force, EU27 plus Norway and Switzerland**

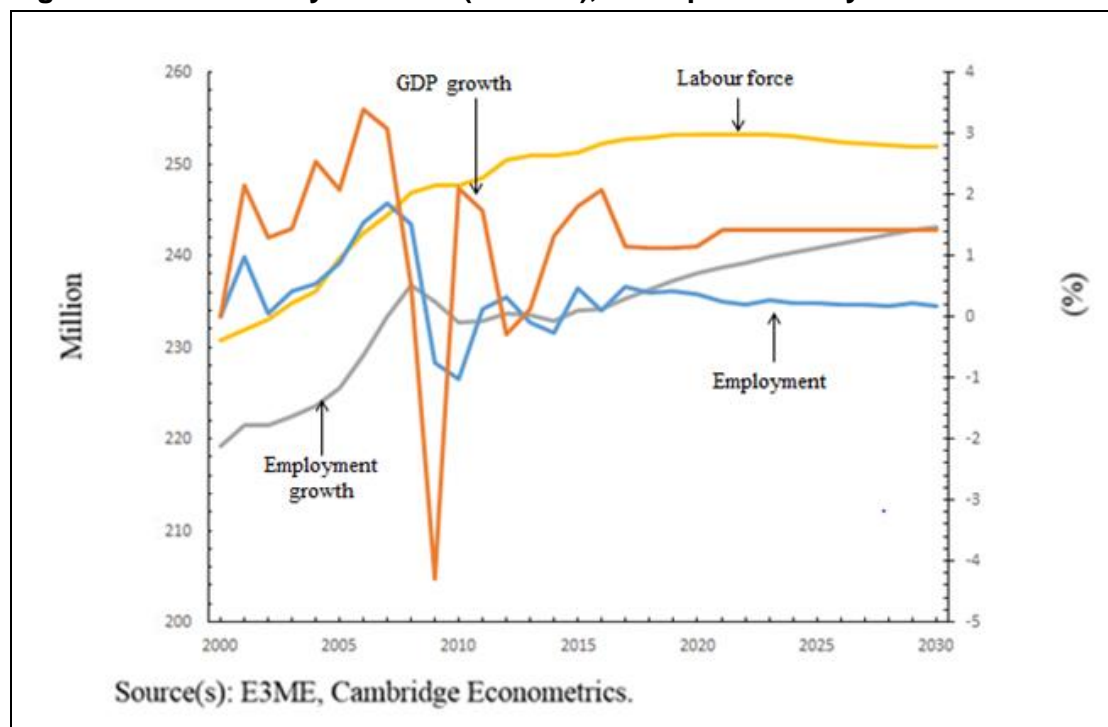


*Forecast to 2030*

In order to supplement the results presents above, Figure 2.17 provides a graphical representation of the main baseline variables, i.e. GDP growth, employment, employment growth and labour force. It provides results to 2030. Some highlights of this extended set of results are provided as follows:

- Employment growth is expected to be positive after 2025, growing at a similar rate to 2020-25.
- Labour force is expected to rise, although a slight decline will take place towards the end of the period.
- Employment and GDP growth are expected to stabilise at long-term trend from 2021 onwards.

**Figure 2.17: Summary Baseline (2000-30), EU28 plus Norway and Switzerland**



## 2.7 Sensitivity Analysis

In the baseline projections it is assumed that Europe as a whole will not experience a rapid recovery in GDP growth following the recession in 2009. Curbed by austerity measures, GDP growth is assumed to pick up only modestly in the near term before returning to previous rates of growth in the longer term. However, much uncertainty remains over the pace and sustainability of economic growth following the recession. Sensitivity analysis has been designed and implemented to explore the impacts on labour market outcomes of variations in economic growth. Two scenarios were set up, one of which is more optimistic, with a swifter recovery and return to previous rates of growth, and one in which the process of recovery will be more prolonged.

This section presents the results of the sensitivity analysis. The scenario inputs are similar to those described in the methodology report (Wilson *et al.* (2013)). First the economic impacts of the scenarios are summarised, providing an overall context for the more detailed labour market impacts. The scenario results for employment demand are then presented. The impacts on labour supply are negligible and so the results are not presented in detail. Similarly the results on the demand for and supply of skills (occupations and qualifications) are not very sensitive to these changes and so are not discussed in detail.



*Economic impacts*

*Aggregate results: GDP in Europe*

Figure 2.18 shows the evolution of GDP over time under the different scenario assumptions. In the optimistic scenario there is a faster recovery with some acceleration in growth to make up for lost output, although an additional 1pp of growth each year is quite small in relation to the output lost during the crisis.

The boost to GDP growth rates is temporary with a reversion to long-run trend rates within a few years. In the more pessimistic case, the additional effects of pressure on government expenditure mean that the effects are more long-lasting, with a lower growth rate, as well as level, of GDP in 2020.

**Figure 2.18: GDP Growth in EU28 Plus Norway, Switzerland and Iceland**

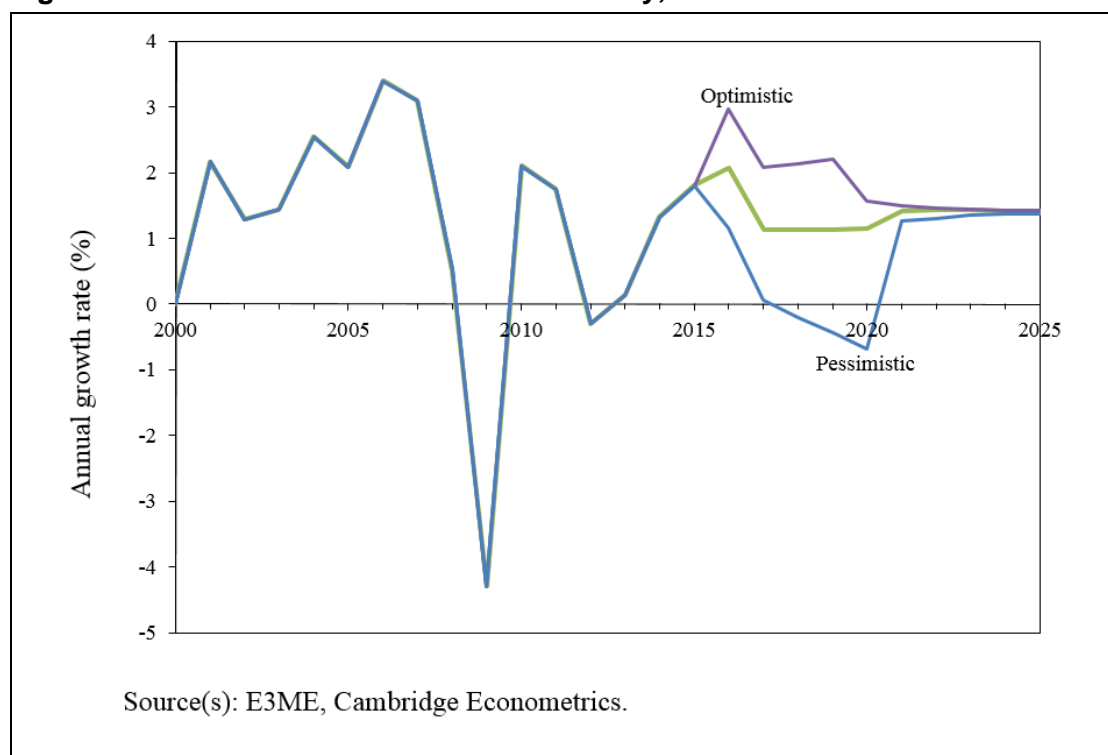


Table 2.8 summarises the employment results in 2025 at Member State level. On average, in the EU there is a 0.8% reduction in employment in the pessimistic case and a 0.6% increase in the optimistic case. It is also important to note that there are quite large differences in employment (and output) impacts between the Member States, even though the scenario inputs for each Member State are the same. The differences reflect the relative sectoral structure and trade patterns of each country. For example, output and employment in Spain are particularly affected in these scenarios due to the large size of the construction and tourist industries; these are both sensitive to shifts in investment and consumption spending.

*Employment results at Member State level*

**Table 2.8: Employment Comparison between Scenarios**

<b>EMPLOYMENT COMPARISON BETWEEN SCENARIOS</b>			
<b>% DIFFERENCE FROM BASELINE IN 2020</b>			
	<b>Pessimistic</b>	<b>Baseline</b>	<b>Optimistic</b>
Belgium	-0.7	4779	0.4
Denmark	-0.9	2868	0.6
Germany	-0.8	41935	0.7
Greece	-0.7	3876	0.4
Spain	-1.6	17706	1.2
France	-1.1	28759	0.9
Ireland	-1.2	2064	0.9
Italy	-0.9	24937	0.5
Luxembourg	-0.1	419	0.1
Netherlands	-1.2	8860	1.0
Austria	-0.7	4375	0.4
Portugal	-1.5	4478	1.2
Finland	-1.9	2580	1.4
Sweden	-0.5	4813	0.4
UK	-1.2	31093	0.8
Czech Rep.	-0.8	5244	0.5
Estonia	-0.2	620	0.2
Cyprus	-0.6	387	0.5
Latvia	-0.2	914	0.1
Lithuania	-1.6	1347	1.3
Hungary	-0.4	4157	0.2
Malta	-0.3	186	0.2
Poland	-0.9	16178	0.7
Slovenia	-0.5	922	0.3
Slovakia	-0.8	2306	0.6
Bulgaria	0.0	3406	0.0
Romania	-1.5	9152	1.3
Norway	-1.0	2934	0.7
Switzerland	0.2	5058	0.2
Iceland	-1.0	178	0.4
Croatia	-0.8	1794	0.5
Total	-0.8	265841	0.6

Note(s) : Figures show total employment in 000s for baseline and % differences from baseline for pessimistic and optimistic scenarios.

Source(s) : E3ME, Cambridge Econometrics.

*Sectoral results*

Figures 2.19 and 2.20 represent the sectoral impacts by Member State. Employment is typically most affected (i.e. dark-coloured [positively] in Figure 2.19 and light-coloured [negatively] in Figure 2.20) in the sectors that are most closely associated with investment and household expenditure. These are:

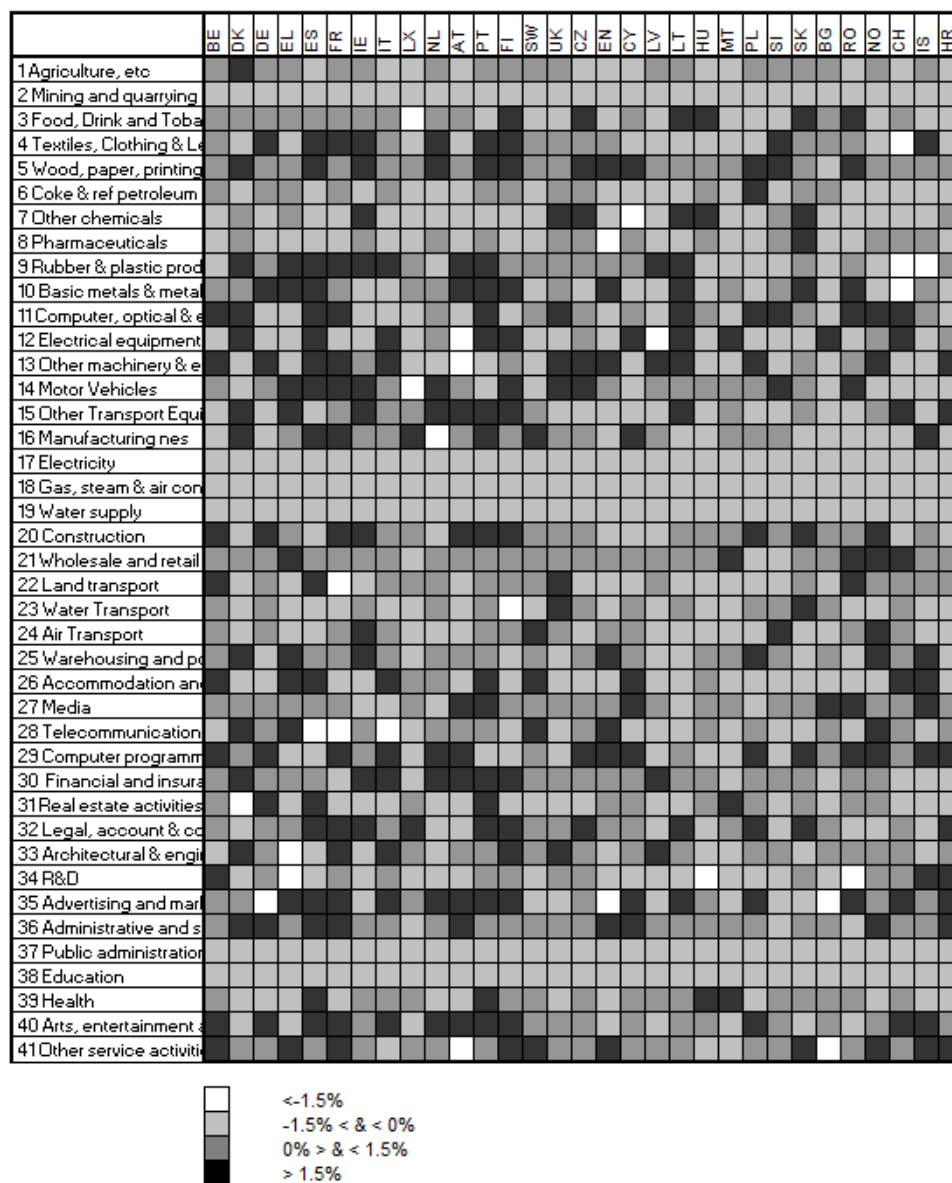
- construction
- sectors that supply construction, such as metal goods
- distribution, retailing, hotels & catering

As in an earlier exercise of sensitivity testing in E3ME, computing services, and professional and business services are particularly sensitive to changes in investment demand.

Some sectors, such as agriculture, have results that go against the main trends in employment. In the case of agriculture, there is little change in economic output and wages fall in response to higher unemployment rates. This suggests that there is some automatic rebalancing within the labour market.

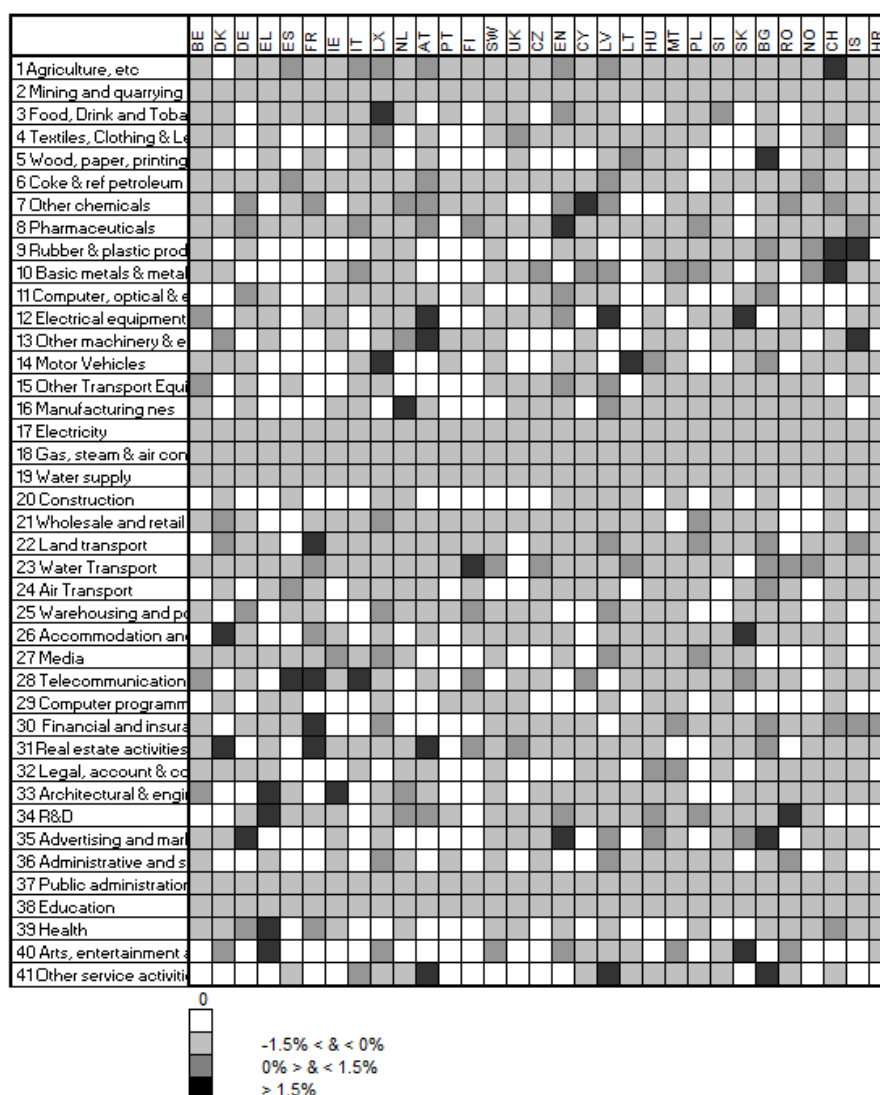
In these scenarios we have maintained the standard assumptions that employment in the energy sectors is fixed. For this exercise we have also maintained public-sector employment as fixed, despite further reductions in government expenditure in the pessimistic scenario. This is because impacts on public-sector employment are likely to vary by country and the model equations are not able to estimate these impacts.

**Figure 2.19: Optimistic Scenario – Percentage Differences from Baseline in 2030**



Source(s) : E3ME, Cambridge Econometrics

**Figure 2.20: Pessimistic Scenario – Percentage Differences from Baseline in 2030**



Source(s) : E3ME, Cambridge Econometrics

## 2.8 Macro Results - Key messages

### Labour supply

The European labour force is expected to continue to expand in the coming years, although the pace of increase will slow after 2020 when the labour force level is expected to remain stable. The increase in labour supply is caused by gradually rising rates of participation, particularly among older workers in part because of the statutory retirement age being raised in some countries. Despite this, one of the demographic trends that will curb the

growth of the labour force is the aging of the population, which will put more individuals in the age brackets with traditionally low rates of participation.

#### *Employment demand*

The projections of employment demand must take this slower growth of the labour supply into account, as well as the recovery from recession. While European employment fell in 2012 and almost no growth is expected in 2013 due to continuing Eurozone uncertainty, growth is expected to resume from 2014 onwards; clearly, however, this is dependent on economic and political developments.

#### *Unemployment*

This combination of the forecast growth of demand for labour and supply of labour will result in a gradual fall in unemployment rates over the projection period, reversing the large increase in unemployment seen in the financial crisis and subsequent recession. It should be noted that the rates of the fall vary quite substantially between the different European countries, with southern Europe projected to have the most persistently high unemployment rates.

### **2.9 Macro Results - Uncertainties**

The main uncertainty around these projections is the rate of recovery from recession. EU28 GDP growth was negative in 2012 and zero growth is projected in 2013. Although modest GDP growth is assumed to resume from 2014 onwards, there is much uncertainty over the pace and sustainability of economic growth following the recession.

Therefore, to explore this uncertainty we designed and implemented sensitivity analysis to assess the responsiveness of labour market outcomes to alternative scenarios of economic growth. The scenarios characterise the key drivers underlying the uncertainty: access to credit; consumer confidence; global growth and commodity prices; and the fiscal responses of Member State governments. The inputs to the scenarios were intentionally designed to illustrate the relative sensitivity of the different sectors and, by extension, Member States.

The results of the exercise show that the most exposed sectors are those that rely on investment spending, in particular construction and its suppliers. Sectors that rely on household expenditure, including hotels & catering may also be vulnerable to lower rates of economic growth. Although the optimistic and pessimistic scenarios reveal variation in the relative sensitivities of sectors and Members States, the key labour market trends remain robust to the alternative scenarios of economic growth: the expansion of the labour force in Europe is set to slow and the economy will become increasingly concentrated in service-based activities.

### **3. Trends in the demand for skills**

#### **3.1 Background**

The overall demand for labour and skills depends crucially on the general state of the economy and especially upon developments in the sectoral structure of employment. **Box 4** provides a brief summary of the methodology. The E3ME model generates sectoral projections for each of the countries (as described in Section 2 above). The underlying drivers of change (globalisation, technological change, etc) are encapsulated in the multi-sectoral macroeconomic model. These are projected to continue the shift in the structure of the economy towards employment in services generally, and towards the knowledge economy in particular. Changing employment patterns within industries are driven by technological and organisational change. Separate models of skill demands are used to represent these shifts.

#### **Box 4: Measurement and Modelling of the Demand for Skills**

The demand for skills is measured by the numbers in employment by occupation and by highest qualification held. Strictly, of course, observed employment levels are the result of both demand and supply factors.

Demand should also include any unfilled vacancies. At present there are no comprehensive and consistent measures of these are available, at a pan-European level at the level of detail required.

Shifts in sectoral employment structure, derived from the multi-sectoral macroeconomic model, are one of the main drivers of change in the demand for skills.

- The projections begin from the E3ME multi-sectoral macroeconomic model.
- Implications for occupations and qualifications are then developed using models of employment structure within industries, as described in Wilson *et al.* (2013).
- Replacement demands are estimated using a cohort component model developed originally by Kriechel *et al.* (2012) and summarised in Wilson *et al.* (2013).

Measuring and projecting the demand for formal qualifications is less straightforward than measuring supply. On the demand side changes in the industrial structure of employment are combining with skill biased technological change to increase the demand for the higher level occupations (managers, professionals, associate professionals), as well as some lower level ones (a process often referred to as polarisation). The former will undoubtedly increase the demand for those qualified at the highest, as well as intermediate level. The latter has a more ambiguous effect.

On balance, the results suggest that the overall prospects for the demand for skills (as measured by formal qualifications) are likely to remain positive.



## 3.2 Implications for occupations

### *Dealing with the change occupational classification*

These projections adopt the ISCO08 system for classifying occupations. Previous sets of projections used the older ISCO88 system. An initial attempt to move to the ISCO08 system was made in the previous round. Now there are a few more data available on the new classification which enables a better effort to be made to produce meaningful estimates of occupational employment for ISCO08 categories. However, this is still very limited as set out in the analysis by Stehrer and Ward (2015).

The analysis of changing employment patterns by occupation (and qualification) is based on the latest ELFS data as described in Stehrer and Ward (2015) and Stehrer *et al.* (2015). The more general methodology for developing the occupational projections is set out in Wilson *et al.* (2013). In most countries, official data on an ISCO08 basis are still only available for just a few years. There are no generally available mappings from the new ISCO08 categories to the old ISCO88 ones. This poses a major challenge for making projections on an ISCO08 basis.

As noted in Stehrer and Ward (2015) and Stehrer *et al.* (2015) the underlying trends on the new basis are still far from clear. As a result no attempt has been made to try to discern such trends at a detailed level within countries (e.g. by industry).

Building on previous work (Wilson *et al.* (2013), three alternatives were considered for developing projections of occupational employment structure:

1. Maintaining fixed shares – holding the occupational employment shares within industries fixed for all future years based on average values for the period for which data are available;
2. Basing changes in shares over time on observed and projected future changes from the previous results using the nearest ISCO88 equivalent;
3. Some more complex alternative based on detailed analysis of the LFS data as discussed in more detail in Stehrer *et al.*(2015).

Country experts were asked to comment on the first two options at various Skillsnet workshops held between 2013 and 2015. Option 2 was presented as the default. The experts agreed that despite the reservation raised in Stehrer and Ward (2015) this approach remains the most plausible in the absence of more reliable data. The results obtained are broadly in line with the expectations of and most country experts. Where there are issues the projections have been amended to reflect the ICE's views. Debate on this issue at the November 2015 Thessaloniki workshop concluded that (in the short- term) there is no viable alternative. Further work on option 3 has continued as set out in Stehrer and Ward (2015).

Examination of the patterns of occupational shares between 2011 and subsequent years (2012-2014) suggest that (as anticipated during the discussion at the Workshop) there has been a “learning process” in adopting the new classification in most countries. As a consequence there appears to have been significant discontinuities between 2011 and subsequent years. The initial estimates for 2011 appear unreliable. Rather than attempt to discern trends from just 3 or 4 observations it has been decided to adopt the same methodology as in the previous round, but simply substituting average values of shares for 2012-2014 for the previous 2011 values.

The new results therefore offer just two possibilities:

- Maintaining fixed shares – holding the occupational employment shares within industries fixed for all future years based on average values for the 2012-2014;
- Basing changes in shares over time from 2013 onwards (the mid-point of 2012-14) on observed and projected future changes from the previous results using the nearest ISCO88 equivalent.

The latter is the default position adopted in the country workbooks. The former can be observed using the shift-share feature available in the country workbooks and stripping out the “occupational effect”.

### *Expansion demands*

The projections of changes in employment levels using this approach are referred to as “expansion demands” (although in many cases they may be negative). The general factors influencing the demand for skills are set out in **Box 5**. They suggest significant growth in employment levels for higher level occupations (managers, professionals, technicians and other associate professionals). Some growth is also expected for some less skilled jobs, especially in service activities such as sales, security, cleaning, catering and caring occupations. Job losses are projected for many skilled manual workers (especially in agriculture), and also for clerks. This can be characterised as a continuation of the trends towards a polarisation of skill demand, with hollowing out of many of the jobs in the middle.

The trends and changing occupational patterns of employment are illustrated in Figures 3.1-3.5. The sectoral changes discussed in Section 2 above are being reinforced by changes in the way work is organised and jobs are performed within sectors. In combination these result in strong increases in demand for many highly and medium-skilled jobs, as well as for some lower skilled occupations working in service sectors.

Positive trends are shown for management, professional and associate professional occupations as well as for many service workers, especially in retail and distribution, and restaurants and hotels. Some of these changes indicate more job opportunities for occupations requiring little or no formal skills. The phenomenon of polarisation, with hollowing out of the job structure in the middle, and growth at both high and low skills ends of the spectrum, is again a key feature of the results. Clerks, skilled agricultural workers and craft and related occupations are the areas where employment losses are projected to be most acute.

### *Replacement needs and total requirements*

The discussion so far has been about expected net changes in employment levels (expansion demands). It is also important to take account of replacement needs as people leave the workforce for retirement or other reasons. Replacement needs reinforce the projected positive changes in “expansion demands”, and also serve to offset any negative changes (which as Figures 3.1 and 3.2 show are quite common). Total job openings or “total requirements” are the sum of expansion and replacement demands. Rates of replacement needs have been estimated using the cohort components method as described in Künn-Nelen and Sijbers (2015).

The results of applying these rates are summarised in Figure 3.6. They show that replacement needs are projected to be positive for all the 9 major occupational groups distinguished (see the white as opposed to black bars). Even for occupations

in significant long-term employment decline, such as clerks, skilled agricultural workers and craft and related occupations, this results in some job openings between 2015 and 2025.

Replacement demand affects both sectors and occupations. Updated estimates of replacement demands by industry as well as occupation can be found in the *Country Workbooks*. These results emphasise that although the employment levels in primary and manufacturing sectors are projected to decline they will remain significant sources of jobs. These are crucial components of the economy and meeting these replacement needs will be essential if activity in these areas is to be sustained.

### *Full set of results at the 2 digit level of !SCO08 (41 categories)*

In the previous round of projections indicative results at the 2-digit level of ISO08 were produced. These were based on a simple sharing out process for the broader categories based on the old ISCO88 occupational groupings used in previous projections.

In this latest set of results the full employment database has been expanded to cover the 41 more detailed ISCO08 categories throughout.

Figures 3.7a-f present the results at this more detailed level for the first time for the EU28+3 countries. Similar results are available for each individual country in the *Country Workbooks*.

As noted above, the data currently available from the ELFS are not robust enough to identify clear historical trends at this level of detail within industries for the new ISCO08 categories. Past trends in ISCO88 categories are therefore combined with estimates for current (2013)<sup>14</sup> patterns classified using ISCO08.

The Shift-Share analysis embedded in the *Country Workbooks* enables users to consider the implications of keeping occupational shares fixed at base levels. For example in Figure 3.7f the default estimates show the projections based on assuming occupational employment shares within industries changes in line with the old ISCO88 patterns for the target year and period (in this case 2030 and 2010-30 respectively). However, the subsequent columns of results separate out the scale, industry and occupation effects, so the latter can be easily excluded to generate an alternative based on assuming fixed occupational shares and only allowing for scale and industry changes.

Most managerial, professional and associate professional occupations are projected to experience significant employment growth. The main exception is teaching professionals. This is mostly due to a negative occupational effect (reflecting the increase in support staff as opposed to professionals in many countries). The industry effect is also negative reflecting the continued impact of austerity measures on public expenditure on education over the longer term.

Legal, social, cultural and related occupations are projected to see one of the fastest rates of job growth. The positive scale effect is reinforced by both strong industry and occupational effects (see Table 3.7f).

General and keyboard clerks, Numerical and material recording clerks and Other clerical support workers are projected to experience some of the fastest rates of job decline as the impact of ICT continues to impact on this kind of routine work. Strong negative occupational effects are the main cause, reflecting the impact of such

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<sup>14</sup> Average values of ELFS shares for 2012-2014.

technological changes. Customer service clerks whose work is less routine and subject to automation have more optimistic prospects.

Skilled agricultural workers have one of the fastest rates of projected job loss, reflecting continued structural change and the decline of employment in the agricultural sector. A strongly negative industry effect is a prime driver (see Table 3.7f). Despite this there are substantial replacement demands that will have to be met if the agricultural sector is to satisfy its skill requirements (see Table 3.7e).

While Craft and related trades workers generally are expected to experience significant job losses, some categories such as Building and related trades workers (excluding electricians) have more positive prospects as the economy picks up and strong occupational effects outweigh negative industry effects. Again for all the n Craft and related trades workers occupations there are significant replacement demands which offset the projected decline in overall employment levels. There will therefore be a continued need to attract and appropriately train people for work in these occupations.

Amongst Plant and machine operators and assemblers and Elementary occupations the picture is mixed, with some occupations growing and others in decline. The outcome reflect a complex mix of scale, industry and occupational effects, which can differ between countries.

**Box 5: Factors influencing the demand for skills**

The sectoral projections drive the demands for different occupations and qualifications. Trends in occupational patterns (as a share of total employment) are generally less affected by the recession than sectoral trends.

Structural change at the sectoral level has been reinforced by changes within sectors in recent years. These changes reflect the changing ways in which goods and services are produced and delivered. Together these two factors are projected to produce a general increase in the demand for skills over the medium term (as measured by occupation).

Similar remarks apply to qualifications, although here supply side factors are also very important.

Most of the increases in employment in recent years have been concentrated in higher skill level occupations (typically requiring higher level formal qualifications such as a university degree). These include areas such as management, professional and associate professional jobs. This pattern is expected to continue.

However some growth has also occurred for lower level occupations, (which do not normally require high level formal qualifications), especially in parts of the service sector where it is difficult to automate tasks. This is also projected to continue.

There have been significant job losses for many traditional (especially manual) skills linked to the sectors where employment is in long term trend decline. In many areas on manufacturing and primary industries, as well as some services, technology has enabled automation of processes of production. These trends are again expected to continue to 2025 and beyond. In many of these sectors output will continue to grow but growth will be “jobless” (or even showing continued declines).

**Figure 3.1: Projected Change by Occupation, 2005-25, (EU28+3)**

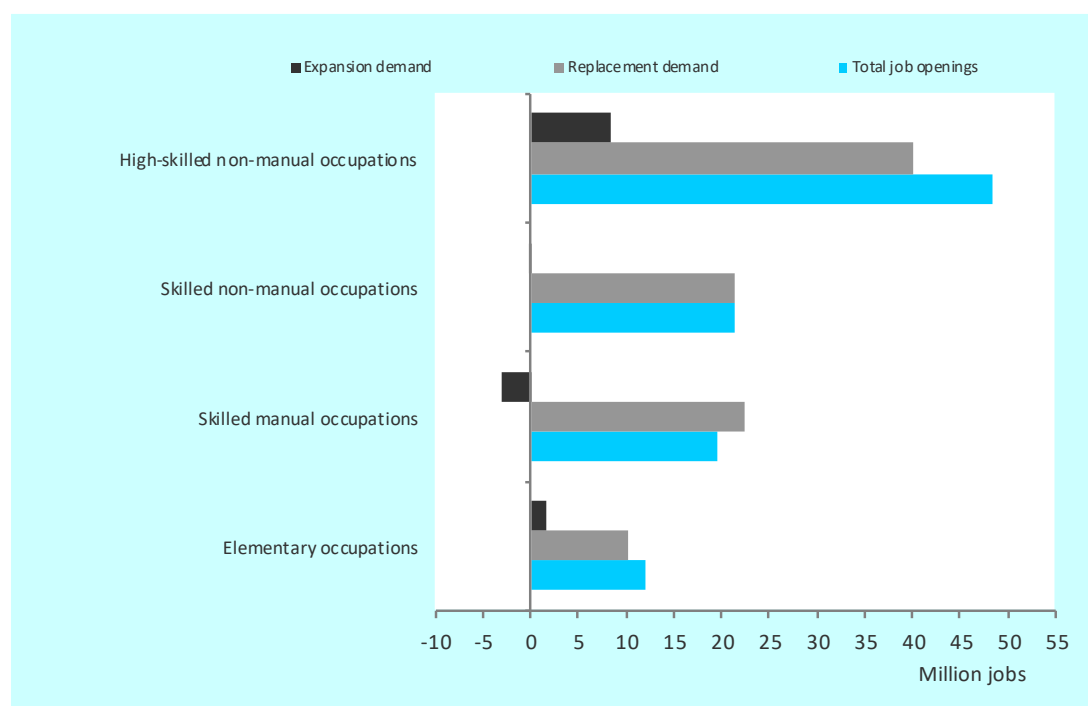
thousands

<b>Change</b>	<b>2005-2010</b>	<b>2005-2015</b>	<b>2015-2020</b>	<b>2020-2025</b>	<b>2015-2025</b>
Armed forces	-95	-235	-67	-81	-147
Legislators, senior officials and managers	566	966	738	616	1,354
Professionals	3,868	5,847	1,829	1,370	3,199
Technicians and associate professionals	1,566	3,186	2,141	1,749	3,891
Clerks	216	-510	-202	-560	-762
Service workers and shop and market sales workers	2,694	3,377	556	142	698
Skilled agricultural and fishery workers	-907	-1,619	-743	-495	-1,238
Craft and related trades workers	-793	-3,189	-833	-685	-1,519
Plant and machine operators and assemblers	-919	-1,227	-161	-137	-298
Elementary occupations	807	1,718	937	829	1,765
<b>All occupations</b>	<b>7,003</b>	<b>8,316</b>	<b>4,195</b>	<b>2,748</b>	<b>6,943</b>

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 2013\data\Workbooks\XCcountry\Eur31DemandConstrained.BaseC.xlsm  
 Source: IER estimates based on E3ME and EDMOD.

Note: The figures shows net changes in numbers in employment (often referred to as expansion demand (although these may be negative)). This is to distinguish it from replacement demands. The latter is the number of job openings arising because of people leaving the employed workforce for retirement or other reasons.

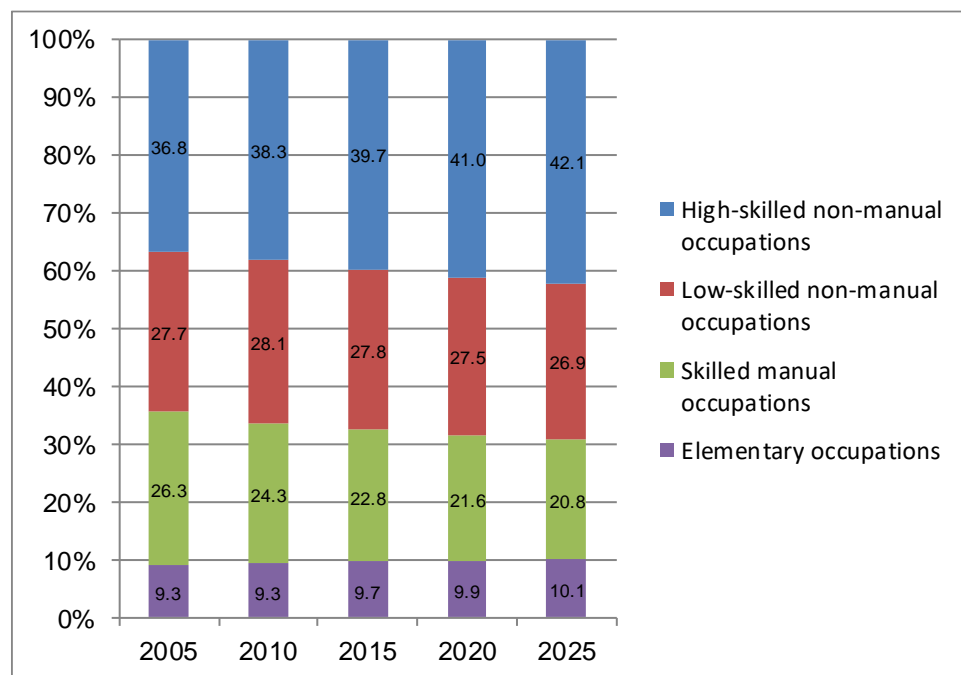
**Figure 3.2: Future job opportunities by broad occupation, 2015-2025 (EU-28+3)**



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 2013\data\Workbooks\Xcountry\Overview&Synthesis\_charts.xlsx  
 Source: IER estimates based on E3ME and EDMOD.

Note: This figure shows both net changes in numbers in employment (expansion demands) and total requirements of job openings (the sum of expansion demands and replacement demands). The latter is the number of job openings arising because of people leaving the employed workforce for retirement or other reasons. Total requirements are the total number of new job openings (net of any general labour turnover).

**Figure 3.3: Past and likely future occupational employment structure (EU28+3)**

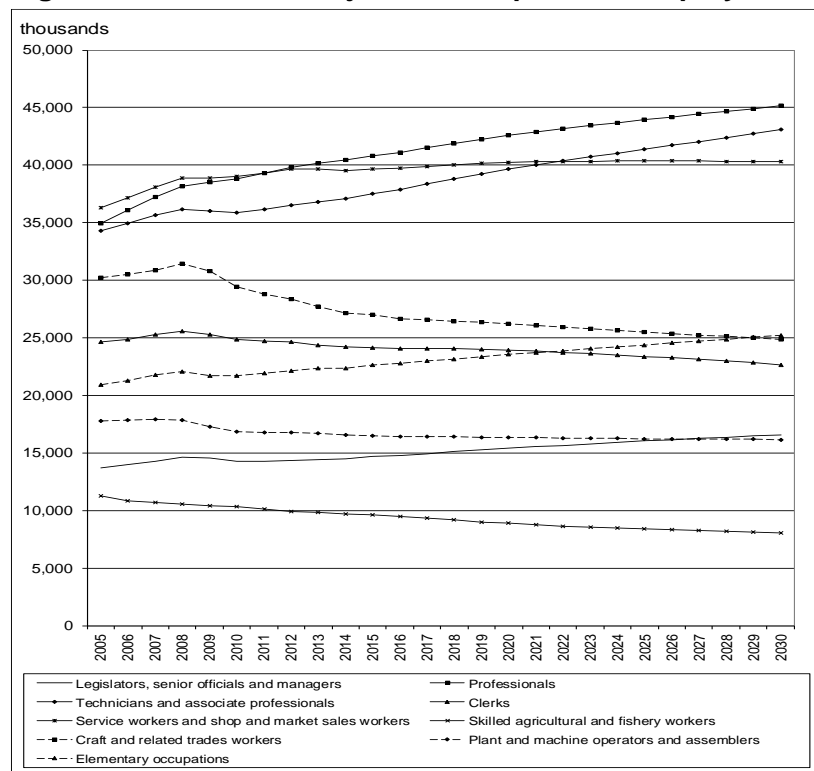


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Note: Numbers in employment (National Accounts based estimates).  
Source: IER estimates based on E3ME and EDMOD.



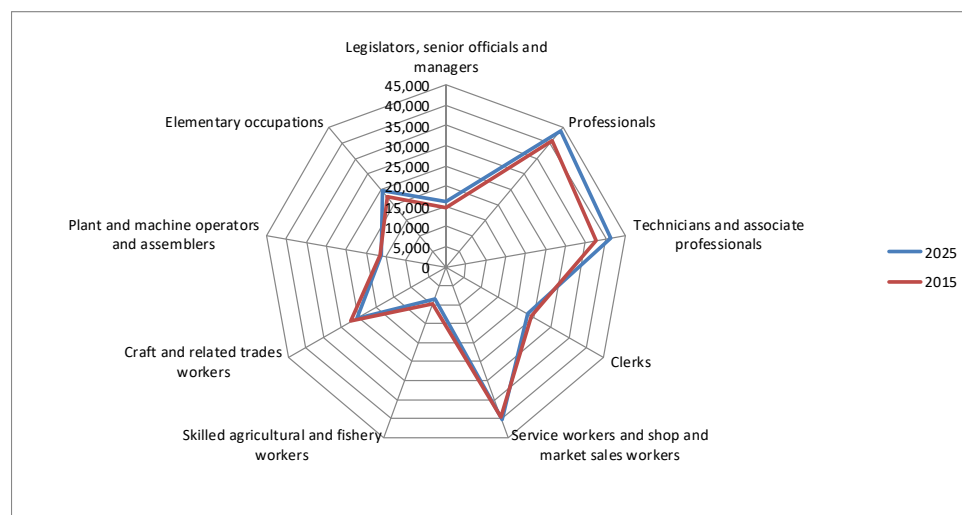
**Figure 3.4: Past and Projected Occupational Employment (EU28+3)**



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2013\data\Workbooks\XCountry\Eur31DemandConstrained.BaseC.xlsm

Note: Numbers in employment (National Accounts based estimates).  
Source: IER estimates based on E3ME and EDMOD.

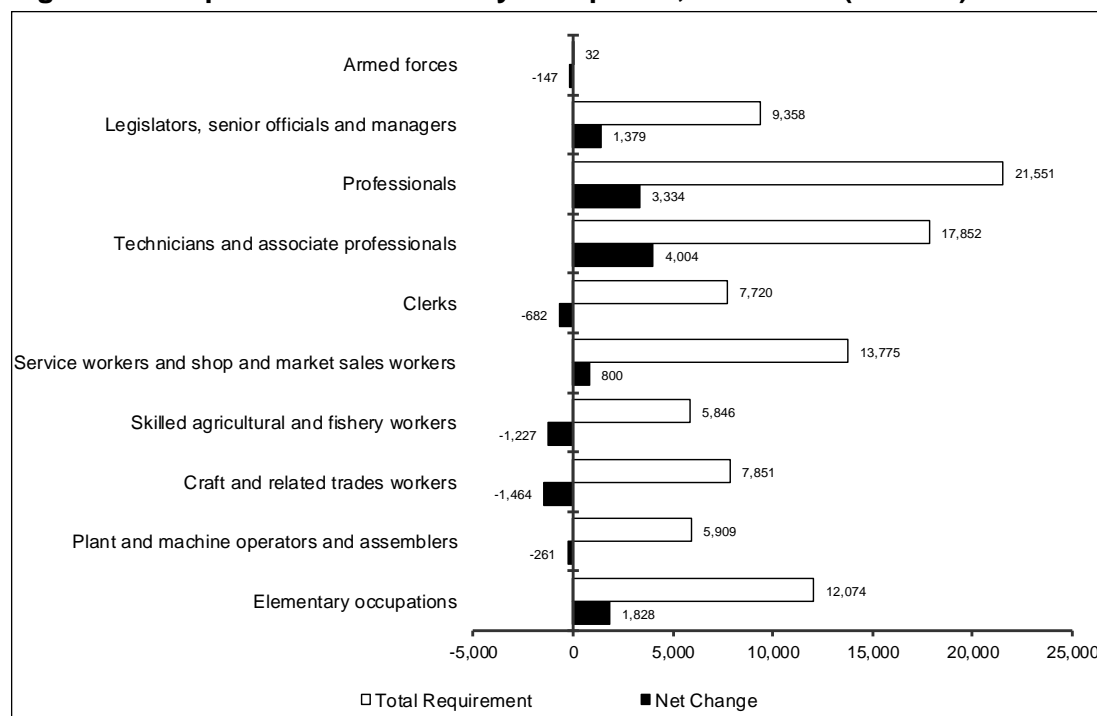
**Figure 3.5: The Changing Occupational Structure of Employment (EU28+3)**



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2013\data\Workbooks\Xcountry\Eur31DemandConstrained.BaseC.xlsm

Note: Based on numbers in employment (National Accounts based estimates).  
Source: IER estimates based on E3ME and EDMOD.

**Figure 3.6: Replacement demand by occupation, 2015-2025 (EU28+3)**



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 2013\data\Workbooks\Xcountry\Eur31DemandConstrained.BaseC\_Chart7.xlsm (modified)

Notes: a. This figure distinguishes expansion demand (the projected net change in employment levels by occupation) and replacement demand (the number of job opening arising because of people leaving the employed workforce for retirement or other reasons). Total requirements are the sum of these (the total number of job openings (net of any general labour turnover)).

b. Numbers in employment (National Accounts based estimates).

Source: IER estimates based on E3ME and STOCKFLOWMOD.

## Forecasting skill supply and demand in Europe: Overview of 2015/16 Projections

**Figure 3.7a: Detailed occupational results, 2005-2025 (EU28+3), Levels**

	Levels				
	2005	2010	2015	2020	2025
<i>Armed forces</i>	1,481	1,386	1,246	1,179	1,098
<i>Legislators, senior officials and managers</i>	13,727	14,293	14,693	15,441	16,072
11. Chief executives, senior officials and legislators	1,617	1,762	1,873	1,955	2,026
12. Administrative and commercial managers	3,564	3,729	3,820	4,103	4,328
13. Production and specialised services managers	4,464	4,764	4,879	5,087	5,280
14. Hospitality, retail and other services managers	4,081	4,039	4,121	4,296	4,438
<i>Professionals</i>	34,934	38,803	40,781	42,666	44,115
21. Science and engineering professionals	5,470	6,000	6,426	6,855	7,231
22. Health professionals	5,124	5,753	5,802	6,013	6,170
23. Teaching professionals	9,989	10,432	10,220	10,148	9,956
24. Business and administration professionals	6,837	7,826	8,656	9,299	9,829
25. Information and communications technology professionals	2,751	3,228	3,658	3,897	4,116
26. Legal, social and cultural professionals	4,764	5,563	6,019	6,453	6,812
<i>Technicians and associate professionals</i>	34,330	35,895	37,515	39,702	41,520
31. Science and engineering associate professionals	7,795	8,118	8,215	8,309	8,366
32. Health associate professionals	5,219	5,541	5,868	6,184	6,453
33. Business and administration associate professionals	14,940	16,228	16,830	17,586	18,119
34. Legal, social, cultural and related associate professionals	4,690	4,251	4,769	5,728	6,639
35. Information and communications technicians	1,686	1,757	1,835	1,894	1,942
<i>Clerks</i>	24,672	24,887	24,162	23,997	23,480
41. General and keyboard clerks	7,688	7,760	7,321	7,033	6,650
42. Customer services clerks	5,155	5,401	5,779	6,392	6,947
43. Numerical and material recording clerks	8,530	8,545	8,115	7,782	7,326
44. Other clerical support workers	3,298	3,180	2,947	2,790	2,557
<i>Service workers and shop and market sales workers</i>	36,316	39,011	39,694	40,286	40,494
51. Personal service workers	10,456	11,409	11,607	11,747	11,852
52. Sales workers	15,433	16,073	16,309	16,508	16,494
53. Personal care workers	6,902	7,676	7,966	8,226	8,394
54. Protective services workers	3,526	3,852	3,812	3,805	3,754
<i>Skilled agricultural and fishery workers</i>	11,272	10,366	9,654	8,919	8,427
61. Market-oriented skilled agricultural workers	10,058	9,286	8,684	8,026	7,588
62. Market-oriented skilled forestry, fishery and hunting workers	491	439	421	404	396
63. Subsistence farmers, fishers, hunters and gatherers	723	641	549	489	444
<i>Craft and related trades workers</i>	30,226	29,433	27,037	26,217	25,573
71. Building and related trades workers, excluding electricians	9,174	9,921	8,981	9,035	9,266
72. Metal, machinery and related trades workers	9,664	9,337	8,735	8,293	7,841
73. Handicraft and printing workers	1,815	1,461	1,323	1,274	1,220
74. Electrical and electronic trades workers	3,999	3,921	3,568	3,450	3,342
75. Food processing, wood working, garment and other craft and rel.	5,573	4,792	4,430	4,165	3,903
<i>Plant and machine operators and assemblers</i>	17,767	16,848	16,540	16,393	16,280
81. Stationary plant and machine operators	6,010	5,421	5,308	5,179	5,049
82. Assemblers	2,238	1,624	1,661	1,857	2,050
83. Drivers and mobile plant operators	9,519	9,804	9,571	9,357	9,181
<i>Elementary occupations</i>	20,925	21,731	22,643	23,602	24,471
91. Cleaners and helpers	8,540	9,278	9,683	10,167	10,566
92. Agricultural, forestry and fishery labourers	1,843	1,891	2,000	2,033	2,089
93. Labourers in mining, construction, manufacturing and transport	6,328	6,209	6,510	6,918	7,319
94. Food preparation assistants	1,678	1,756	1,809	1,807	1,803
95. Street and related sales and service workers	201	204	192	184	173
96. Refuse workers and other elementary workers	2,335	2,394	2,448	2,493	2,520
<b>All industries</b>	<b>225,649</b>	<b>232,652</b>	<b>233,965</b>	<b>238,400</b>	<b>241,529</b>

## Forecasting skill supply and demand in Europe: Overview of 2015/16 Projections

**Figure 3.7b: Detailed occupational results, 2005-2025 (EU28+3), changes**

	Change				
	2005-2010	2005-2015	2015-2020	2020-2025	2015-2025
<i>Armed forces</i>	-95	-235	-67	-81	-147
<i>Legislators, senior officials and managers</i>	566	966	748	631	1,379
11. Chief executives, senior officials and legislators	145	255	83	71	154
12. Administrative and commercial managers	165	256	283	225	508
13. Production and specialised services managers	299	415	208	193	401
14. Hospitality, retail and other services managers	-42	40	175	142	317
<i>Professionals</i>	3,868	5,847	1,884	1,449	3,334
21. Science and engineering professionals	530	956	429	376	805
22. Health professionals	629	679	211	157	368
23. Teaching professionals	443	231	-72	-192	-264
24. Business and administration professionals	989	1,820	643	530	1,173
25. Information and communications technology professionals	477	907	239	219	458
26. Legal, social and cultural professionals	799	1,254	435	359	794
<i>Technicians and associate professionals</i>	1,566	3,186	2,186	1,818	4,004
31. Science and engineering associate professionals	322	419	95	56	151
32. Health associate professionals	323	649	316	270	585
33. Business and administration associate professionals	1,288	1,889	757	533	1,290
34. Legal, social, cultural and related associate professionals	-438	79	959	911	1,870
35. Information and communications technicians	72	149	60	48	108
<i>Clerks</i>	216	-510	-165	-517	-682
41. General and keyboard clerks	72	-367	-288	-382	-671
42. Customer services clerks	246	624	613	555	1,168
43. Numerical and material recording clerks	15	-415	-333	-456	-789
44. Other clerical support workers	-118	-352	-157	-233	-390
<i>Service workers and shop and market sales workers</i>	2,694	3,377	592	208	800
51. Personal service workers	953	1,151	139	105	245
52. Sales workers	640	876	199	-14	185
53. Personal care workers	774	1,064	260	168	428
54. Protective services workers	327	286	-6	-52	-58
<i>Skilled agricultural and fishery workers</i>	-907	-1,619	-735	-491	-1,227
61. Market-oriented skilled agricultural workers	-772	-1,374	-657	-439	-1,096
62. Market-oriented skilled forestry, fishery and hunting workers	-52	-70	-18	-8	-26
63. Subsistence farmers, fishers, hunters and gatherers	-82	-174	-60	-45	-105
<i>Craft and related trades workers</i>	-793	-3,189	-820	-644	-1,464
71. Building and related trades workers, excluding electricians	747	-193	54	231	285
72. Metal, machinery and related trades workers	-327	-930	-441	-452	-893
73. Handicraft and printing workers	-354	-493	-49	-54	-103
74. Electrical and electronic trades workers	-78	-431	-119	-107	-226
75. Food processing, wood working, garment and other craft and rel.	-781	-1,143	-265	-262	-527
<i>Plant and machine operators and assemblers</i>	-919	-1,227	-148	-113	-261
81. Stationary plant and machine operators	-589	-701	-129	-130	-259
82. Assemblers	-614	-577	196	194	389
83. Drivers and mobile plant operators	284	52	-214	-176	-390
<i>Elementary occupations</i>	807	1,718	960	868	1,828
91. Cleaners and helpers	738	1,144	484	398	883
92. Agricultural, forestry and fishery labourers	47	157	33	56	89
93. Labourers in mining, construction, manufacturing and transport	-119	182	408	402	809
94. Food preparation assistants	78	131	-2	-4	-6
95. Street and related sales and service workers	3	-9	-8	-10	-19
96. Refuse workers and other elementary workers	60	114	45	27	72
<b>All industries</b>	<b>7,003</b>	<b>8,316</b>	<b>4,435</b>	<b>3,129</b>	<b>7,564</b>

## Forecasting skill supply and demand in Europe: Overview of 2015/16 Projections

**Figure 3.7c: Detailed occupational results, 2005-2025 (EU28+3), % changes**

	Growth (% per annum)				
	2005-2010	2005-2015	2015-2020	2020-2025	2015-2025
<i>Armed forces</i>	-1.3	-1.7	-1.1	-1.4	-1.3
<i>Legislators, senior officials and managers</i>	0.8	0.7	1.0	0.8	0.9
11. Chief executives, senior officials and legislators	1.7	1.5	0.9	0.7	0.8
12. Administrative and commercial managers	0.9	0.7	1.4	1.1	1.3
13. Production and specialised services managers	1.3	0.9	0.8	0.7	0.8
14. Hospitality, retail and other services managers	-0.2	0.1	0.8	0.7	0.7
<i>Professionals</i>	2.1	1.6	0.9	0.7	0.8
21. Science and engineering professionals	1.9	1.6	1.3	1.1	1.2
22. Health professionals	2.3	1.3	0.7	0.5	0.6
23. Teaching professionals	0.9	0.2	-0.1	-0.4	-0.3
24. Business and administration professionals	2.7	2.4	1.4	1.1	1.3
25. Information and communications technology professionals	3.3	2.9	1.3	1.1	1.2
26. Legal, social and cultural professionals	3.1	2.4	1.4	1.1	1.2
<i>Technicians and associate professionals</i>	0.9	0.9	1.1	0.9	1.0
31. Science and engineering associate professionals	0.8	0.5	0.2	0.1	0.2
32. Health associate professionals	1.2	1.2	1.1	0.9	1.0
33. Business and administration associate professionals	1.7	1.2	0.9	0.6	0.7
34. Legal, social, cultural and related associate professionals	-1.9	0.2	3.7	3.0	3.4
35. Information and communications technicians	0.8	0.9	0.6	0.5	0.6
<i>Clerks</i>	0.2	-0.2	-0.1	-0.4	-0.3
41. General and keyboard clerks	0.2	-0.5	-0.8	-1.1	-1.0
42. Customer services clerks	0.9	1.1	2.0	1.7	1.9
43. Numerical and material recording clerks	0.0	-0.5	-0.8	-1.2	-1.0
44. Other clerical support workers	-0.7	-1.1	-1.1	-1.7	-1.4
<i>Service workers and shop and market sales workers</i>	1.4	0.9	0.3	0.1	0.2
51. Personal service workers	1.8	1.1	0.2	0.2	0.2
52. Sales workers	0.8	0.6	0.2	0.0	0.1
53. Personal care workers	2.1	1.4	0.6	0.4	0.5
54. Protective services workers	1.8	0.8	0.0	-0.3	-0.2
<i>Skilled agricultural and fishery workers</i>	-1.7	-1.5	-1.6	-1.1	-1.3
61. Market-oriented skilled agricultural workers	-1.6	-1.5	-1.6	-1.1	-1.3
62. Market-oriented skilled forestry, fishery and hunting workers	-2.2	-1.5	-0.8	-0.4	-0.6
63. Subsistence farmers, fishers, hunters and gatherers	-2.4	-2.7	-2.3	-1.9	-2.1
<i>Craft and related trades workers</i>	-0.5	-1.1	-0.6	-0.5	-0.6
71. Building and related trades workers, excluding electricians	1.6	-0.2	0.1	0.5	0.3
72. Metal, machinery and related trades workers	-0.7	-1.0	-1.0	-1.1	-1.1
73. Handicraft and printing workers	-4.3	-3.1	-0.8	-0.9	-0.8
74. Electrical and electronic trades workers	-0.4	-1.1	-0.7	-0.6	-0.7
75. Food processing, wood working, garment and other craft and rel.	-3.0	-2.3	-1.2	-1.3	-1.3
<i>Plant and machine operators and assemblers</i>	-1.1	-0.7	-0.2	-0.1	-0.2
81. Stationary plant and machine operators	-2.0	-1.2	-0.5	-0.5	-0.5
82. Assemblers	-6.2	-2.9	2.3	2.0	2.1
83. Drivers and mobile plant operators	0.6	0.1	-0.5	-0.4	-0.4
<i>Elementary occupations</i>	0.8	0.8	0.8	0.7	0.8
91. Cleaners and helpers	1.7	1.3	1.0	0.8	0.9
92. Agricultural, forestry and fishery labourers	0.5	0.8	0.3	0.5	0.4
93. Labourers in mining, construction, manufacturing and transport	-0.4	0.3	1.2	1.1	1.2
94. Food preparation assistants	0.9	0.8	0.0	0.0	0.0
95. Street and related sales and service workers	0.3	-0.4	-0.9	-1.2	-1.0
96. Refuse workers and other elementary workers	0.5	0.5	0.4	0.2	0.3
All industries	0.6	0.4	0.4	0.3	0.3

## Forecasting skill supply and demand in Europe: Overview of 2015/16 Projections

**Figure 3.7d Detailed occupational results, 2005-2025 (EU28+3), % shares**

	Shares (per cent)				
	2005	2010	2015	2020	2025
<i>Armed forces</i>	0.7	0.6	0.5	0.5	0.5
<i>Legislators, senior officials and managers</i>	6.1	6.1	6.3	6.5	6.7
11. Chief executives, senior officials and legislators	11.8	12.3	12.7	12.7	12.6
12. Administrative and commercial managers	26.0	26.1	26.0	26.6	26.9
13. Production and specialised services managers	32.5	33.3	33.2	32.9	32.9
14. Hospitality, retail and other services managers	29.7	28.3	28.0	27.8	27.6
<i>Professionals</i>	15.5	16.7	17.4	17.9	18.3
21. Science and engineering professionals	15.7	15.5	15.8	16.1	16.4
22. Health professionals	14.7	14.8	14.2	14.1	14.0
23. Teaching professionals	28.6	26.9	25.1	23.8	22.6
24. Business and administration professionals	19.6	20.2	21.2	21.8	22.3
25. Information and communications technology professionals	7.9	8.3	9.0	9.1	9.3
26. Legal, social and cultural professionals	13.6	14.3	14.8	15.1	15.4
<i>Technicians and associate professionals</i>	15.2	15.4	16.0	16.7	17.2
31. Science and engineering associate professionals	22.7	22.6	21.9	20.9	20.1
32. Health associate professionals	15.2	15.4	15.6	15.6	15.5
33. Business and administration associate professionals	43.5	45.2	44.9	44.3	43.6
34. Legal, social, cultural and related associate professionals	13.7	11.8	12.7	14.4	16.0
35. Information and communications technicians	4.9	4.9	4.9	4.8	4.7
<i>Clerks</i>	10.9	10.7	10.3	10.1	9.7
41. General and keyboard clerks	31.2	31.2	30.3	29.3	28.3
42. Customer services clerks	20.9	21.7	23.9	26.6	29.6
43. Numerical and material recording clerks	34.6	34.3	33.6	32.4	31.2
44. Other clerical support workers	13.4	12.8	12.2	11.6	10.9
<i>Service workers and shop and market sales workers</i>	16.1	16.8	17.0	16.9	16.8
51. Personal service workers	28.8	29.2	29.2	29.2	29.3
52. Sales workers	42.5	41.2	41.1	41.0	40.7
53. Personal care workers	19.0	19.7	20.1	20.4	20.7
54. Protective services workers	9.7	9.9	9.6	9.4	9.3
<i>Skilled agricultural and fishery workers</i>	5.0	4.5	4.1	3.7	3.5
61. Market-oriented skilled agricultural workers	27.7	23.8	21.9	19.9	18.7
62. Market-oriented skilled forestry, fishery and hunting workers	1.4	1.1	1.1	1.0	1.0
63. Subsistence farmers, fishers, hunters and gatherers	2.0	1.6	1.4	1.2	1.1
<i>Craft and related trades workers</i>	13.4	12.7	11.6	11.0	10.6
71. Building and related trades workers, excluding electricians	30.4	33.7	33.2	34.5	36.2
72. Metal, machinery and related trades workers	32.0	31.7	32.3	31.6	30.7
73. Handicraft and printing workers	6.0	5.0	4.9	4.9	4.8
74. Electrical and electronic trades workers	13.2	13.3	13.2	13.2	13.1
75. Food processing, wood working, garment and other craft and rel	18.4	16.3	16.4	15.9	15.3
<i>Plant and machine operators and assemblers</i>	7.9	7.2	7.1	6.9	6.7
81. Stationary plant and machine operators	33.8	32.2	32.1	31.6	31.0
82. Assemblers	12.6	9.6	10.0	11.3	12.6
83. Drivers and mobile plant operators	53.6	58.2	57.9	57.1	56.4
<i>Elementary occupations</i>	9.3	9.3	9.7	9.9	10.1
91. Cleaners and helpers	40.8	42.7	42.8	43.1	43.2
92. Agricultural, forestry and fishery labourers	8.8	8.7	8.8	8.6	8.5
93. Labourers in mining, construction, manufacturing and transport	30.2	28.6	28.8	29.3	29.9
94. Food preparation assistants	8.0	8.1	8.0	7.7	7.4
95. Street and related sales and service workers	1.0	0.9	0.8	0.8	0.7
96. Refuse workers and other elementary workers	11.2	11.0	10.8	10.6	10.3
<b>All industries</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

## Forecasting skill supply and demand in Europe: Overview of 2015/16 Projections

**Figure 3.7e Detailed occupational results, 2015-2025 (EU28+3), RDs**

<b>Summation over qualifications above (Scaled) - Final result</b>	<b>2015</b>	<b>2025</b>	<b>Net Change</b>	<b>Replacement Demand</b>	<b>Total Requirement</b>	<b>RD ratio</b>
01. Armed forces	1,246	1,098	-147	179	32	0.01
11. Chief executives, senior officials and legislators	1,873	2,026	154	1,303	1,457	0.05
12. Administrative and commercial managers	3,820	4,328	508	1,470	1,977	0.03
13. Production and specialised services managers	4,879	5,280	401	2,756	3,157	0.05
14. Hospitality, retail and other services managers	4,121	4,438	317	2,450	2,767	0.05
21. Science and engineering professionals	6,426	7,231	805	2,183	2,987	0.03
22. Health professionals	5,802	6,170	368	2,988	3,356	0.04
23. Teaching professionals	10,220	9,956	-264	5,030	4,766	0.04
24. Business and administration professionals	8,656	9,829	1,173	3,815	4,988	0.04
25. Information and communications technology professionals	3,658	4,116	458	1,608	2,066	0.04
26. Legal, social and cultural professionals	6,019	6,812	794	2,593	3,387	0.04
31. Science and engineering associate professionals	8,215	8,366	151	2,803	2,954	0.03
32. Health associate professionals	5,868	6,453	585	2,008	2,593	0.03
33. Business and administration associate professionals	16,830	18,119	1,290	6,708	7,997	0.03
34. Legal, social, cultural and related associate professionals	4,769	6,639	1,870	1,721	3,591	0.03
35. Information and communications technicians	1,835	1,942	108	609	716	0.03
41. General and keyboard clerks	7,321	6,650	-671	2,530	1,860	0.03
42. Customer services clerks	5,779	6,947	1,168	1,795	2,962	0.03
43. Numerical and material recording clerks	8,115	7,326	-789	2,972	2,183	0.03
44. Other clerical support workers	2,947	2,557	-390	1,105	715	0.03
51. Personal service workers	11,607	11,852	245	3,952	4,197	0.03
52. Sales workers	16,309	16,494	185	5,001	5,187	0.03
53. Personal care workers	7,966	8,394	428	2,735	3,162	0.03
54. Protective services workers	3,812	3,754	-58	1,287	1,229	0.03
61. Market-oriented skilled agricultural workers	8,684	7,588	-1,096	6,394	5,298	0.06
62. Market-oriented skilled forestry, fishery and hunting workers	421	396	-26	294	268	0.05
63. Subsistence farmers, fishers, hunters and gatherers	549	444	-105	384	280	0.05
71. Building and related trades workers, excluding electricians	8,981	9,266	285	2,980	3,265	0.03
72. Metal, machinery and related trades workers	8,735	7,841	-893	2,978	2,085	0.03
73. Handicraft and printing workers	1,323	1,220	-103	545	443	0.04
74. Electrical and electronic trades workers	3,568	3,342	-226	1,233	1,007	0.03
75. Food processing, wood working, garment and other craft and rel.	4,430	3,903	-527	1,580	1,052	0.03
81. Stationary plant and machine operators	5,308	5,049	-259	1,686	1,427	0.03
82. Assemblers	1,661	2,050	389	483	872	0.03
83. Drivers and mobile plant operators	9,571	9,181	-390	4,000	3,610	0.04
91. Cleaners and helpers	9,683	10,566	883	4,773	5,655	0.04
92. Agricultural, forestry and fishery labourers	2,000	2,089	89	1,044	1,132	0.04
93. Labourers in mining, construction, manufacturing and transport	6,510	7,319	809	2,112	2,922	0.03
94. Food preparation assistants	1,809	1,803	-6	974	968	0.04
95. Street and related sales and service workers	192	173	-19	87	68	0.04
96. Refuse workers and other elementary workers	2,448	2,520	72	1,257	1,329	0.04
All occupations	233,965	241,529	7,564	94,403	101,967	0.03

## Forecasting skill supply and demand in Europe: Overview of 2015/16 Projections

**Figure 3.7f Detailed occupational results, 2015-2025 (EU28+3), Shift-Share Analysis**

All qualifications SOC2010 Sub-Major Groups	Base year 2010		Target year 2025		Change 2010-2025		Components of change					
	000s	% share	000s	% share	000s	%	Scale effect 000s	%	Occupation effect 000s	%	Industry mix effect 000s	%
01. Armed forces	1,386	0.6	1,098	0.5	-287	-20.7	53	3.8	-192	-13.9	-148	-10.7
11. Chief executives, senior officials and le	1,762	0.8	2,026	0.8	264	15.0	67	3.8	182	10.3	16	0.9
12. Administrative and commercial manag	3,729	1.6	4,328	1.8	599	16.1	142	3.8	316	8.5	140	3.8
13. Production and specialised services m	4,764	2.0	5,280	2.2	517	10.8	182	3.8	443	9.3	-108	-2.3
14. Hospitality, retail and other services m:	4,039	1.7	4,438	1.8	399	9.9	154	3.8	42	1.0	203	5.0
21. Science and engineering professionals	6,000	2.6	7,231	3.0	1,231	20.5	229	3.8	850	14.2	151	2.5
22. Health professionals	5,753	2.5	6,170	2.6	417	7.3	220	3.8	-254	-4.4	452	7.9
23. Teaching professionals	10,432	4.5	9,956	4.1	-477	-4.6	398	3.8	-702	-6.7	-173	-1.7
24. Business and administration professio	7,826	3.4	9,829	4.1	2,004	25.6	299	3.8	1191	15.2	514	6.6
25. Information and communications techn	3,228	1.4	4,116	1.7	888	27.5	123	3.8	408	12.7	357	11.1
26. Legal, social and cultural professionals	5,563	2.4	6,812	2.8	1,249	22.5	212	3.8	566	10.2	471	8.5
31. Science and engineering associate prc	8,118	3.5	8,366	3.5	248	3.1	310	3.8	169	2.1	-230	-2.8
32. Health associate professionals	5,541	2.4	6,453	2.7	912	16.5	211	3.8	305	5.5	396	7.1
33. Business and administration associate	16,228	7.0	18,119	7.5	1,892	11.7	619	3.8	751	4.6	521	3.2
34. Legal, social, cultural and related asso	4,251	1.8	6,639	2.7	2,387	56.2	162	3.8	2027	47.7	198	4.7
35. Information and communications techn	1,757	0.8	1,942	0.8	185	10.5	67	3.8	-17	-0.9	135	7.7
41. General and keyboard clerks	7,760	3.3	6,650	2.8	-1,110	-14.3	296	3.8	-1613	-20.8	206	2.7
42. Customer services clerks	5,401	2.3	6,947	2.9	1,545	28.6	206	3.8	977	18.1	362	6.7
43. Numerical and material recording clerk	8,545	3.7	7,326	3.0	-1,219	-14.3	326	3.8	-1800	-21.1	255	3.0
44. Other clerical support workers	3,180	1.4	2,557	1.1	-623	-19.6	121	3.8	-856	-26.9	111	3.5
51. Personal service workers	11,409	4.9	11,852	4.9	443	3.9	435	3.8	-780	-6.8	788	6.9
52. Sales workers	16,073	6.9	16,494	6.8	421	2.6	613	3.8	-339	-2.1	147	0.9
53. Personal care workers	7,676	3.3	8,394	3.5	717	9.3	293	3.8	-101	-1.3	525	6.8
54. Protective services workers	3,852	1.7	3,754	1.6	-99	-2.6	147	3.8	-289	-7.5	43	1.1
61. Market-oriented skilled agricultural wor	9,286	4.0	7,588	3.1	-1,698	-18.3	354	3.8	-184	-2.0	-1,869	-20.1
62. Market-oriented skilled forestry, fishery	439	0.2	396	0.2	-43	-9.9	17	3.8	31	7.0	-91	-20.7
63. Subsistence farmers, fishers, hunters ;	641	0.3	444	0.2	-197	-30.7	24	3.8	-62	-9.6	-159	-24.9
71. Building and related trades workers, e;	9,921	4.3	9,266	3.8	-655	-6.6	379	3.8	128	1.3	-1,162	-11.7
72. Metal, machinery and related trades w	9,337	4.0	7,841	3.2	-1,496	-16.0	356	3.8	-1411	-15.1	-442	-4.7
73. Handicraft and printing workers	1,461	0.6	1,220	0.5	-241	-16.5	56	3.8	-177	-12.1	-119	-8.2
74. Electrical and electronic trades worker	3,921	1.7	3,342	1.4	-579	-14.8	150	3.8	-476	-12.1	-252	-6.4
75. Food processing, wood working, garm	4,792	2.1	3,903	1.6	-889	-18.5	183	3.8	-668	-13.9	-404	-8.4
81. Stationary plant and machine operator	5,421	2.3	5,049	2.1	-372	-6.9	207	3.8	-84	-1.6	-495	-9.1
82. Assemblers	1,624	0.7	2,050	0.8	426	26.3	62	3.8	413	25.4	-49	-3.0
83. Drivers and mobile plant operators	9,804	4.2	9,181	3.8	-623	-6.4	374	3.8	-438	-4.5	-559	-5.7
91. Cleaners and helpers	9,278	4.0	10,566	4.4	1,288	13.9	354	3.8	140	1.5	794	8.6
92. Agricultural, forestry and fishery labour	1,891	0.8	2,089	0.9	199	10.5	72	3.8	503	26.6	-377	-19.9
93. Labourers in mining, construction, mar	6,209	2.7	7,319	3.0	1,110	17.9	237	3.8	1164	18.7	-291	-4.7
94. Food preparation assistants	1,756	0.8	1,803	0.7	47	2.7	67	3.8	-129	-7.3	109	6.2
95. Street and related sales and service w	204	0.1	173	0.1	-31	-15.0	8	3.8	-42	-20.6	4	1.8
96. Refuse workers and other elementary	2,394	1.0	2,520	1.0	126	5.3	91	3.8	9	0.4	26	1.1
All occupations	232,652	100.0	241,529	100.0	8,877	3.8						



### 3.3 Implications for qualifications

The changes in sectoral and occupational employment discussed above will have a strong influence on the demand for formal qualifications. However, the numbers of people in employment holding different qualifications is also highly dependent on what is happening to the supply side. Most countries have seen huge increases in participation in formal education and the acquisition of formal qualifications, driven in part by government policy aimed at raising the stock of human capital. Skills are seen by most governments as a key element in policies to maintain economic growth and productivity, as well as helping to address a range of other social and economic issues. The discussion here therefore begins by examining developments on the supply side before turning to demand and the reconciliation of the two (imbalances and mismatches).

#### ***Supply of Qualifications:***

Developments in the supply of skills (as measured by qualifications) are driven by the overall demographic and labour market trends set out above, in combination with the outcomes of many individual decisions about how much to invest in education and training. Modelling these developments at a pan-European level is difficult due to problems in obtaining consistent and relevant data. The approach data adopted here is based on an analysis of stocks and flows using Eurostat LFS data. These approaches suggest significant further increases in the numbers of people participating in further and higher education beyond the compulsory minimum school leaving age and going on to acquire formal qualifications at medium and higher level. **Box 6** provides a summary of the approach.

Figures 3.8-3.17 illustrate the expected patterns of change for the total population and the economically active labour force between 2005 and 2030 for the EU28+3.

The population aged 15+ holding high-level qualifications (ISCED 5 and 6, university degree or equivalent) is projected to increase by around 45 million between 2015 and 2030. The numbers with highest qualification at medium-level are also expected to increase, but at a more modest rate (by just under 20 million). In sharp contrast, the proportions and number of those with low-level or no qualifications are projected to continue their historical downward trend. Between 2015 and 2030 the population of Europe (EU-28+3) aged 15+ with low-level or no qualifications is projected to fall by about 50 million.

Substantial increases are projected for the overall numbers of those who are economically active qualified at the highest level. Slight decreases are expected for those whose highest qualification is at intermediate level. The former is now projected to increase by just over 22 million between 2015 and 2030, while the numbers at intermediate level are projected to decrease slightly (by about 2½ million). In fact the numbers acquiring intermediate level qualifications will be much higher, but many of those doing so will then go on to obtain even higher level qualifications. About 47 percent of the labour force will be qualified to intermediate level (as their highest qualification) by 2030 only marginally lower than the share in 2015.

The numbers economically active with no or low qualifications is projected to fall by just under 20 million.

### **Box 6: Projecting the Supply of Skills**

The supply of skills is measured by numbers of people holding different types of qualifications. The latter are classified using the ISCED system and divided here into three broad levels. Individuals are classified according to the highest qualifications held. The analysis focuses on the total numbers of people in the population and in particular those who are economically active (in employment or unemployed, but actively searching for work (ILO definition)).

The projections depend upon:

- demographic developments (the size and structure of the population by age and gender, taken from official Eurostat projections);
- prospects for labour market participation (as developed in the main macroeconomic model (E3ME); and
- the patterns of acquisition of qualifications.

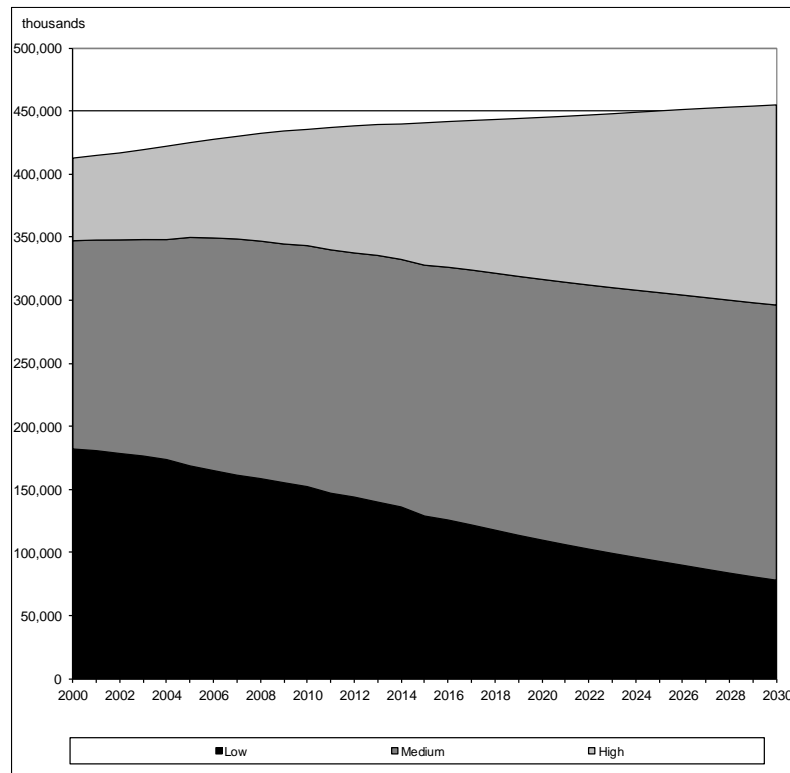
The Eurostat demographic projections include explicit assumptions about migration patterns as determined by Eurostat. These are essentially assumptions rather than projections based on any particular model.

Prospects for overall labour market participation are based on an econometric analysis of the participation decision by age and gender, using LFS data for each country, embedded into the macroeconomic model (see Wilson *et al* (2013)).

The patterns of acquisition of qualifications are based on an analysis of total numbers of people in the population and labour force holding particular levels of qualification, country by country. Results have been developed by Bosworth *et al.* (2012a) using a pseudo cohort /stock flow model approach (STOCKFLOWMOD). These have been refined and are now used as the default method, although because there are differences between the databases used for the stock-flow modelling and the main database the stock flow results are grafted on to the historical data, assuming the same rates of change from the base year (2010), working at a detailed level by age and gender. This is referred to as the “Hybrid” model). Stock -flow models have not been estimated for Croatia, Malta, Switzerland, FYROM and Turkey because of lack of relevant data. In these cases the model developed in Livanos and Wilson (2009) which uses a logistic specification for extrapolation of qualification shares is used instead.

Labour market participation rates for those with different level of qualifications are projected to develop in line with those for the total population, recognising that the better qualified tend to have higher rates of labour market participation.

**Figure 3.8: Supply of qualified people, EU28+3**

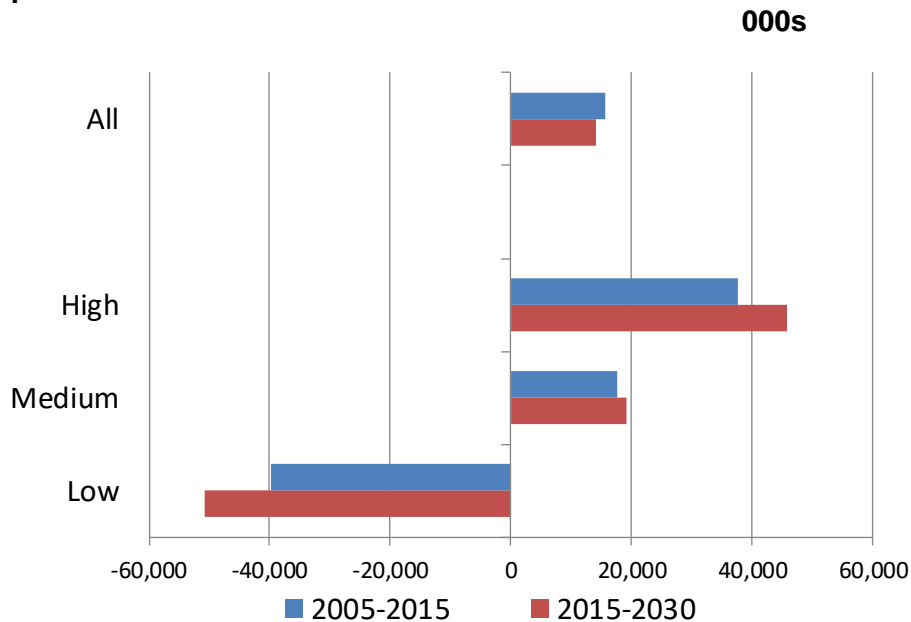


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Note: Numbers in the economically active labour force.  
Source: IER estimates based on E3ME and STOCKFLOWMOD.

**Figure 3.9: Past and likely future supply of qualifications (EU28+3)**

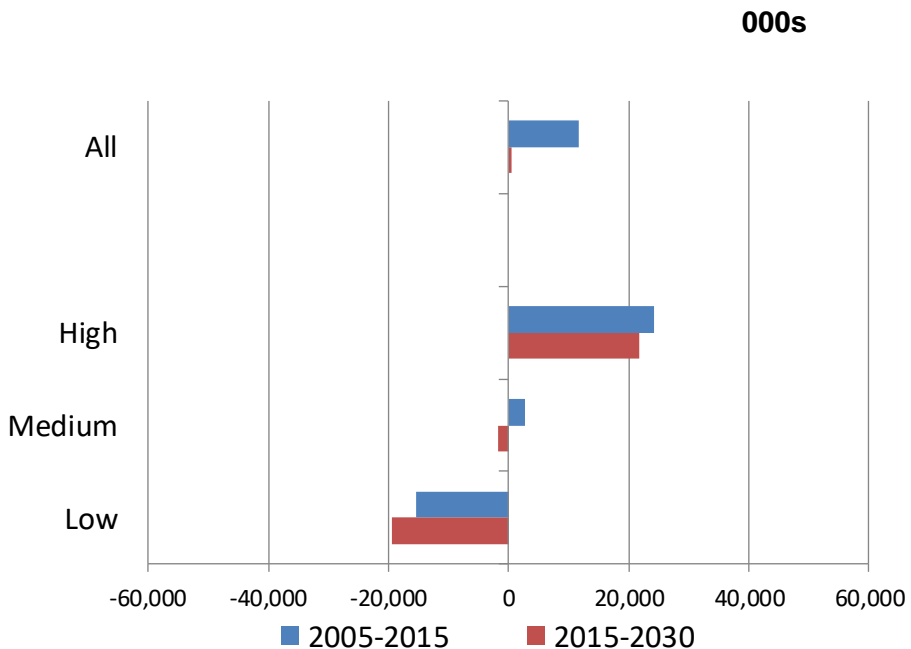
**Population**



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Note: Numbers in the population aged 15+.  
Source: IER estimates based on E3ME and STOCKFLOWMOD.

**Labour Force**



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Note: Numbers in the economically active labour force aged 15+.  
Source: IER estimates based on E3ME and STOCKFLOWMOD.

**Figure 3.10: Supply Trends, Stocks: Population (EU28+3, aged 15+)**

	2005	2010	2015	2020	2025	2030
<b>Levels (000s)</b>						
Low	176,398	152,121	128,807	109,789	92,900	77,956
Medium	171,603	191,067	198,870	206,677	213,047	218,142
High	71,270	92,154	112,888	128,392	144,065	158,679
Total	419,272	435,342	440,564	444,858	450,012	454,777
<b>Shares (per cent)</b>						
	<b>2005</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>2025</b>	<b>2030</b>
Low	42.1	34.9	29.2	24.7	20.6	17.1
Medium	40.9	43.9	45.1	46.5	47.3	48.0
High	17.0	21.2	25.6	28.9	32.0	34.9
Total	100.0	100.0	100.0	100.0	100.0	100.0
<b>Growth (% per annum)</b>						
	<b>2005-2010</b>	<b>2005-2015</b>	<b>2015-2020</b>	<b>2020-2025</b>	<b>2020-2030</b>	<b>2015-2030</b>
Low	-2.9	-3.1	-3.1	-3.3	-3.4	-3.3
Medium	2.2	1.5	0.8	0.6	0.5	0.6
High	5.3	4.7	2.6	2.3	2.0	2.3
Total	0.8	0.5	0.2	0.2	0.2	0.2
<b>Change (000s)</b>						
	<b>2005-2010</b>	<b>2005-2015</b>	<b>2015-2020</b>	<b>2020-2025</b>	<b>2020-2030</b>	<b>2015-2030</b>
Low	-24,278	-47,592	-19,018	-16,889	-31,833	-50,851
Medium	19,464	27,266	7,808	6,370	11,464	19,272
High	20,884	41,617	15,504	15,674	30,287	45,791
Total	16,070	21,292	4,294	5,154	4,765	14,213

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Note: Numbers in the population aged 15+.  
Source: IER estimates based on E3ME and STOCKFLOWMOD.

## Forecasting skill supply and demand in Europe: Overview of 2015/16 Projections

**Figure 3.11: Supply Trends, Labour Force (EU28+3, aged 15+)**

	2005	2010	2015	2020	2025	2030
<b>Levels (000s)</b>						
Low	66,393	58,544	47,876	40,844	33,899	28,326
Medium	112,178	120,456	121,107	121,499	120,663	119,439
High	56,211	68,697	82,342	90,831	98,218	104,091
Males and females	234,781	247,698	251,325	253,174	252,780	251,856
<b>Shares (per cent)</b>	<b>2005</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>2025</b>	<b>2030</b>
Low	28.3	23.6	19.0	16.1	13.4	11.2
Medium	47.8	48.6	48.2	48.0	47.7	47.4
High	23.9	27.7	32.8	35.9	38.9	41.3
Total	100.0	100.0	100.0	100.0	100.0	100.0
<b>Growth (% per annum)</b>	<b>2005-2010</b>	<b>2005-2015</b>	<b>2015-2020</b>	<b>2020-2025</b>	<b>2020-2030</b>	<b>2015-2030</b>
Low	-2.5	-3.2	-3.1	-3.7	-3.5	-5.1
Medium	1.4	0.8	0.1	-0.1	-0.2	-0.1
High	4.1	3.9	2.0	1.6	1.2	1.6
Total	1.1	0.7	0.1	0.0	-0.1	0.0
<b>Change (000s)</b>	<b>2005-2010</b>	<b>2005-2015</b>	<b>2015-2020</b>	<b>2020-2025</b>	<b>2020-2030</b>	<b>2015-2030</b>
Low	-7,849	-18,517	-7,032	-6,945	-12,518	-19,550
Medium	8,279	8,929	392	-837	-2,060	-1,668
High	12,487	26,131	8,489	7,387	13,259	21,749
Total	12,916	16,543	1,849	-395	-924	531
<b>Activity Rate</b>	<b>2005</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>2025</b>	<b>2030</b>
Low	37.6	37.6	37.2	37.2	36.5	36.3
Medium	65.4	65.4	60.9	58.8	56.6	54.8
High	78.9	78.9	72.9	70.7	68.2	65.6
Total	56.0	56.0	57.0	56.9	56.2	55.4

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Note: Numbers in the economically active labour force aged 15+.  
Source: IER estimates based on E3ME and STOCKFLOWMOD.

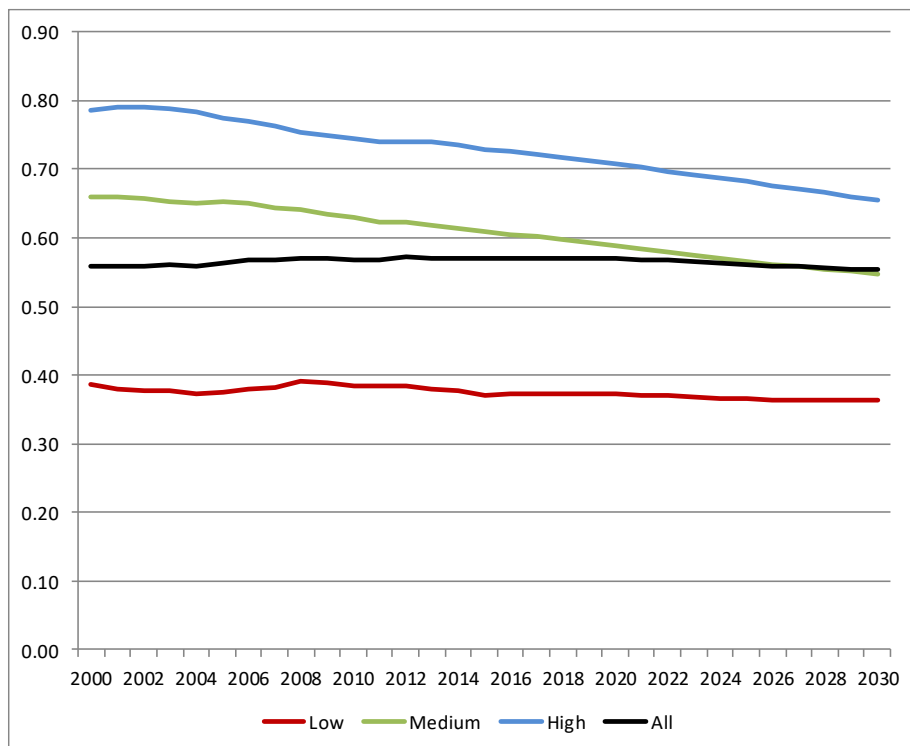
Figure 3.12 shows the implications for labour market participation (or activity) rates. These vary significantly between the qualification categories. The better qualified are much more likely to be economically active and in employment in the formal economy. The rates for all categories show a slight positive trend as a result of the increase in the share of better qualified people in the population. This offsets a combination of the increasing average age of most populations, as well as increasing educational participation rates for younger people and earlier retirement for many older workers. This results in economic participation rates falling overall for each of the broad qualification categories.

There are some significant differences by gender. Female activity rates are generally lower than those for males, but they are rising for many age groups, whereas those for males are declining. The hierarchy between the qualification categories is common to both genders. Full details are available in the various *Country Workbooks*, with summaries in the EU28+3 and multi-country workbooks.

The patterns are generally similar across countries, although there are some variations, notably for some parts of Central and Eastern Europe. The top panel of Figure 3.15 illustrates that for nearly all countries the share of the economically active labour force that is qualified at high level is projected to be greater in 2030 (vertical axis) than in 2015 (horizontal axis). In contrast, the bottom panel shows that the shares in the economically active labour force with low (or no) qualifications are generally projected to fall. The picture at intermediate level is shown in the middle panel and is more complex. In some countries this share rises. In others it is projected to decline. In all cases it is likely that many citizens will be acquiring qualifications at intermediate level, but for many countries many of these will go on to obtain even higher qualifications, so the share with medium level qualifications as their highest qualification level may fall.

Figure 3.16 shows how the absolute changes compare across countries. This highlights that large countries dominate the picture in terms of overall numbers. Germany, the UK, France, Italy, Poland and Spain all exhibit similar patterns of change to those described for Europe as a whole.

**Figure 3.12: Labour Market participation rates by qualification category**

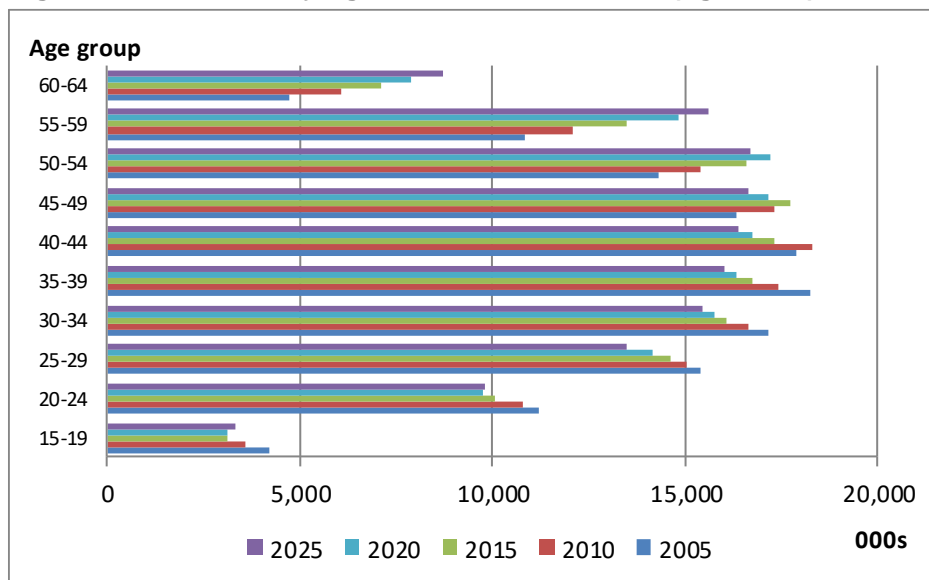


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Note: Based on numbers in the economically active labour force aged 15+.  
Source: IER estimates based on E3ME and STOCKFLOWMOD.



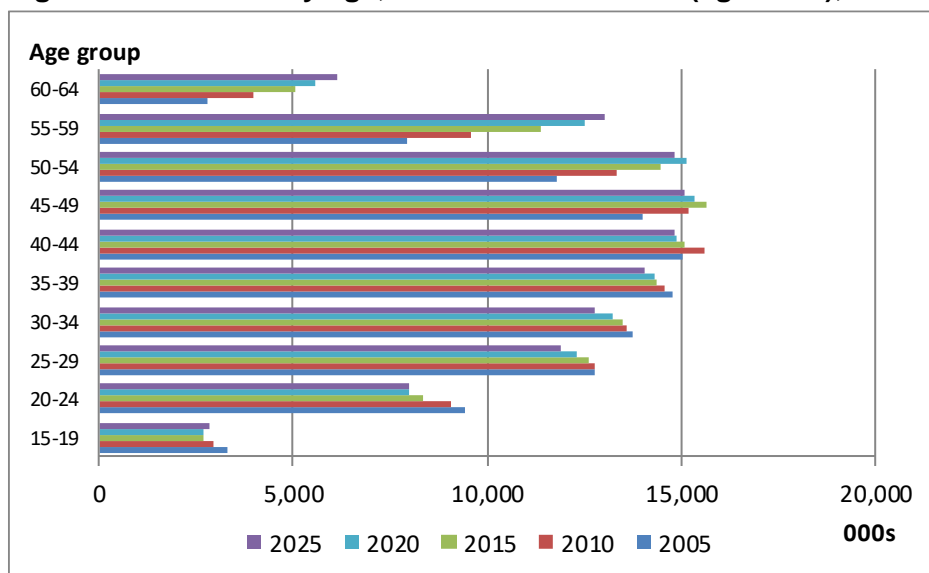
**Figure 3.13: Details by age, labour force, males (aged 15+), EU28+3**



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Note: Numbers in the economically active labour force aged 15+.  
Source: IER estimates based on E3ME and STOCKFLOWMOD.

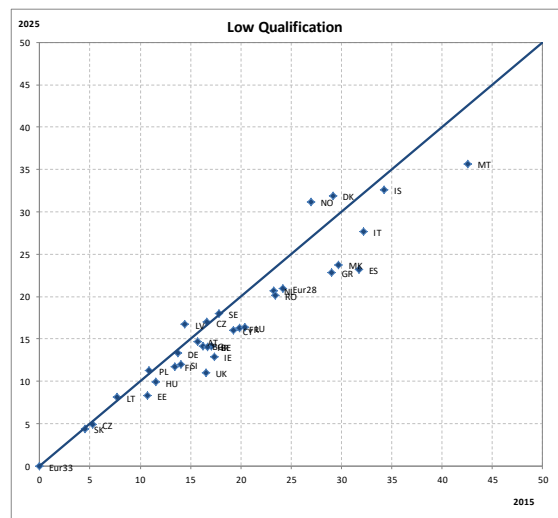
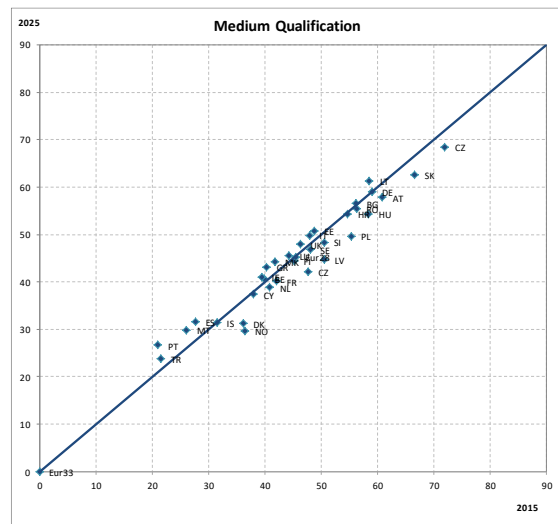
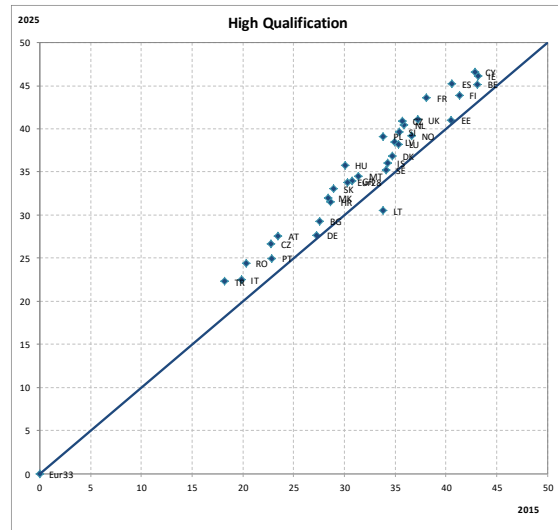
**Figure 3.14: Details by age, labour force females (aged 15+), EU28+3**



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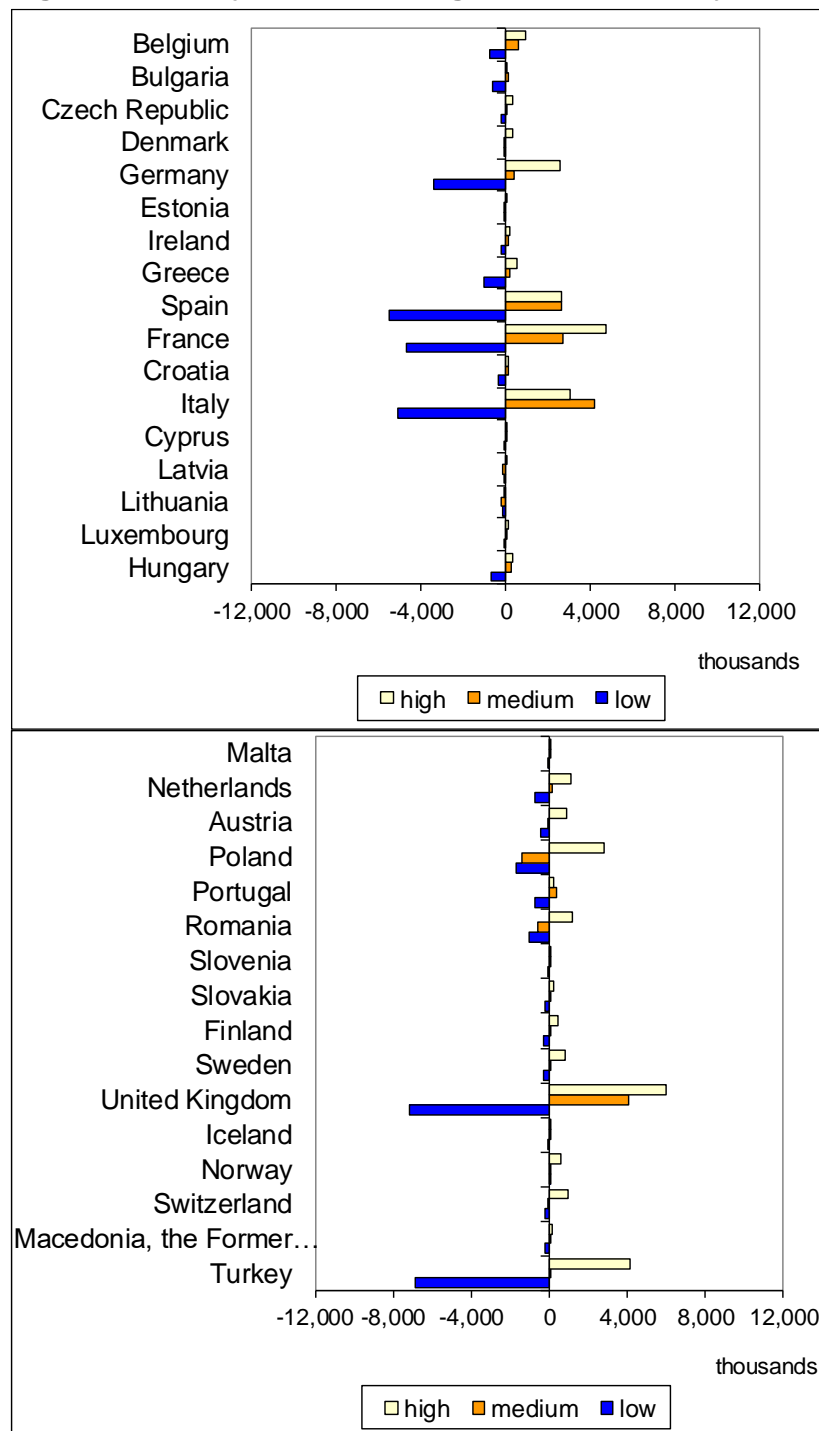
Note: Numbers in the economically active labour force aged 15+.  
Source: IER estimates based on E3ME and STOCKFLOWMOD.

Figure 3.15: Variation across countries – shares in 2015 and 2030



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 2013\data\Workbooks\Xcountry\Overview&Synthesis\_charts.xlsx  
 Note: Numbers in the economically active labour force aged 15+.  
 Source: IER estimates based on E3ME and STOCKFLOWMOD.

**Figure 3.16: Projected Net change, Labour Force by Educational level, 2015-30**



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Note: Numbers in the economically active labour force aged 15+.  
Source: IER estimates based on E3ME and STOCKFLOWMOD.

**Demand:**

Measuring and projecting the demand for formal qualifications is much less straightforward than measuring supply. The main trends in demand by qualification (as measured here by numbers in employment by highest qualification held) reflect the supply trends. They are presented in Figure 3.17, which show the projected changes in *notional* demand for formal qualifications, unconstrained by possible supply developments. These are based on a continuation in past patterns of employment shares in the three broad qualification categories within both occupations and sectors. As noted by various country experts, this may exaggerate the increase in demand for some higher qualification categories. If people qualified at such levels find employment in preference to less well qualified people (especially in jobs that do not strictly require higher level qualifications) this may give a misleading impression of demand pressures.

Nevertheless, the general demand for skills (as measured by formal qualifications) is likely to continue to rise. Changes in industrial structure are combining with skill biased technological change to increase the demand for those occupations that typically require intermediate or higher level educational qualifications. Qualification requirements within most occupations are also rising due to regulatory changes and other factors.

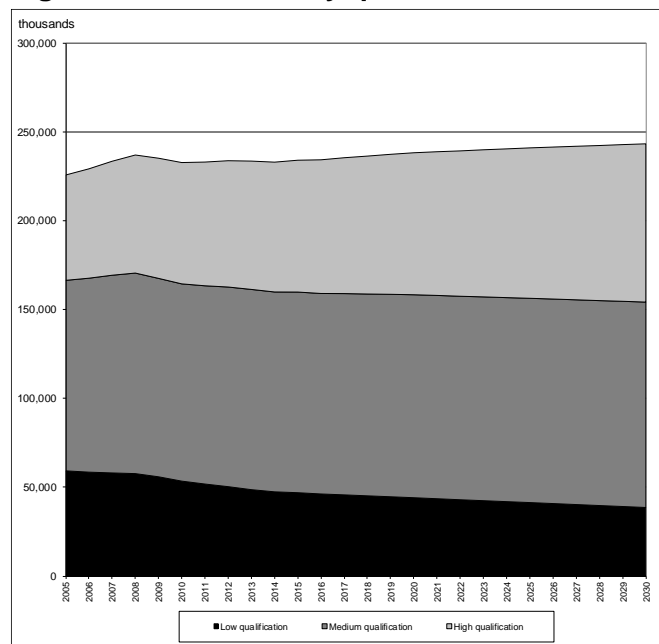
Ignoring the supply side, for Europe as a whole, the numbers of people employed with qualifications at the highest level is projected to rise by around 15 million between 2015 and 2030 (these are the “**unconstrained**” results shown in the top part of Figure 3.22 below). The position for those with intermediate level qualifications is one of less rapid increases (around 1½ million). The **unconstrained** demand for those with low (or no) qualifications is projected to fall by around 9 million.

In practice, as described in **Box 7**, the future patterns of employment observed will reflect both demand and supply factors and the labour market will adjust in various ways to accommodate those offering themselves for work. This is reflected in the projections of the “**constrained**” demand results as shown in Figures 3.22-3.24.

The unconstrained results show the notional demand in the absence of supply constraints. The constrained estimates reflect the realities of the skills actually likely to be available. The differences between the constrained and unconstrained figures, as well as more general implications for imbalances and mismatches, are discussed in more detail in Section 3.4 below. The constrained results show an increase in the number of highly qualified people in employment between 2015 and 2030 of around 22 million, a small rise for the intermediate category of about ½ a million and a decline of around 15 million for the low or no qualified category.

These patterns are consistent with those in previous sets of projections. The main message is that the workforce is becoming increasingly well qualified but supply may now be outpacing demand.

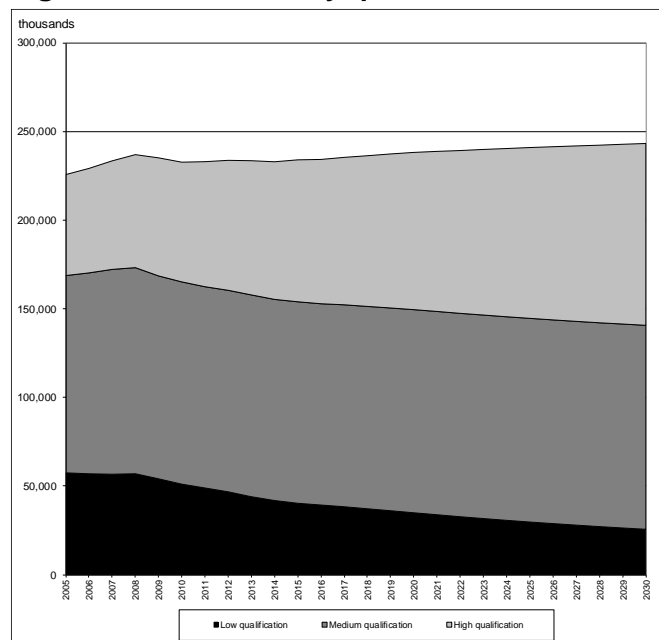
**Figure 3.17: Demand by qualification, 2005-2030 (EU-28+3) Unconstrained**



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Notes: Unconstrained estimates. The estimates in this figure are the notional demand for formal qualifications, unconstrained by likely supply developments. For constrained estimates see the next figure.  
Source: IER estimates based on E3ME and BALMOD.

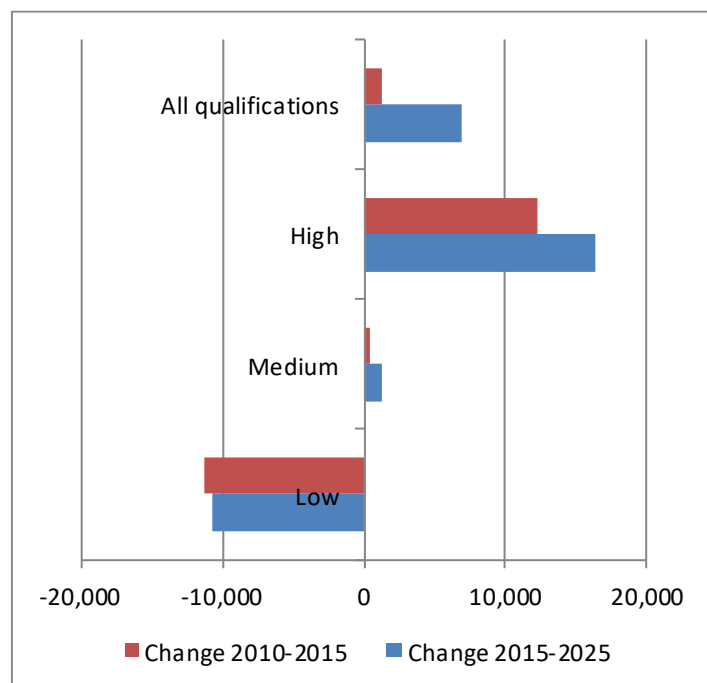
**Figure 3.18: Demand by qualification, 2005-2030 (EU-28+3) Constrained**



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Notes: Constrained estimates. The estimates in this figure are constrained to match the supply available AND scaled to match E3ME employment figures (i.e. taking into account the so called Labour Market Accounts Residual (LMAR) which measures the difference between employment (workplace jobs) and labour supply net of unemployment (residence, people/ heads)). They are therefore consistent with, and match, the employment estimates for sectors and occupations presented elsewhere in this report  
Source: IER estimates based on E3ME and BALMOD.

**Figure 3.19: Past and projected demand for qualifications, constrained (EU28+3)**



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2013\data\Workbooks\XCountry\Eur31\ImbalanceResults.BaseC.xlsm

Note: Changes in numbers in employment, constrained to match E3ME total and to reconcile demand with available supply.

Source: IER estimates based on E3ME and BALMOD.

### 3.4 Imbalances and mismatches – reconciling demand and supply

#### *Introduction*

This section provides a brief overview of how demand and supply are reconciled in the projections. Bringing together supply and demand to investigate possible future skills imbalances mismatches is the final challenge in any skills forecasting project. Confronting and comparing the forecast supply and demand is therefore a crucial element in the overall conceptual framework. In principle, this can be done both in the context of the whole economy but also at a more detailed level. This section focuses on the former while Section 3.6 goes into more detail by country/region within Europe.

These issues are discussed in greater detail in Kriechel (2015) and also in Kriechel (2013) and Meagher *et al.* (2013).<sup>15</sup> In the methodology used currently to generate the projections, supply and demand are projected separately and independently, using comparable data and consistent assumptions. When these “raw” data are confronted, the resulting imbalances are resolved by changing the mix of

<sup>15</sup> The latter paper presents an alternative way of looking at the way the labour market adjusts to emerging skills imbalances, using computable general equilibrium modelling methods.

## Forecasting skill supply and demand in Europe: Overview of 2015/16 Projections

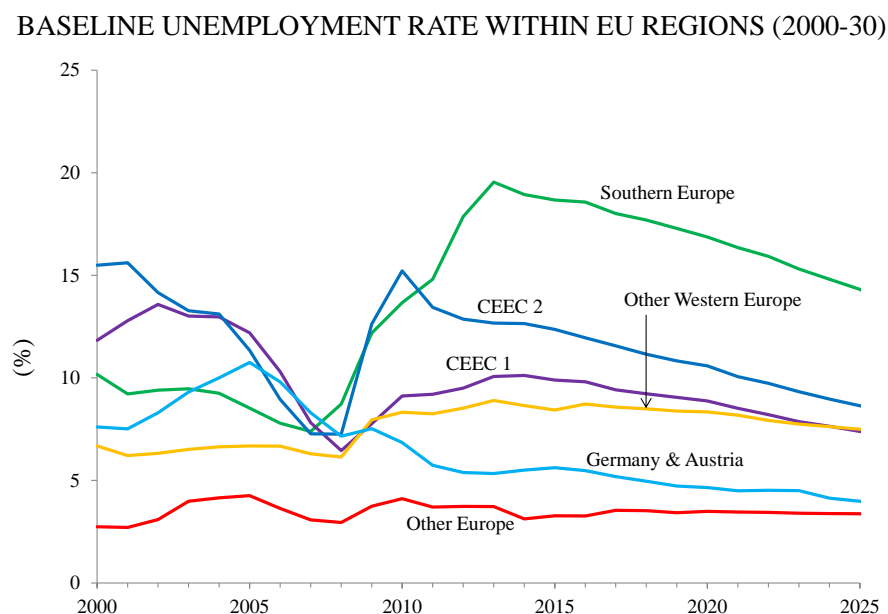
qualifications of those in employment until these match the available supply (net of unemployment) (for details see **Box 7**). As described in **Box 7**, bringing together supply and demand is a complex process in any skills forecasting project. Any observed imbalances that emerge between demand and supply reflect various adjustments that occur in the labour market to reconcile any divergent trends in supply and demand. There are few if any reliable and precise indicators of labour market shortage or surplus.

### *Imbalances between labour supply and demand*

Unemployment is one important indicator. The E3ME model produces an estimate of unemployment that gives an indication of the overall imbalance between labour demand and supply. The overall unemployment rate measures the imbalance between labour supply and demand. Figure 3.20 (identical to Figure 2.6) presents the projected unemployment rates that accompany the baseline projections of labour supply and demand. Rates are shown for broad regions of Europe over 2000-30.

Sharp increases were observed in all regions in 2009, following the financial and economic crisis, though the group comprising Germany, Austria & Switzerland quickly returned to its long-term downward trend. The lagged nature of unemployment as an economic variable is reflected in the observation that the UK & Ireland (combined) and CEEC regions peaked around 2011. Most countries other than Germany, Austria & Switzerland do not return to pre-crisis unemployment levels before 2030. In Southern Europe, where there remains considerable uncertainty regarding austerity measures and Euro related matters, unemployment is expected to stay high for much longer although falling steadily from now onwards.

**Figure 3.20: Baseline Unemployment Rate within EU Regions (2000-30)**



Note(s): Southern Europe is Greece, Portugal, Malta, Italy, Spain ; CEEC 1 is Bulgaria, Croatia, Hungary, Poland, Czech Rep. And Romania CEEC 2 is Estonia, Latvia, Lithuania, Slovenia and Slovakia; Other Western Europe is Belgium, France, Ireland, Denmark, UK, the Netherlands, Finland and Sweden; and Other Europe is Luxembourg, Norway, Switzerland & Iceland.

Source(s): E3ME, Cambridge Econometrics.

### **Box 7: Measuring imbalances and mismatches**

Bringing together supply and demand to investigate possible future skills imbalances mismatches is the final challenge in any skills forecasting project. Imbalances are high on the policy agenda. Both policy makers and individuals are keen to know where areas of mismatch and imbalance may arise. Confronting and comparing the forecast supply and demand is therefore a crucial element in the overall, conceptual framework. In principle, this can be done both in the context of the whole economy but also at a more detailed level. In practice, there are significant conceptual and practical problems in identifying and measuring such imbalances and mismatches.

In the present methodology which is used to generate the projections, supply and demand are projected separately and independently, using comparable data and consistent assumptions. When these “raw” data are confronted, the resulting imbalances are resolved by changing the mix of qualifications of those in employment until these match the available supply (net of unemployment). This is done using an iterative RAS process. (RAS is a well-established process to reconcile a data array (A) with row and column totals (R and S) for details see McMenamin *et al.* (1974), Toha, (1998), Miller and Blair (2009) and Lahr and Mesnard (2004)).

The current approach focuses upon the qualifications dimension. It examines the way that supply (people who have acquired formal qualifications) are sorted into jobs (demand, occupational employment within sectors). This is done using a two stage “sorting” procedure that:

- first, makes some assumptions about the distribution of employment and unemployment amongst different qualification categories; and
- second, then sorts those who are employed into jobs.

Better qualified people are assumed to have higher employment (lower unemployment) probabilities. People in employment are sorted into jobs using an algorithm based on the relative employment sizes in the industry by occupation cells.

Historical evidence on patterns of unemployment by qualification level are used to develop estimates of how the overall levels of unemployment projected from the macroeconomic model are shared out between different qualification categories. The results reflect the strong hierarchical patterns in unemployment rates for the different categories. The share of the highly qualified category in total unemployment is projected to rise, since they are becoming a growing proportion of the labour force. However they are likely to suffer less from unemployment than the less well qualified. There is a clear hierarchy in unemployment rates.

The reconciliation process between the demand and supply numbers does not imply that there are no problems of mismatches between employers’ skill demands and the available supply. Some individuals may be employed in jobs that do not strictly require the levels of qualifications they possess, while in other employers may not have the skills they need to succeed. This could imply wasted resources as the investment in prior education and training made is not being fully utilised or lost opportunities to grow business because of skill shortages.

Another important aspect of imbalances is the geographical dimension. The results suggest that there may be some structural problems across Europe (with Eastern Europe facing particular problems of potential oversupply of people in the high qualification category).



The estimates in Figure 3.21 show the projected pattern of unemployment by qualification across all countries. They are based on assuming that the main features of the historical patterns of unemployment amongst the qualified categories will continue, in each country. In particular, the better qualified are expected to continue to have lower probabilities of unemployment than those qualified at intermediate level, who in turn have lower probabilities of being unemployed than those with low (or no) qualifications. The total level of unemployment across all three qualification categories is constrained to match the E3ME total unemployment for that country. On this assumption unemployment rates for all three categories in 2025 remain well above the values experienced immediately before the global financial crisis of 2008 (see Figure 3.21). Even by 2030 the overall unemployment rate only just managed to get back to the level observed in 2008 (7%). However the unemployment rates for each of the qualification categories individually is higher in 2030 than the 2008 values. Changes in the structure of employment by highest qualification held in favour of better qualified people explains the overall reduction.

These estimates of unemployment are then combined with the supply projections to get an estimate of the numbers of people in employment by qualification. This is then constrained to match the number of jobs available in the SORT routine within BALMOD (see **Box 7** for further details). The SORT routine employs an iterative process (RAS) to reconcile the available supply with the jobs available.<sup>16</sup> The final results of this process are referred to as **constrained demand** estimates. In these estimates demand (employment) plus unemployment = supply (the economically active labour force) for each qualification category. The RAS process reallocates people into the jobs available so that the better qualified find employment more quickly than less well qualified people.

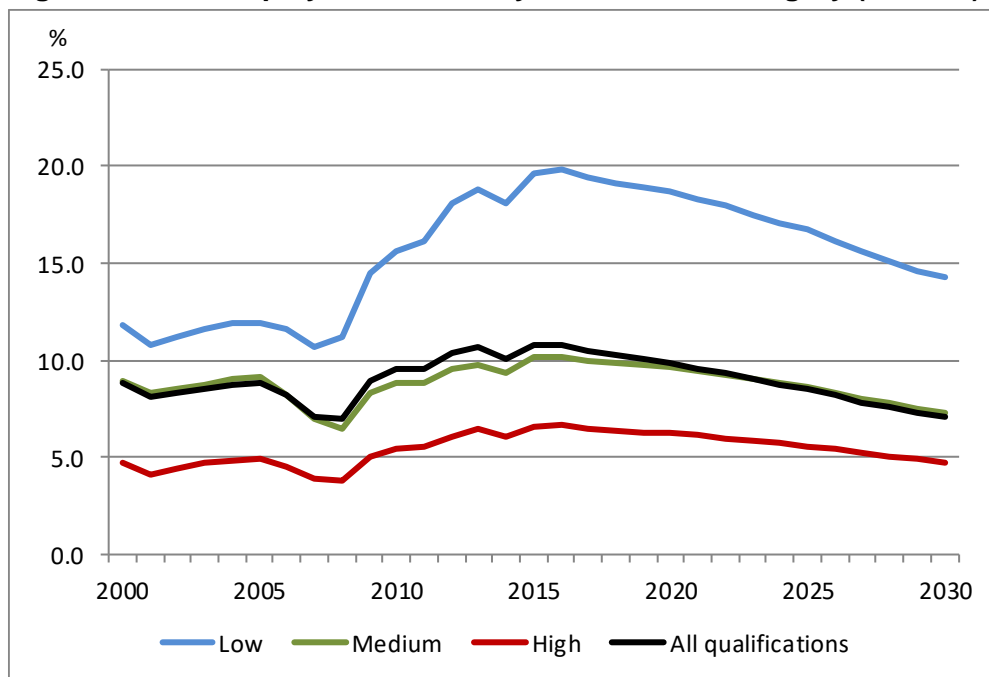
The discrepancies between the supply of people, based on their education and formal qualifications held, and notional demand (before constraint) can be used to obtain an assessment of imbalance or mismatch. They are indicative of a situation that would evolve if current trends in sectoral, occupation and qualification level continue to develop unaltered. Kriechel (2015) focuses on these discrepancies and summarises them in his analysis of imbalances and mismatches.

If anything, the positive trends in demand towards higher level qualifications are somewhat stronger than before the crisis and the subsequent recession. However the supply side trends towards better qualified workforce have accelerated even more. As a consequence there are likely to be increasing shares of those in the highly qualified and intermediate qualified categories employed in lower level jobs.

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<sup>16</sup> See McMenamin *et al.* (1974), Toha, (1998), Miller and Blair (2009) and Lahr and Mesnard (2004) for a general discussion of RAS methods.

**Figure 3.21: Unemployment Rates by Qualification category (EU28+3)**



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Notes: Constrained estimates.

Source: IER estimates based on E3ME, EDMOD and BALMOD.

The latest projections of skill supply, based for most countries on the stock-flow model approach, show significant increases of numbers economically active and qualified at the highest level between 2015 and 2025 (about 15 million), at the medium qualification level a modest decline, and a significant decline in numbers of those with low or no formal qualifications (of around 14 million). See Figure 3.11 for details.

Over the coming decade, while the situation for the lower qualified, and to a lesser extent medium qualified, categories are projected to see supply barely matching demand, the higher qualified category seems likely to see supply increasing more rapidly than projected demand (see Figure 3.24). This assumes a continuation of previous trends in both demand and supply.

The figure shows the numbers in the economically active labour force and the unconstrained estimates of the numbers in employment, before adjustments to reconcile the demand and supply side estimates. Both sets of time series distinguish the highest levels of qualification held.<sup>17</sup> For those with higher level qualifications the “supply” trend (the labour force) has been rising more rapidly than the “demand” trend (employment), and this difference is projected to continue to 2030. For those with low (or no) qualifications the opposite is true. At intermediate level the trends follow more or less parallel paths.

The results suggest that there will be greater deployment of “graduates” (HQ), and those qualified at intermediate level (MQ), in lower level jobs than was the case in the past. Despite these developments, those in the HQ (and MQ) categories will still have better chance of getting the better jobs compared with those with low or no formal qualifications (the LQ category). A higher supply of better-educated workers, combined with an increasing tightening of the labour market at the lower and intermediate level of education, is likely to lead to various changes in the labour market which helps to accommodate these changes. It is likely that there will be an increasing shift of better qualified into occupations that have not previously required such high level qualifications.

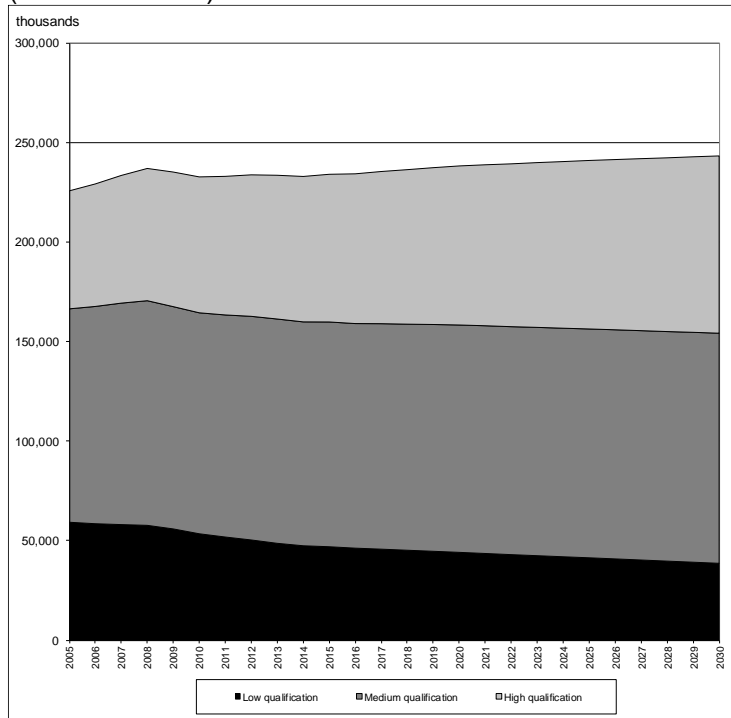
This may lead to tensions in the labour market. Highly educated workers, that cannot find employment in occupations that fully utilise the skills they have invested in, may not be content and at least part of their investment in human capital will be wasted. Conversely shortages of intermediate technical skills may lead pressures to move some production activities to countries outside Europe where such skills may be more easily found.

Another important aspect of imbalances is the geographical dimension. This is considered in more detail in Kriechel (2015). The results suggest that there may be some structural problems across Europe (with Eastern Europe facing particular problems of potential oversupply).

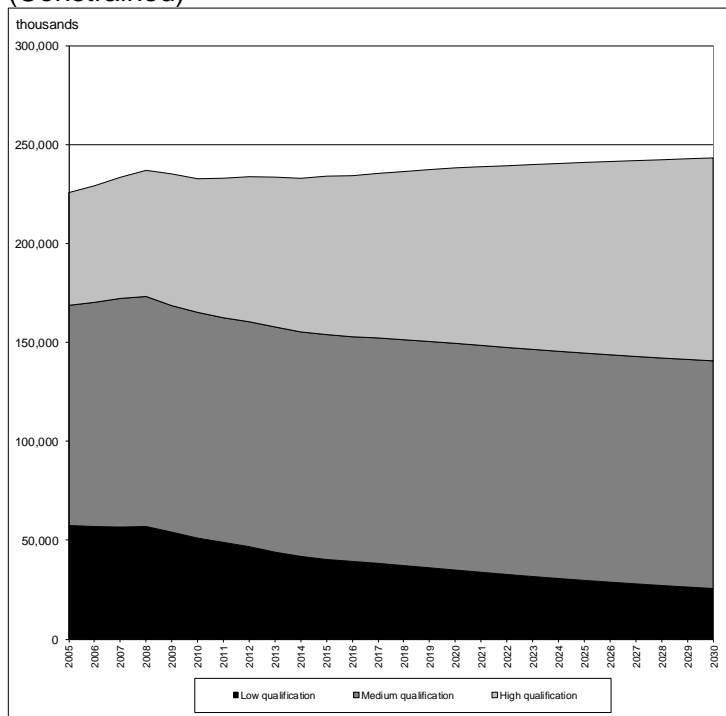
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<sup>17</sup> Differences between the labour force and the employment series shown cannot simply be interpreted as unemployment. Differences arise because: some people have more than one job; the distinction between residence and workplace; as well as errors and differences in the measure of employment, unemployment and related indicators in different sources (in combination this is referred to as the Labour Market Accounts Residual (LMAR)).

**Figure 3.21: Past and Projected Qualification Trends in Employment (EU28+3)  
(Unconstrained)**



**(Constrained)**



**Figure 3.22: Constrained and unconstrained qualification structure, in Employment (EU28+3)**

## Unconstrained

	Base Year <b>2015</b>	Projected Year <b>2025</b>	Net Change	Replacement Demand <b>2015-2025</b>	Total Requirement
<b>Levels (000s)</b>					
Low qualification	46,903	41,349	-5,554	20,364	14,810
Medium qualification	112,891	114,932	2,040	42,180	44,220
High qualification	74,171	84,627	10,456	31,859	42,315
All qualifications	233,965	240,908	6,943	94,403	101,346
			change (%)	as a proportion of base year (%)	
<b>Shares (per cent)</b>					
Low qualification	20.0	17.2	-11.8	43.4	31.6
Medium qualification	48.3	47.7	1.8	37.4	39.2
High qualification	31.7	35.1	14.1	43.0	57.1
All qualifications	100.0	100.0	3.0	40.3	43.3

## Constrained

	Base Year <b>2015</b>	Projected Year <b>2025</b>	Net Change	Replacement Demand <b>2015-2025</b>	Total Requirement
<b>Levels (000s)</b>					
Low qualification	40,121	29,406	-10,714	20,364	9,650
Medium qualification	113,568	114,887	1,319	42,180	43,498
High qualification	80,276	96,614	16,339	31,859	48,198
All qualifications	233,965	240,908	6,943	94,403	101,346
			change (%)	as a proportion of base year (%)	
<b>Shares (per cent)</b>					
Low qualification	17.1	12.2	-26.7	50.8	24.1
Medium qualification	48.5	47.7	1.2	37.1	38.3
High qualification	34.3	40.1	20.4	39.7	60.0
All qualifications	100.0	100.0	3.0	40.3	43.3

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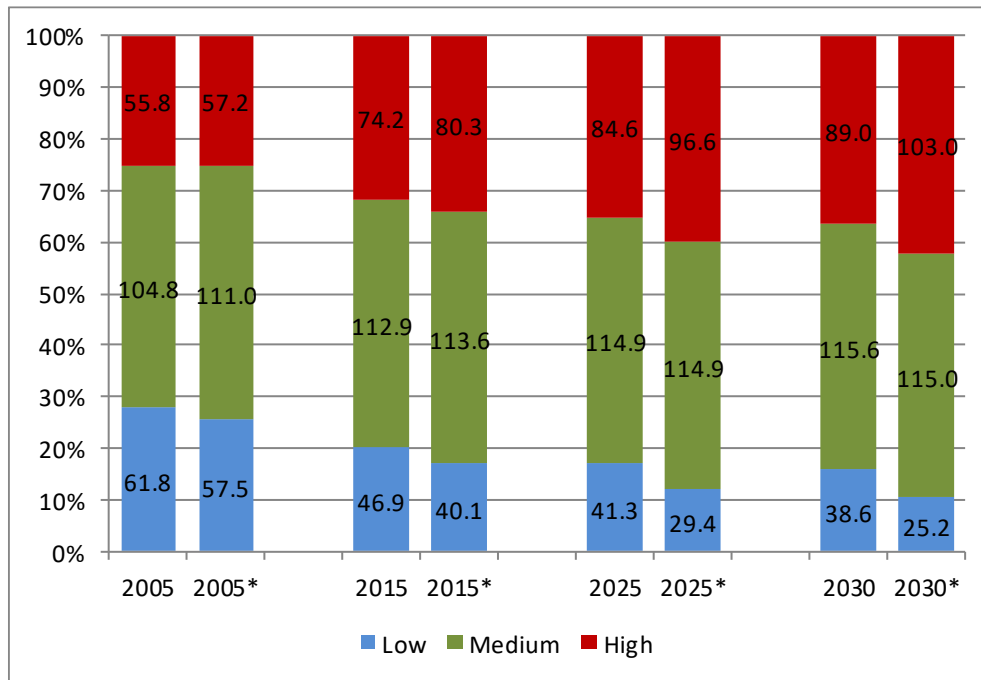
Notes: *Unconstrained estimates*. The estimates in the top part of the table show the notional demand for formal qualifications, unconstrained by likely supply developments.

*Constrained estimates*. The estimates in the bottom part of the table are constrained to match the supply available AND scaled to match E3ME employment figures (i.e. taking into account the so called Labour Market Accounts Residual (LMAR) which measures the difference between employment (workplace jobs) and labour supply net of unemployment (residence, people/ heads)). They are therefore consistent with, and match, the employment estimates for sectors and occupations presented elsewhere in this report.

Values in 2015 differ in the two parts of the table as this year is itself a projection.

Replacement demand estimates depend on the opening stock and the rates of outflow assumed. As the opening stock is the same in the constrained and unconstrained estimates they are the same for both.

**Figure 3.23: Constrained and unconstrained qualification structure, in Employment (EU28+3)**



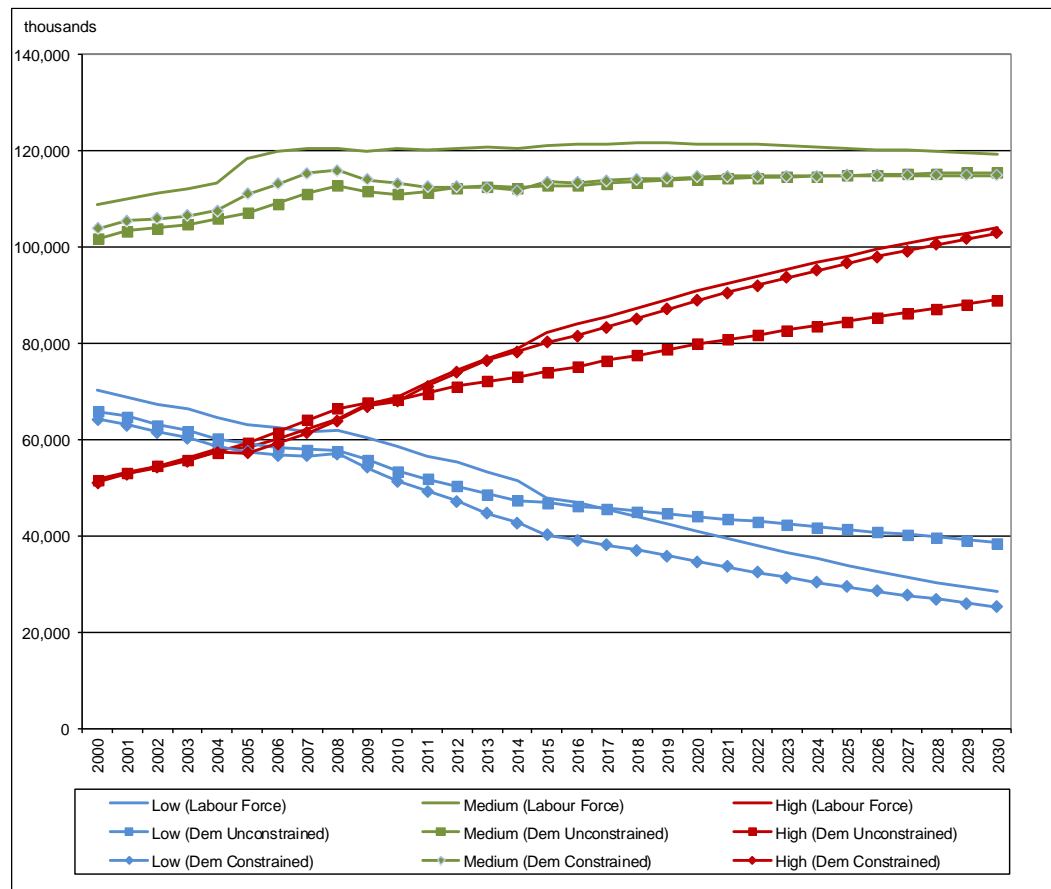
\\ads.warwick.ac.uk\shared\IE\Projects\Cedefop projections

2013\data\Workbooks\XCountry\Eur31ImbalanceResults.BaseC.xlsm

Notes: Constrained (to match supply available for employment and unconstrained “notional demand” estimates. The constrained estimates are indicated by a \*.

Source: IER estimates based on E3ME, EDMOD and BALMOD.

**Figure 3.24: Comparison of Supply and Demand Trends**



\\ads.warwick.ac.uk\shared\IE\Projects\Cedefop projections  
 2013\data\Workbooks\XCountry\Eur31ImbalanceResults.BaseC.xlsm  
 Notes: Unconstrained estimates of employment and numbers in the labour force aged 15+.  
 Source: IER estimates based on E3ME, EDMOD, STOCKMOD and BALMOD.

### *Replacement demand*

The results discussed so far focus on the “expansion demand” element. It is also important to consider replacement needs by level of qualification. Figure 3.22 shows how these compare by qualification category. Of the total of around 94 million replacement job opportunities projected over the period 2015-2025, around 20 million are projected to be for jobs where low or no qualifications are needed. About 32 million will be for jobs requiring high level qualifications and the remaining 42 million at intermediate level. Even for the jobs with low or no qualification requirements there will be large numbers of job openings over the coming decade.

Replacement demand estimates by occupation are summarised in Figure 3.2 and in more detail in Figure 3.7f.

## **3.5 Imbalance by regions**

Another important aspect of imbalances is the geographical dimension. The results suggest that there may be some structural problems across Europe (with Eastern Europe facing particular problems of potential oversupply of people in the high qualification category).

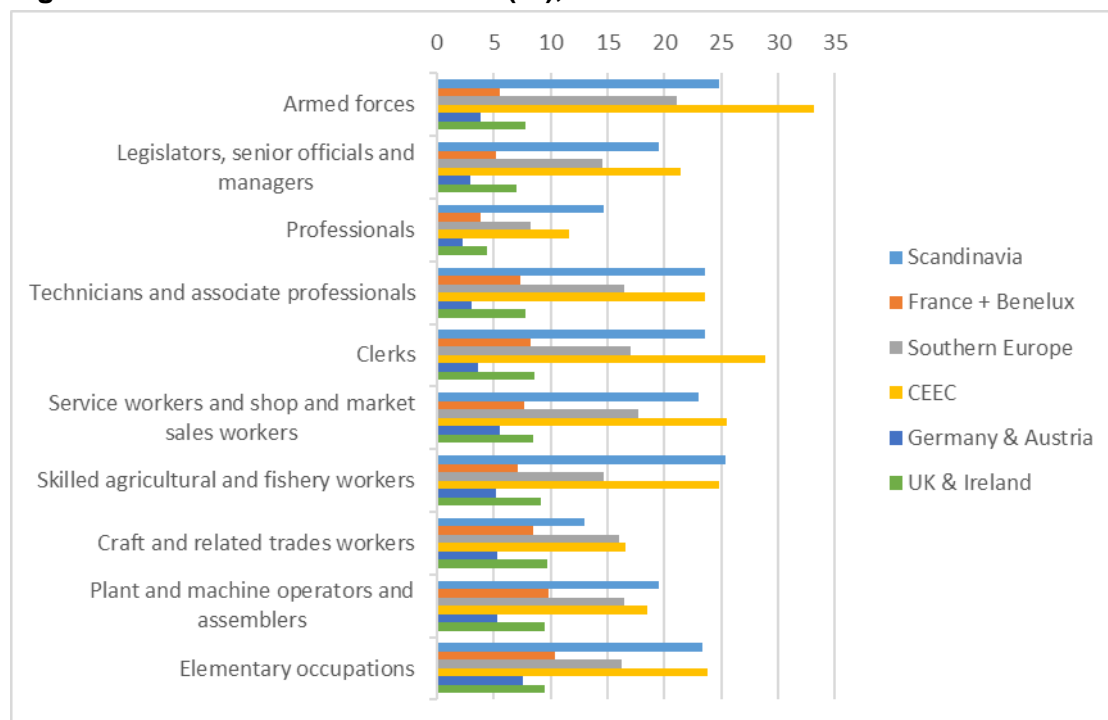
In this section imbalances are summarised in three indicators – the *Indicator of Constraint* (IC) the *Indicator of Future Imbalances of Demand* (IFIOD), and the *Measure of Change* (MC) – that focus on specific aspect of the imbalances/mismatches or the process of adjustment. The regional groupings provide in this report show indicator values for groups of countries and aggregated occupations. The aggregation is based on weighted averages of country specific indicators for the period 2015-25, where the employment numbers serve as the weights. The indicators are described in more detail in Kriechel (2015). These and additional indicators at a more disaggregated level can be found for each country in the country workbooks.

The first two measures, the *Indicator of Constraint* (IC) and the *Indicator of Future Imbalances of Demand* (IFIOD) capture the degree to which there is an imbalance between the ideal mix of qualifications within an occupation and the available supply.

The first, the *Indicator of Constraint* (IC), uses the difference between the constrained and unconstrained demand to reflect the degree to which the ideal mix is not achieved. Higher values of the indicator reflect a greater distance to the ideal mix, i.e. greater imbalances. The indicator outcomes are depicted in Figure 3.25 using aggregated occupational groups. They are, however, based on the underlying indicators developed at the full 2 digit level (41 occupations) within each country of the country groups.



**Figure 3.25: Indicator of Constraint (IC), 2015-2025**



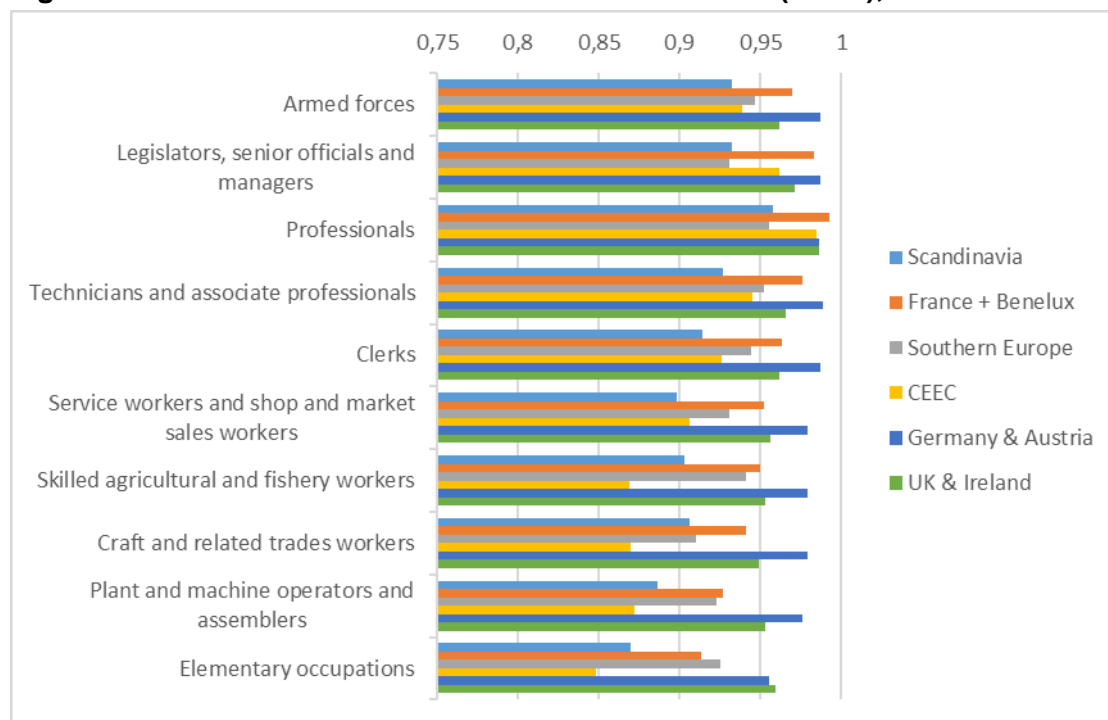
Notes: Indicators are based on employment weighted averages across 41 occupations and individual countries within the country groups.

Source: ERC estimates based on E3ME, EDMOD, STOCKMOD and BALMOD using country workbooks

Higher levels of imbalances can be found within the countries of the CEEC and Scandinavia. Occupations with higher imbalances are found especially among the group of Clerks, Service workers, Shops and market sales, and Skilled agriculture and fishery workers. There are fewer problems within the group of higher skilled occupations, reflecting the overall increasing supply of higher education.

The second indicator, the *Indicator of Future Imbalances of Demand (IFIOD)*, measures a similar aspect, but uses a different methodology. Here, only the overall level of supply and demand mismatches by qualification is calculated. Based on the importance of specific qualifications in an occupation the indicator shows in how far hiring difficulties are expected as (some of the) skills are in short supply relative to the overall demand in an economy. Here, values of 1 indicate no shortage, lower values indicate some shortage and zero complete mismatch. A simplified interpretation of the number would be the extent to which the occupations can easily satisfy their demand (a value of 1 = 100%).

**Figure 3.26: Indicator of Future Imbalances of Demand (IFIOD), 2015-2025**



Notes: Indicators are based on employment weighted averages across 41 occupations and individual countries within the country groups.

Source: ERC estimates based on E3ME, EDMOD, STOCKMOD and BALMOD using country workbooks

A similar picture emerges from the indicator of future imbalances of demand (IFIOD). Note here, that an indicator value lower than one indicates potential future imbalances based on the forecast outcomes. So the lower values in Scandinavia (e.g, 0.9 for Service workers and shop/market sales workers) reflect the outcome of the first indicator discussed, the *Indicator of Constraint* (IC). However, the low indicators for almost all intermediate and lower skilled occupations for Scandinavia, the CEEC, and also for France and Benelux, indicate a potential shortage of lower and intermediate workers, which might lead to imbalances on the labour market. The differences towards the *Indicators of Constraint* are due to a larger weight on the current qualification mix in the IFIOD relative to the *Indicator of Constraint* that indicates the extent of reallocation necessary to reconcile the demand for and supply of qualifications in 2025.

Overall the forecast indicates many changes in the economy. On the one hand they are due to structural changes in work organisation and employment, but they also reflect the reaction to the changes in the supply by qualification. On an occupational level these changes are summarized in the third indicator the *Measure of Change* (MC). The underlying idea is that higher levels of change (e.g: in the qualification mix within occupations), while possible, usually imply more frictions and potential problems as it necessitates actions to be taken.

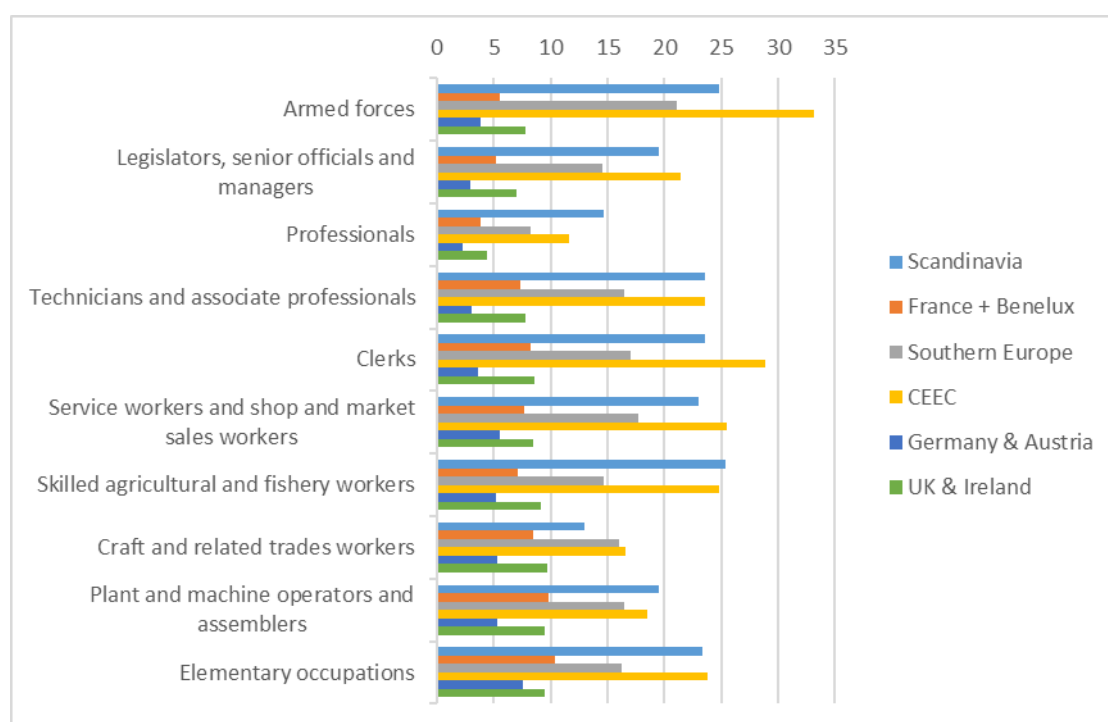
Note that while imbalances can imply changes (in the qualification mix within occupations) that take place, especially if one has to substitute across qualification levels to overcome supply shortages, change can also come from structural changes that evolve. An example is the increasing demand for higher qualified, especially in intermediate level occupations. This leads to a continuous shift towards higher educated over time which will be picked up by the *Measure of Change* (MC) as a

## Forecasting skill supply and demand in Europe: Overview of 2015/16 Projections

move out of lower qualified and an increase in higher educated in an intermediate occupation. In addition, imbalances will also need to a substitution of the skill that is demanded by skills that are available. It is thus not surprising that the *Measure of Change* (MC) is often following the same direction as the other indicators implying imbalances (such as IC and IFIO).

Figure 3.27 provides the summarized indicator values for the *Measure of Change* (MC). Higher values indicate higher rates of change, where the indicator value approximately relates to the absolute value of changes by occupation and qualification relative to the overall employment in an occupation.

**Figure 3.27: Measure of Change (MC), 2015-2025**



Notes: Indicators are based on employment weighted averages across 41 occupations and individual countries within the country groups.

Source: ERC estimates based on E3ME, EDMOD, STOCKMOD and BALMOD using country workbooks

Again, high indicator values can be found especially for CEEC countries, while Scandinavia also follows suit. However, this not only reflects the potential imbalances in these countries but also ongoing structural changes in the qualification supply and skill mix within occupations. Partly this is also the result of changes in the employment structure by sectors. Much lower changes are found for countries in the Western European group of countries. Intermediate changes are projected in Southern European countries.

Among the occupations, the highest values are found in the intermediate skilled occupations. Within these occupations the expected changes are likely to be highest, as they are usually based on mix of workforce from all skill levels. Thus the likelihood for change is also high. In addition, it is among these intermediate occupations that effects from skill-biased technological change and job polarisation are most likely to be felt.

The results suggest that there may be some structural problems across Europe with Eastern Europe facing particular problems of potential oversupply, especially among higher educated youth.

Within the current forecast, the imbalances among higher occupations and higher qualifications might be underestimated as it is especially important in this area to match the right specialisation and skills to specific occupations. Given data limitations, this has yet to be fully implemented in the current analysis of imbalances and mismatches.

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## Appendix A: Supplementary Country Results

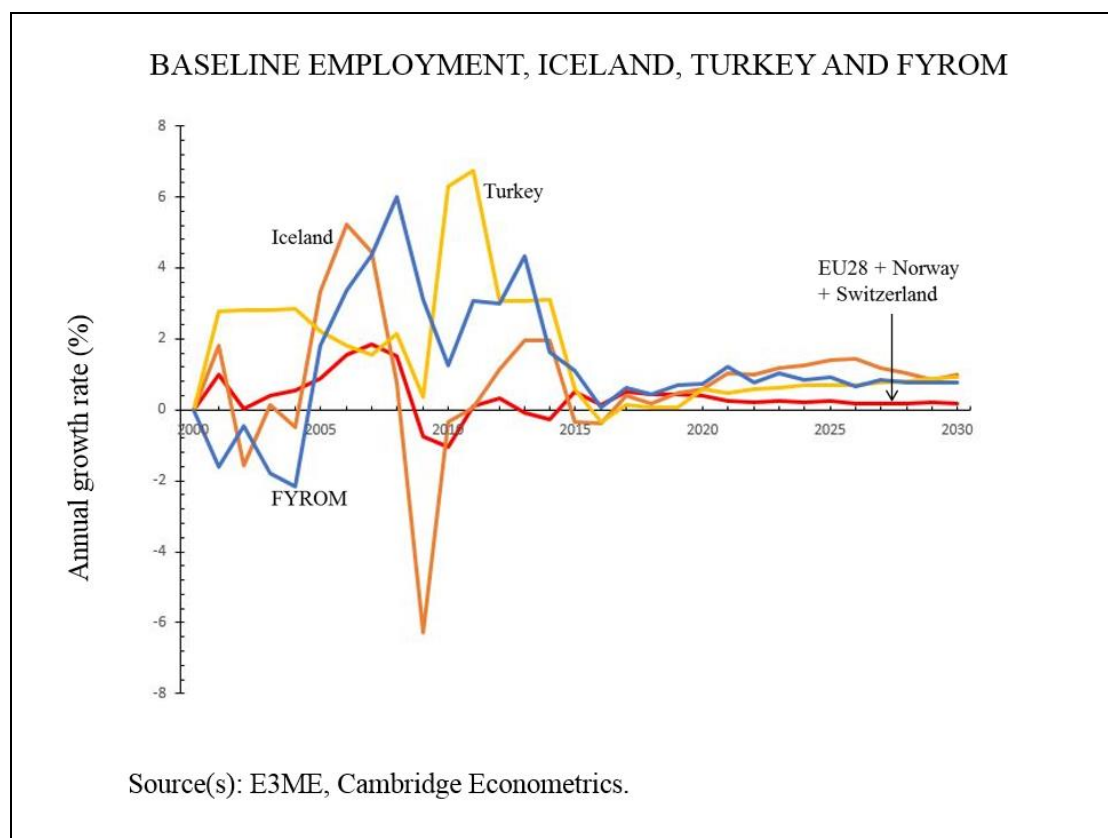
**Table A.1: Summary Statistics for Iceland, Turkey and FYROM (2013)**

SUMMARY STATISTICS FOR ICELAND, TURKEY AND FYROM (2013)			
	Iceland	Turkey*	FYROM
Population (000s)	322.0	75627.0	2062.0
Population (15+) (000s)	255.0	56770.0	1711.0
Employment (000s)	172.6	25751.5	617.7
Unemployment Rate (%)	5.2	8.6	30.5

Note(s): \* \*The historical broad sector employment data for Turkey are consistent with the Eurostat National Accounts data and WIOD database. Please note that the national accounts data are very different from the LFS data provided by the national sources.

Source(s): E3ME, Cambridge Econometrics.

**Figure A.1: Baseline Employment, Iceland, Turkey and FYROM**



**Table A.2: Baseline Employment by Broad Industry (Average Annual Growth 2013-30)**

<b>BASELINE EMPLOYMENT BY BROAD INDUSTRY (AVERAGE ANNUAL GROWTH RATE 2013-30)</b>			
	<b>Iceland</b>	<b>Turkey*</b>	<b>FYROM</b>
Primary sector & utilities	0.9	-3.4	-1.1
Manufacturing	0.2	-0.4	0.3
Construction	1.2	2.8	2.5
Distribution & transport	2.0	0.3	1.5
Business & other services	1.4	3.0	3.6
Non-market services	2.1	2.3	4.1
Primary sector & utilities	0.9	-3.4	-1.1

Note(s): \* The historical broad sector employment data for Turkey are consistent with the Eurostat National Accounts data and WIOD database. Please note that the national accounts data are very different from the LFS data provided by the national sources.

Source(s): E3ME, Cambridge Econometrics.

**Figure A.2: Baseline Labour Force, Iceland, Turkey and FYROM**

