**European Centre for the Development
of Vocational Training**

# Building on skills forecasts — Comparing methods and applications

Conference proceedings

# CEDEFOP

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# Foreword

In recent years, Cedefop has provided important evidence on future skill needs. Cedefop's 2010 skill forecasts and its 2011 update provide the most recent indications of the future patterns of skill supply and demand needs in the European labour market, examining closely the impact of the recession. To increase the quality of the new skill demand and supply forecast, which will be published in 2012, Cedefop continues working on further developments of the modelling framework.

This publication discusses how to best forecast skill supply and demand and how to improve the Cedefop approach. The publication examplifies Cedefop's commitment not only to provide evidence for policy-making but also to support active exchange of views and ideas among experts. It is based on the contributions from the international expert conference organised by Cedefop in February 2011, which brought together more than 60 researchers and experts in labour-market forecasting. This event aimed at gathering insights on how Cedefop's forecast is used at national level, and what other (innovative) forecasting activities are taking place in the individual Member States. It provides sound evidence and suggests innovative ways of skills forecasting. The findings support improvements of Cedefop's forecasting methodology.

During the conference, experts touched upon all the main elements of the basic forecasting approach and conveyed several important messages. First, it was confirmed that even if the scope and methods of the forecasting exercise differ across countries, the results produced are in line with Cedefop's forecast. Better quality data sets and better insight into national policies may however influence the precision of the trends obtained and thus their direct relevance for policy. Second, the forecasting results are important for further research (for instance, to assess the contribution of skills to productivity and economic growth) but they are especially valuable as additional labour-market intelligence (i.e. in public employment services and for guidance and counselling) and provide evidence for policy decisions. Third, all participants agreed that continuous improvements of methods and tools for skills forecasting is important

Cooperation with stakeholders is necessary to achieve progress and to ensure that these objectives can be realised. Key challenges identified for future forecasting include refined methods for the assessment of the consequences of migration (scenario); a more detailed interpretation of qualification and skills levels; a more exact definition of imbalances between supply and demand as well as innovative ways of reflecting the differences on regional labour markets. Cedefop is committed to address these challenges.

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2

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# Note from the editors

An agenda for new skills and jobs, one of the flagship initiatives of the Europe 2020 strategy, aims at modernising labour markets and empowering people by developing their skills throughout the lifecycle with a view to increase labour-market participation and to match better labour supply with demand. Following the Council conclusions of 7 June 2010 on *New skills for new jobs: the way forward*, Cedefop is mandated to provide a pan-European skill supply and demand forecast every two years.

Cedefop started its forecasting exercise with two pilot projects focused on the skills demand in 2008 and labour-market skills supply in 2009. The outcome published by Cedefop in 2011 combines and presents the first pan-European projection of skills supply and demand for 27 Member States of the European Union, plus Norway and Switzerland.

Forecasting is a dynamic exercise and needs to be continuously developed. To obtain feedback from international experts and scientific community Cedefop organised a technical conference, *Building on the skills forecasts: comparing methods and applications*, in February 2011 in Thessaloniki. The conference brought together an international forum of researchers and experts in anticipating labour-market as well as skill demand and supply. It gathered the latest insights into use of the Cedefop forecast and on other (innovative) processes in different Member States and helped to promote skills supply and demand among different experts in the field.

This publication, collecting selected papers presented at the conference, helps to identify the challenges and to offer solutions to skills and labour-market forecasting in general and Cedefop's in particular; it also discusses various national approaches, methods and results and their comparisons to Cedefop forecasts. We hope that this publication will be a step forward in increasing transparency and sharing expertise in skills anticipation. We wish to see, however, many more such steps helping researchers and practitioners to exchange their views. Cedefop will continue to contribute to this process.

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# Table of contents

# List of tables and figures

## Tables

## Figures

## Boxes

CHAPTER 1.

# Cedefop's skills supply and demand forecast: 2011 update and reflections on the approach

*Vladimir Kvetan, Rob Wilson and Alena Zukersteinova*

The Cedefop skills supply and demand forecast is one of the important contributions towards the coordinated anticipation of skills needs at European level. The forecasting approach used by Cedefop has been developed over the past few years and enabled the research team to publish in 2010 a first pan-European cross-country comparable projection of *Skills supply and demand in Europe* (Cedefop, 2010). This chapter presents the overview of current methodological framework and approach as well as the results of the skills demand and supply forecast released early 2011 ([1]). Description of four different alternative scenarios of possible future development of the European labour market which were developed alongside the main baseline scenario can be considered as a unique contribution to the discussion on the paths to recovery. The concluding part discusses the way forward and different constraints faced.

## 1.1.   Introduction

The European labour market is fast becoming a reality. This requires the identification of occupations, skills, competences and qualifications, which will be in demand in the future at pan-European level. This information is now even more urgent for setting up the strategy to speed up the recovery process after the end of the global economic crisis. Finding ways to obtain consistent and comprehensive information on future skill demand, as well as supply, in Europe — including joint European action — is a priority stated in key European strategic documents.

In 2005, Cedefop started to explore the feasibility of establishing a European skill needs and supply forecasting system. The main rationale was to fill the gap in information on future skill needs at pan-European level. Today Europe faces a situation where, despite increasing unemployment rates, there are still significant numbers of vacancies not easy to fill. Forecasting skill needs involves estimating

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([1]) This article was sent for publication in spring 2011. In the meantime, Cedefop has produced a new set of forecasting results. The new forecast confirms previous general trends on development, though some detailed numbers may differ.

the expected future number of jobs available in an economy and their particular skill or qualification requirements. Skills needs forecasts are complemented by forecasts of the number of people (supply) with particular skills. The comparison of demand and supply can indicate potential imbalances or skill mismatches in future labour markets in the EU, as well as in particular Member States.

The first pan-European forecast of skill needs providing consistent and comprehensive medium-term projections of employment and skill demand across Europe up to 2015 was published by Cedefop in 2008 (Cedefop, 2008). In 2009, this forecast was complemented by the first medium-term projection of skill supply in Europe up to 2020 (Cedefop, 2009). At the beginning of 2010, the first comprehensive forecast of both skills supply and demand was published (Cedefop, 2010). Cedefop is continuing to work on the system developed there, to produce regular forecasts, integrating skills supply and demand and providing indications of skill imbalances. The 2011 update presented in this chapter provides latest results of skills demand and supply forecasts. The projections were carried out in 2010 and published early 2011 (Cedefop, 2011a).

Section 1.2 describes the main features of Cedefop's methodology. It presents the general platform and focuses on key characteristics of different models, modules and methods used. The main outcomes and results from the 2011 update are detailed in Section 1.3. This provides information on the key trends in labour supply by qualification and in labour demand by occupation, sector and qualification. Conclusions and general recommendations for policy-makers are presented in Section 1.4.

When interpreting the forecasting results it is important to keep in mind the 'golden rule': the forecasts do not provide a 'crystal ball' showing precise information about the future. Rather they serve as a source for informed decision-making, and an early warning for various labour-market actors on what might happen in the future.

## 1.2. Methodological framework and approach

The conceptual/methodological framework (Figure 1:1) for the development of skills supply and demand forecasts is based on a modular approach, which enables continuous improvements and further development of particular elements. It also allows the input data and key assumptions, to be changed easily for updating or developing different alternative scenarios.

The first module is a multi-sectoral macroeconomic model (E3ME) which is used to drive the forecast. E3ME is a pan-European multi-sectoral model developed by Cambridge Econometrics and others (Pollitt et al., 2010) ([2]). This model provides a set of consistent employment forecasts by sector and country. The module combines elements of an annual econometric model and a medium-term sectoral model. The model produces labour demand forecasts for 42 economic sectors (compatible with ESA 95 and NACE). Labour supply is disaggregated by gender and five-year age groups. Eurostat (national accounts) data, as well as some OECD data from the STAN database are used to obtain consistent and commonly comparable forecasts for EU-27 Member Sates plus Norway and Switzerland (EU-27+). The forecast is calibrated to match the latest forecast from the Directorate General for Economic and Financial Affairs (DG EcFin) of the European Commission.

Expansion demand by occupation is calculated in the second module (EDMOD), using harmonised data from EU labour force survey. This set of data includes consistent multi-sectoral information which is comparable across countries. The data enable the construction of sector by occupation employment matrices. Connecting these matrices and the outputs from E3ME provides results for labour demand by occupation. Demand is proxied by the number of jobs. This module is based on econometric methods which enable the introduction of dynamics to the different elements of the matrix (the detailed description of this module can be found in Livanos and Wilson, 2010a).

Expansion demand by qualifications (QMOD) is based on similar data and principles to EDMOD. Qualifications can be regarded as individual characteristics to fill jobs, as well as criteria used in the selection process. Information about qualification requirements is an important input from the educational and VET policies point of view. Due to data limitations the current level of disaggregation is quite restricted to three broad formal qualification levels (low, medium and high). The design of this module enables, in principle, further disaggregation of different types of educational levels, skills and qualifications. In practice, the key limitation remains the availability, quality and range of the data (detailed discussion is provided in Livanos and Wilson, 2010a).

Replacement demand (RDMOD) represents a key element in skill demand, concerning the need to replace those who leave labour force for different reasons (retirement, migration, etc.). To estimate replacement demand is not a simple

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([2])  More detailed information is available from Internet:
http://www.camecon.com/ModellingTraining/suite_economic_models/E3ME.aspx
[cited 27.7.2011].

task and is crucially dependant on quality of input data. In an ideal situation this module should be based on information on the outflows from the labour market including inter-occupational mobility. Such data are not generally available at pan-European level, therefore the current estimates are based on information available on the supply of the labour force by age cohort (and inter-occupational mobility is largely neglected) (more details of the methodology are described in Kriechel and Sauerman, 2010).

The supply of skills is measured by the highest formal qualification achieved by individuals. Consistent pan-European forecasts using existing data disaggregated by age, gender and formal qualification ([3]) are produced. This depends on several modules.

An augmented version of E3ME* model delivers projections of overall labour supply as the function of economic activity, real wages, unemployment rates and benefit rates. At present, the model parameters are estimated for different countries, age groups and gender. This is also of key importance for modelling educational participation and attainment since these are known to be gender and age specific. This expanded model framework is then used to create a detailed set of baseline projections for labour supply over a 10 to 15 year period (for more details see Pollitt et al., 2010).

A full stock-flow model would represent an ideal tool for forecasting labour supply by different educational types. Such a model would enable a record of qualification development during the whole productive period of individuals to be followed. This ideal state is not easy to achieve due to restricted availability of data. Initial pilot analysis for a few countries suggests that it may be possible to develop such models using data from the EU labour force survey. At present, the main projections rely only on the overall trends in stocks in StockMod. This module forecasts the qualification structure of labour supply (focusing on the highest formal qualification achieved). Earlier work did focus on flows. FlowMod analysed educational participation of young people and the initial acquisition of qualifications, but this was based on partial and incomplete information (detailed characteristics of both modules are described in Livanos and Wilson, 2010b).

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([3]) The forecast distinguishes three broad levels of qualifications based on ISCED classification: low for ISCED 1 and 2; medium for ISCED 3 and 4 and high for ISCED 5 and 6.

Figure 1:1 **Conceptual framework of modelling the demand for and supply of skills**
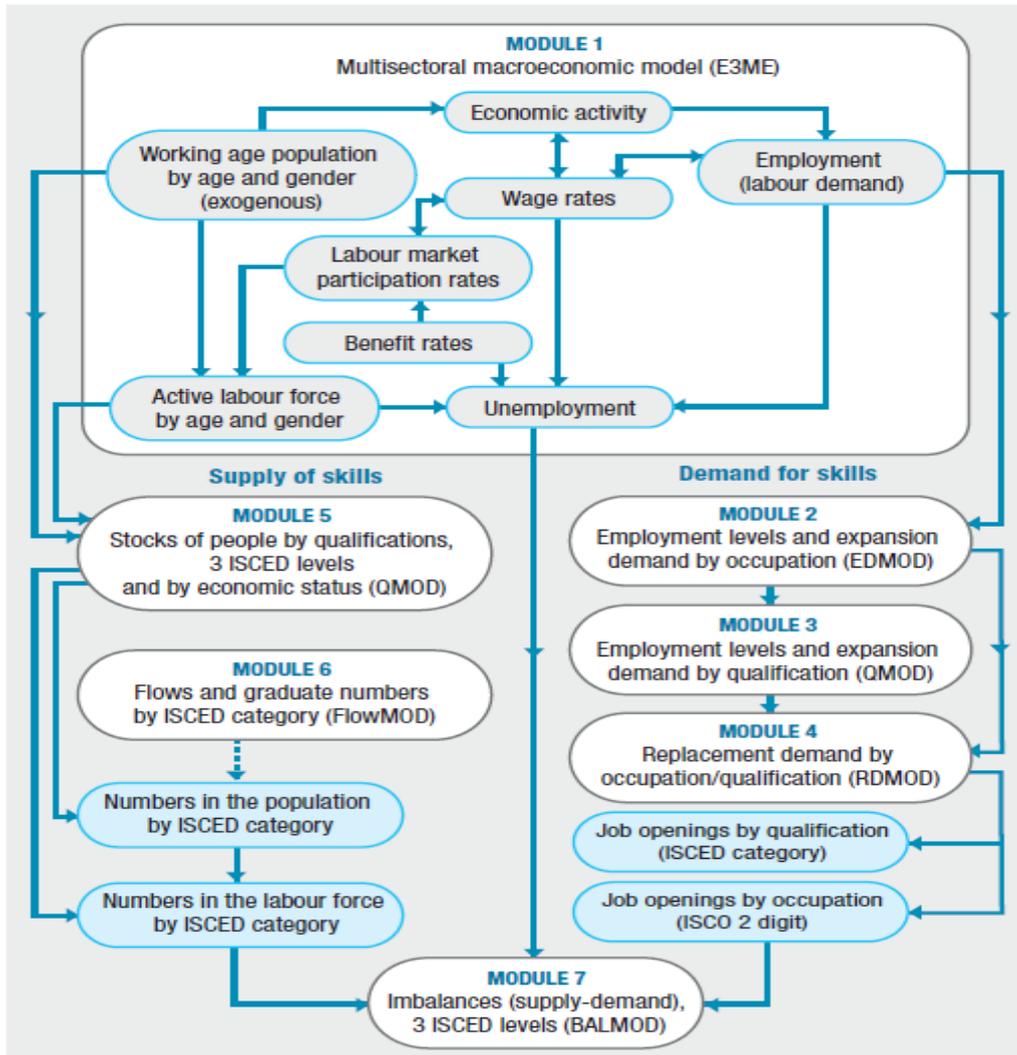


*Source*: Cedefop (2010).

The interaction between labour supply and demand by qualifications is a complex matter. Many jobs are filled by individuals with qualifications different from the 'norm'. The model that confronts demand and supply by considering this issue is BalMod. BalMod distributes the available labour supply holding certain qualifications into jobs, based on assumptions on trends in employment patterns at detailed level, plus assumptions about unemployment rates by broad level of qualifications. Final adjustments are made considering double jobbing; differences between the place of residence and place of work; participation in training; different definitions of unemployment; and statistical discrepancies (for more information see Kriechel and Wilson, 2010).

## 1.3.  Results: 2011 update on future skills supply and demand for EU-27+

### 1.3.1.  Baseline results

The Cedefop forecast of skills demand and supply in Europe published in the 2011 update (Cedefop, 2011a) suggests that the initial assessment of the impact of the recession on employment in the 2010 report was reasonably accurate (Figure 1:2). The crisis has significantly reduced the number of new job opportunities. There are probably around 10 million fewer jobs across Europe than if there had been no crisis.

Figure 1:2    **Impact of the recession on employment, EU-27+**
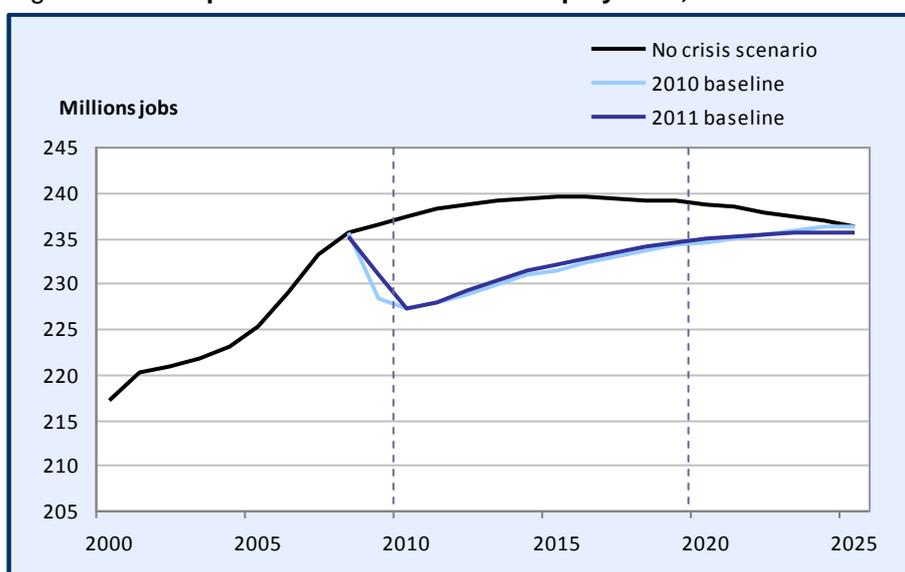


*Source*: Cedefop (2011a).

At sectoral level, the recession appears to have continued the shift in jobs from primary and basic manufacturing to services (Figure 1:3). Productivity gains are reducing costs and improving competitiveness, but can also cut the numbers of workers required to produce the same or even higher levels of output. The 2011 update shows that primary industries are projected to lose slightly fewer jobs than expected in the previous forecast. Many will be in agriculture, which is still a significant source of jobs in some countries and regions. Manufacturing was hit less hard by the crisis than expected. This points to the continuing importance of manufacturing to Europe's economy and indicates that some jobs are being saved, or relocated within rather than outside the EU. Services are still expected to provide most of the job growth between now and 2020. However, the

16

2011 update is less optimistic about the number of jobs the service sector will create by 2020. This is partly due to austerity measures and cutbacks in public and private spending and investment.

Figure 1:3    **Past and forecast employment changes by economic sector, EU-27+**
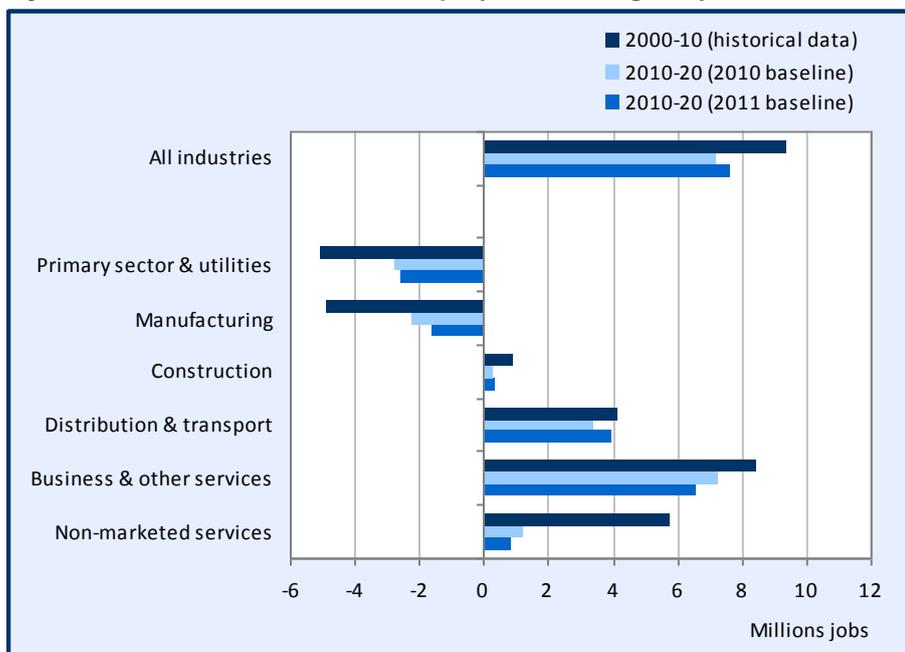


*Source*: Cedefop (2011a).

Over the next 10 years (to 2020), some 81 million job opportunities are projected. This includes around eight million new jobs (expansion demand). The other job opportunities arise due to the necessity to replace those leaving the labour force for various reasons (retirement, migration, etc.).

The 'skill intensity' of jobs has increased recently and this is expected to be a continuing feature. Most of the projected net increases in employment levels up to 2020 are concentrated in higher level occupations such as management, professional and associate professional jobs (around eight million in total between 2010 and 2020; Figure 1.4). However, significant employment increases are also expected for some lower level occupations involved in service activities such as sales, security, cleaning, catering and caring (around two million in total). Job losses are projected for some skilled manual workers and clerks (over five million in total). There are continued indications of possible polarisation in the demand for skills, with significant growth in employment in both high level occupations such as managers and professional as well as many less skilled occupations in the service sector. These trends might have significant

implications for issues of social exclusion, equality and job quality (for more on job polarisation see Cedefop, 2011b).

The net changes in employment by occupation are only part of the story. When replacement needs due to retirement or other reasons are considered they reinforce the projected net change. Replacement needs are much more significant in terms of numbers than new job opportunities. As a result, total job openings are positive for all major occupational groups (as older workers retire and need to be replaced). Even for the skilled agricultural and fishery workers group, where the most negative employment prospects are expected, there will be some job openings between 2010 and 2020 following the need to replace at least some of the current labour force. For many other occupations the numbers are even larger, notably for managerial, professional and associate professional and technical groups (with increases of between 10 and 15 million jobs for each group). There are also significant increases projected for some of the least skilled occupational groups, including the service and sales workers group, craft and related workers and even in elementary occupations (each with around 10 million job openings; Figure 1.4).

Figure 1:4    **Future job opportunities by occupation, EU-27+**
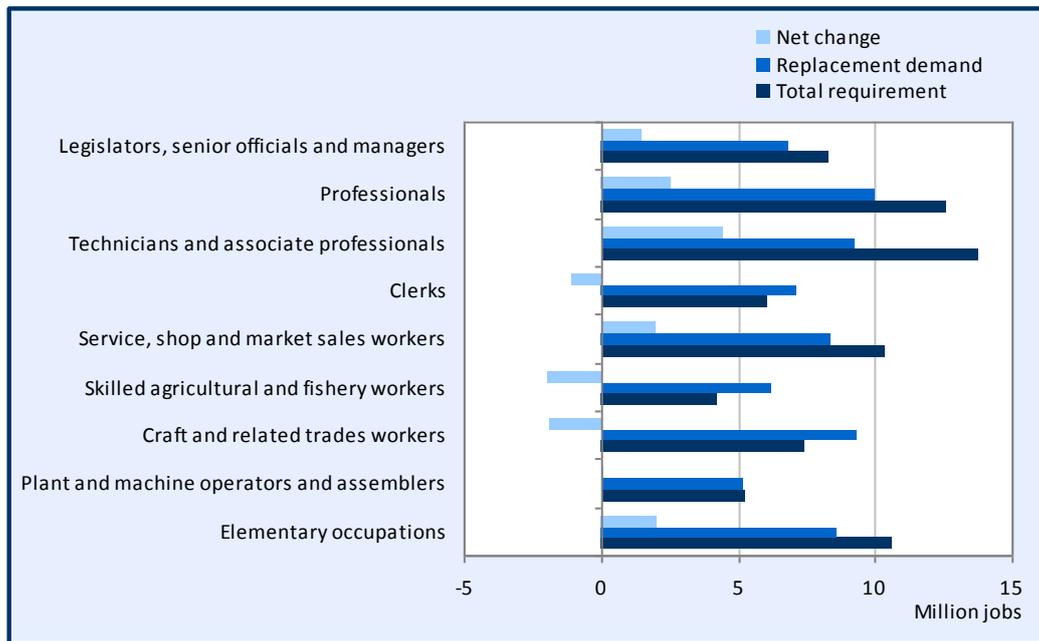


*Source*: Cedefop (2011a).

Many future jobs will require a better and more highly skilled workforce. The proportion of jobs employing highly qualified people is projected to increase to over a third. In contrast, the proportion of those requiring low or no formal

qualifications is projected to decrease. Those jobs requiring intermediate level qualifications will continue to constitute around half of all jobs.

This increase in average qualification levels is in part a supply phenomenon, driven by strong cohort effects and the interaction between supply and demand.

The need for better qualifications is also in line with the need to ensure better productivity and use of modern technology.

Figure 1:5  **Future job opportunities by broad level of qualifications, EU-27+**
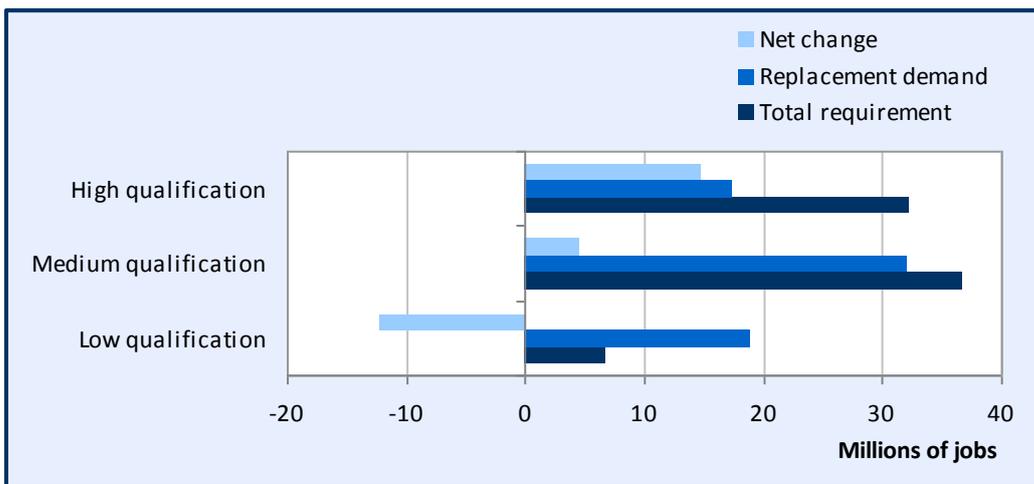
Future labour supply will be influenced by two important facts:
(a)  the increase in the average age of the working population: future labour force is expected to grow only in the age group 45+;
(b)  higher educational attainment of younger age cohorts: younger people tend to stay longer in education, they should acquire better qualifications raising the average qualification levels of those in employment as they replace more experienced workers leaving the labour market due to retirement.

Figure 1.6 presents the apparently inexorable rise in the proportions of the workforce with medium and high formal qualification, with especially large increases at the highest level, and sharp reductions in the shares of the workforce with no or low formal qualifications.

There is evidence that in many countries the recession has encouraged participation in further training and higher education in the short term. The long-term sustainability of these trends is highly dependant on, for example, the state of public finances, and the individual's perceptions of the prospects of receiving a positive return on such investments. Nevertheless, most countries appear on

track to meet the targets for improvements in the qualifications of their workforces set at European level.

Figure 1:6    **Labour supply by level of qualifications (EU-27+)**
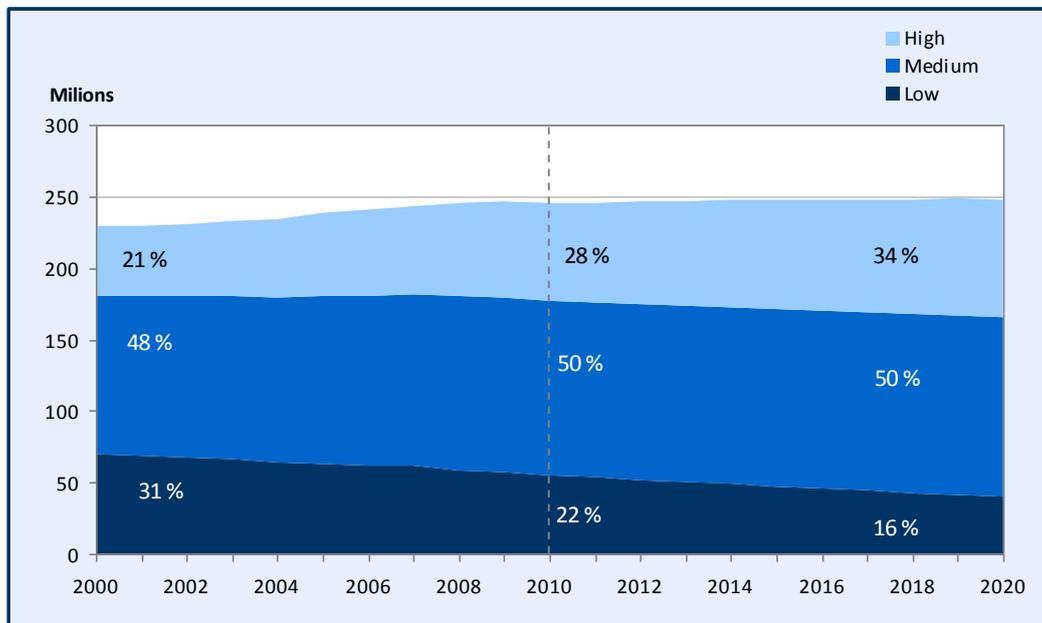


*Source*: Cedefop (2011a).

### 1.3.2.    Alternative scenarios

One of the valuable contributions of the forecasting exercise is that it allows the development of different scenarios describing the possible impact of certain policy measures on the labour market. In 2011, alongside the base line forecast, four alternative scenarios of the impact of possible policy measures taken were calculated:

(a)  the fiscal austerity scenario investigated the possible impact of announced government fiscal policies and the impacts that they are likely to have on the economy and employment. It included both changes to the level and pattern of government spending and tax rates;

(b)  the economic uncertainty scenario can be characterised by two exogenous changes: a reduction in investment to reflect the uncertain nature of returns; and a fall in the overall value of the euro;

(c)  the retirement age scenario looked at the impact of higher participation rates among the older age groups as a result of ageing populations and government policies to raise official retirement ages;

(d)   the ageing, health and pensions scenario investigated the impacts of higher government spending on health care (including higher employment in the sector), as well as higher government spending on pensions, as a result of the ageing population trends.

It is important to separate the short-term and long-term effects. In the short term, the scenarios can result in changes in aggregate employment rates. This is particularly the case in the scenarios where confidence collapses, for example, due to the austerity measures expected to be introduced in some countries. Even so, changes in employment often lag the changes in economic output that result from this.

Employment in the sectors that produce investment goods is most vulnerable to general economic shocks, as output in these sectors tends to be more volatile (investment is itself one of the most volatile components of GDP). This has particular skills implications as there are often specific skills associated with these sectors (e.g. engineering, motor vehicles and construction).

**Table 1:1      Main impacts on employment in the different scenarios**

|  | **Short term** | **Long-term Increases** | **Decreases** |
|---|---|---|---|
| Fiscal austerity | Overall reduction | Private sector | Public sector |
| Economic uncertainty | Overall reduction | Most sectors except investment goods | Sectors that produce investment goods |
| Retirement age | None | Most sectors | None |
| Ageing, health and pensions | Increase in health | Health sectors | Most other sectors |

Throughout the financial and economic crisis public sector employment has been largely protected across much (but not all) of Europe. However, it now looks much more vulnerable to cutbacks in spending in the future as governments try to rebalance their economies and balance sheets.

The main exception to this is that, especially in the long term, employment in the health sector is likely to increase by more than average, because of the continued growth in demand for health services (associated with the increase in the average age of the population).

In all the scenarios, in the non-public and non-investment goods sectors there are employment losses. This leads to workers that will either withdraw from the labour market or need to be reallocated. For example, in the scenario where healthcare employment increases, this largely comes from attracting workers from other sectors.

In general, the scenarios do not have much impact on the size of the labour force, with one exception: if State retirement ages increase there will be more older workers. Again this has both short and long-term implications; in the short term it is likely to lead to higher unemployment, but if labour markets are allowed to adjust, the long-term economic effects will be more beneficial.

The main implication of these results for policy is that, in the short term, there could continue to be quite large reductions in employment levels compared to the pre-crisis trend. Lagged effects mean that the impacts of the recession on labour markets may not yet have fully worked through. In addition, impacts from the possible policy responses that are now beginning to be implemented (such as significant cuts in public expenditure) are yet to be felt. Any negative impacts are likely to put further pressure on State budgets and welfare systems.

In the longer term, the results suggest that welfare will be maximised by implementing policies that allow the transition of employment between sectors to take place as efficiently as possible. For this, there is a need to allow wage rates to adjust flexibly and to ensure that workers have the necessary skills to move between sectors. The assumption in the scenarios is that workers will generally have the necessary skills to make the transition. If this is not the case, and if suitable retraining is not available, the macroeconomic outcomes could be significantly worse.

## 1.4. Conclusions and the way forward

The work done to date proves the general feasibility of skill supply and demand forecasting at European level, but many features can still be improved or developed further. There are continuous requests for greater detail in the forecasting results which leads back to the recurring issue of data problems and constraints. The present forecasts use mainly data from the EU labour force survey which while strong in terms of their availability and (in principle at least) comparability across Europe, still have limitations. They were not designed for modelling purposes. They are, in practice, often still inconsistent, both over time and across countries and they generally provide only rather short time series. The other key limitations are linked to the sample sizes, which are insufficient in many countries to provide enough details by skills. There is only limited information by occupation and qualification as a proxy for skills and no data at all on other aspects of skills, (e.g. generic skills, etc.). Pushing the data to their limits demonstrates the feasibility of providing some more detailed breakdowns but further progress is likely to require more substantial investment in data at pan-European level.

Many technical alternatives to the current modelling approach have been examined and others are still in the pipeline. As an example, the desirable stock-flow approach for the supply side shows some promise. This addresses the cohort inconsistency problem but may be problematic for small countries. On the demand side, the skills upgrading approach tells a broadly consistent story to the simpler approach used in the QMOD module but is much more demanding in terms of data requirements and cannot really substitute for the simpler methods currently in use as it is difficult to generalise and apply it within the full, detailed modelling framework. It is planned to explore more theoretical approaches (similar to those used in computable general equilibrium [CGE] models), as well as the scope for greater use of expert judgement to extend and enhance the analysis.

The replacement demand module currently uses the cohort component method, which is well established but still open to criticism. Alternative approaches using panel data, which allow identification of individual decisions and the different causes of replacement demand could be easily implemented in countries where data are available. However, the estimates are very similar to those from the cohort component approach, and moreover, such data are currently not generally available across Europe. Therefore, it has been decided to continue using the cohort component method until better data from Eurostat are available.

When measuring potential future imbalances, simple comparison of demand and supply is problematic for various reasons, including the difficulty in capturing robust indicators of interaction. The results suggest that governments may need to stimulate demand from employers and to find ways to increase the utilisation of skills but more focused information is needed. The following indicators are being developed to link occupational demand to educational supply: qualification employment shares in occupations, indicators of constraint and change based on the iterative procedure used to reconcile the supply and demand measures. These will be further refined in the next forecasting round, with more detailed distinction by field of education (depending on data availability).

More generally it may be possible to improve the results for individual countries by making better use of country specific information rather than relying solely on the pan-European data (using the same basic definitions, sources and methods, but moving beyond the limitations imposed by reliance on the pan-European labour force survey, using country specific information which may be more reliable and more detailed).

The development of occupational skill profiles aims to bring the forecast results closer to the actual skill demand by linking the results to characteristics

essential to a given occupation: the level of education and training required (and hence the complexity of the occupation); the field of education and training required; main and supplementary requirements concerning knowledge, skills, personal abilities, attitudes and values. Occupational skill profiles for specific occupations can be aggregated into those for occupational groups, further into sectoral ones, then into those for national economies, and finally up to pan-European level.

The Council conclusions of 7 June 2010 on *New skills for new jobs: the way forward* (Council of the European Union, 2010), mandate Cedefop to update its skill supply and demand forecast every two years. Though European level forecasts are now available, there is still a lot to be done to develop various parts of the model framework to address adequately important policy issues such as imbalances and mismatches or migration. Therefore, the key plans for the future include a further review and refinement of the data as well as (where possible) additional detail for skill demand and supply. A full update of both the supply and demand projections is planned every two years, including a thorough analysis of mismatches and imbalances as well as development of more scenarios and their interpretation to policy-makers. The next full update is now underway and will be published in early 2012. In addition to the general improvements set out above, it will include further development of models and scenarios to explore the possible impact of climate change and related mitigation measures, exploration of implications for productivity and growth, and further analysis of sensitivity of the results to assumptions about migration. The work programme also includes validation and further development of the occupational skills profiles and other methodological developments. More ideas will arise from the various expert contributions in this publication. In combination these elements should ensure the provision of even better information to policy-makers and others about the prospects for skill demand and supply in Europe in the future.

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CHAPTER 2.

# Lessons learned: how to improve Cedefop's forecast

*Ben Kriechel and Hector Pollitt*

As part of the new Europe 2020 strategy, Cedefop is mandated to produce every two years a skill demand and supply forecast. Cedefop work is based on the cooperation with important European research institutions and universities. Setting up the broad platform for discussion is one of the key priorities of Cedefop skill forecasting team. To share the knowledge and obtain inspiration for further work, Cedefop organised the international conference 'Building on skills forecast: comparing methods and results' in Thessaloniki in February 2011. This chapter summarises key findings and tries to indicate new insights and ideas for the pan-European model.

## 2.1.   Introduction

As part of the new Europe 2020 strategy (European Commission, 2010), aims to modernise the European labour market included the wish to gain insights into the developments of skills supply and demand in the future. The influence of some of the more important trends, such as changes in the development of work and the greying of the workforce, are evaluated.

Cedefop started to play an active role in the process of development of tools to improve information on future labour-market trends. The two pilot projects on development of forecast for skills demand and skills supply (Cedefop, 2008; 2009) led to the publishing of first pan-European skills supply and demand forecast for EU-27 Member States plus Norway and Switzerland (Cedefop, 2010). Use of single methodology and databases provides a consistent and commonly comparable forecast across countries.

The development of such forecast is a continual process which is never completed. The international conference on skills demand and supply forecasting organised by Cedefop in Thessaloniki on 17 and 18 February 2011, summarised in this chapter, had the aim to bring new insights and ideas into the pan-European model, by discussing with international experts their views and approaches to forecasting at national or international level.

This chapter provides an initial overview of the presentations ([4]), which are also developed into independent chapters in this publication, by discussing several aspects of their relation to the Cedefop pan-European model. First, national forecasts presented at the conference are discussed. How they are developed, which data they use and what goals they pursue can teach us both about approaches to skill forecasting, and about the use of their results at national level. Section 2.3 provides a summary of studies that have compared results of the pan-European study with other sources, mainly national forecasts or outcomes. They usually focus on the problems of the pan-European forecast in catching national developments. Section 2.4 discusses extensions that are, be it implicitly, suggested. Section 2.5 deals with the presentation of the results, which is closely linked to the usability of results. Finally, some technical points are raised in Sections 2.6-2.8.

## 2.2.    National forecasts

In the group of 'national forecasts' the presentations on France (even though it is a regional model), Germany, Italy, Norway, Poland and Switzerland are summarised. Rather than summarise the contributions, the aim is to point to aspects that either highlight a certain noteworthy angle of the forecasting process, or can teach us how to (differently) approach the modelling process.

Nils Martin Stølen described the Norwegian forecasting model, a labour-market projection model that exists in Norway since 1993. The model builds upon rich administrative data sources that are typical for the Scandinavian countries. Traditionally, the focus of the model is on the education side of the labour market. Problems such a model has with migration are also noteworthy. Most information comes from administrative data on schooling and labour-market participation, the model had to be adjusted to fit in migrants that lack part of their education and labour market history, as they were not in Norway at that point of time.

Tobias Maier presented the German forecasting, another national model encompassing various modules determining supply and demand. It is a typical example of how a national model can use the more detailed, national data, and adapt the model to the institutional setting of the country. One of the current challenges is the modelling process of the mismatch between supply and demand. They use an approach to determine a 'flexibility matrix' that allows to determine the historical relation between education and choice of occupation.

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([4])    Available from Internet:
http://events.cedefop.europa.eu/skills2011/presentations.html [cited 5.10.2011].

The Italian model, presented by Massimiliano Tancioni, is a macro (dynamic stochastic general equilibrium, DSGE) simulation model that allows for the breakdown to sector, age, profession and skill. This theory-driven model allows with the use of the breakdown to evaluate the impact of policies enabling their optimisation. It is a theory-based way to translate (policy) changes into economic outcomes at sectoral, occupation or skill levels.

The Swiss educational planning model was presented by Jacques Babel. The model includes detailed flows in the Swiss education and training system. With a time horizon of 10 years, it is used to forecast future flows of graduates, but also to evaluate the impact of enacted or planned policies. It is based on a hierarchical multistate model which includes the, for Swiss important, flow of foreign migrants.

Artur Gajdos introduced the Polish model, which emphasised the breakdown of outcomes to the regional level. He showed the differences in sectoral and occupational structure on the regional level, and how they are included in the Polish model. The main model is built on a forecast based on macro model that is further refined by a linked occupational structure forecast.

Marie-Béatrice Rochard, presented the French purely regional model of occupation and skills monitoring. Using a macro regional model and scenario's data for regional economic policy are generated that allow to improve not only the decision-making process but also form the basis for discussions between different stakeholders in the region.

## 2.3.   Comparison and evaluation studies

Many presentations compared, implicitly or explicitly, the outcomes of their own models and those of the Cedefop project for their country. For the Baltic States, Žilvinas Martinaitis, compared the Cedefop forecast by sector, occupation, and education with the realisations published by Eurostat. Even though the group of countries fits perfectly in the category of countries that are difficult to forecast for as they are small, in a transition process, and prone to in- and out-migration, he concludes that overall the forecast was close to the realisation. Many national studies mentioned in the previous section explicitly or implicitly make a comparison to at least a part of the national outcome of the EU-wide Cedefop forecast. While there are differences, many times the conclusion is that the outcomes are in line with the national model, be it with less level of detail or lower accuracy. The Swiss presentation made a detailed comparison concluding that there are significant differences in the age distribution (by education), while the overall outcome of the forecast of the national and the Cedefop model are

similar. It also shows the importance of migration for the national labour market at a level of detail that is not feasible for a EU wide study, given the current data.

## 2.4. Extensions

The extensions presented were mainly along two lines. First, there were a series of projects and suggestions to investigate the nexus of skills and occupations more deeply. And second, the use of alternative or additional data or modelling environments.

For the first line of extensions, the treatment of skills, Jiří Braňka presented a EU wide project on the transferability of skills. The projects goal is to determine the skill composition and transferability of and between sectors and occupations. By using several in-depth sector studies, the team tried to identify soft and (generic) hard skills for lower and intermediary occupations. Understanding the skill composition would help foster policies that target an increase in employability of the lower and intermediate skill group, which is likely to come under more and more pressure.

Other countries have tried, on the national level, to consider similar issues. The aforementioned 'flexibility matrix', for example, tries to model something similar, be it less explicitly. For Austria, Rainer Humpl showed the use of skill contents extracted from vacancies to characterise occupations and the skills needed. Pekka Tiainen's question is related: how can we connect literature on the sources of economic growth with outcomes of our skills forecast, or maybe more ambitious how could we include feedback loops into the model that includes the outcome of skill mismatches in the future growth expectations of a country? He proposes an index-based growth accounting framework to this end.

The second branch of extensions was by using alternative data sources. The above-mentioned project could also be seen in this line of extensions as both the project by Jiří Braňka and the one by Stefan Humpl use, for example, employer surveys to identify changes in the skill composition of employment. Furthermore, the explicit inclusion or extension of results to the regional level was emphasised by several contributors.

## 2.5.  Presentation of skill supply and demand forecasts

A forecast is useful only if the end-users understand its outcomes and apply them to the correct questions. The presentation of the results is of crucial importance to achieve this. Tom May presented the qualitative component of the Cedefop forecast, among other things it also allows to package the results into stories that can be evaluated on the qualitative level. As such, it uses the quantitative outputs as input to be placed in a context.

Another aspect of presentation is the collection of various results by the variable of interest to the end-user. A good example is the AMS-skills barometer as a tool of presentation. It collects and presents data from various, quite detailed, sources to characterise, for example, occupations by several aspects such as skills content, change in demand over time, income, and so on. A user-friendly interface invites end-users such as high school students to investigate the possibilities various educational and occupational choices might lead to.

A further element of presentation is often more implicit in the building of a model. Many models developed out of a demand for a specific question. Regional models were developed to present information on regional level, it is both a methodological choice and a level of presentation. Other models are extended to include regional components because a national presentation of results would not otherwise be in line with an important component in the labour market.

## 2.6.  Technical responses to the presentations and discussions

Discussion touched on all the main elements of the basic forecasting approach. Figure 2:1 shows a generalised version of the modelling structure that is used to produce the Cedefop forecasts (although this could be applied for summarising any *ex ante* modelling task).

### 2.6.1.  Historical data

There was much discussion about data issues during the conference. Although this is highly relevant to quantitative assessment and the modelling team, in terms of lessons learned this is largely outside our control.

Figure 2:1     **Overview of (Cedefop) existing approach**
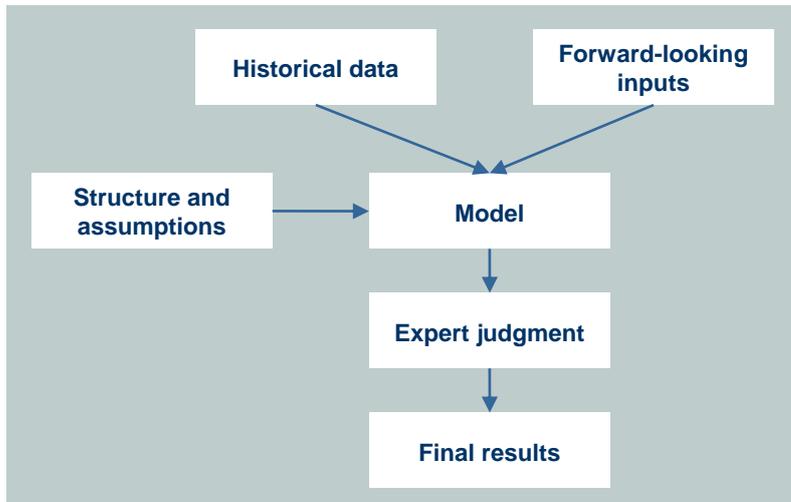


*Source*: Authors.

However, one recurring theme was the trade-off between the data requirements and the degree of complexity involved; with better quality (i.e. more detailed and more reliable) data it is possible to apply more sophisticated modelling techniques. This is particularly relevant when considering geographical boundaries, as data at national level tend to offer a higher level of detail than the pan-European data sets used in the Cedefop forecasts. The question of how to make best use of the data available still remains largely open.

### 2.6.2.     Forward-looking inputs

The main forward-looking inputs to the forecasting exercise are the baseline assumptions for population growth and economic development. Both of these were discussed at various points during the conference, particularly in relation to the crisis (e.g. Chapter 7).

The issue of migration is important on the supply side. The current approach uses Eurostat projections as exogenous inputs, even though post-crisis they are now dated. The current programme of work aims to improve on this, with some model runs based on alternative migration assumptions.

### 2.6.3.     Expert judgment

Many of the Skillsnet team members who provided the feedback on the projections were present at the conference. Some of them presented the differences between the final versions of the Cedefop projections and the national ones, or the actual outcomes (mainly discussed in the session on national projections). This is a very valuable input to the overall exercise, as the

pan-European approach is not able to make use of local information, expected developments and more specialised data. In the coming year the team will be focusing on how to make the most use of the information provided.

The possibility of incorporating sectoral and national feedback was another point raised in the discussion. The previous forecast made a comparison against the DG Employment sectoral studies ([5]), but there are limitations on the quantitative inputs they can provide.

## 2.7.   Limitations of the modelling

In the introductory session to the conference, Rob Wilson noted that modelling cannot provide an answer to everything, it can address some questions and others not.

Modelling represents a simplification of reality, based on a series of assumptions about how the world can be represented in a computer-based format. A recent Cambridge Econometrics publication (Poliitt et al., 2010) commenting on the current state of the art in modelling, four major limiting factors to current modelling approaches were highlighted. During the conference presentations and subsequent discussion, all of these were raised in the context of labour-market forecasting. They are described below.

### 2.7.1.   Degree of exogeneity

The boundaries of the model provide an important and necessary constraint on the analysis. As described above, the main exogenous inputs in the modelling are the population and migration projections and economic projections. Most other inputs are assumed to remain broadly constant with historical patterns. Developments in the rest of the world is another noted exogenous input.

### 2.7.2.   Parameterisation and non-linear responses

Several of the presentations compared the econometric approach used in Cedefop's forecasting and other modelling approaches including:
(a) continuation of previous trends;
(b) use of computable general equilibrium(CGE) models or methods;
(c) use of dynamic stochastic general equilibrium (DSGE models, Chapter 10).

Each method favours a different means of deriving behavioural parameters. Equilibrium-based approaches favour a more theoretical than empirical

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([5])  See http://ec.europa.eu/social/main.jsp?catId=784&langId=en.

methodology. Each method has its own data requirements, with the current methodology used having quite stringent requirements (for all EU Member States).

While it is important to compare results from the different approaches, at the moment there is only limited scope for changing the methodology used to produce the Cedefop projections.

The use of linear responses in the modelling approach was also implicitly called into question. The model parameters are generally appropriate for marginal changes but it is not necessarily true that these can be extrapolated in a linear fashion for larger impacts. For example, many of the forecasting results, including the Cedefop projections, slightly overestimated the employment impacts of the recent crisis.

### 2.7.3. Technology

The treatment of technology in forward-looking modelling approaches is always problematic for the basic reason that it is not possible to predict the future direction of technologies. Currently the most discussed aspect of technological change is the response to challenges posed by greening the economy. This is hampered by problems with data classifications and the definitions of what is actually 'green'. There is ongoing work at both Cedefop and the European Commission looking into labour-market impacts, and the research team will aim to ensure consistency in approach over the coming year.

### 2.7.4. Treatment of uncertainty

Another area of modelling that is growing in importance is the treatment of uncertainty. There are many sources of uncertainty, including many of the issues discussed at the conference and in this chapter (e.g. data, model parameters, exogenous inputs, policy responses).

The skills forecasts will never be 'correct'. The modelling results present a single set of point results and, although these are supported by additional sets of positive and negative outcomes, this still does not address the full range and likelihoods of possible developments.

In the previous year's work, additional scenarios were developed to look at some of the most important policy developments that might take place before 2020. This helped to focus on some of the key issues. However, it can be concluded that the modelling results must be taken in context and should be considered as part of a wider analysis. This should include qualitative elements, telling the story and providing interpretation, as described by Tom May (in Chapter 3).

## 2.8.    Incorporation of the supply side?

One important development to the existing framework discussed at the conference was the possibility of including the link from skills to the wider economy. The presentation by Pekka Tiainen presented one such approach, based on the growth-accounting method.

This link (Figure 2:2) has been put forward as one of the options to be explored in the ongoing Cedefop project but there are methodological differences between the supply-side approach described and the E3ME model, which is more focused on demand. Nevertheless, it is worth further consideration.

Completing this loop would open up other possibilities in the modelling, such as considering the transfer of skills between sectors, which was discussed by Jiří Braňka and Tobias Maier among others.

This will be considered further in the next year.

Figure 2:2    **Incorporation of supply side?**
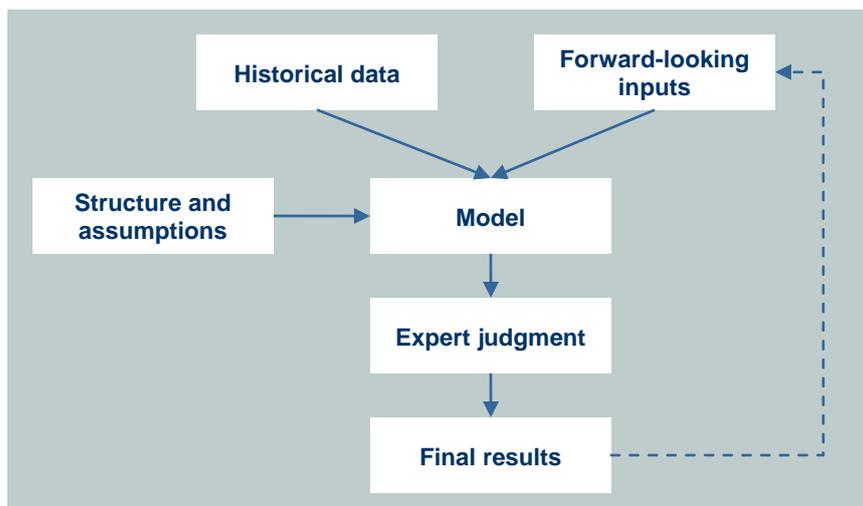


*Source*:    Authors.

### 2.8.1.    Impacts of the crisis

The effects of the recent financial and economic crisis were mentioned in several of the presentations. The crisis raises important methodological questions for different model approaches:

(a)   if using trends to predict future growth, what period should be used;

(b)   is it appropriate to use empirically derived parameters for forecasting post-crisis;

(c)   what is the most appropriate base year for a computable general equilibrium (CGE) model to use.

The opening to the conference described the existing imbalances (with both high levels of unemployment and skills shortages in certain sectors) which partly result from the sharp negative impacts of the crisis.

This is something that the research team will keep in mind in the coming year. However, it is still too early to tell what the lasting effects will be; at the moment the last year of data is 2009 so it is not possible to make pre- and post-crisis comparisons. The expert judgment will therefore play a particularly important role in the upcoming projections.

### 2.8.2.     The wider policy perspective

The European policy landscape is now shaped by the Europe 2020 strategy (European Commission, 2010), which has a target for employment rates and also for reducing early school leavers. However, some of the other fixed targets (e.g. the environmental targets) may also have considerable effects on labour markets.

Cedefop forecasts are not expected to meet the employment targets (as they are largely based on current policy only) but will offer a comparison. It is clearly important that the wider policy perspective be considered, as well as the links between policy areas.

Policy developments are also of major importance at national level as, for example, many of the policies required to meet the 2020 targets will be implemented by the Member States. In many cases this will require local knowledge, so it is another area in which the role of the country experts will be important.

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# Part 1:
# Building on Cedefop's forecasting results

**Qualitative scenarios for policy-makers**
*Tom Leney*

**Polarisation or segmentation?**
**Occupational change and the implications for the future EU labour market**
*Antonio Ranieri*

**Use of forecast results in a skills transferability project**
*Jiří Braňka*

CHAPTER 3.

# Trends, drivers and qualitative scenarios in Europe 2020: for education and training policy-makers engaged with meeting skills needs

*Tom Leney ([6])*

This chapter sets out some qualitative scenarios that emphasise skills supply and demand in 2020. It aims to help education and training policy-makers to contribute to meeting labour-market skills demands. The research is based on the results of recent analyses of European labour-market demand and supply, and education and training analysis. Using a 10-step methodology devised for the Cedefop project, the chapter describes wide-ranging trends and identifies powerful drivers and uncertainties that will impact on education and training policies and provision.

The chapter then elaborates three scenarios that are based on economic trends and focus on identifying and meeting skills needs. These are expressed as 2020-snapshots. Each scenario has two variants (scenarios 1A/1B; 2A/2B; 3A/3B). Finally, it evaluates the usefulness of the research conducted, and suggests steps to take in 2011.

## 3.1.    Introduction

This chapter develops an overview of trends and drivers and builds a set of scenarios. This is intended as a helpful tool for education and training policy-makers who — among other priorities — have to be as sure as possible that their policies when implemented are capable of making a strong contribution to meeting the various demands for labour-market skills. The work forms a qualitative part of the Cedefop project 'Forecasting skill supply and demand in Europe', whose main goal is to develop an econometric model that can measure and anticipate skills needs and supply at the European, national and sectoral levels.

The methodology for preparing and presenting the qualitative scenarios was developed in 2010 specifically for the project. This involves following a series of 10 steps. The chapter takes the process through to Step 8. It encompasses

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([6])   The paper was presented at the conference by Tom May.

identifying data for a range of trends, identifying powerful drivers and also uncertainties that can be expected to impact on education and training policies ([7]). As a result of the analysis, 100 vital trends are specified, and these impact on skills development aspects of European systems of education and training. Next, some of the key areas of likely uncertainty for education and training planners and policy-makers are suggested and 9 factors that are driving change in education and training planning (the drivers) are identified. Each of these relates strongly, but not exclusively, to questions of skills demand and supply as concerns policy development in education and training. Three scenarios are constructed, and subjected to some preliminary consultation and validation. They are expressed as 2020-snapshots. Each scenario has two variants (scenarios 1A/1B; 2A/2B; 3A/3B). The scenarios are:

Scenario 1: strong economic growth: lessons learnt;
Scenario 2: gradual recovery: all to play for;
Scenario 3: double dip and down: a bumpy ride.

## 3.2.   The 10-step methodology

A detailed paper proposing a methodology (Leney, 2010a) for developing skills related scenarios for education and training policy-makers resulted in the adoption of a method that the research has followed carefully as far as Step 8 (for more detail see Leney, 2010a). In outline, these are the 10 steps of the procedure for developing qualitative scenarios in this case:

Step 1    define the problem;
Step 2    identify the contexts to be explored for trends;
Step 3    gather data and identify the key drivers;
Step 4    identify the main trends;
Step 5    decide on the most important trends whose outcome is uncertain;
Step 6    use the data to construct a grid or matrix for a set of scenarios;
Step 7    develop the provisional scenario statements;
Step 8    check out the scenario statements for plausibility;
Step 9    modify and polish, then present the scenarios. Test with prospective users;

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([7])   This has entailed gathering data on a range of trends and issues in relation to skills demand and skills supply in the European labour markets (Cedefop, 2010; 18 of the DG Employment sectoral skills and scenarios studies) and in relation to developments in European systems and policies for education and training (Council of the EU, 2009). These sources contained a lack of trends concerning migration as a factor, so recent OECD data was used to fill this gap.

Step 10   introduce the scenarios into policy-making. Keep under review.

The next sections describe the results of following the procedure.

## 3.3.   Trends analysis

A careful analysis of the important trends that are likely to have a strong impact on education and training policy in Europe was needed to develop a clearer understanding of the challenges policy-makers face as ensure that their policies and reforms help to meet labour market skills needs. We identified 100 important trends from the sources consulted, using these categories:

(a)  trends that lie outside the labour markets — population; natural resources and technology; globalisation and economic factors; social and political factors (31 trends);

(b)  trends in labour-market skills demand (14);

(c)  trends in labour-market skills supply (12);

(d)  trends in education and training outcomes, systems and policies (43, further subdivided).

To give an indication of the trends identified, the table that follows summarises the labour-market demand and supply trends. Mostly, these are identified from the Cedefop project and from the EU sector scenarios work ([8]).

## 3.4.   Drivers of change and key uncertainties

From the analysis undertaken, we have been able to identify some key drivers that are impacting on the decisions that education and training policy-makers are responsible for ([9]). The most important underlying factor is the economic trajectory beyond the recent crisis. Nine drivers are identified:

(a)  global/economic shifts including economic recovery and limitations on public funding;

(b)  demand and supply pressures for skills in the labour market;

(c)  organisations reviewing their structures continuously;

(d)  technological development;

(e)  unresolved and new challenges facing education and training systems;

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([8])  For a full account of the 100 trends identified see Leney (2010b, p. 7-15).

([9])  In particular from the views expressed in the European Union sectoral scenario studies, from the evidence of the Cedefop anticipating skills supply and demand project and from the EU reports progress towards the Lisbon goals for education and training. See reference list.

(f)  pressures on companies to innovate and perform;

(g)  the effectiveness/ineffectiveness of European, regional, national policy regimes and networks;

(h)  the effectiveness of localised links between education and training providers, companies and government;

(i)  demographic change.

Several factors associated with these drivers and the trends summarised above create uncertainty for education planners, as they work with stakeholders to develop their education and training systems to meet anticipated skills needs. These can be expressed as a series of questions. Will the Member States be successful or otherwise in emerging from the recession? Will there be sufficient numbers of well trained teachers and trainers? Will countries be able to develop and sustain models for increasing access to continuing training in the workplace (continuing vocational training)? How will long-term priorities be viewed in the light of short-term expediency — in terms of trade offs and achieving 'more for less'? While education systems face growing demands for medium and high skills, will they be successful in combating school dropout and inequalities? Higher levels of formal qualifications are expected, but what kinds of knowledge/skills, attitudes, and competences does this imply? How can the education systems meet both national and local or niche demands? What will be the impacts of IT on both education structures and wider business models? Will job polarisation be limited or extensive?

**Box 3:1      Summary of likely trends in labour market skills demand and supply (2010 to 2020)**

**Labour-market skills demand (2020):**

• limited convergence: levels and types of skills demand continue to vary from Member State to Member State, across the EU regions, and within sectors;

• European employment growth is gradual. Emergence from the recession is modest and varies by country. In 2020 employment is higher than in 2010 but below the peak of 2008 ([a]);

• knowledge- and skills-intensive jobs continue to take an increasing share of all employment. Managers, professionals and technicians are increasing, while agricultural, many craft- and some clerical-skills jobs decline;

• there is some polarisation/hollowing out of the labour market, and concern about quality of many jobs, particularly in countries shifting to service economies;

• the number of job openings will total around 80 million (as a baseline) over the decade, made up of replacement and expansion demand;

- expansion demand is positive (job creation) in knowledge and skills intensive areas, and in sales, security, catering and caring. Losses are likely in clerical and skilled manual jobs;

- replacement demand is a substantial amount of all job openings, as ageing EU citizens retire. Even where there are job losses, many viable options will remain;

- overall there is increasing demand for people with high and medium qualifications, and decreasing demand for low skills. Some jobs previously calling for low skills call for higher skills levels;

- skills profiles are changing. Many increasingly need combinations of transversal, core and specialist skills, as well as new technical skills and more multi-skilling;

- almost (but not quite) everywhere, there seems to be a growth in the demand for managers;

- manufacturing: significant job losses over the decade, particularly in skilled occupations. Yet increased specialisation and value-added activities result in more high-skilled jobs;

- some manufacturing industries will continue to expand. Chemicals and some niche industries are just such an example, and this has implications for the demand for skills;

- services: significant job growth has continued. Unlike much manufacturing, there is a steady increase in the need for low-skilled and high-skilled jobs in the services sectors;

- a shift in skill structures in Europe is still taking place. Central and eastern Europe specialise more in production and assembly activities, while western Europe concentrates on the research and development, and high-value segments.

**Skills supply (2020):**

- limitations to convergence in qualifications and skills supply is a continuing feature of the European map, reflecting differing demands and differing education traditions;

- the supply of people with medium and high level qualifications has continued to increase, particularly university or equivalent qualifications. Medium, mainly vocational qualifications still form half of the EU labour force;

- the supply of people in the EU labour force with low-level qualifications falls sharply;

- in individual Member States, the trends in high- and low-qualified people in the labour force is similar to the European trend. The trend for medium-level qualifications is more complex: shares are rising in some countries, falling in others;

- on average, women are formally more highly qualified than men, except at medium qualification level. More (and better qualified) women to be active in the labour market;

- age cohort trends: the qualification structure of those aged 55 is changing (more highly qualified). Labour-market participation rates among some older age groups are increasing, but the impact varies.

- trends in skills supply within a sector are complex — with major differences between industries and countries, in terms of expansion and contraction and market shares;

- matching high skills demand and supply is difficult in many cases: some sectors risk remaining short of appropriate skills. Some sectors remain unattractive to job seekers. Often, it is more difficult for medium and high skilled people to find the jobs they like; even so, they still have relatively better chances;

- the development/supply of innovative and effective leadership is a clear trend in some sectors/labour markets;

- increasingly, skills that are developed in one industry can be used in another. The situation for transfer of skills flexible: mobility, dual labour markets, generic/soft skills;

- until 2010, free movement migration was generally for lesser skilled jobs in expanding sectors: it declined rapidly through the economic crisis. Labour migration has declined more slowly for higher skilled jobs. But in OECD countries inflows remain greater than outflows;

- informal and formal skills supply: in some sectors family members/contacts are an informal source of the skills supply. The extent varies between EU Member States and sectors.

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([a])  Where figures and percentages are included in these trends, they reflect the result of the Cedefop project projections for labour-market skills demand and supply to 2020, emanating from a 'baseline scenario' of slow but fairly steady growth.

## 3.5.  Draft scenarios 2020: to assist European education and training policy-makers to contribute to meeting labour market skills needs

Education and training policy-makers have several main tasks, one of which is to try to ensure that education and training policies, systems and reforms make as full a contribution as possible to achieving an adequate and efficient supply of well-skilled people in the labour market, whether as new entrants, people continuing to expand their knowledge and skills in the workplace or as job seekers. The context in which policy-makers operate is often one of both uncertainty in terms of outcomes, and complexity in terms of the range of considerations that they must consider. Scenarios are seen as a tool that can help policy-makers as they deal with uncertainty and complexity. Also, by using evidence to construct alternative yet plausible views of the future, scenarios can help policy-makers to achieve a broader view of the available policy alternatives and their likely impacts.

In the qualitative scenarios project, we have identified three main components around which to construct the scenarios, taking 2020 as the vantage point. These components are the mode and trajectory of economic recovery after the recession, the impact of the recovery on skills demand and supply, and the overall strategy adopted by government. These components are best expressed as questions:

(a)  to what extent have Europe and Member States recovered since 2010 from the recession of the late 2000s, and what is the main economic trajectory;

(b)  what is the impact of this recovery, or otherwise, on skills demand, and on the supply of skills;

(c)  how has government strategy in the broadest sense geared its response to the wider economic and social developments.

At this stage, we have developed three qualitative scenarios:

**Scenario 1:**  strong economic growth — lessons learned?

EU is holding its own in terms of BRIC competition. Specialist manufacturing holds up and finance and services sectors thrive. Increased demand for managers' skills, but limited job polarisation. Matching labour-market supply and demand is a challenge. Education and training providers are tasked with equipping graduates with appropriate combinations of specialist and generic skills.

**Scenario 2:**  gradual growth— all to play for?

Drop in manufacturing. Increase in job polarisation. Gender trends in labour-market transitions can be harnessed to improve skills supply, but obstinate barriers remain if continuing vocational training is to improve. Disparities of labour-market demand/supply. Education and training policy-makers have to provide employability skills, working under funding constraints of 'more for less' and shifting responsibility to the users — employers and learners.

**Scenario 3:**  double dip and down — a bumpy ride?

Relative collapse of manufactured goods and services, particularly those lined to basic manufacturing industries. Job polarisation. Little optimism, little up-scaling of innovation, yet an increase in medium and highly qualified entrants to the labour market. Lack of funding limits possibilities for government intervention in education and training reforms, while shorter, more vocational qualifications become more attractive to learners.

The title of each scenario indicates the broad direction of recovery, and what this may mean for education and training planners.

Each of these scenarios has two variants (scenarios 1A/1B; 2A/2B; 3A/3B). These vary according to the role that government assumes or pursues. In variant A the government seeks to have a strong and continuing role in economic development and, not least, in developing or protecting a social model. In variant B the government seeks (or is constrained) to lessen its role and to let the markets find the ways forward. This is more of a *laissez-faire*, less interventionist approach. For example, by 2020 we can identify two variants of the Scenario 2 the two variants are described as follows:

(a) in variant 2A governments have attempted to maintain direct influence over education and training. Budgets may have reduced and the respective burden of 'who pays?' and prioritisation of spending and reforms remains open to debate within each Member State. The government remains the main player in leading economic and social development. Depending on the context, this tends to mean one variant or another of the pre-crisis or reformed European model. Additionally, regulation has directly created new skills demands through environmental, health and safety, labour-market licensing and other requirements. Good planning on the part of national and local government, effective partnerships and the translation of policies into good practice make this the 'more for less' scenario: there is often less spending, but it is better targeted;

(b) in variant 2B governments have chosen, or felt constrained, to steer education and training policy via the markets, and thus loosen the control and influence of the State. Liberalisation has continued to promote new markets particularly in utilities and service industries such as healthcare and education. Public sector employment has decreased significantly as a consequence of government policy, although this has tended to be offset by increases in the private tertiary sector. Individuals who found their jobs moving from the public to private sector are now competing through cost and or skills levels and this is a further incentive for them to both refresh and to extend their training, often at their own expense. In terms of planning, 'more for less' in this variant means giving a freer hand to the market place in education and training and finding ways to reduce the role (and expenditure) of the State. In contrast to variant 2A, the European social model here has become less interventionist and more of a minimal safety net (Leney, 2010b, p. 26-27).

At the end of 2010 we were able to consult on and test out in a limited way both the draft scenarios and the range of statements (trends, drivers,

uncertainties) that lay behind the scenario construction ([10]). Throughout, we had been able to liaise closely with the main, econometric results of the Cedefop labour-market skills anticipation project.

## 3.6. Results of the (limited) consultation

The European experts, including Cedefop and Skillsnet experts we consulted, expressed broad agreement as to the strengths of the scenarios exercise undertaken:

(a)  the scenarios are coherent and fairly easy to understand;

(b)  almost all respondents described the scenarios as useful, or somewhat useful, for a general understanding and planning of future skills demand and supply;

(c)  the trends and drivers provide a solid base for the development of the scenarios;

(d)  the optimistic, slow but steady growth and pessimistic scenarios are viewed as coherent alternatives, although not all are equally plausible when applied to particular countries. Country situations vary, and in some aspects the scenarios can coexist;

(e)  variant A and B in each scenario is helpful.

The consultation also helped to establish aspects that respondents consider to be in need of strengthening. This includes:

(a)  bringing out more clearly regional disparities in EU economic developments, and thus more nuanced labour-market demand and supply developments;

(b)  similarly, accentuating sectoral trajectories in a more differentiated way;

(c)  making sure that the results of the main project are best incorporated (and well flagged);

(d)  Scenario 1 looks a bit simplistic. In discussion it was recognised that Scenario 1 is implicitly linked to Europe 2020 ([11]). In this case, the

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([10])  Consultation on the methodology and on the draft scenarios was undertaken at the Cedefop Skillsnet seminars in summer and autumn 2010, then through a limited survey of experts in policy aspects of European education and training developments (November 2010) and at a specially convened seminar of experts working at Cedefop in Thessaloniki (December 2010). This made it possible to gather views on the methodology and scenarios, and to prepare a section of the report that reflects on the outcomes, methodology and potential usefulness of the approach (Leney, 2010a; 2010b).

([11])  See, in particular, European Commission, 2010.

achievement/non-achievement of the objectives of Europe 2020 can be treated in more balanced and refined way;

(e) migration could be an important driver and uncertainty, and calls for more attention;

(f) the education and training trends look a bit too institutional — it is important to find ways of reflecting the importance of on-the-job learning and other informal and non-institutionalised aspects;

(g) the strategic role of the State could be better exemplified, or in more detail, as this provides such an important context for education and training policies.

In the last weeks of 2010 it was possible to consider some of these comments. Other aspects remain on the agenda for further work in 2011. An important and interesting challenge will be to capture the likely diversity of directions of travel in different Member States, since it is clear that a single European scenario outcome is unlikely.

## 3.7. Conclusion

As this chapter shows, the first year's work on the qualitative scenarios has achieved several results. We have:

(a) developed a 10-step methodology, which seems to be reliable and robust and also to be capable of adaptation to local circumstances;

(b) linked the introduction of a new qualitative approach to on-going econometric approach of the forecasting skill supply and demand in Europe project;

(c) identified 100 key trends across a wide range of relevant social, economic, labour market and educational fields;

(d) linked the key trends to several important aspects of uncertainty and to some of the major drivers of change;

(e) established a conceptual framework for three qualitative scenarios, on the above basis;

(f) drafted more detailed provisional scenario statements, including two variants of each;

(g) tested and modified the scenarios in a limited way, through three consultation exercises with appropriate groups of experts;

(h) amended the scenarios statements to consider some of the commentaries.

The work is being taken further in 2011. More work can be done to incorporate the detailed commentaries provided by respondents and outlined

above. For this to happen, it will be necessary to complete the complex task of taking the methodology through to Step 10 (Section 3:2). The scenarios also still have to be refined.

Specifically, we are now attempting to analyse the evidence gathered using statistical or other systematic approaches to the analysis of text, rather than relying on the expertise of the researcher to extrapolate the key data and their significance.

We will also use the developed statements of the trends, drivers, uncertainties and scenarios to engage more fully with the education and training policy community at European level. The purpose now is to work out how the scenarios can be used to engage with the policy options and dilemmas that planners face.

The strongest and most pertinent challenge is now to understand how the scenarios may apply at local level — particularly as several Member States currently tend to correspond to different scenarios, not to one single and converging scenario. It is therefore helpful that some countries have indicated, through the Skillsnet network and through Cedefop's work [12], that they are already using an approach similar to this as one of their planning tools. Several Member States have indicated their interest in developing such an approach at national level, they are therefore interested to see how the approach set out in this chapter can be adapted to their national circumstances.

This sets out a formative set of tasks for the next stage of the qualitative aspect of the Forecasting skill supply and demand in Europe project and the possibility to build upon the solid basis already achieved.

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[12] Cedefop organised a conference on forecasting skill supply and demand in Europe in Thessaloniki (February 2011).

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Leney, T. (2010b). *Trends, drivers and qualitative scenarios in Europe 2020: for education and training policy makers engaged with meeting skills needs*. Task 04 Paper 2: Trends, drivers and qualitative scenarios. Cedefop: Report prepared for Warwick University/Cedefop skills forecasting project.

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European Commission, employment social affairs and inclusions, Progress programme — http://ec.europa.eu/social/main.jsp?catId=327&langId=en

European Commission, employment social affairs and inclusions, Sectoral level analysis — http://ec.europa.eu/social/main.jsp?catId=784&langId=en

CHAPTER 4.

# Polarisation or segmentation? Occupational change and the implications for the future EU labour market
*Antonio Ranieri and Marco Serafini*

Between 1998 and 2008, occupational polarisation emerged for the first time in Europe not only in terms of low- and high-paid jobs: labour demand rose for both high-skilled and elementary occupations. Using a shift-share approach, our analysis shows that much of this phenomenon can be traced to macroeconomic trends and structural changes between sectors. The rising supply of non-national workers is also a factor in this, together with some institutional characteristics of the labour markets, while technological and task content changes seem to play a lesser role than expected.

In light of the continuous shift towards a tertiary-based economy and predictable changes in consumption models and lifestyles of European societies, it is likely that a relative increase in elementary occupations will persist also in the near future. However specific policies, including vocational education and training, could potentially favour a process of 'occupational upgrading' in the future, weakening the polarisation trend.

## 4.1.    Introduction

European challenges are essentially driven by technological change, globalisation pressures and sociodemographic developments. During the 2000s, such processes took place in relatively favourable conditions. In 2008, when the recession interrupted a long period of increasing employment, there were about 20 million new employees in Europe compared to the previous decade. The international crisis dramatically changed the picture. Millions of jobs have been lost during the last two years; while net employment growth will probably remain low in the next decade as a result of the economic downturn. Against this background, a better understanding of developments and changes in occupational and labour skill structure is perhaps more important than in the past.

Over the last decades some consensus has been achieved in literature that, besides a general trend of expansion of highly-qualified employment, continuing polarisation is affecting labour markets in most developed economies. The findings supporting this hypothesis are based mainly on a wage structure analysis, highlighting that some countries have increased the shares of both high-paid and low-paid jobs, while 'intermediate' occupations tend to decline. For

the first time, at least since 1970 and arguably even before, during the decade 1998-2008 occupational polarisation also emerged across Europe, with a concomitant rising demand at the upper and lower ends of the occupational skill distribution. Looking forward to the next decade, the results of Cedefop's skills forecast (Cedefop, 2010a) seem to confirm that polarisation is bound to continue in the near future (Figure 4:1), with a possible simultaneous growth in the demand for both high-skilled and elementary occupations, while most intermediate occupations — especially manual ones — are on the decline.

Figure 4:1    **Projected change in share in occupational structure ([a]), EU-27\*, 2010-20**
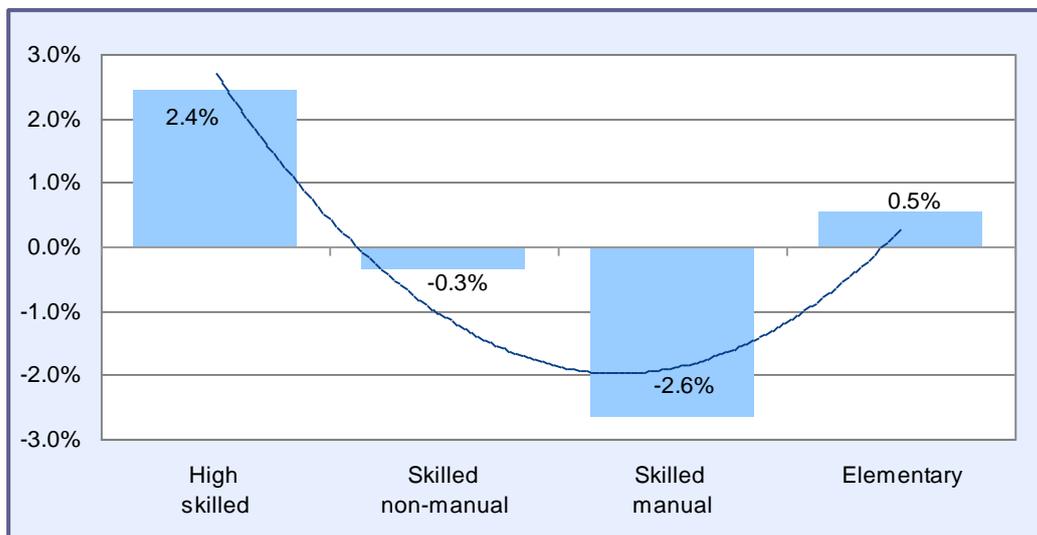


([a])   High-skilled occupations include major groups 1, 2 and 3 (managers legislators, senior officials and managers; professionals; technicians and associate professionals). Skilled non-manual include major groups 4 and 5 (clerks; service workers and shop and market sales workers). Skilled manual include major groups 6, 7 and 8 (skilled agricultural and fishery workers; craft and related trades workers; plant and machine operators and assemblers). Elementary includes major group 9.

*Source*:   Cedefop (IER estimates based on E3ME, EDMOD and RDMOD).

The dimension and the intensity of these trends are expected to differ between countries, sectors and even between specific occupations within the major group of elementary occupations. Interpretation is complicated by the fact that results also suggest increasing deployment of higher- and medium-qualified people in low-ranked occupations. Several important and policy-relevant questions emerge: how should we interpret this phenomenon; why are people with higher qualifications increasingly employed in elementary occupations; are there particular groups which are more affected than others; should we attribute these trends to technological and/or task content changes occurring within sectors?

## 4.2.  Theoretical background

The possible drivers of changes in occupational structure are many and varied (Box 4:1). Alongside the general trends of increasing return entailed by economic growth (diversified by sector and/or occupation), the main drivers considered in the literature can be traced back to competitiveness and international trade, technological, organisational or task-content changes, and socio-institutional aspects.

However, since the technological shift brought about by ICT spread through the economy, interest in the role of technological change in explaining labour demand composition has strongly increased. The basic premise is that new technologies lead to higher productivity, but the impact on employment is diversified between highly-skilled workers (who complement new technologies) and lower-skilled workers. This is why, despite the large and constant increase in highly-qualified labour supply, in many countries more skilled and educated workers have increased both their relative employment rate and wages [13]. The skill-biased technological change (SBTC) hypothesis has found support in several theoretical and empirical studies.

In line with the SBTC hypothesis, data clearly show that jobs at the upper end of the occupational skill distribution — which usually require also a higher level of formal qualification — tend to absorb an increasing share of labour demand. However, in most developed countries increasing demand seems also to emerge in a growing number of lower level jobs. The findings that support this hypothesis are based mainly on a wage structure analysis providing evidence of an overall increase in demand for low- and high-paid jobs, while people working in the middle of the wage spectrum tend to decline [14].

Without contradicting the skill-biased technological change, the task-biased technological change (TBTC) hypothesis provides a good explanation for this trend. By lowering the opportunity-cost of capital, technological progress tends to substitute human labour performing routine tasks, which generally occupy the middle of the wage ranking, while many of the worst paid jobs are non-routine in nature and, therefore, relatively unaffected by technological change. This

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[13]  See Katz and Murphy (1992), Davis (1992), Juhn et al. (1993), Katz et al. (1995), Goldin and Katz (1996, 2008), Berman et al. (1998), Murphy et al. (1998), Machin and Van Reenen (1998), Acemoglu (1998, 1999), Haskel and Slaughter (1999), Caroli and Van Reenen (2001), De Santis (2002), Fitzenberger and Kohn (2006), Autor et al. (2006, 2008), Atkinson (2008), Carneiro and Lee (2009).

[14]  See Autor et al. (2003), Goos and Manning (2007), Spitz (2003), Spitz-Oener (2006), Maurin and Thesmar (2005).

'passive way' to job polarisation has found support in several studies carried out for the US, the UK, and for some European countries ([15]).

Box 4:1    **Possible drivers of change in occupational structure**

From the point of view of the individual worker or employer, occupational choice/change is not only a consequence of exogenous macro phenomena. At micro level, the probability that a person decides to seek/accept a specific occupation is the result of a complex decision process that involves: the predicted returns, and expected unemployment risk, associated with alternative occupations; the worker's family income; the inter-sectoral/inter-area mobility costs; individual preferences and expectations. Similarly, the probability that an employer decides to offer a job with a particular occupation involves: the expected productivity; the cost incidence of on the job training; the actual transferability of skills between occupations; individual intuitive perception about market perspectives. In this framework, the individual choice of workers and employers in terms of occupations might not coincide (and they generally do not), generating an occupational mismatch of which skill mismatch is only one component.

However, most empirical studies show that labour-market mobility is, above all, an individual behavioural response to medium- or long-term macroeconomic changes. Four main structural drivers of change in labour demand by occupation can be identified.

**Main structural determinants of occupational changes at macro level**

|  | Demand drivers | Supply drivers |
|---|---|---|
| **Growth and distribution effects** | • Engel's Law (or similar)<br>• wage inequality/ income distribution effect | • increasing returns diversified by sectors and/or occupations (Kaldor-Verdoon effect), changes in the inter-sectoral links |
| **Competitiveness effects** | • extension of needs and intensive diffusion of consumption patterns<br>• increasing movement of goods and people | • internationalisation/ globalisation (Stolper-Samuelson effect, offshoring, IDL and specialisation in general) |
| **Technological and organisational effects** | • changes in models of purchasing (retail/ delivery), reduction of transaction times, consolidation effect, quality effect, innovation and creation/substitution of needs | • skill-biased technological change, routinisation hypothesis, etc.<br>• job specific productivity, outsourcing, new inputs sectors |
| **Socio-demographic macro trends and institutional effects** | • increasing participation and employment rates (especially women<br>• changes in family/social structures and changes in lifestyle in general) | • changes in substitution relations between occupations due to flexible labour market institutions, black economy, migration flows, etc.<br>• educational and social objective functions (policies) |

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([15]) For the US see Autor et al. (2003, 2006, 2008). For the UK see Goos and Manning (2007). For France see Maurin and Thesmar (2005). For Germany, Spitz-Oener (2006). Although affected by strong data limitations, similar results have been obtained by Goos et al. (2010) considering the period 1993-2006 and 16 European countries. They also report that the task dimension is a significant predictor for employment change, even after the model is controlled for the formal qualification level.

The task-biased technological change focuses on the task-dimension of employment that is related to, but not completely explained by, the qualification-skill level. In fact, technical and organisational advances tend to cause non-neutral changes in productivity among job tasks rather than high- and low-skilled jobs. However, following Autor (2007), the division of productive tasks into abstract-complex tasks, routine and manual tasks is to be considered. Since most non-routine tasks (both abstract and manual tasks) lie at the opposite end of the occupational skill distribution, the task-biased technological change entails a progressive polarisation of the labour market also in occupational terms, with an increasing number of workers at the extremes of the spectrum and fewer in the middle.

In this chapter, the starting point is the acceptance, in general terms, of the skill and the task-biased technological change hypotheses. However, we focus on the 'occupational' polarisation that is particularly relevant when implementing forecast models and labour market scenario analyses as a tool for policy-making in education and training.

## 4.3.    Recent structural change in occupations

Looking at the very long-term picture, while the share of knowledge- and skill-intensive occupations increased almost constantly between 1970 and 2000, occupational polarisation has clearly emerged across Europe only since the end of the 1990s (Figure 4:2). Even though the recent economic crisis partially changed the picture ([16]), the number of workers in elementary occupations rose by almost 3.9 million between 2000 and 2008, contributing 20% to the overall growth in employment, and showing the highest growth rate together with high-skilled occupations. As a consequence, the proportion of elementary occupations in total employment increased from 8.7% to 9.6%, unlike all the other groups except highly-skilled occupations that increased from 34.6% to 38.6%.

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([16])  The share of elementary occupations was steady in 2008 and declined in 2009.

Figure 4:2    **Share % of highly skilled and elementary in total occupation, EU-27\***
              **(1970=100)**



| Average share % of elementary in total occupation EU-27* | | | |
|---|---|---|---|
| 1970-1980 | 1980-1990 | 1990-2000 | 2000-2008 |
| 8.5% | 8.4% | 8.5% | 9.3% |
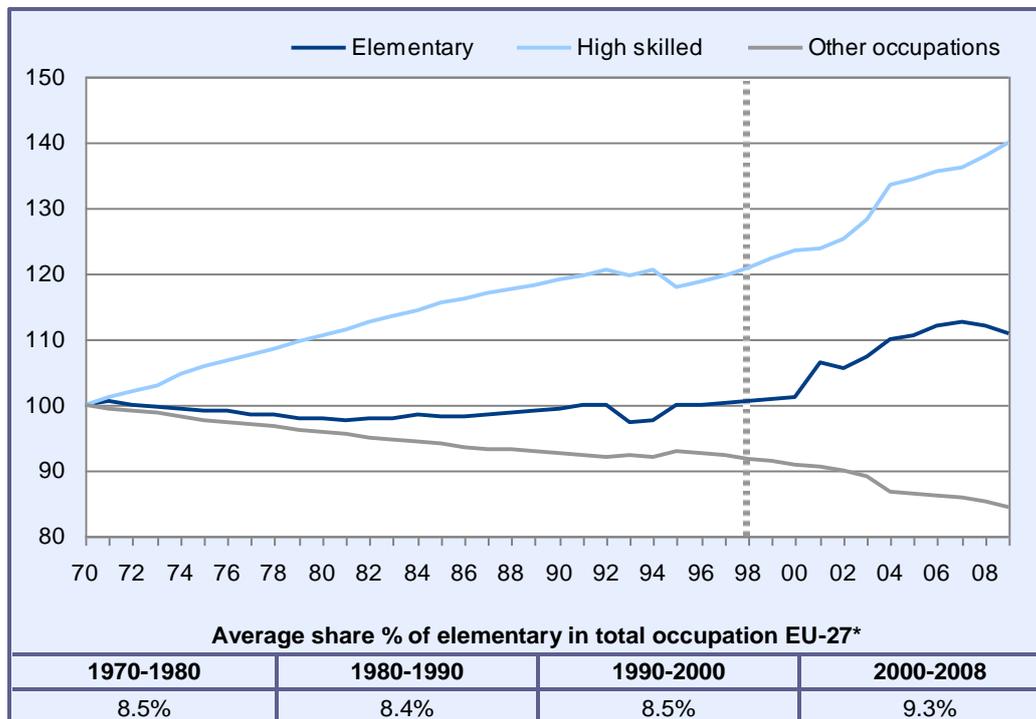
*Source*: Cedefop (IER estimates based on E3ME, EDMOD and RDMOD).

The recent growth in share of elementary occupations in Europe differs across countries, sectors and among specific occupations within elementary occupations. The simple analysis of level and change in share of elementary occupation across European countries does not allow us to identify a general trend or explanation for the variability of the phenomenon (Cedefop, 2011). Not only level but, especially, change in share of elementary occupations in total employment varies widely among countries; although in almost half of them, the share of elementary occupations decreases between 2000 and 2008 and no convergence trend can be identified.

From a sectoral point of view the picture is quite different (Table 4:2). While a polarisation trend involves most sectors, tangible increases in elementary occupation are concentrated in a few sectors and, in particular, in 'private household', 'agriculture' and, to a more limited extent, 'transport, storage and communication' and 'wholesale and retail trade'. Further, 'private household' emerges as the unique growing sector where polarisation occurred during the decade. Activities which are more likely to be influenced by social and demographic structural changes (female participation in the labour-market,

changes in lifestyle, flexibility of the labour market, migration, etc.) rather than technological or organisational change.

Table 4:1 **Sectoral trends and polarisation, EU-27\*, 2000-08**

| | | Overall growth (%) | Polarisation (changes in share ISCO 1+2+3+9) (percentage points) | Incidence elementary (change in share ISCO 9) (percentage points) |
|---|---|---|---|---|
| **GROWING SECTORS** | Private household | 42.3 | 10.3 | 9.2 |
| | Real estate renting and business activities | 31.4 | 3.1 | -0.2 |
| | Hotels and restaurants | 16.8 | 1.5 | 0.1 |
| | Health and social work | 12.5 | -2.0 | 0.0 |
| | Construction | 6.0 | 0.5 | -0.1 |
| | Other community social and personal service | 5.8 | 0.8 | -1.1 |
| | Extra-territorial organisations | 4.0 | 10.9 | -0.3 |
| | Education | -0.1 | -0.3 | -1.0 |
| **FALLING SECTORS** | Financial intermediation | -1.0 | 6.9 | -0.2 |
| | Wholesale and retail trade | -1.5 | 6.0 | 1.3 |
| | Public administration | -2.8 | 2.5 | 0.6 |
| | Transport storage and communication | -3.3 | 4.4 | 2.5 |
| | Electricity gas and water supply | -15.1 | 9.3 | -0.3 |
| | Manufacturing | -15.9 | 4.6 | -0.1 |
| | Fishing | -26.4 | -0.4 | -0.1 |
| | Mining and quarrying | -41.0 | 7.7 | 0.0 |
| | Agriculture | -42.5 | 10.5 | 7.2 |

Consistent with these trends, 'sales and service' is the most substantial and dynamic submajor group (Figure 4:3). This set of professions is usually considered to require limited education and training: street or door-to-door sales or services, cleaning services, property watching and caretaking, delivering goods and messages or carrying luggage.

## 4.4. Structural changes versus occupational-specific changes in employment

To assess to what extent the observed occupational trends can be potentially attributed to technological or task content changes, using a shift-share approach (Cedefop, 2011) we decompose cross-sectoral differences in occupational structure within sector (structural effect) and between sectors (occupational skill effect). Figure 4:4 gives a synthetic idea of the importance of the two components

in the overall growth of individual occupations. Looking at the clusters identified (see also Box 4:2), the main conclusions are:

(a) although elementary occupations show positive effects for both sectoral composition and occupational intensity, only a minor part (one third) of the overall growth of elementary occupations can be ascribed to changes within individual sectors (attributable to occupational-specific explanations);

(b) alongside elementary occupations, professionals, and technicians (consistent with the polarisation hypothesis), also some intermediate groups show positive occupational-intensity effects (skilled agricultural, and plant and machine operators);

(c) more broadly, the analysis shows that the polarisation has been largely determined by the sectoral trends which occurred during 2000-08, while the potential role of technological and/or work content changes within sectors has generally been weaker and more uncertain.

Figure 4:3    **Trends in the share of occupations, EU-27*, 2000-08**



| | | |
|---|---|---|
| High skilled | Legislators, senior officials and managers | 0.5% |
| | Professionals | 1.6% |
| | Technician | 1.9% |
| Skilled non-manual | Clerks | -1.1% |
| | Service workers and sales | 0.7% |
| Skilled manual | Skilled agricultural and fishery | -2.4% |
| | Craft and related trades | -1.6% |
| | Plant and machine | -0.5% |
| Elementary | Sales and services | 0.7% |
| | Agricultural and fishery | 0.1% |
| | Mining, construction, manifacturing and transport | 0.1% |
| | Other | 0.0% |
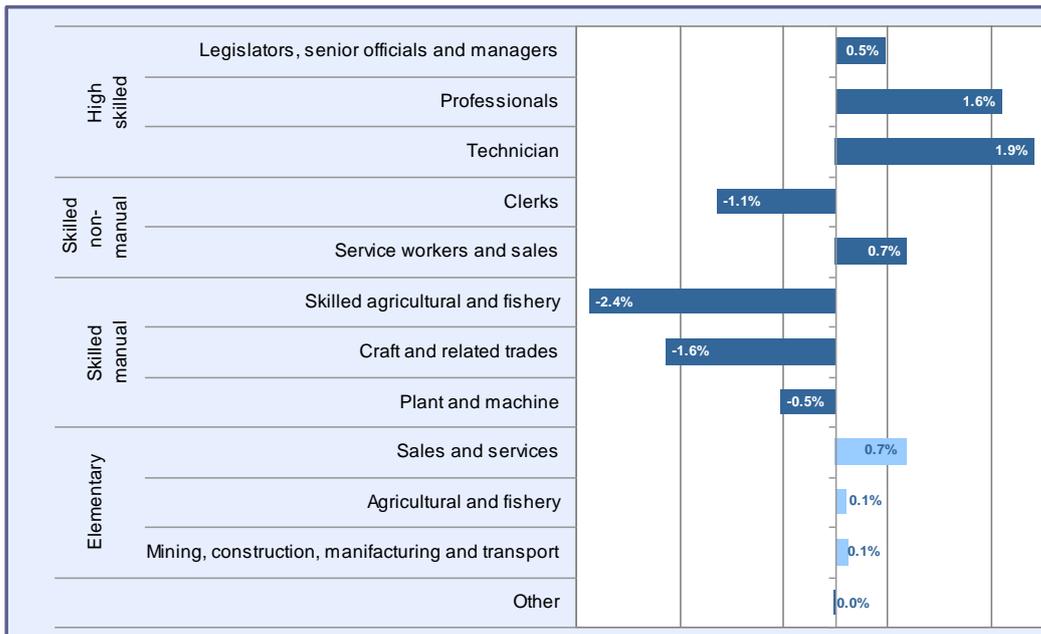
*Source*: Eurostat, LFS – Reference age: 15+.

Figure 4:4   **Shift-share groups: structural and occupational-specific growth components**
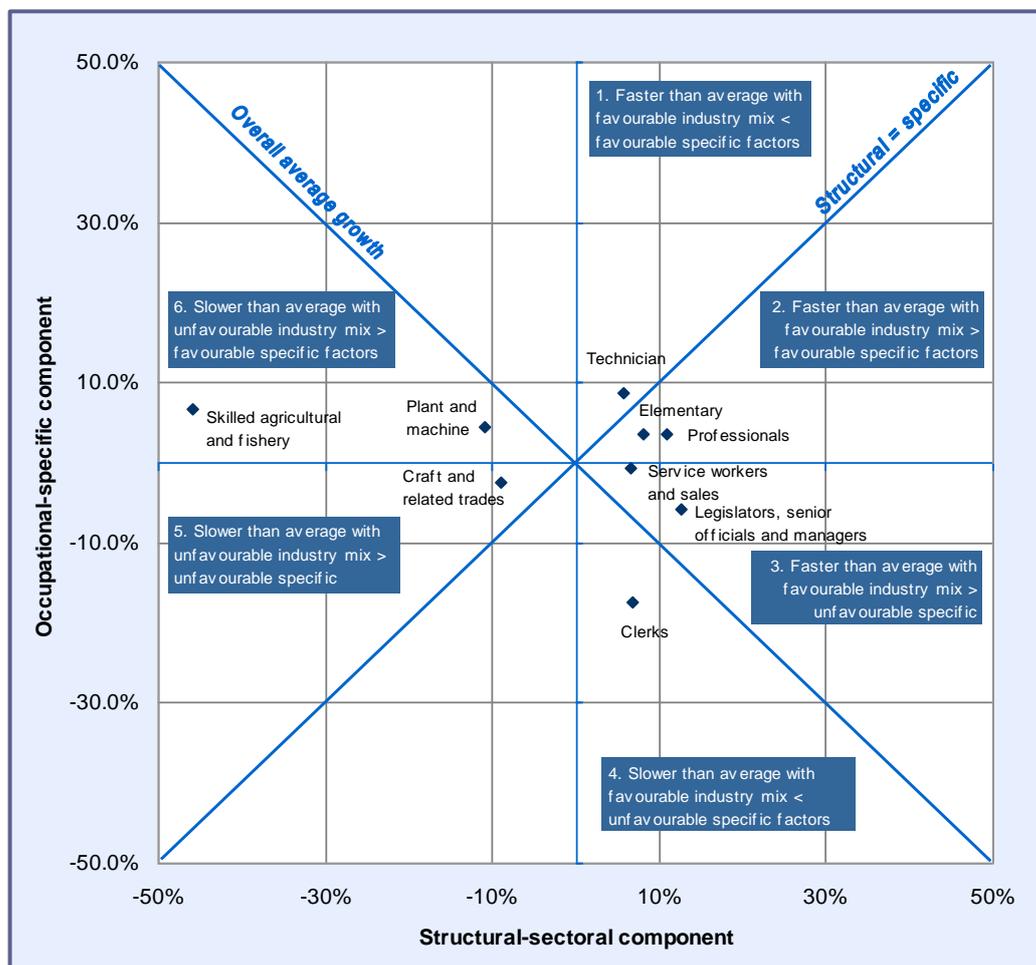


*Source*:   Author, based on Eurostat LFS.

## 4.5.   Potential labour-supply drivers of occupational changes

Although these trends do not exclude a role for a 'technological-task' explanation to polarisation, we are not aware of literature developing a comprehensive approach to disentangling the effects and to assigning a specific magnitude to the different causes. The wage-structure approach is difficult to apply to European countries for theoretical reasons and scarcity of data, particularly when approaching polarisation in terms of occupations rather than low- and high-paid jobs.

Box 4:2        **Shift-share groups interpretation**

In this context, the shift-share analysis approach has been adapted to evaluate to what extent the observed changes in occupations can be attributed to an increase of 'occupational intensity' within sectors, or if they are a direct consequence of changes in sectoral composition.

Figure 4:4 must be read in four dimensions: (1) the oblique 135° line divides the occupations between fast-growing and slow-growing occupations (faster or slower than the average employment growth); (2) along the X axis, the relevance of the structural-sectoral effect is measured (positive or negative changes between sectors); (3) along the Y axis the relevance of the occupational-specific effect is measured (positive or negative changes within sectors); (4) finally, the 45° line distinguishes the occupations where the occupational-specific effect is more favourable (or less unfavourable) than the other.

On this basis, six relevant clusters of occupations can be identified.

| | Occupations | Growth in share | Structural-sectoral component | | Occupational-specific component |
|---|---|---|---|---|---|
| 1 | • technician and associate | faster than average | positive | < | positive |
| 2 | • professionals<br>• elementary | faster than average | positive | > | positive |
| 3 | • service workers and shop/ market sales<br>• legislators, senior officials and managers | faster than average | positive | > | negative |
| 4 | • clerks | slower than average | positive | < | negative |
| 5 | • craft and related trades | slower than average | negative | > | negative |
| 6 | • plants and machines<br>• skilled agricultural and fishery | slower than average | negative | > | positive |

For high-level occupations, the skill and the task-biased technological change hypotheses are confirmed by the dramatic increase both in numbers and in share which occurred in recent decades, and partly corroborated by the wage premium observed in some occupations at the upper end of income distribution. If technological development and/or changes in work content are also in favour of elementary occupations, an increase in the relative wage should be observed at the lower end of the occupational structure as well. Apparently, this is not what happened.

This leads to the question of imperfect mobility and labour-market segmentation. When specific groups are trapped in low-paid segments of the labour market, irrespective of their qualification and skill level, one consequence is the alteration of labour cost differentials (considered in a broad sense), so that employees can be induced to overuse some kind of occupations and/or worker groups. Given the observed trend towards a higher qualification shown by

elementary occupations, to what extent can labour market segmentation be considered a cause of polarisation? An analysis of elementary workers in terms of sociodemographic characteristics provides some first evidence in this direction. Figure 4:5 presents an analysis of differences in share (by age, gender, education and nationality), where the levels and changes in share by socioeconomic characteristics are calculated in differences from total employment. In this way it is possible to note not simply the changes which occurred during 2000-08, but also the shifts in relative labour demand for elementary occupations among different groups of workers.

Figure 4:5    **Main socioeconomic characteristics in elementary occupations, in-differences analysis between ISCO 9 and total occupations EU-27***
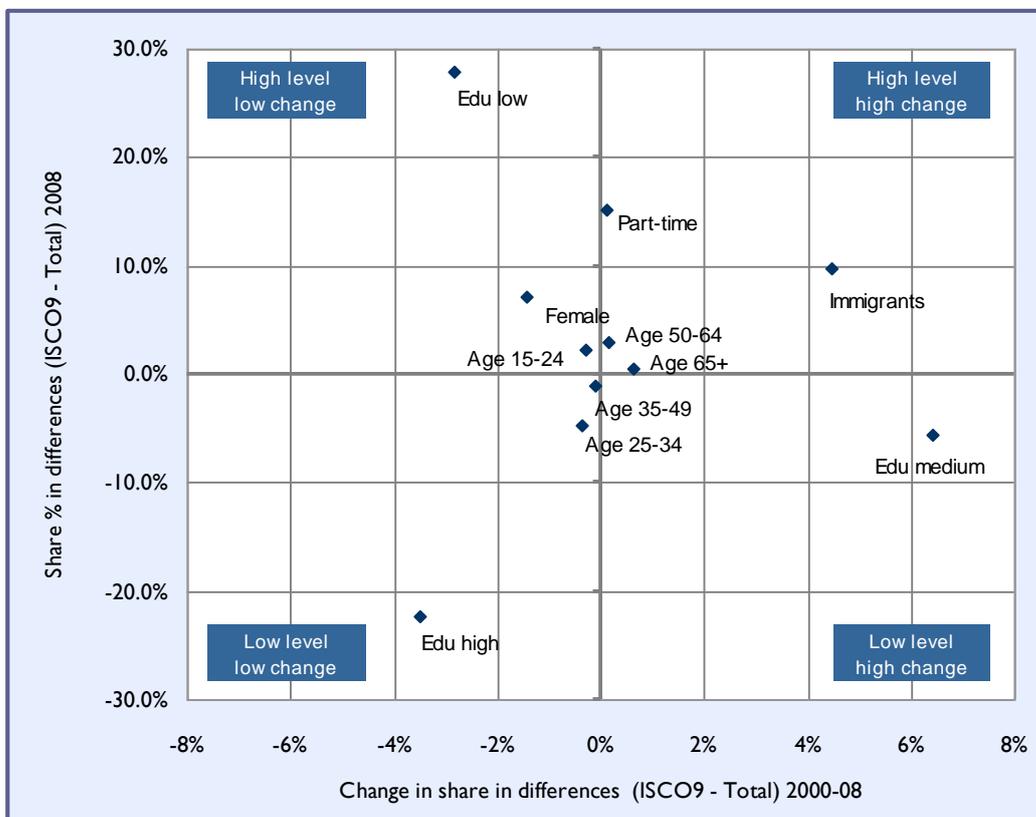


*Source*:    Eurostat, LFS – Reference age: 15+.

Figure 4:5 shows that the sharpest increase occurred in the incidence of immigrants and medium-qualified workers, greatly exceeding all the other components. Further, both higher- and lower-educated workers are losing ground on the average occupation trends. These results require a deeper analysis of the role of immigration and qualification trends in polarisation.

Figure 4:6 shows the strong increase in immigrant workforce in almost all occupations (an average of +35.9% compared with +8.2% of the national workforce). However, the rate of increase is extremely high for elementary occupations (+85.5%) and 'service workers and shop and market sales' (+53.6%). Although relative change in percentage does not reflect the absolute dimension of the trends, the impact of immigration on elementary occupations is quite relevant. At the end of the period, the share of immigrants in elementary occupations reaches 16.6%, much higher than in the other occupations (5.8% on average).

Figure 4:6    **Change % in employment by occupation and nationality, EU- 27\*, 2000-08**
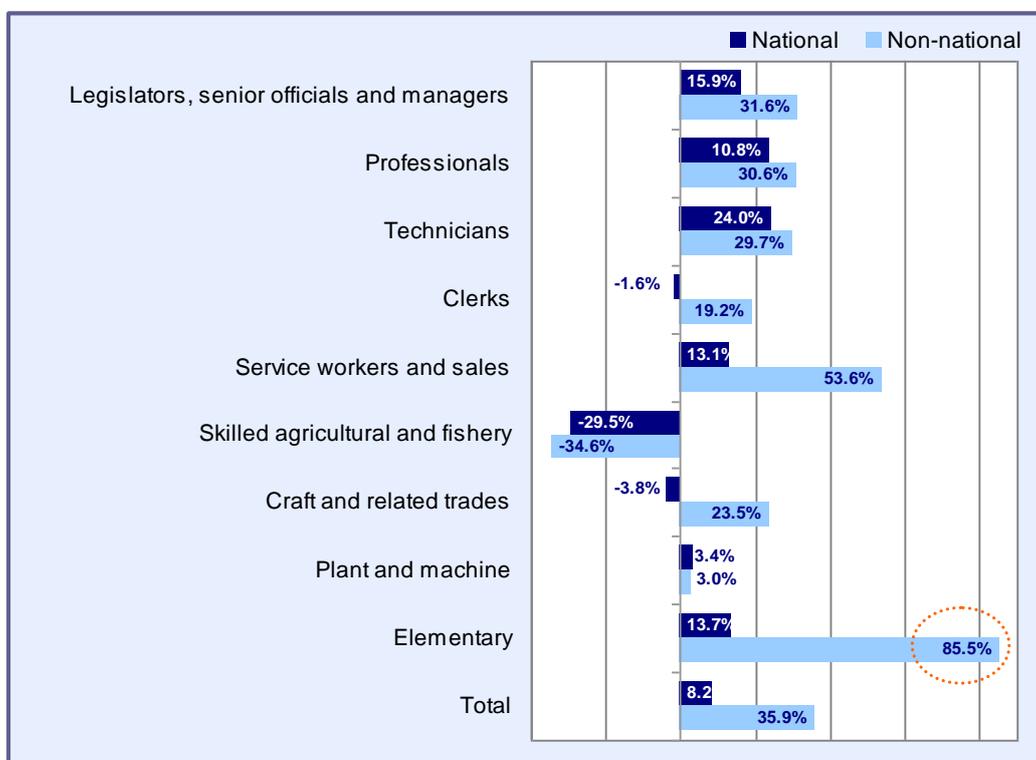


*Source*:    Eurostat, LFS – Reference age: 15+.

It is not a surprising result. Several studies highlighted some relevant supply-side effects of labour related to immigration (Biffl, 1996). Lower reservation wage, lower substitutability, dampening effect on wages, are all factors that offer a key to interpretation for a significant part of the overall phenomenon. If we also consider the peculiar socioeconomic characteristics of immigrants and the institutional factors that tend to segregate part of the non-national workforce, we

can assume that a supply-side effect related to migration can play a significant role in polarisation.

Data on qualification by nationality also support the idea that, in the specific case of elementary occupations, labour-market segmentation and consequent misallocation of labour across occupations could also play a relevant role. Figure 4:7 shows that observed trends are significantly differentiated between the national and non-national workforce. While the increase in medium and high qualifications in national elementary workers is quite close to the average of total employment, for immigrants the share of medium and high qualification increases at almost double the average pace.

Figure 4:7    **Share of medium and high qualifications in total employment, EU-27\*, 2000-08**
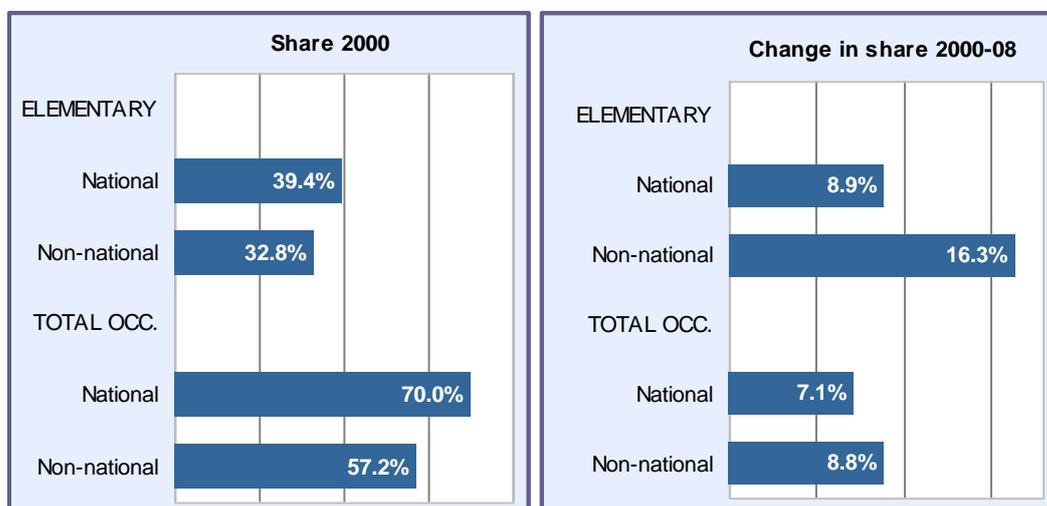


*Source*:    Author, based on Eurostat LFS.

Further evidence of immigrants' difficulties to find jobs matching their qualifications emerges when considering the workforce level of qualification by occupation. Figure 4:8 shows the ratio between non-national and national workers by qualification levels, comparing elementary occupations with the overall employment average. Not only are non-national workers concentrated in elementary occupations (2.4 times more so than national workers), but also the index rapidly increases with the level of education, peaking at 5.3 for the highly-educated non-national workers.

Various explanations can be given to account for this phenomenon. There is some evidence, for example, that employers tend to value education and experience in the host country (EIU, 2009). Also, what is referred to as over-education actually can be the result of differences in skills and competences

among individuals with the same qualification level. However, it is also reasonable to come to a diagnosis of underutilisation rather than overqualification of the workforce. The term 'underutilisation' is used here in opposition to 'over-qualification' to underlie that, in this case, the causes of educational mismatch should be traced back to segmentation of the labour market rather than to an excess supply of skilled labour. It is worth underlining that in 2008 about 33% of the tertiary-educated workers in elementary occupations were immigrants compared to 6% on average for other occupations.

Figure 4:8     **Concentration index of non-national workers in elementary occupations by qualification, EU-27\*, 2008**
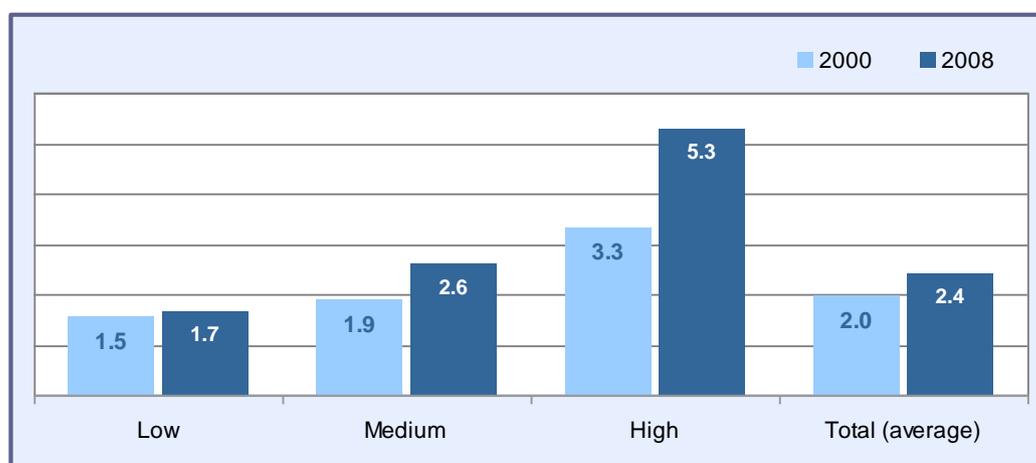


*Source*: Eurostat, LFS – Reference age: 15+.

## 4.6.    Conclusion

What can the analysis of past trends say about the potential role of elementary occupations in the future European labour market? Much occupational polarisation in Europe can be traced back to macroeconomic and structural changes (between sectors), to demand-driven increase in specific service activities (e.g. private households), and to the increasing labour supply of non-national workers. In light of the continuous shift towards a tertiary-based economy, together with the predictable changes in consumption models and lifestyle of European societies, a relative increase of elementary occupations will likely persist.

However, technological progress and/or work content changes seem to play a minor role in this. On one side, there are many service sectors where 'qualitative' innovations have little to do with technology. On the other, although the routinisation hypothesis is potentially significant, when approaching

occupation polarisation focusing on elementary occupations, other factors — whether institutional or sociodemographical in nature — appear to offset and/or assume a greater explanatory value. Migration regulation, flexible working, undeclared work, direct public support, and role of self-employment, are all factors that can modify the opportunity-cost of labour, such as the probability that a person decides to accept a specific occupation. It is possible that labour market segmentation and/or segregation tend to characterise many elementary occupations described as 'lousy' jobs (low paying, few opportunities and no benefits) even when it should not be.

It is likely that better and more inclusive labour market and migration policies would reduce the 'low-cost' workforce which has no other option than to work in simple jobs. This would induce employers to switch to production techniques that use more higher-skilled workers and/or to rely on more capital-intensive production methods. As a consequence, the share of elementary occupations within some sectors — such as household services — would decrease. In this context, specific policies, including vocational education and training, could drive a process of occupational upgrading in the future, and counteract the polarisation trend. In the absence of new policies and institutional changes, elementary occupations would probably increase and become even more unattractive to the local population. In this scenario, the share of immigrants in elementary occupations is bound to increase.

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CHAPTER 5.

# Use of forecast results in skills transferability project
*Jiří Braňka*

The aim of the skills transferability project was to identify transferable skills and their role and importance with regard to the employability, adaptability and occupational mobility of people on the labour market. One of the project tasks was to analyse transferability of skills within and among 20 sectors and 204 occupations up to the year 2020. Project outputs included a catalogue of skills for 219 occupations in 20 sectors of the economy, matrixes of skills transferability, analysis of the EU survey and in-depth interviews, examples of good practice and recommendations for further development of skills transferability.

The project also examined in detail potential use of the Cedefop projection for the purposes of determining future transferable skills. The research team has come to the conclusion that the projection provides a highly valuable and comprehensive source of information, nevertheless certain weak points require to add further tools that are mostly still in development. Combination of these tools will compensate for weaknesses of each approach and provide detailed and reliable information.

## 5.1.    Context of the forecast use

During 2010, the European Commission, through a consortium of Czech and German partners, carried out the project 'transferable skills across economic sectors: role and importance for employment at European level' ([17]). The aim of the project was to identify transferable skills and their role and importance with regard to the employability, adaptability and occupational mobility of people on the labour market. The project consisted of these major parts:

(a)  the analysis of the role of transferable skills in occupational pathways and the fluidity of the labour market;

(b)  the analysis of skills transferable across economic sectors;

(c)  the analysis of the role, importance and involvement of stakeholders active in development of transferable skills;

(d)  the analysis of the instruments, tools and methods used to enhance mobility on the labour market through transferable skills (RPIC-ViP et al., 2010).

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([17])  Called hereafter 'skills transferability project'.

The research consortium consisted of five companies/institutions, four of them seated in the Czech Republic (RPIC-ViP s.r.o.; Trexima spol. s r.o.; National Training Fund; and Research Institute for Labour and Social Affairs) and one in Germany (Institut für Wirtschaft, Arbeit und Kultur at Goethe University in Frankfurt-am-Main).

Main outputs of the project included:

(a) skills catalogue containing a total of 292 skills sorted in three main categories (soft skills, generic hard skills and specific hard skills);

(b) occupational profiles for 219 occupations in 20 sectors;

(c) matrixes of skills transferability within particular sectors, between particular sectors and occupations and the evaluation of their development by the year 2020;

(d) outcomes of the EU survey (a total of 451 questionnaires and 66 in-depth interviews among employers and representatives of the public and administration service sector and the education sector in a total of 21 European countries ([18]));

(e) examples of good practice related to the development of skills transferability;

(f) recommendations aimed at further development of skills transferability within the EU.

## 5.2.   Sectors, occupations and skills

### 5.2.1.   Sectors

The scope of the project encompassed 20 economic sectors (or rather groups of sectors) which had to cover the whole EU economy. Three largest sectors had more than 20 million employees (telecommunications, management, public and administration service; electromechanical engineering and related services; and health and social care) while the smallest one, ICT, had just 2.5 million employees (Figure 5:1).

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([18]) Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Lithuania, the Netherlands, Poland, Portugal, Romania, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Figure 5:1 **Groups of sectors analysed in the project (employment in thousands within the EU)**
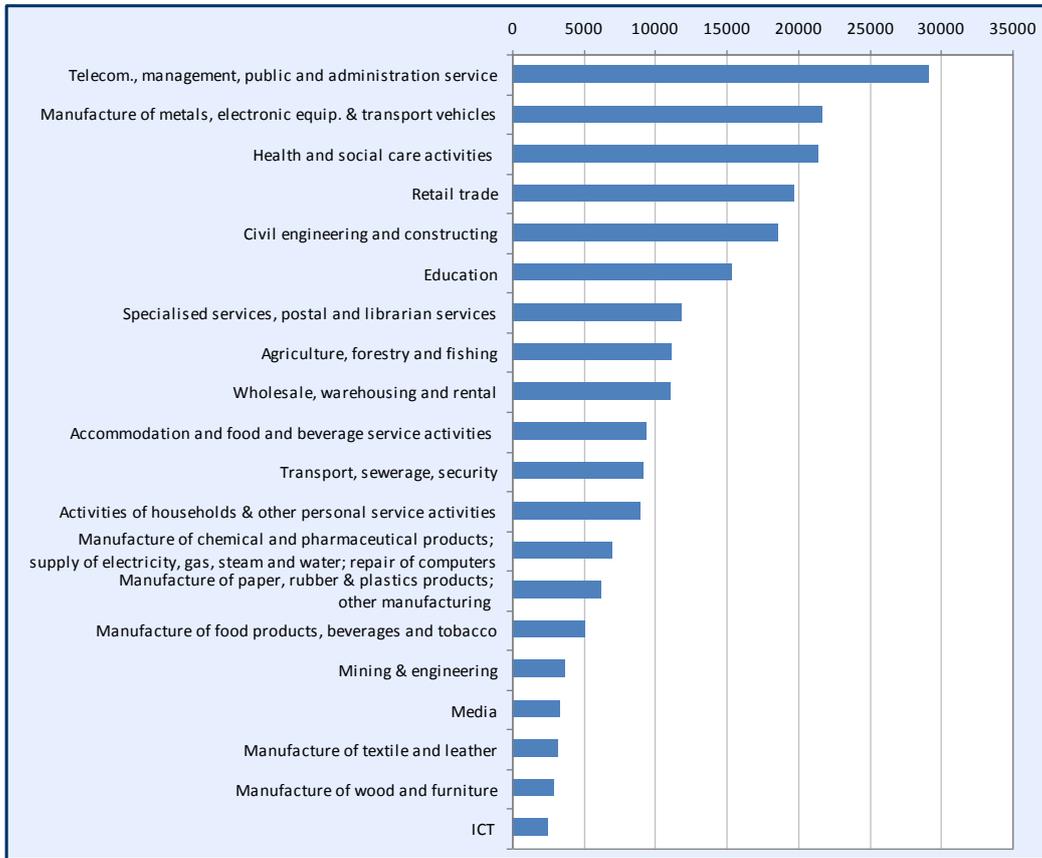


*Source*: Eurostat, labour force survey, annual averages for 2009, own calculations.


These sectors were put together on the basis of occupational cluster analysis. The analysis examined occupational structure in particular sectors at 2-digit level of NACE and 4-digit level of ISCO-88 ([19]) (based on the labour force survey, annual averages for 2009). Created sectors were composed of industries that were, according to ISCO-88, most similar to one another in terms of occupational structure.


### 5.2.2. Occupations

On the basis of the labour force survey analysis, key occupations were selected in each of the created sectors. The analysis works with 204 different occupations at 4-digit level of ISCO-88. Mid-qualified and low-qualified occupations were


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([19]) International standard classification of occupations.

preferred in the selection ([20]). These occupations (at 1-digit level of ISCO-88, belonging to the major categories 3-9) are usually more vulnerable to cyclical economic developments and restructuring processes and therefore the research of transferable skills and their relevance in terms of employability is of particular importance. The presence of some occupations in more sectors led to an increase in the number of occupations to 219.

The occupational profile (consisting of a set of skills relevant for each occupation) was defined on the basis of two main sources: the integrated system of typal (standard) positions ([21]) and O*Net ([22]).

### 5.2.3. Skills

Skills catalogue, created on the basis of occupational profiles, included a total of 292 skills. The skills were divided — with regard to their fundamental transferability characteristics — into three major categories: soft skills, generic hard skills and specific hard skills. (Table 5:1).

## 5.3. Current transferability of skills

The definition of the skills categories implies that soft skills and generic hard skills are skills of generally much higher transferability than specific hard skills. The occupational profiles of 204 analysed occupations proved that the most frequent 20 skills represent more than a half (56%) of all employers' requirements in terms of skills and they are demanded by more than one third of occupations. With only one exception ([23]), these skills always belong among generic hard skills or soft skills.

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([20]) The selection, however, includes also a number of high-qualified occupations as some sectors (such as ICT, education) represent a significant share in total employment.

([21]) Ministry of Labour and Social Affairs of the Czech Republic: http://ktp.istp.cz (in Czech only). The system provides information on occupations in the Czech Republic related to level and field of education and set of skills required, average wages and other relevant information. It is used by Czech sector councils as background for the Czech national occupations framework.

([22]) O*Net Online: http://onet.onetcenter.org.

([23]) Administration of information and documentation records.

Table 5:1    **Definition of major skills categories ([a])**

| | **Hard skills**<br>Range of technical, job-specific abilities which require training and instruction for a worker to become proficient or skilled within a particular job reference | **Soft skills**<br>Not job-specific skills, which are related to individual ability to operate effectively in the workplace either alone or with others |
|---|---|---|
| **General skills**<br>Skills applicable in most firms, occupations and sectors | Generic hard skills (6) | Soft skills (22) |
| **Specific skills**<br>Skills applicable in very narrow number of firms, occupations and sectors (or even only in one firm) | Specific hard skills (264) | |

NB:   Language knowledge, basic ICT skills, basic knowledge of science and technology (like mathematics) can be described as examples of generic hard skills. Specific hard skills are applicable in very narrow number of firms, occupations and sectors and describe special attributes of performing the occupation in practice (e.g. flame cutting, technical drawing or engineering in machinery production).

*Source*:   Research team (skills transferability project).

From the sectoral perspective, the most interesting aspect of the analysis is its part focused on 'skills intensity' — an average number of skills required by an occupation. The outputs show that performance of an occupation (one of the analysed occupations) within the ICT sector requires 22 skills as this sector is one of the most demanding in this respect, while the manufacture of textile and leather sector requires only 13 skills and, therefore, ranks at the end of the group of sectors. The analysis does not consider a relative complexity of acquiring a particular skill (this might disadvantage some sectors, e.g. health care). The output of the analysis has been also determined by the fact, that within the particular sectors, only the top 10-15 key occupations (in terms of number of employees) have been considered.

The skills intensity analysis offers a reliable basis to determine whether the given sectors are internally homogeneous in terms of key occupations' requirements and whether it is easy or complicated for a worker performing an occupation to be retrained for the performance of a different one. 'Skills transferability' represents a result of the analysis and it has been defined as follows: number of skills transferable for all pairs of occupations within each sector was quantified and divided by the number of cross-possible combinations among occupations (e.g. there could be 45 possible cross-combinations for a sector with 10 key occupations, etc.). The resulting number was called skills transferability. It, for example, says that ICT sector is proving highest skills

transferability, because one can find on average almost 17 skills that are transferable between two key occupations within the sector.

Both indicators might be further used to calculate the 'transferability index' quantifying the ratio of the skills that are transferable between two key occupations within the sector and an average number of skills per key occupation.

$$\text{Transferability index:} \quad \frac{\text{Skills transferability}}{\text{Skills intensity}}$$

The result of this calculation for example says: the education sector has the highest skills transferability index, because an average key occupation within this sector has 18 skills and on average 15 of them (which is 80%) are shared with some other occupation.

This proves that in some sectors (those with a higher skills transferability index) it is easier to switch from one job to another, while in other sectors it is much more complicated. This has some impact on sectoral labour market mobility.

Although identification of transferable skills between occupations can be considered as very interesting output, its practical usage is limited by the fact that only occupations in the same group of sectors are compared with one another. Limitations arise when choosing a new occupation outside the given sectoral group, which can be caused by both individual preferences and economic downturn affecting the whole sectoral group and leading to a lower number of job opportunities.

## 5.4.  Future transferability of skills — General approach

One of the project tasks was to analyse transferability of skills within and among sectors and occupations up to the year 2020.

The identification of future skills needs can be generally based on quantitative or qualitative approaches. The first one is represented by quantitative projections of future supply of and demand for skills, for example Cedefop projections (Cedefop, 2009a; 2009b), while the second one is focused more on

qualitative description of future skills needs without any quantifications of the skills needs, for example 18 EU sector studies published in 2009 ([24]).

Speaking of the EU level, both approaches have been in development during recent years. The research team consisting of the Institute for Economic Research at Warwick University, Cambridge Econometrics, Research Centre for Education, the Labour Market (ROA) at Maastricht University and Alphametrics Ltd develops medium- to long-term skills projections at EU level, broken down by country, sector, education level and occupational group for Cedefop. The EU sector studies provide an outlook on key skills to be required in selected sectors of the economy in respective occupational groups based on different scenarios.

Since both approaches have their indisputable advantages (but also weaknesses) and there is a lot of high-quality results based on both qualitative and quantitative methods, the research team decided to build on existing research work related to forecasting and matching skills and concentrate on their usage bringing new added value rather than developing and testing a completely new methodology. The approach of the research team was to identify, analyse and use results of available future-oriented studies and projections and adjust them to acquire a relevant and reliable base for additional analyses. Table 5:2 summarises specification of future skills needs analysis developed in this study, and the specification of main information sources used for it, i.e. Cedefop projections and 18 EU sector studies.

The analysis of EU sector studies focused on future knowledge and skills needs recognised in 18 EU sector studies published in 2009 and identified skills that were pivotal in key occupations within these sectors. Studies, however, do not describe all necessary skills, but focus on those most important in relation to main drivers of future development in each sector (Rodrigues, 2007).

Information on future skills needs development varies — in terms of occupations — by the level of detail (it is provided on 1-3-digit levels of ISCO-88). In case of these occupational groups, the research team analysed for example the most transferable skills among particular sectors. The analysis is based on counting the share of occupational groups or sectors or both, where separate knowledge and skills will be applicable (example in Table 5:3).

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([24]) European Commission, Employment, Social Affairs and Inclusion, sectoral level analysis web pages. Available from Internet:
http://ec.europa.eu/social/main.jsp?catId=784&langId=en.

Table 5:2    **Analysis of forecast approaches and their application**

|  | **Skills transferability project' forecasts requirements** | **Cedefop forecast (2010 version)** | **18 EU sector studies** |
|---|---|---|---|
| Coverage | 20 sectors covering whole economy (NACE rev 2) | 41 sectors covering whole economy (NACE rev 1.1) | 34 economy sectors (NACE 1.1) and approximately ⅔ of total employment |
| Forecast period | 2020 | 2020 | 2020 |
| Scenarios | One scenario, otherwise matrixes that include 292 skills and 219 occupations will be too complicated | Base, Optimistic, Pessimistic (based on scenarios of the recovery from economic crisis) | Up to four scenarios per study |
| Skills analysis | Soft, generic hard and specific hard skills analysis required | None (skills represented only by level of education) | Studies concentrate on soft skills analysis |
| Occupations analysed | ISCO 4-digit level (219 occupations) | ISCO 2-digit level (27 occupational groups) | Selected ISCO one to 3-digit level (usually 8-12 occupational groups) |
| The impact of economic crisis | Considered | Considered | Not embodied |

*Source*: Research team (skills transferability project).

Table 5:3    **An example of analysis of highly transferable skills across sectors**

| **Occupational group** | **Highly transferable skills** | **Across how many sectors?** |
|---|---|---|
| **IV Business professionals (ISCO 241)** | Legislative, regulatory (94.4), Flexibility (94.4), Language (88.9), E-skills (83.3), Analytical skills (79.6), Understanding suppliers and customers (79.6), Communication (77.8), Intercultural (77.8), Stress and time management (75.9), Networking (70.4), Business development (70.4) | 9 sectors (Printing and publishing, Chemical, pharmaceutical, rubber and plastic manufacturing, Non-metallic manufacturing, Computer, electronics and optical manufacturing, Furniture manufacturing, Distribution and trade, Transport and logistics, Posts and telecommunication) |

*Source*:    Research team (skills transferability project).

## 5.5.    Future transferability of skills —Cedefop forecast

### 5.5.1.    Methodological approach and its limitations

This analysis of future skill needs develops findings of Cedefop projections and links them with structure and profiles of sectors and occupations created in the skills transferability project. The task of this analysis was to describe the shift in demand for skills in the period 2008-20.

The process of transition of Cedefop projections data to skills transferability project methodology includes the following steps:

(a) transition of sectors in Cedefop projections (41 sectors by NACE 1.1) to sectors in Skill transferability project (20 groups of sectors by NACE rev. 2);

(b) recalculation of growth/decline rates in employment for occupational groups (2 digits ISCO) in accordance with new sectoral division of EU economy);

(c) recalculation of growth/decline rates in employment for key occupations (4 digits ISCO) defined for groups of sectors in skills transferability project;

(d) scaling of significance of the growth/decline rates by current share of key occupations (4 digits ISCO) on total employment in respective group of sectors;

(e) the calculation of impact of scaled growth/decline rates on demand for skills associated with key occupations;

(f) the calculation of total change in demand for skills in the period 2008-20.

The process of use of Cedefop projections in skills transferability project had also some limitations caused by the quality and structure of input data available. These limitations include:

**Problem 1:** There is a default presumption that the level and range of skills required for key occupations will not change during analysed period. This is a serious simplification of the structural changes that in reality affect the labour market. But it is not possible to analyse future shifts in skills needs for each and every key occupation defined in this project.

*Solution:* Research team uses current occupational profiles for forecasting future skills needs in this exercise for two reasons. The first reason is the lack of relevant information on skills needs development related to the analysed occupations, the second is the fact that the results of EU survey carried out among the employers implied that the occupational profiles of most occupations will not show substantial changes, it is rather expected that the importance of some of the key skills will grow.

The problem might be solved by links to the outputs of sectoral studies or Cedefop project 'Pilot employer survey on skills need in Europe', however, it is vital to coordinate the focus of relevant projects in terms of examined occupations' structure.

**Problem 2:** There are no scales for skills importance in occupational profiles which means every skill associated with an occupation has the same level of significance — this also simplifies the reality.

*Solution:*       Unfortunately, there is no tool at European level that can provide such information. Waging of skills importance can be set by groups of experts (like sector skill councils) or (in a survey) by representative sample of employers who employ the respective occupations. The latter option is used in O*Net and the core of such European tool is under development in the above mentioned project, pilot employer survey on skill needs in Europe. This project deals (among others) with importance of skills in occupational profiles for 3-digit ISCO, which may add significant value to the knowledge base regarding skills, their transferability and importance.

**Problem 3:**       The replacement demand for occupational groups within economic sectors (e.g. job opportunities created by those who leave existing jobs either permanently or temporarily) is not considered because of insufficient data.

*Solution:*       Cedefop should be able to provide data on replacement demand for occupational groups within economic sectors in the foreseeable future.

**Problem 4:**       The process of transition of Cedefop occupational groups to those in key occupations was difficult because the information on future employment was available for less-detailed ISCO only.

*Solution:*       Cedefop projection disposes of 21 occupational groups, while the skills transferability project required gathering information on outlook for 204 occupations. While this task seemed impossible, initial findings proved that it may be achieved in many cases by using projections for separate economy sectors. ISCO 2-digit occupation often represents just one or two ISCO 4-digit occupations within one sector (see Table 5:4 for an example of occupations within retail trade sector) and therefore (using the sectoral approach) the outlook for a significantly larger number of more specific occupations is feasible.

An example of the retail trade sector shows that 15 largest ISCO 4-digit groups in retail trade are represented by no less than 11 ISCO 2-digit occupations. It was possible to use the Cedefop projection for 50-75% of occupations in each of 20 defined sectors.

Table 5:4 **The largest occupational groups in retail trade sector**

| ISCO 2 digit | | ISCO 4 digit |
|---|---|---|
| 52 | - - - - - - - - - - - - - - - - - ▶ | 5220 |
| 13 | - - - - - - - - - - - - - - - - - ▶ | 1314 |
| 12 | - - - - - - - - - - - - - - - - - ▶ | 1224 |
| 42 | | 4211 |
| 93 | - - - - - - - - - - - - - - - - ▶ | 9330 |
| 34 | | 3415 |
| 34 | | 3419 |
| 41 | | 4190 |
| 41 | | 4131 |
| 32 | - - - - - - - - - - - - - - ▶ | 3228 |
| 42 | | 4220 |
| 22 | - - - - - - - - - - - - - ▶ | 2224 |
| 91 | | 9132 |
| 83 | - - - - - - - - - - - - - ▶ | 8322 |
| 91 | | 9151 |

*Source*: Research team (skills transferability project).

### 5.5.2. Outputs and interpretation

These methodological issues will significantly affect reliability of the outputs. Given the current availability and particularity of data, the analysis can be used only for a rough estimate and determination of major trends in future skills needs development.

The outputs can be divided in two parts: occupational outlook and skills outlook.

**Occupational outlook** shows that the number of declining occupations (93) is higher than the number of growing occupations (69) while employment in 51 occupations will change only slightly ([25]). Total employment in analysed occupations will decrease by 2.3% in the respective period.

Because of above-mentioned limitations, the research team decided not to use exact growth/decline rates in employment (the process of transition highly influenced their reliability). They were aggregated into seven-stage scale, which enables to identify general trends in expansion demand rather than exact but less reliable percentage changes. This scale uses these stages:

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([25]) The fact that the number of occupations expected to show an overall decline in employment is higher than the number of occupations expected to grow is significantly influenced by the methodology of their selection. Medium and low qualified occupations, representing most analysed group of occupations, are forecasted lower growth than highly qualified occupations.

Table 5:5    **Growth/decline rates**

| Stage | Description |
|---|---|
| High growth | 25% and more |
| Medium growth | 15% till 24% |
| Small growth | 5% till 14% |
| No change | -4% till 4% |
| Small decline | -5% till -14% |
| Medium decline | -15% till -24% |
| High decline | -25% and more |

*Source*:    Research team (skills transferability project).

Major trends regarding occupations and sectors are described in Table 5:6.

Table 5:6    **Growth/decline rates in occupations**

| Stage | Number of occupations | Sectoral/occupational trends |
|---|---|---|
| High growth | 16 | Selected occupations (both lower and highly qualified in sectors healthcare, media and telco, management and administration service |
| Medium growth | 20 | Selected occupations distributed among low, medium and high qualified in number of sectors, namely HoReCa, retail, transportation and telco, management and administration service |
| Small growth | 33 | Number of highly qualified technical-oriented occupations in industry sectors and management and also some occupations in HoReCa and retail |
| No change | 51 | Building construction, ICT, household activities, healthcare, telco, management and administration service and specialised services |
| Small decline | 50 | Lower-qualified occupations in food, electro mechanical engineering and printing and publishing, most occupations in education, some IT, healthcare and specialised services |
| Medium decline | 15 | Selected occupations (mostly low qualified) in electro mechanical engineering, wood processing, mining and energy supply |
| High decline | 28 | Many occupations in textile, mining and agriculture. |

*Source*: Research team (skills transferability project).

**Skills outlook** is derived from occupational analysis. Major trends regarding changes in skill demand are as follows:

(a) **generic hard skills** will experience slight decline in importance (0-5% in total appearance), mostly for decline of total employment (in key occupations). Probably because of projected structural changes in employment (many jobs will be cancelled in industry — low and medium qualified, technical oriented staff) the basic skills in science and technology will lose most importance (-4.25%);

(b) **specific hard skills** will lose some importance as well (-5.36%), again partly because of the development of total employment in key occupations and partly because of structural changes. The analysis of development in demand for specific hard skills must take two things into account:

(i) relative change in demand (changes in less transferable skills appear to be more significant);

(ii) total change in demand (highly transferable skills will usually show smaller changes).

Major specific hard skills that will lose part of their significance for key occupations are those connected with low or medium qualified occupations in the industry (e.g. technical drawing; orientation in technical documentation; appraisal and control of quality of raw materials, semi-products and products; or handling of machines for metal processing). Many skills related to agricultural production (e.g. growing of plants and crop-plants or operation of agricultural and forestry mechanisms) are also among those which lose importance both relatively and absolutely.

Specific hard skills that will gain importance both from relative and absolute points of view are usually those connected with rising share of services in sectoral structure of EU economies and with growing importance of effectiveness of businesses, for example representing clients in communication with institutions; bookkeeping, accounting and taxes; applying knowledge of risk management; elaborating, production and financial plans; or applying knowledge of economics and entrepreneurial subjects;

(c) more than half of **soft skills** show decline in importance. However, particularly here it is necessary to emphasise one of the limitations of the approach — it was not possible to involve also qualitative development in skills demand regarding respective occupations. It is very likely that many of the soft skills will be positively affected by the process of growing demand for skills in most occupations. Some soft skills that seem to be less important (both relatively and absolutely) in time are also those that appear in profiles of many occupations that are subject to job cuts.

Nevertheless, the analysis confirms some results of the EU survey among employers, education and public service institutions (survey was conducted in the skills transferability project) concerning future demand for soft skills. Many respondents mention requirements of employers regarding employees' ability to work independently, actively and with growing care for customer needs. The major growing soft skills from the analysis are initiative, proactive

approach and customer orientation. The fastest growing soft skill is leadership;

(d) **reliability**

Because of adopted simplifications, the results of future transferable skills analysis must be regarded with caution and as an exercise which can be developed and improved in successive projects;

(e) **use of the analysis**

These outputs allow performing additional research and some actions aimed at skills transferability and its support. For example it will be possible to sort out skills according to their transferability and future prospects which may be illustrated by the matrix in Table 5:7.

Finally, the interconnection between Cedefop projections and analysis of skills requirements for key occupations may be used for identification of possible solutions to future imbalances in demand and supply of skills. For example, it is possible to identify the level of proximity of occupations, in terms of skills matching (the higher skills match, the higher their transferability among occupations and thus occupational mobility). The future skills analysis shows in which occupations people may have problems to find employment and the skills matching analysis then may show in which (prospective) occupations they may be easily and successfully retrained;

(f) **summary**

The analysis of future transferability of skills is achievable, but it relies on multiple tools that are either already used or currently being developed. These tools have to be combined in order to compensate weaknesses of each approach and to provide detailed and reliable information (Figure 5:2).

Table 5:7    **Example of additional outputs**

| | | TRANSFERABILITY | | |
|---|---|---|---|---|
| | | **Small** | **Medium** | **High** |
| FORECAST | **Insufficiency of skills** | Priority concern | Some action may be needed | |
| | **Balance** | No need for action | | |
| | **'Surplus' of skills** | Priority concern | Some action may be needed | |

*Source*: Research team (skills transferability project).

Figure 5:2    **Possible tools for identification of future skills and their transferability**
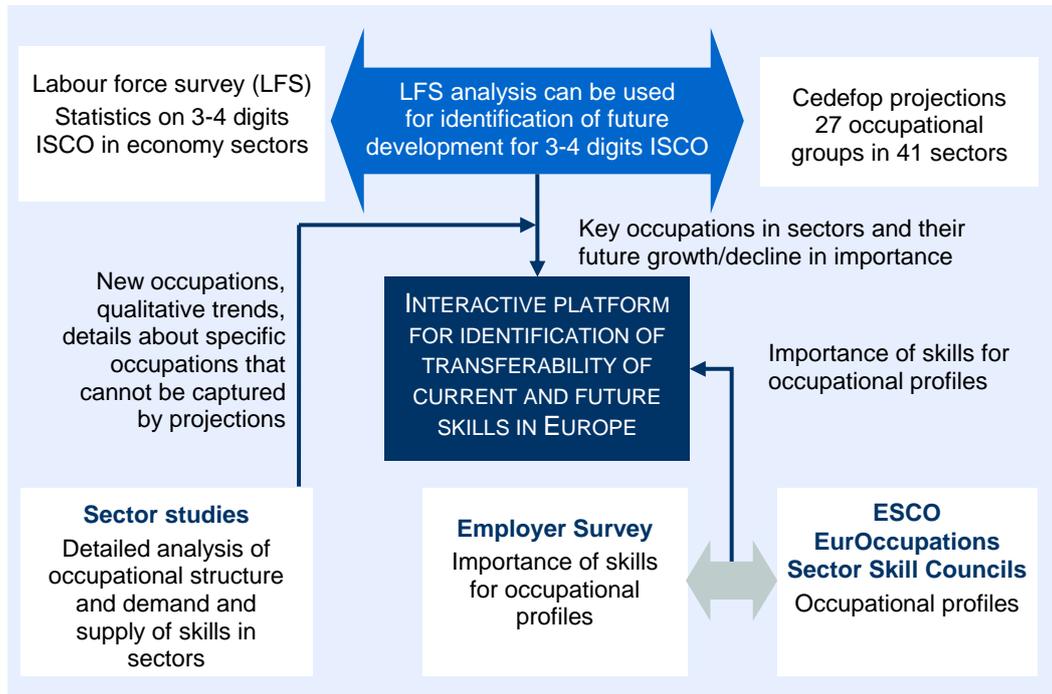


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# Part 2:
# Sharing other European forecasting experiences

CHAPTER 6.

# The AMS-skills barometer: a web-based labour-market tool. Making use of forecast results by stakeholders

*Stefan Humpl and Daniel Bacher*

The paper illustrates the AMS ([26]) skills barometer as a web-based labour-market information tool in the context of the EU agenda for new skills and jobs and Cedefop initiatives of identifying and anticipating future skill needs. Cedefop on the one hand produces regular, systematic and quantitative skills forecasts at pan-European level. European forecasts, however, are not a substitute for national level projections. Cedefop emphasises that its value added lies in the provision of a common framework for discussion. Results are relevant not only to experts and policy-makers, but also to the broader public.

The AMS-skills barometer on the other hand is a good practice example in Austria developed to provide a broad group of different users with valid, comprehensible and well-structured information on current and medium-term occupation and qualification needs. Available information from different forecast sources is exploited and merged in a synoptical way. The chapter discusses the value added of possibly integrating Cedefop results to link European and national forecasts.

## 6.1.    Introduction

In the rapidly changing economic world, Europe's future position will be defined by growth, which should be smart, sustainable, and inclusive, and will also depend on jobs for the wellbeing of its citizens. Therefore, the forecast of occupations and qualifications to have a flexible, but well qualified, labour force for the challenges of this development is one of the key issues in the design of the future European qualification systems. Several initiatives like new skills for new jobs are focusing specifically on skills upgrading, matching and anticipation. It aims at developing more effective ways to analyse and predict which skills will be required in tomorrow's labour markets and, with this knowledge, developing and adapting education and training so that the workers gain the skills required.

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([26])  *Arbeitsmarktservice*, Austrian Public Employment Service.

Cedefop clearly contributes to those initiatives by identifying and anticipating future skill needs, potential skill mismatches and skills needs in specific sectors. Its pan-European forecast on skills demand and supply developed in cooperation with the Skillsnet network provides 'the most comprehensive and consistent set of skill projections ever produced for Europe' (Cedefop, 2008, p. 16). European forecasts, however, are not a substitute for national level projections. Cedefop emphasises that its value added lies in the provision of a common framework for discussion. Such discussion, however, is not only relevant to researchers, experts and policy-makers. As Cedefop notes: 'It is important to bear in mind that the audience for these results is not just policy-makers. It is crucial to escape from the thrall of planning — and recognise that such information is crucial to making markets work better by better informing individual choices. This raises significant issues of dissemination. There is a need for better web-based tools' (Cedefop, 2010, p. 81-82).

The question of the use of forecast results will be at the centre of this chapter. The AMS-skills barometer is the first comprehensive nation-wide online labour-market information system in Austria. It was designed for the Austrian Public Employment Service in 2002 and has developed further since then. Basically the AMS-skills barometer provides a broad group of different users with valid, comprehensible and well-structured information on current and medium-term occupation and qualification needs. It is a tool to inform not only 'expert groups' about labour-market needs, but much more so to guide individual people on jobs and qualifications. Along with recent trends in vocational research the tool also attempts to pay more attention to skills and competences. In the following, some background information on the basic structure and methodology of the AMS-skills barometer as a web-based labour-market information tool will be given. Especially, the value added of having such a tool for different user groups will be dealt with. Eventually the mutual benefits of linking the AMS-skills barometer and the Cedefop pan-European forecasts will be discussed. A final conclusion outlines possible ways forward.

## 6.2. Short history of the AMS-skills barometer

The Austrian Public Employment Service (*Arbeitsmarktservice*, AMS) was outsourced from the Federal Ministry of Employment, Health und Social Affairs to become a service enterprise under public law in 1994. Its primary task is to do labour-market matching by assisting job-seekers and companies in their search and providing various services such as information, advice or finance. The AMS

is Austria's leading provider of labour-market services ($^{27}$). It works in close cooperation with labour and employers organisations ($^{28}$).

In the late 1990s the AMS reworked its labour-market information system. At that time, labour-market information was mainly targeted at young people entering the labour market and encompassed only a few specific occupations. Job counselling was also complicated by no uniform source of information. The AMS responded by developing an encompassing labour-market information system for job and career guidance and counselling. For this purpose the AMS-skills barometer was implemented with the main objective of providing a broad group of different users with valid, comprehensible and well-structured information on current and medium-term occupation and qualification needs. As job flexibility gained in importance at the expense of stable job requirements defined by occupations, the new system integrated as well comprehensive information on skills and competences over time (Humpl and Kargl, 2008).

The AMS-skills barometer as an online tool for labour-market information was designed and developed by 3s Unternehmensberatung and the Institut für Bildungsforschung der Wirtschaft (ibw, Institute for research on qualifications and training of the Austrian economy) being two important players in labour-market consultancy and research in Austria (Humpl and Kargl, 2008).

## 6.3. Basic structure of the AMS-skills barometer

The AMS-skills barometer is based on two different systems for labour market representation: An occupational classification and one of qualifications in the sense of skills and competences. Both are integrated within the tool, so that information on skills and competences for specific occupations can be portrayed. The user can navigate through the tool by using given frames, links and buttons. Figure 6:1 shows the basic structure of the barometer which will be explained in more detail in the following.

### 6.3.1. Occupational information

The occupational classification distinguishes 24 occupational areas (*Berufsbereiche*), 95 occupational fields (*Berufsfelder*) and several occupations in each field. These occupational areas do not follow any other classification (like

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($^{27}$)  About AMS: http://www.ams.at/english/14595.html.

($^{28}$)  AMS history: http://www.ams.at/english/14603.html.

ISCO or the former Austrian classification of occupations), but was designed for the purpose of describing the occupational structure of a modern labour market.

Figure 6:1    **Basic structure of occupations and skills in the AMS-skills barometer**

| Hierarchical level | Occupational structure | Skill structure |
|---|---|---|
| Level 1 | 24 occupational areas | 23 skills areas |
| Level 2 | 95 occupational fields | Appr. 230 skills |
| Level 3 | Appr. 600 occupations | Appr. 8 000 detailed skills |
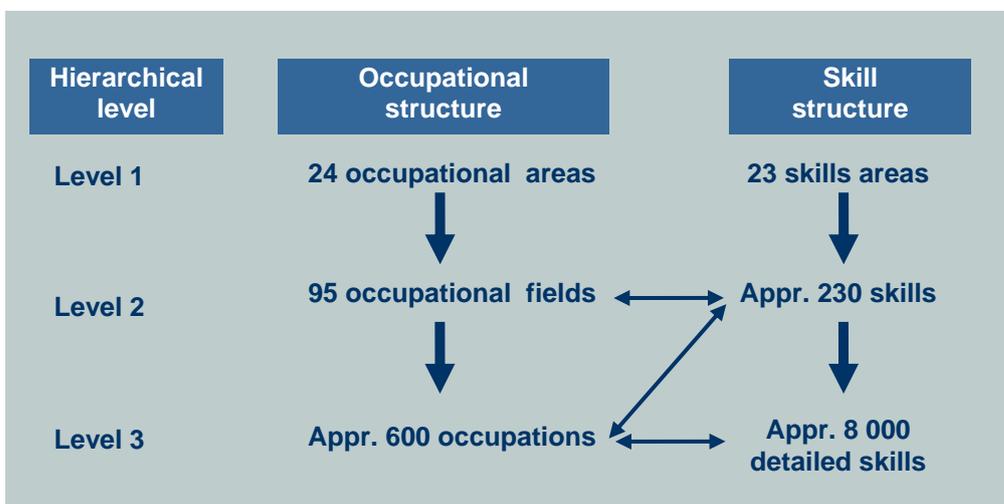
Source: 3s.

Single occupations can also feature in more than one occupational field. Hence, occupational information follows a three-part hierarchy whereby 'bigger' occupational areas are broken down to 'smaller' occupational fields and eventually occupations (Figure 6:1). More detailed information on single occupations can be found in another online information system of the AMS – the 'Vocational Information System' (*AMS-Berufsinformationssystem*) – which is linked to the website (around 600 occupations) ([29]). The AMS-skills barometer provides also gender specific information for each occupational field (Humpl and Kargl, 2008).

For each of the 24 occupational areas and 95 occupational fields labour market needs and trends are illustrated. Figure 6:2 shows the occupational area 'information technology' whereby overall trends are visualised with a diagram. Further information on trends is received by using the button 'more information'. Within the occupational area information technology also data on previous and current vacancies and future trends of the respective occupational fields within information technology are portrayed. Trends are visualised by arrows and the current labour-market significance of the occupational fields by dots. Exact

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([29])  AMS-*Berufsinformationssystem*: http://www.ams.at/bis/.

numbers are only stated for jobs available (at print media and the AMS) in the last two years and current vacancies at AMS.

Figure 6:2    **Occupational area 'information technology'**



> Grafik, Druck, Papier und Fotografie
> Handel und Verkauf
> Hilfsberufe und Aushilfskräfte
> Hotel- und Gastgewerbe
> Informationstechnologie
> Körper- und Schönheitspflege
> Landwirtschaft, Gartenbau und Forstwirtschaft
> Lebensmittel
> Maschinen, Kfz und Metall
> Medien, Kunst und Kultur
> Reinigung und Hausbetreuung
> Reise, Freizeit und Sport
> Sicherheitsdienste
> Soziales, Erziehung und Bildung
> Textil, Mode und Leder
> Umwelt
> Verkehr, Transport und Zustelldienste
> Wissenschaft, Forschung und Entwicklung

**Frauen und Männer am Arbeitsmarkt: Informationstechnologie**

**Hoher Frauenanteil bei den Call-Centern, abgesehen davon aber ein klar männlicher Berufsbereich**

Mit einem Frauenanteil von knapp 31 % ist die Branche Datenverarbeitung und Datenbanken eine klar männlich segregierte Branche. Eine spezifische IT-Arbeitsform, die seit den 90er Jahren quantitativ stark an Bedeutung gewonnen hat, ist die Arbeit im Call Center. Hier ist der Frauenanteil mit 80 % sehr hoch.

Mehr Informationen ▽

**Entwicklung der Anzahl der unselbstständig Beschäftigten im Bereich "EDV und Telekommunikation"**

- Erbringung von Dienstleistungen der IT
- Telekommunikation
- Informationsdienstleistungen
- Rep. v. Datenverarbeitungs- und Telekommunikationsgeräten

**Quelle:** Hauptverband der österreichischen Sozialversicherung, Grafik: AMS Österreich.

Österreich gesamt ▼

| Berufsfelder Informationstechnologie | Beschäftigte | | Offene Stellen | | | | |
|---|---|---|---|---|---|---|---|
| | prognostiziert | derzeit | Printmedien | | AMS | | |
| | | | 2009 | 2008 | 2009 | 2008 | aktuell online |
| >> Softwaretechnik und Programmierung | ↑ | ▪▪ | 1.290 | 3.626 | 1.443 | 725 | 463 |
| >> Analyse und Organisation | ↑ | ▪ | 433 | 681 | 159 | 107 | 82 |
| >> EDV- und Netzwerktechnik | ↑ | ▪ | 826 | 2.041 | 929 | 411 | 135 |
| >> Datenbanken | ↔ | ▪ | 560 | 1.374 | 102 | 38 | 18 |
| >> IT-Vertrieb | ↔ | ▪ | 269 | 569 | 354 | 286 | 59 |
| >> Support, Beratung und Schulung | ↓ | ▪ | 316 | 1.368 | 425 | 31 | 246 |

>> Offene Stellen im eJob-Room

Beschäftigte prognostiziert: steigend ↑↑   tendenziell steigend ↑   gleichbleibend ↔   tendenziell sinkend ↓   sinkend ↓↓

*Source*: AMS-skills barometer.

For each single occupational field, such as 'software technology and programming' categorised under 'information technology', estimates of jobs available in the previous two years, current vacancies and forecasts are provided for several occupations in the same manner as before (Figure 6:3).

At this level the AMS-skills barometer is also directly linked to jobs available at the AMS — the 'eJob-Room' — being the largest job exchange in Austria (see right hand side of Figure 6:3 AMS button).

Figure 6:3     **Occupational field software technology and programming**



*Source*: AMS-skills barometer.

### 6.3.2.     Qualification information

The tool integrates a second ontology of skills and competences. Similar to occupational areas the AMS-skills barometer defines 23 skill areas, also designed especially for the purpose of the description of a modern labour market and not following any other classification of skills and competences. Those 23 skill areas are again subdivided into approximately 230 skills at the level of occupational fields. The two taxonomies are also linked at this level (Figure 6:1). Every occupational field integrates information on relevant knowledge, skills and abilities.

The skills ontology is highly differentiated as it does not only focus on skills acquired on the basis of formal education. It integrates skills acquired through non-formal education and informal learning at the workplace. The skills ontology

is visualised by differentiating occupation specific skills (*fachliche Qualifikationen*) and non-occupation specific skills (*überfachliche Qualifikationen*). The latter are for instance personal and social skills, language skills, generic skills or transversal skills. Figure 6:4 shows the representation of skills at the AMS-skills barometer at the level of occupational fields whereby dots illustrate current labour-market significance of respective skills and arrows the forecasts. More information on skills (around 8 000 detailed skills) is given at the third level of occupations linked to the AMS-vocational information system (Humpl and Kargl, 2008).

### 6.3.3. Regional information

A last important feature regarding the basic structure of the tool is the regional dimension. The AMS-skills barometer provides regional labour-market information as well for the nine Austrian federal provinces. Such information was integrated right from the beginning, even though the main focus of the tool is at national level. Regional information is still guided primarily by occupational information, even though skills trends are referred to in texts. Administrative boundaries are not necessarily the same as regional labour markets. The barometer partly refers to regional specifics. Recently, the limited database at this level could be improved by using a regular employer survey carried out by the AMS (Humpl and Kargl, 2008).

## 6.4. Methodology

The methodological approach applied during the process of establishing and updating the AMS-skills barometer is one of editing existing labour-market relevant information. This is done by a process of searching sources, collecting and evaluating information critically, joining these together and finally editing them along the given structures of the barometer. The result, both textual and graphic, can be looked upon as a synopsis of compiled information (Humpl and Kargl, 2008).

A general update of the online tool AMS-skills barometer takes place every March and October. Editing is done by a team of experienced authors. They follow a common framework of 'working rules' that guarantee that all texts within the barometer are homogenous with regard to content and style. Therefore it is first and foremost an instrument for representation and only secondary of data analysis (Humpl and Kargl, 2008).

Figure 6:4    **Occupational field software technology and programming**



Qualifikationstrends

**Zusatzqualifikationen und Soft Skills werden wichtiger**

Beschäftigungssuchende mit dem Fokus auf reine Programmiertätigkeiten stehen am Arbeitsmarkt unter großem Konkurrenzdruck. Daher ist zusätzliches Wissen über Prozesse in den AnwenderInnenbranchen vorteilhaft. Ebenso können Qualifikationen aus anderen Bereichen, wie z.B. der Medizintechnik für SoftwareentwicklerInnen und ProgrammiererInnen Vorteile bringen. Neben solidem IT-Fachwissen steigt zunehmend auch die Bedeutung von Soft Skills, allen voran von Kommunikationsfähigkeit und Teamfähigkeit.

Mehr Informationen ⊻

| Fachliche Qualifikationen | Prognose | Bedeutung am Arbeitsmarkt |
|---|---|---|
| >>> Programmiersprachen-Kenntnisse | ↑ | ∎∎∎ |
| >>> Softwareentwicklungskenntnisse | ↑ | ∎∎∎ |
| >>> Datenbankentwicklungs- und -betreuungskenntnisse | ↑ | ∎∎ |
| >>> Datensicherheitskenntnisse | ↑ | ∎∎ |
| >>> Projektmanagement-Kenntnisse | ↑ | ∎∎ |
| >>> Betriebswirtschaftskenntnisse | ↑ | ∎ |
| >>> Betriebssystem-Kenntnisse | ↔ | ∎∎ |
| >>> Internet-Entwicklungs- und Administrationskenntnisse | ↔ | ∎∎ |
| >>> Netzwerktechnik-Kenntnisse | ↔ | ∎∎ |
| >>> SAP-Kenntnisse | ↔ | ∎∎ |

| Überfachliche Qualifikationen | Prognose | Bedeutung am Arbeitsmarkt |
|---|---|---|
| >>> Kommunikationsstärke | ↑ | ∎∎ |
| >>> Teamfähigkeit | ↑ | ∎∎ |
| >>> Fremdsprachen-Kenntnisse | ↑ | ∎ |
| >>> Analytische Fähigkeiten | ↔ | ∎∎∎ |
| >>> Problemlösungsfähigkeit | ↔ | ∎∎∎ |
| >>> Systematische Arbeitsweise | ↔ | ∎∎∎ |

Prognose:    steigend ↑↑    tendenziell steigend ↑    gleichbleibend ↔    tendenziell sinkend ↓    sinkend ↓↓

Bedeutung am Arbeitsmarkt:    hoch ∎∎∎    mittel ∎∎    niedrig ∎

▸ Quellen zum Berufsbereich    ▸ Quellen zum Berufsfeld

*Source*: AMS-skills barometer.

The sources of information are both quantitative and qualitative:

(a)    yearly analysis of job advertisements commissioned by the AMS;

(b)    statistical AMS data on job vacancies;

(c)    regular enterprise survey in more than 20 000 firms with at least 20 employees. Survey is carried out by regional offices of AMS. Allows for quantitative occupational information and information on skills and competences;

(d) AMS standing committee: three yearly sectoral discussions between experts, company representatives and educational providers for 10 different sectors;

(e) quantitative data (labour-market statistics from data providers like Statistics Austria, public insurance association, etc.);

(f) research, analyses and forecasts on skills demand for the Austrian labour market (at regional and national level);

(g) relevant texts from a broad range of sources ranging from general publications (even articles from mass media) to specific branch journals;

(h) relevant PhD- and Master-theses.

To use those sources for representing current labour-market needs and provide for short to medium-term forecasts (up to three years) the editing process is crucial. To allow for solid forecasts and a common framework, several planes of analysis have to be considered. First, since many of those sources use labour-market classifications different from the AMS's own system, the sources must be critically adapted to the AMS structure if possible. Second, it is necessary to consider levels of differentiation. The AMS-skills barometer delivers information for occupations and skills at a highly detailed level. Other sources often focus on trends for specific sectors (not necessarily labour-market specific) or focus on skills on a more general level. Third, sources have different research scales. The barometer provides information at national and regional level, whereas studies dealing with certain regions or branches have limited value for forecasts within the tool. Fourth, differences in time frames have to be dealt with. The barometer has a time span of up to four years and other sources must be adjusted to this time frame (Humpl and Kargl, 2008).

The quality of forecasts can be improved by making use of several sources for occupations and skills. Qualitative expert interviews are often useful for validating and supplementing available sources. Recently, quantitative data such as the mentioned large enterprise survey in more than 7 000 companies has been integrated. This study allows for the quantification of skills at regional level. Generally, the classification of skills is getting increasingly important at the expense of the concept of occupations (Humpl and Kargl, 2008).

## 6.5. User groups of the AMS-skills barometer

The objective of the AMS-skills barometer is to provide a broad group of users with relevant labour-market information. Among them are individual job-seekers, labour-market counsellors, enterprises and policy-makers in public agencies.

More detailed knowledge about the preferences of user groups has been gained by regular surveys. The latest user survey was carried out in 2010. It delivers information on the purpose of visiting the website, time spent using the tool, how often it is used, usability of the tool, satisfaction, recommendations for improvement and information on the user itself (Ziegler, 2010).

Results of the previous survey show two main groups of users. Most people use the tool for the first time for seeking jobs and information about jobs. A smaller group of regular users not only search for jobs and vocational information, they also research for labour-market counselling and information. This means that the tool is also used by a group of 'expert users'. Such a conclusion is confirmed by taking a look at personal information of users. About half of the first time users completed education up to the level of primary or apprenticeship. Another 30% completed secondary education and 20% tertiary education. Among the regular users about 40% have tertiary education and only 30% completed primary education or apprenticeship. This shows that among the regular users the qualification level is much higher (Ziegler, 2010).

The use of the tool by a group of experts is also visible by looking at the professional background of users irrespective of the pattern of use. Of first time users, 39% were job-seekers, 17% were still in education, 21% were working for private companies and 23% for the AMS, educational providers, public administration, NGOs or social partners. This does not change substantially by comparing it with the group of regular users (Ziegler, 2010).

The most popular sites at the AMS-skills barometer are vacancies, job information, labour-market developments, occupational and qualification structures and information on occupational fields. In this regard, there are no major differences between new and regular users (Ziegler, 2010).

A challenge is certainly to provide the same kind of information to quite different user groups. In the future, information for the broader public and for experts might be separated to allow for more customised representation of results.

## 6.6. Comparing Cedefop forecasts and the AMS-skills barometer

Cedefop forecasts follow a regular, systematic and quantitative approach to skills supply and demand forecasting based mainly on a regional econometric input-output model (E3ME). At the same time, Cedefop acknowledges the need to combine quantitative and qualitative approaches. It calls for a 'multifaceted approach', whereby quantitative and qualitative approaches to anticipation are

merged to provide labour-market information to various user groups (Cedefop, 2008, p. 20-21). In comparison, the AMS-skills barometer follows primarily a qualitative approach on labour-market needs (demand), even though quantitative sources are integrated. The tool depends to a great extent for its representation on occupational and qualification information on other sources. A logic next step is to ask what Cedefop and the AMS-skills barometer have in common and which differences exist between the two approaches.

Therefore, it is necessary to compare classifications, differentiation level, scale information and time frames. Those criteria were already outlined in the section on methodology given that an integration of sources into the barometer needs to be edited along those lines. In addition, the question of user groups needs to be addressed.

### 6.6.1.     Classifications

Cedefop forecasts translate employment projections from a multisectoral macroeconomic model into demand for skills. Cedefop provides comprehensive information by sector (NACE classification), occupation (ISCO) and qualifications (ISCED). The AMS-skills barometer designed its own classification on occupations and qualifications adequately describing the Austrian labour market. It is not following a sectoral approach, because for the important user group of job-seekers occupational information is the priority. The barometer is also not following the ISCO classification, even though it is possible to translate some ISCO occupations into AMS occupational taxonomy. Pilot projects for that purpose have been carried out. Besides, forecasts using simple forecast methods (exponential smoothing, Holt-Winters) were piloted trying to combine AMS data (AMS-datawarehouse) and macro data (Mikrocensus, based on ISCO and NACE) (Bacher et al., 2007). As the educational census data are under development still, and this information would be crucial for further econometric forecasts, we have to wait for this information for further developments.

### 6.6.2.     Level of differentiation

Cedefop offers a comprehensive macro view of sectors, occupations and qualifications. But qualifications are only broadly represented by differentiating low, medium and high qualification. Cedefop notes that at present it is possible 'to undertake only a broad brush analysis' (Cedefop, 2008, p. 59). The AMS-skills barometer, in comparison, provides highly differentiated information on occupations (around 600 occupations) and skills (around 8 000 detailed skills). Skills representation is not only based on formal education, but also on non-

formal education and informal learning. Hence, the barometer is a tool at micro and meso level.

### 6.6.3. Scale level:

Cedefop forecasts focus on European and national level. Thus, forecasts cover the EU-27 (forecasts in 2008 not yet included Bulgaria and Romania), Norway and Switzerland. Cedefop emphasises that their forecasts do not substitute national work on forecasting. 'Pan-European projections should not compete with forecasting work of individual countries, which draws on many years investment in data, systems and knowledge, but offer a common framework and a consistent set of underlying assumptions. They therefore can provide a context for more detailed national analyses and forecasts' (Cedefop, 2010, p. 16).

The AMS-skills barometer focuses mainly on the national level, but integrates regional information and forecasts for the Austrian federal provinces (Cedefop, 2010).

### 6.6.4. Time period

Cedefop provides short- and medium-term forecasts based on the econometric E3ME sectoral model. In addition, Cedefop is able to provide long-term forecasts up to 2020 being based on methods of computable general equilibrium (CGE) models. The AMS-skills barometer, in comparison, provides only short- to medium-term forecasts up to three or a maximum of four years.

### 6.6.5. User groups

Cedefop notes that its analyses and forecasts are relevant to a broad audience: 'the latter should include: policy-makers, stakeholders, social partners, sectoral organisations, practitioners and individuals. This project is concerned with developing quantitative models and projections. The results are aimed at all these audiences, across all the countries of the EU (plus some associated members)' (Cedefop, 2008, p. 12).

Despite the relevance of results for a broad audience, one can assume that forecasts are used primarily by an expert group. Cedefop itself states that results are not just relevant to policy-makers and underlines the need for 'better web-based tools' to disseminate results. But the interest for results is not just a question of dissemination. The methodology behind Cedefop forecasts is complex, results do not allow for manpower planning and macro forecasts are less tangible for individuals. Such conclusion one can draw on the basis of the experience with user groups of the AMS-skills barometer.

The use of the tool by experts and individual job-seekers differs substantially. Individuals using the tool a first time are mainly people searching

for a job or re-orientating themselves. They favour information on job vacancies and information on jobs more than developments on the labour market or systematic information on occupation and skills. Regular users, among them a significant group of expert users, are not only interested in job vacancies and information. They see labour-market developments and information on occupations and skills as equally important. Experience shows as well that seemingly contradictory information due to different sources pose problems to the broader public. This means that the interest for European forecasts is not just a matter of dissemination, but equally important, one of representation.

## 6.7.    A way forward: integrating European and national forecasts

The paper illustrated the AMS-skills barometer as a web-based labour-market information tool in the context of the EU Agenda for new skills and jobs as well as Cedefop initiatives of identifying and anticipating future skill needs. Cedefop provides the most comprehensive pan-European skills forecasts including country workbooks ever produced for Europe. Despite this achievement, Cedefop views the current results as a starting point. Further analyses of forecast results as well as methodological and data improvements remain an important task. And even more imperative is to intensify dialogue with various stakeholders to establish a common European framework and better disseminate results (Cedefop, 2010, p. 81).

In this context, the AMS-skills barometer as a tool for labour market information and skills forecasts was presented. The question on how to possibly link both approaches remained open. A further integration of both approaches could be of use concerning the information flow to different user groups, but this would need more intense and detailed discussions by stakeholders. Possible synergies should be reflected as points of common interest, but still the differences in methodologies, scale, level of differentiation, and classifications are challenges to be overcome in the respective common development.

The barometer's own taxonomy of occupations and skills is only partly compatible with most other forecasts including Cedefop classifications. Similarly are the differentiation levels substantially different. Cedefop provides macro projections and the barometer primarily micro and meso projections. Its highly detailed description of occupations and skills is currently not compatible with Cedefop's focus on sectors, occupations and broad skills levels. The scale level and time periods are also quite different. Cedefop offers European and national forecasts over the short, medium and long term. The barometer focuses on the national and regional level over the short and medium term.

Despite those differences there is a great value added of combining the two approaches. While classification and differentiation are only partly compatible, Cedefop results can be used as an additional source for validating national forecasts at macro level, especially for occupations with ISCO compatibility. For Cedefop forecasts the AMS-skills barometer and the stakeholders involved can be viewed as dialogue partners for checking plausibility of results. More importantly, the integration of Cedefop results would allow for a link between current illustration of regional as well as national labour market developments and European trends. The differing time periods are no problem in this respect. Cedefop offers also short- to medium-term forecasts and the long-term perspective would be an additional value for the barometer.

While the results are relevant to the broader public in Austria, they are primarily of interest to an expert group among them educational providers, counsellors, researchers, the Austrian Public Employment Service and policy-makers. The barometer could function as a tool for discussing labour-market trends and developments also at European level. For the broader public the results need probably to be adequately illustrated. It provides various texts on labour-market developments and thereby European labour-market information could be integrated. The consequences of European developments are certainly of importance to forward looking individuals orientating themselves about future careers fields.

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## Web links

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 http://www.ams.at/english/14595.html [28.2.2011].

AMS — Qualifikationsbarometer
 http://bis.ams.or.at/qualibarometer/berufsbereiche.php [28.2.2011].

AMS — Berufsinformationssystem
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European Commission — From the Lisbon Strategy to 'Europe 2020'
 http://ec.europa.eu/education/focus/focus479_en.htm [28.2.2011].

European Commission — Agenda for new skills and jobs
 http://ec.europa.eu/social/main.jsp?langId=en&catId=958 [28.2.2011].

CHAPTER 7.

# Forecasting skills demand and labour market dynamics in the Baltic States
*Žilvinas Martinaitis*

What are the specific challenges to forecasting labour-market demand in the Baltic countries (Estonia, Latvia and Lithuania)? The paper argues that small, open and flexible Baltic economies are highly sensitive to exogenous shocks. This creates considerable uncertainty regarding future level and structure of the demand for skills. As a result there is a gap between policy-makers' expectations for detailed and largely accurate estimates and the capacities of the forecasting exercises to meet these demands. The paper provides an overview of the national forecasting systems, discusses why forecasting labour-market demand is particularly challenging the Baltic countries and assesses how accurate in the short term (2008-09) were the medium-term forecasts produced by Cedefop for Estonia, Latvia and Lithuania.

## 7.1.    Introduction

Forecasting exercises tend to inspire high hopes among the European Union (EU) and national policy-makers. As the Commission argues, forecasting and anticipation of future skills and labour market needs '[…] is a precondition for the design of efficient employment, education and training policies and individual career choices' (European Commission, 2008, p. 5).   From the policy-making perspective, forecasts should be detailed, comprehensive and, above all, they should be accurate. Yet, as the forecasters do not practise 'the art of future telling', the forecasting exercises have focused on the identification of trends and possible scenarios, rather than provision of detailed numbers that are yet to be confirmed by statistical offices in a decade or so. Attempts to close the gap between the expectations and practice of labour market forecasting have inspired long-standing discussions on the assumptions, methods and quality of data (e.g. Neugart and Schömann, 2002).

This paper seeks to contribute to the discussions by focusing on the specific challenges to labour-market forecasting in the Baltic States (Estonia, Latvia and Lithuania). The forecasting efforts so far have been concentrated in large OECD countries, which exhibit moderate economic cycles, relatively stable structure of the economy and institutionalised labour markets. The small, open and highly flexible Baltic economies, however, demonstrate steep economic upswings and

downturns, unclear competitive advantages and fuzzy labour-market institutions. How do these contextual factors affect the forecasting of the demand for skills in the Baltic countries?

The paper argues that forecasting of labour-market demand in the Baltic countries is indeed highly challenging. The 'usual' forecasting problems related to the assumptions, methodology, and data are topped by dramatic swings in the level of output and employment. Between 2004 and 2007 the Baltic 'tigers' exhibited the fastest GDP growth in the EU. This period was followed by a deep recession and raise in unemployment in 2008-09. As a result, the forecasts produced in the Baltic States prior to the global financial crisis have been subjected to widespread scepticism.

The structure of the paper is as follows: the first part explores the national forecasting systems. The second part discusses why labour-market forecasting has proved so difficult in the Baltic States. The third part assesses, how accurate in the short term are the medium-term forecasts produced by Cedefop ([30]). The forecasts were prepared in 2009 and published in 2010, but due to data restrictions, the latest data used in the forecasts refer to 2007. This provides a unique opportunity to compare the forecasts for 2008 and 2009 with the actual data. This allows assessment of the accuracy of the Cedefop forecasts under the most unfavourable conditions, since 2008 and 2009 were marked by an unexpected and dramatic economic downturn.

## 7.2. State of play: experience with forecasting labour market demand in the Baltic States

Efforts aimed at forecasting labour-market demand in the Baltic States share several important commonalities. First, it is a relatively recent activity, which emerged around 2004. Since then anticipation exercises heavily relied on funding from the European Social Fund and methodological advice from experts of EU-15. Second, the overall ambition of forecasting was to provide data for the debates on funding of education and training. This ambition largely remains unattained in all countries in question due to the low level of detail of forecasts. 'Small country' effect has created considerable problems in this respect: most economic sectors employ less than 100 000 employees and, therefore, standard surveys fail to capture the composition of the workforce of specific sectors by

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([30]) The aggregate forecasts for EU-27, Norway and Switzerland are discussed in Cedefop, 2010.

detailed occupation group and level of education. The third commonality: due to the dynamic nature of the Baltic economies (fast economic growth in 2004-07 and dramatic economic recession in 2008-10) medium- to long-term forecasts tend to be very inaccurate (even in the short term). This, for example in Lithuania, caused widespread scepticism regarding the overall utility of forecasting.

### 7.2.1. Estonia

Anticipation of skills demand in Estonia rests on two types of studies.

First, sectoral studies focusing on the demand for skills in specific industries (wood processing, metalworking, engineering, machinery and equipment; ICT and food processing) (Cedefop, 2008). Since 1999 these studies have relied on the Irish methodology, which seeks to use quantitative and qualitative insights into strategic trends of specific sectors.

Second, the Ministry of Economic Affairs and Communications prepares aggregate medium- to long-term employment forecasts. Work in this area started in 2003 and since then has developed into regular six-year forecasts of labour-market needs in 34 sectors and five occupational groups. The exercise uses a macro model Hermin, which is quite similar to the model used for this purpose in Ireland. The results of the forecast are corrected with sectoral models and expert assessments (Järve, 2010). The forecasts are updated annually and are primarily used as a source of information for the discussions regarding the number of State-funded students.

The main issue encountered during the forecasting exercise is lack of detailed data on the structure of employment in specific sectors by detailed occupational group and education level. Small size of the economy and small samples of the surveys preclude generation of more detailed data. As a result, the forecasts provide an important framework for deliberations, but are not detailed enough to support specific decisions (Järve, 2010).

### 7.2.2. Lithuania

Since 1995 the Lithuanian Labour Exchange provides short-term estimates of the labour-market demand. They indicate employment prospects (high, medium or low) for detailed occupational groups and economic sectors in 10 geographical regions. The estimates are based on the number of registered job openings and a survey of 4 000 enterprises.

Since 2004 many medium-term forecasts have been developed. Several studies [31] sought to provide estimates for the whole economy. However, most

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[31] BGI Consulting and Sweco EuroFutures, 2008; ETKC, 2007; NPI, 2008.

studies were sectoral, i.e. they focused on the future demand in specific economic sectors ([32]) or sought to assess the demand for VET or university graduates ([33]). The most frequently used forecasting methods include surveys of employers and qualitative assessments of future demand, while several studies also engaged in econometric modelling and time series analysis.

A recently published meta-study (BGI Consulting, 2010) on Lithuanian experience in labour-market forecasting concluded that despite considerable efforts, the utility of forecasting exercises has been limited. Fragmentation of efforts prevented systemic accumulation of a knowledge base in forecasting and understanding of the dynamics of the Lithuanian labour market. Furthermore, the results of the forecasts have been called into question due to the effects of the severe economic crisis of 2008-09.

### 7.2.3. Latvia

In Latvia three types of forecasts have been developed. First, the State Employment Agency provides short-term estimates by occupational group and geographical regions. Similar to the Lithuanian system, the short-term forecasts are based on the surveys of employers (Rastrigina, 2009).

Second, considerable efforts were made to develop economy-wide long-term forecasts. Between 2005 and 2007 the University of Latvia produced forecasts of labour-market demand and supply until 2020 (University of Latvia, 2007). The estimates were broken down by 15 economic sectors, 120 professions, 37 aggregated groups of professions, level of education and age. The exercise was based on the models developed in Sweden. In 2007 the forecasts concluded that by the year 2013 there will be shortages of labour in 99 professions out of 120 (Dubra and Gulbe, 2008). This widely discussed finding, however, was dramatically revised in 2009.

Third, the Ministry of Economic Affairs produces annual medium-term labour force supply and demand forecasts. The estimates are based on the dynamic optimisation model, which uses three medium-term economic development scenarios and Eurostat demographic projections. The projections are presented for 35 aggregated occupational groups and 15 economic sectors (Ministry of Economic Affairs, 2010).

Last, in addition to the economy-wide forecasts, efforts have also been made to provide forecasts for labour-force demand in specific economic sectors.

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([32])  PMMC, 2008a; 2008b; 2008c; 2008d; 2008e; 2008f; 2008g; Lithuanian University of Agriculture, 2007; ETC, 2007.

([33])  VPVI, 2006; 2008; DSTI, 2008.

The Higher Education Council also produces forecasts on the future labour-market demand for university graduates.

Within the policy-making circles the sentiment regarding the existing forecasting infrastructure remains cautious. On the one hand, some doubts have been raised regarding the adequacy of forecasting methodology (Rastrigina, 2009; Ecorys, 2010). On the other hand, the dynamic nature of the Latvian economy imposes considerable uncertainty regarding the reliability of any medium- to long-term growth scenario.

## 7.3.    Why forecasting is so difficult in the Baltic States

So far much of the academic and policy debate has focused on the overall strengths and weaknesses of different forecasting approaches, application of econometric models and technical issues related to availability of detailed historic data. This section, however, seeks to ask a different question: to what extent does the reliability of labour-market forecasts depend on the characteristics of the economy?

To the extent that forecasts of future demand for labour force depend on the past trends, the 'ideal' country for forecasting should exhibit the following characteristics:

(a) stability — moderate economic cycles and absence of strong external shocks reduce uncertainty regarding the overall level of future demand for labour;

(b) clear comparative advantages — due to natural endowments and institutional structures, countries historically tend to deepen their comparative advantages, which is important in forecasting the changes in demand for skills by sector, educational level and profession;

(c) stable labour-market regulation, which affects how the labour market reacts to external shocks. For example, the costs of firing affect how the firms will react to decline in aggregate demand.

The Baltic States do not exhibit the above characteristics. First, the economic cycles in the Baltic countries are far from moderate as they have exhibited the periods of extremely fast economic growth and steep declines (Figure 7:1). This is partly explained by high openness of the economies, which exposes them to the strong impact of external economic shocks.

Figure 7:1    **Real GDP growth in the Baltics**
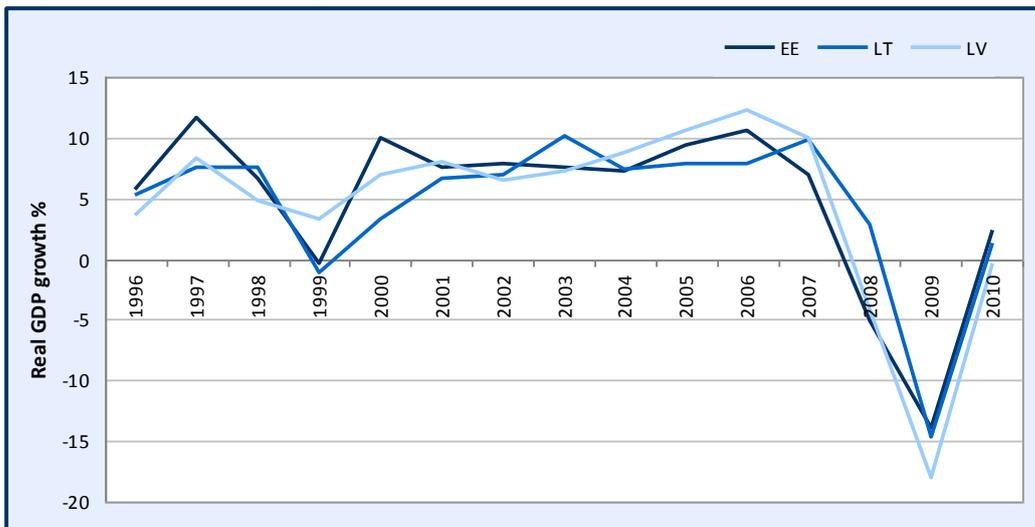


*Source*: Eurostat.

Second, identification of key sectors, which are likely to drive the future economic growth of the Baltic economies, remains problematic. In the 1990s transition from planned to market economies has dramatically reshaped the structure of the economies. Subsequent economic development was heavily distorted by large shocks: the Russian crisis of 1998, inflow of cheap credit and EU structural funds between 2004 and 2007, global financial crisis and the burst of internal real estate bubbles in 2008-10. This caused large sectoral shifts in terms of output and employment. As a result it is nearly impossible to pinpoint any sectors with a historically stable growth curve. Hence, 20 years after transition considerable uncertainty regarding the competitive advantages of the Baltic economies remains.

Third, labour-market regulation has remained relatively stable over the past decade. Nevertheless, attempts to explain how the regulation affects labour-market outcomes have encountered a paradox. Numerous previous studies ([34]) have shown that despite rigid regulation, the Baltic labour markets are very flexible. This paradox is explained by poor enforcement of the existing regulation.

To sum up, the above discussed characteristics of the Baltic economies imply considerable difficulties in forecasting labour-market demand in the medium-long term. As a result one could expect large discrepancies between the results of the forecasts and actual labour-market demand.

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([34])  Paas and Emets, 2006; Boguslavas and Blažienė, 2007; Martinaitis, 2008.

## 7.4. Assessment of Cedefop forecasts

This section seeks to assess how accurate are the labour-market demand forecasts for the Baltic States, which have been developed during the project 'Forecasting skills supply and demand in Europe' (hereafter Cedefop forecasts) ([35]). The forecasts were published in 2010 and explicitly considered the effects of the global financial crisis. The forecasts of the labour-market demand used the data from the labour force survey covering the period between 1998 and 2007. Hence, this section compares the forecasts for 2008 and 2009 with the actual data. The results of comparison are reported as average percentage difference between forecasted number of employed persons (by sector, occupational group and education) and actual data of the labour force survey.

Interpretation of the findings should consider several caveats. First, 2008 and 2009 were marked by an unexpectedly large economic contraction. Hence, the analysis tests the Cedefop forecasts under the least favourable conditions. Second, the forecasts produced in the Baltic States prior to mid-2008 did not see the unfolding economic crisis (and therefore forecasted steep increase in the demand for labour) or severely underestimated the scale and effects of the downturn. Therefore, the analysis below does not seek to compare Cedefop estimates with results of efforts taken in the Baltic States.

The number of employed persons is an aggregate measure of labour force demand. Comparison of forecasts with historical data (Table 7:1) shows that the forecasts for 2008 did not deviate from actual number of employed persons by more than 0.5%. However, the differences for 2009 are considerably larger. Further, the forecasts underestimated the impact of crisis on employment: actual drop in employment in 2009 was steeper than forecasted. Poor enforcement of labour-market regulations and the resulting high flexibility of the Baltic labour markets could explain this result: a drop in aggregate demand has a larger negative effect on employment in the Baltic States compared to the EU-15, since the costs of firing in the former are considerably lower than in the latter.

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([35]) The aggregate forecasts for EU-27, Norway and Switzerland are discussed in Cedefop, 2010.

Table 7:1    **Forecasted and actual number of employed persons**

| | | Number of employed persons (thousands) | | % difference between forecasts and actual data | |
|---|---|---|---|---|---|
| | | **2008** | **2009** | **2008** | **2009** |
| **EE** | Forecast | 659.1 | 619.6 | 0.39 % | 3.84 % |
| | Actual | 656.5 | 595.8 | | |
| **LV** | Forecast | 1.119.6 | 1.049.2 | 0.44 % | 6.3 % |
| | Actual | 1.124.5 | 983.1 | | |
| **LT** | Forecast | 1.521.6 | 1.459.8 | 0.11 % | 3.01% |
| | Actual | 1.520.0 | 1.415.9 | | |

*Source*: Own calculations based on Eurostat data and Cedefop forecasts.

What are the forecasted changes in terms of the structure of the demand for skills? The Cedefop forecasts for EU-27 emphasise three general trends:

(a)  demand in services is expected to grow, while employment in primary sectors should substantially decline;

(b)  employment in knowledge- and skills-intensive jobs should increase, while the number of jobs for traditional agricultural, clerical and craft and related trades workers will decline;

(c)  demand for highly-qualified workers should increase, while the demand for persons with low qualifications should decline.

In sum, during the next decade the structure of the European labour markets should shift towards high value-added knowledge-intensive services. To what extent have the developments in the Baltic States in 2008-09 matched these expectations?

Table 7:2 reports forecasted and actual number of employed persons by occupational group. In line with above discussed general forecasted trends, the share of managers, professionals and technicians has increased (although in absolute numbers it has declined), while the share of crafts and related trades workers has rapidly decreased in all three Baltic States. However, the share of skilled agricultural workers has not declined as fast as forecasted. A more detailed comparison of the forecasts and actual developments suggest that the largest discrepancies have occurred in three occupational groups. First, the forecasts suggested dramatic decline in the number of employed technicians and associated professionals in Lithuania. Employment in this occupational group, however, has increased. Second, while the number of employed skilled agricultural and fishery workers has declined in Estonia and Latvia (although not as fast as forecasted), unlike expectations, it has increased in Lithuania. The latter observation could be explained by historical trends: dramatic rise of unemployment tends to be related with increase in employment in the agricultural

sector. On the one hand, this is likely to reflect hidden unemployment, when unemployed persons move to rural areas in search of part-time jobs. Rise of food prices in 2009 could also provide a partial explanation of the increase in the number of skilled agricultural and fishery workers in Lithuania. Last, the forecasts indicated a decline in the number of persons employed in elementary occupations. The data show that the forecasts were too optimistic and employment in elementary occupations dropped faster than expected. Flexibility of the labour markets and high substitutability of the skills of persons in elementary occupations are likely to be the main factors behind these trends.

Table 7:2 **Forecasted and actual number of employed persons by occupational groups**

| | | Estonia | | Latvia | | Lithuania | |
|---|---|---|---|---|---|---|---|
| | | 2008 | 2009 | 2008 | 2009 | 2008 | 2009 |
| Legislators, senior officials and managers | Forecast | 82 | 77 | 98 | 93 | 156 | 152 |
| | Actual | 80 | 72 | 101.1 | 92 | 159 | 143 |
| | % difference | 3.38 | 5.93 | -3.16 | 0.97 | -1.86 | 5.66 |
| Professionals | Forecast | 98 | 97 | 155 | 146 | 288 | 284 |
| | Actual | 90 | 96 | 164 | 167 | 274 | 256 |
| | % difference | 7.87 | 1.45 | -5.85 | -14.68 | 4.75 | 9.96 |
| Technicians and associate professionals | Forecast | 85 | 84 | 186 | 176 | 139 | 137 |
| | Actual | 85 | 83 | 186 | 150 | 170 | 174 |
| | % difference | 0.41 | 0.82 | 0.09 | 14.86 | -22.17 | -27.29 |
| Clerks | Forecast | 32 | 30 | 52 | 50 | 65 | 63 |
| | Actual | 35 | 33 | 53 | 51 | 69 | 63 |
| | % difference | -8.58 | -9.01 | -0.51 | -2.81 | -5.71 | 0.09 |
| Service workers and shop and market sales workers | Forecast | 83 | 81 | 137 | 131 | 208 | 205 |
| | Actual | 83 | 75 | 139 | 131 | 183 | 187 |
| | % difference | -0.54 | 6.87 | -1.50 | 0.06 | 11.67 | 8.92 |
| Skilled agricultural and fishery workers | Forecast | 10 | 8 | 46 | 38 | 84 | 81 |
| | Actual | 12 | 9 | 46 | 43 | 79 | 93 |
| | % difference | -21.27 | -8.11 | 0.06 | -12.81 | 6.38 | -15.61 |
| Craft and related trades workers | Forecast | 105 | 87 | 195 | 180 | 277 | 247 |
| | Actual | 111 | 84 | 170 | 124 | 288 | 233 |
| | % difference | -5.57 | 3.34 | 12.55 | 31.26 | -4.11 | 5.69 |
| Plant and machine operators and assemblers | Forecast | 90 | 85 | 111 | 104 | 143 | 136 |
| | Actual | 93 | 85 | 112 | 93 | 156 | 141 |
| | % difference | -3.41 | -0.49 | -1.11 | 11.31 | -8.90 | -4.02 |
| Elementary occupations | Forecast | 70 | 68 | 139 | 129 | 157 | 150 |
| | Actual | 63 | 56 | 150 | 127 | 139 | 122 |
| | % difference | 9.53 | 18.25 | -8.08 | 0.89 | 11.55 | 18.90 |

NB: Data presented refer to thousands of persons, while the % difference was calculated using the most detailed data available.

*Source*: Own calculations based on Eurostat data and Cedefop forecasts.

Table 7:3 reports forecasted and actual trends in employment by selected sectors. As forecasted, employment in manufacturing, construction and distribution and transport considerably declined in 2008-09. However, in contrast to the forecasts, employment in agriculture did not dramatically decline in Estonia and Latvia and increased in Lithuania. This could be explained by the above discussed factors: hidden unemployment and higher global demand for agricultural products. Furthermore, it seems that employment in business and other services has decreased faster than forecasted (data are not provided due to high uncertainty regarding its reliability).

Table 7:3 **Forecasted and actual number of employed persons in selected sectors**

| | | Estonia | | Latvia | | Lithuania | |
|---|---|---|---|---|---|---|---|
| | | **2008** | **2009** | **2008** | **2009** | **2008** | **2009** |
| Agriculture, forestry and fishing | Forecast | 25 | 21 | 106 | 91 | 120 | 115 |
| | Actual | 25.3 | 24.0 | 88.6 | 85.4 | 119.8 | 130.5 |
| | % difference | -1.30 | -14.40 | 16.54 | 6.18 | 0.17 | -13.28 |
| Manufacturing | Forecast | 136 | 120 | 170 | 159 | 266 | 262 |
| | Actual | 135.0 | 113.9 | 165.7 | 135.9 | 260.4 | 226.0 |
| | % difference | 1.04 | 4.89 | 2.30 | 14.35 | 2.04 | 13.73 |
| Construction | Forecast | 72 | 58 | 126 | 117 | 165 | 120 |
| | Actual | 81.0 | 58.3 | 128.7 | 80.1 | 166.5 | 122.6 |
| | % difference | -12.50 | 0.13 | -2.16 | 31.29 | -0.91 | -2.23 |
| Non-marketed services | Forecast | 134 | 136 | 215 | 211 | 331 | 330 |
| | Actual | 129.4 | 132.2 | 231.4 | 208.1 | 329.9 | 326.5 |
| | % difference | 3.49 | 2.79 | -7.54 | 1.39 | 0.34 | 0.91 |
| Distribution & transport | Forecast | 178 | 174 | 327 | 313 | 417 | 415 |
| | Actual | 181.325 | 167.3 | 336.125 | 299.6 | 429.875 | 400 |
| | % difference | -1.81 | 3.63 | -2.79 | 4.37 | -3.06 | 3.57 |

NB:  Data presented refer to thousands of persons, while the % difference was calculated using the most detailed data available.

*Source*: Own calculations based on Eurostat data and Cedefop forecasts.

Table 7:4 reports forecasted and actual changes in the number of employed persons by qualification. In absolute numbers all groups of workers have witnessed a decline in employment prospects. However, in line with the general expected trends, the share of highly-skilled workers has increased at the expense of persons with low qualifications, i.e. demand for highly-qualified persons has declined less than the demand for persons with low qualification. The number of persons with low qualification has decreased faster than forecasted, while the reverse is true in the case of demand for highly-qualified persons.

Table 7:4    **Forecasted and actual number of employed persons by qualification**

| | | Estonia | | Latvia | | Lithuania | |
|---|---|---|---|---|---|---|---|
| | | **2008** | **2009** | **2008** | **2009** | **2008** | **2009** |
| Low qualification | Forecast | 68 | 63 | 155 | 147 | 119 | 112 |
| | Actual | 68 | 52 | 140 | 104 | 95 | 79 |
| | % difference | -0.09 | 17.84 | 10.09 | 29.32 | 20.09 | 29.91 |
| Medium qualification | Forecast | 361 | 335 | 686 | 638 | 879 | 838 |
| | Actual | 361 | 313 | 681 | 589 | 896 | 818 |
| | % difference | 0.02 | 6.54 | 0.70 | 7.65 | -2.00 | 2.44 |
| High qualification | Forecast | 230 | 222 | 278 | 264 | 523 | 509 |
| | Actual | 231 | 228 | 304 | 290 | 526 | 517 |
| | % difference | -0.14 | -2.76 | -9.09 | -9.73 | -0.56 | -1.59 |

NB : Data presented refer to thousands of persons, while the % difference was calculated using the most detailed data available.

*Source*: Own calculations based on Eurostat data and Cedefop forecasts.

To sum up: how accurate in the short term are the Cedefop projections for the Baltic countries? When assessing the results, one should consider that the forecasting exercise took place during one of the largest global economic recessions, which created high uncertainty regarding the demand for labour in small dynamic and flexible economies. However, the overall conclusions are two-fold. On the one hand, the broad forecasted trends seem to be correct: persons with high qualification in knowledge- and skills-intensive jobs seem to have weathered the 'economic storm' better than low-qualified workers in elementary occupations. However, in contrast to the forecasts, employment in agriculture did not dramatically decline (it has increased in Lithuania). Further, considerable growth of demand in high-value added service sectors seems to be overstated at least in the short term.

On the other hand, the forecasts considerably differ from historic data when one compares the absolute numbers. The more detailed the breakdown of demand, the larger are the discrepancies. Also, the forecasts for 2008 were more accurate than the ones for 2009. Hence, if the detailed forecasts are used for manpower planning decisions, they could lead to wrong choices.

## 7.5.   Implications and further discussion

Several broad lessons stand out from the above discussion. First, consolidation of efforts within national forecasting systems helps capacity building and the learning process. In Lithuania many medium-term forecasts were developed, but fragmentation of efforts prevented systemic accumulation of know-how and establishment of forecasting infrastructure. Concentration of efforts within a

single ministry in Estonia and subsequently in Latvia helped development of a stable forecasting system.

Second, the characteristics of the Baltic economies imply considerable difficulties in forecasting labour-market demand in the medium- to long-term. Small, open and flexible economies are highly sensitive to exogenous shocks, which creates considerable uncertainty regarding future level and structure of the demand for skills. Individuals seem to be adapting to the uncertainty by investing in highly transferable general skills and shunning away from industry-specific skills, which are developed in vocational education and training systems (Martinaitis, 2010). The policy-makers, on the other hand, tend to muddle through the uncertainty with the hope of better forecasting systems. The assessment of Cedefop forecasts revealed, that the estimates capture the overall trends in labour-market demand. However, the detailed estimates in absolute numbers considerably deviate from actual developments.

Last, qualitative analysis of future demand for skills is still underdeveloped compared to the quantitative estimates in the Baltic countries. Considering the dynamic nature of the economies and chronic lack of high quality and detailed data, qualitative insights into the changing nature of skills requirements could considerably contribute to reduction of uncertainty for policy-makers and learners.

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CHAPTER 8.

# Demand and supply of labour by education in Norway towards 2030 — Linking demographic and macroeconomic models

*Roger Bjørnstad, Marit L. Gjelsvik, Anna Godøy, Inger Holm and Nils Martin Stølen*

Updated projections on labour demand and supply in Norway towards 2030 are presented. The macroeconomic model Modag gives projections for labour demand by education within five aggregated educational levels/groups. To compare the projections for demand with projections for supply we have used the dynamic microsimulation model Mosart based on constant educational propensities and labour force participation rates. The projections show that the previous trends of increasing demand for workers with a tertiary education and higher secondary vocational education will continue towards 2030. Demand for labour with a lower tertiary education may increase more than the corresponding increase in supply. The need for labour with primary, lower secondary and higher secondary general education is decreasing. A module translating labour demand by industry into labour demand by education at detailed level is linked to Modag. This shows a particularly strong growth in demand for candidates in economics and administration and nursing and caregiving at a lower tertiary level.

## 8.1.    Main structure of the model system

Because of globalisation and technological progress, Norway has seen a considerable growth in demand for labour with higher skills and educational levels the past decades. Labour supply has followed demand rather closely, and unemployment and wage differences have stayed relatively equal. In many other OECD countries, supply has not grown correspondingly. This has resulted in increasing differences either in unemployment or in wages between high and low-skilled workers. The past trends in educational upgrading will probably continue, and further stability in the labour market requires that labour demand and supply matches also in the future. Both for future students, who must decide on education, and the authorities, who must plan the educational capacity, industrial development and welfare reforms, etc., projections on demand and supply of labour by education are useful.

Statistics Norway has produced such projections since 1993, and the paper presents updated projections towards 2030. The main structure of the model

system used for projecting supply and demand for different kinds of labour by Statistics Norway is presented in Figure 8:1. According to what Cedefop (2008) calls 'best practice' in projecting demand for labour, the Norwegian projections are based on a macroeconomic model. The Modag model has a core of input-output relations to capture the interaction between the different industries. In the version of the model used for this analysis labour is divided by five educational groups. Production in the different industries is dependent on the macroeconomic functioning of the Norwegian economy and on exogenous assumptions about economic development abroad, further growth in industries based on natural resources and the further growth in public services. In addition to the level of production, demand for labour in the different industries depends on technological progress and the possibility of substitution with other inputs.

In a separate submodel, the aggregate demand for labour in each industry is further spread by educational fields using exogenous assumptions about how the employment shares within each main educational group may develop. The continuation of trends observed from the past decade regarding the composition of labour is used as a standard assumption. On the demand side our projections correspond rather closely to the European joint project managed by Cedefop that aims to project demand and supply for different kinds of labour for EU-27, Norway and Switzerland (Wilson et al., 2008).

On the supply side of Modag labour force by the five educational categories is determined by linking equations for labour-market participation by age and gender to the corresponding groups of individuals in working age. A discrepancy between total supply and demand, expressed by the corresponding rates of unemployment, affects wage formation. Because wages affect labour-market participation rates and demand for labour, this link helps in the direction of achieving consistency between the labour demand and supply by education. However, in line with observations of real life, the equilibrium correction mechanisms are not strong enough to secure a steady path for the economy and stable unemployment. Therefore, we have chosen to let the labour force for the five educational groups in the projections be determined from the demand side instead. Hence, future mismatches in the labour marked cannot be analysed using the Modag-based projections alone.

However, labour supply by education is also projected with the demographic-based dynamic microsimulation model Mosart. From a representative sample of the population in a base year, Mosart simulates the further life course for each person in this initial population by using estimated transition probabilities. The transition probabilities are kept constant, and the projections then show what will happen if everything continues as recently

observed. Some degrees of consistency between the two labour supply projections are secured because Statistics Norway's official demographic projections by age and gender form a common basis for them. Nonetheless, while labour supply is in line with labour demand in Modag, educational propensities and detailed participation rates that differ by age, gender and education are assumed to be fixed in the Mosart projections. Thus, there may be discrepancies between the projections from the models regarding labour supply, and these discrepancies may be viewed as indications of potential mismatches in the future labour market.

Figure 8:1    **Main structure of the model system**
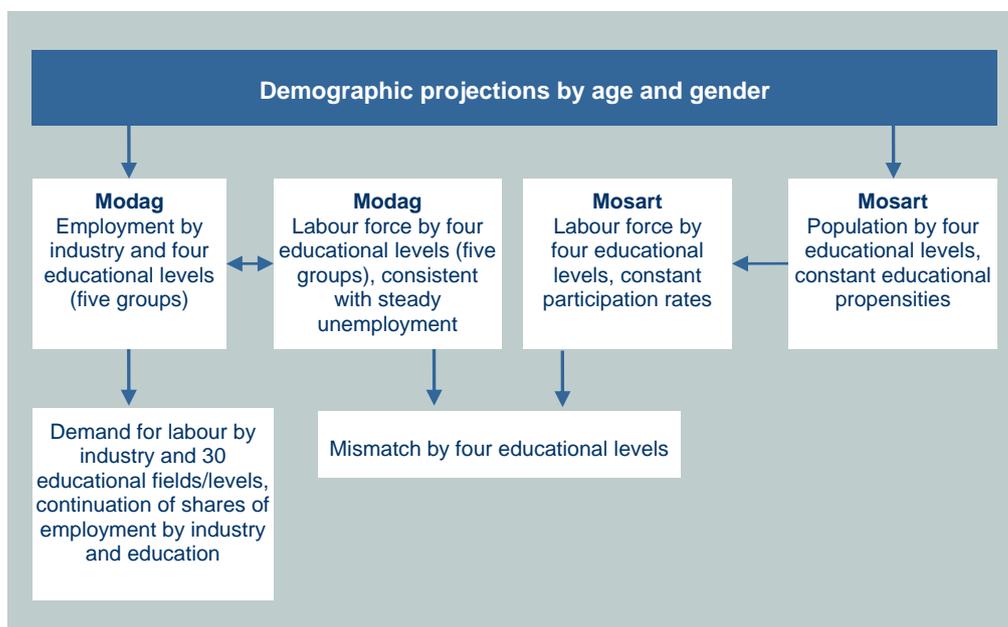


*Source:*   Statistics Norway.

The five main groups of education are presented in Table 8:1. The levels are in accordance with the typical design of the Norwegian educational system and correspond closely with international standards for education (ISCED97). At detailed level, each of the three upper levels of education is divided into about 10 fields reaching a total of 30 educational groups. The main criterion for the division was to subdivide educational groups to present the greatest possible homogeneity within subgroups regarding supply and demand for labour.

## 8.2.   Modag — Model of the Norwegian economy

Modag is a macroeconometric model for the Norwegian economy developed at Statistics Norway. In this section, we provide a short description of the model. Cappelen (1992) provides a more detailed presentation of an earlier version of Modag, and Boug and Dyvi (2008) present the newest version written in Norwegian. The standard version of Modag has homogeneous labour. In the version we use here, labour is disaggregated into five educational groups. Bjørnstad and Skjerpen (2006) describe the education-specific labour demand and wage setting.

Table 8:1   **Classification by main group of education and corresponding numbers of employed in 2006 (1 000 persons)**

| Code | Field of education | Employed |
|------|--------------------|----------|
| 0 | Total, including unknown | 2362.1 |
| 1 | Primary and lower secondary education (ISCED 0-2) | 499.3 |
| 2a | Upper secondary education general programmes (ISCED 3 and 4) | 462.7 |
| 2b | Upper secondary education vocational programmes (ISCED 3 and 4) | 607.2 |
| 3 | Tertiary education, lower degree (ISCED 5, lower degree) | 591.7 |
| 4 | Tertiary education, higher degree (ISCED 5, higher degree and ISCED 6) | 177.9 |
| 9 | Unknown | 23.3 |

*Source:*   Statistics Norway.

Modag is relatively disaggregated and distinguishes between 45 different products and 21 different sectors. The model specifies many final applications of the products, and these products have different prices depending on supply (home- or foreign-produced) and utilisation (export or home market). The Norwegian national accounts form the conceptual framework and the empirical basis of the model. Specifically, Modag balances all products in terms of input and output. These relationships connect — at the most detailed level in the model — the supply and usage of the products to different activities in the economy. Modag also contains a consistent account of income and capital balances within each institutional sector, and in the economy as a whole. At the same time, the input-output structure and the account-based relationships are supplemented with econometric equations describing how the agents in the economy tend to respond to different options. While the long-term relations are based on economic theory, the dynamic adjustments towards the long run are largely quantified to fit data.

The main structure of the model implies that prices — along with interest rates, exchange rates and wages — determine the demand from private consumption and investment and foreign demand. Public sector's income and expenditures are richly represented in the model. However, the public use of

resources and various tax rates are exogenous. In 11 of the industries, the demand for variable input factors is based on a Cobb-Douglas production function in materials, a CES-aggregate in energy and a CES-aggregate in high- and low-educated labour. The model assumes that there is no substitution between the different types of labour within the two aggregates ([36]). Total real capital is treated as a quasi-fixed input, and Hicks-neutral technological change is represented by a linear trend. For seven of the industries, individuals with vocational training at higher secondary level are regarded as low-educated labour, while the other four — which in sum is much larger —are regarded as high-educated labour. This choice is based on the empirical results obtained by Bjørnstad and Skjerpen (2006). The assessment of high- versus low-educated workers depends on relative wages, the stock of machine capital and production volume following a linear trend, which is assumed to represent skill-biased technological change (but possibly also other factors).

The model involves a traditional Keynesian multiplier, where higher income leads to more spending, which increases production in the next round and activates further growth in employment and income. In this way, the initial change in aggregate demand causes a change in aggregate output for the economy that is a multiple of the initial change. The operational version of the model does not contain mechanisms that ensure full resource utilisation or balance in the external account or in public sector budgets. We believe this property is in line with the functioning of the Norwegian economy, where centralised wage negotiations and an active fiscal and monetary policy play a central role. Thus, in applying the model, the user must decide on a fiscal policy that is sustainable.

## 8.3. Projections of the Norwegian economy towards 2030

To study the effects of economic development on labour demand, we have projected a path for the Norwegian economy that extends to 2030 using Modag simulations. Our projections are based on final national account figures up until 2006 and preliminary figures for 2007. The Modag simulations start in 2008, but we have generated residuals so that the simulated figures should match the preliminary account figures for 2008 and 2009 fairly well. The path is based on a rather quick adjustment from the low growth we have observed through 2009

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[36] In the other industries in which the demands for variable inputs are modelled, there is no possibility for substitution between any different types of labour.

following the international financial crisis, to a more balanced economic development where employment, wages, consumption, prices and activity grow at rates close to the prevailing trend. This ensures that the demand for labour by education in our analysis results from structural rather than cyclical conditions.

During the upswing period 2004-08 there has been an extensive labour supply growth in Norway. There are multiple explanations, but most importantly the expansion of the EU on 1 May 2004 has increased the flow of foreign workers and immigrants seeking work in Norway, particularly from central east European and Baltic countries. In addition participation rates have increased. A substantial share of the population in Norway of working age is participating in working life. It has among the highest participation rates in the world. However, the average age within the cohort is continually increasing, and the demographic situation will be less favourable as we move towards 2030. But immigration is assumed to stay at a high level. Even though labour supply is determined from the demand side in our projections, total labour supply is reasonably consistent with these trends. In our projections, the participation rate falls gradually from a level of about 73% in 2009 and 2010 to about 69% towards 2020. This development is fairly in line with what we would expect in light of the cyclical movements and the demographic changes during this period. Then, the fall in the participation rate stops and it even turns to increase after 2025. At the end of the period, the participation rate reaches 70%. The increase mainly comes from an increase in labour demand in the public health and social sector as the elderly population grows (keeping in mind that labour supply is determined by employment plus unemployment).

Figure 8:2 shows employment by sectors of the economy as a share of total employment. The sectors include the primary industries ([37]), manufacturing ([38]), private services ([39]), construction industry, public sector ([40]) and the remaining industries ([41]). The extent of public activity is expected to grow both in quantity and as a share of total employment. The public sector's share of total

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([37]) Primary industries consist of agriculture, forestry, hunting and fishing and fish farming.

([38]) Manufacturing includes production of consumer goods, products of input and investment, industrial raw materials, workshop products, ship and oil platforms and production and refining of petroleum products, etc.

([39]) Private services include services in banking and insurance, retail, domestic transport and communication including air transport, housing services and other private service activities.

([40]) Central and local government including the military.

([41]) Among the remaining industries are the extraction of crude oil and natural gas, foreign shipping and production of electric energy.

employment rises from 30% in 2009 to nearly 37% in 2030. This growth also illustrates the demand for public health and caregiving services as the population of elderly people grows.

Figure 8:2    **Employment by sector, share of total employment**
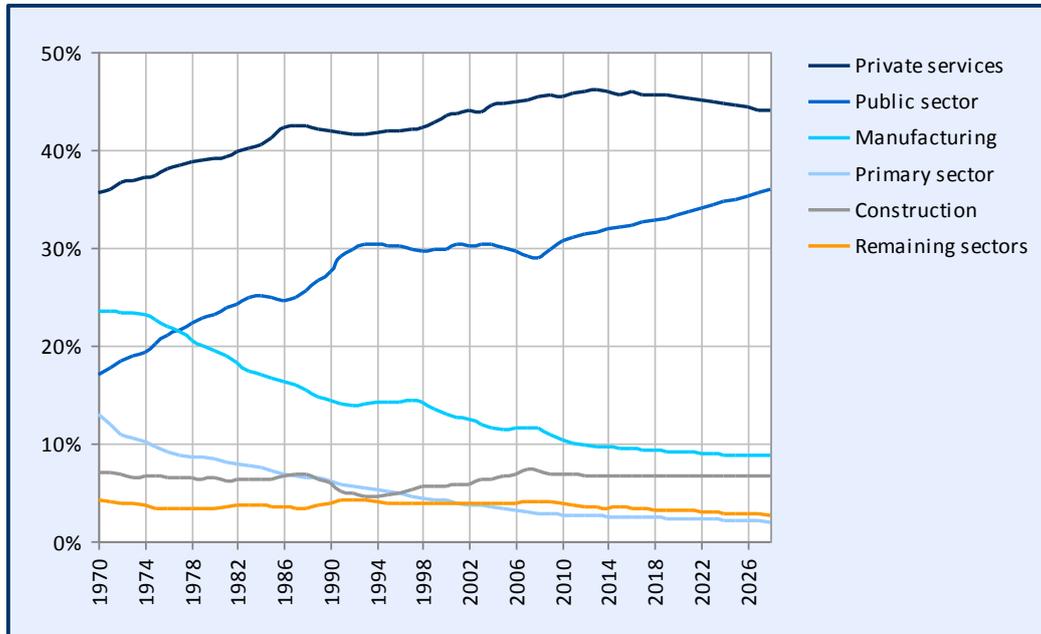
We have assumed that the oil price stays around USD 80 per barrel in the period towards 2015, and then increases gradually to USD 100 per barrel in 2030. The petroleum production in Norway has already reached its peak, and is expected to decline further the years ahead. Although the revenues from the petroleum activity will remain high for many years still, the possibility of financing the rapid increase in public pension expenditures after 2025 abates. The Norwegian government has adopted a fiscal rule that the deficit in the government sector, corrected for oil and gas revenues and cyclical conditions, should be approximately 4% of the value of the government pension fund – global in the beginning of the budget year. This corresponds to the expected real surplus of the fund. The rest of the petroleum revenues are invested in the fund. In the projections, the government is assumed to stick to this rule. Even though the growth in public employment continues during the entire period, the growth in standards in public services is relatively moderate, also before 2020. Instead we have assumed a reduction in income tax rates up until 2025. After 2025 we have assumed gradual increases in the income tax rates again

The growth in households' disposable real income remains relatively high through the entire projection period. The growth in demand for private services also stays at a relatively high level. However, because of the growth in the public sector, the private service sector measured as a share of total employment will decline. The primary industries and manufacturing are projected to continue their downward trend. The remaining industries also reduce their activity, especially in the extraction of crude oil and natural gas. The construction industry, on the other hand, is expected to expand somewhat.

## 8.4. Demand for labour by education

Figure 8:3 shows historical and projected employment, aggregated across all industries in the economy for each of the five educational groups in percent of total employment. Statistics Norway has supplied us with data consistent with the present national account figures for the period 2000-07. In the figure we have linked these numbers with the data used in Bjørnstad and Skjerpen (2006). Bjørnstad and Skjerpen used an older version of Modag, but had the same disaggregated labour market as in the version used here. In their analyses Bjørnstad and Skjerpen used provisional figures provided by the unit for national accounts at Statistics Norway, and they relied on their own imputations in the cases where data were not available to obtain figures for the period 1972-97. They then used Modag together with ordinary national account figures to generate data on employment and wages by education for 1998-2000. Data in the larger groups are linked by adding the absolute differences between these two data sets in 2000 also in the period 1972-99. Data in the smaller groups are linked by adding the relative differences.

The number of employed persons with unknown education grew from about 40 000 in 2000 to 180 000 in 2007. The growth was particularly high in 2006 and 2007 and reflects the considerable labour immigration into Norway from central east European and Baltic countries. These immigrants have largely not been registered with an education at the register of the population's highest level of education. In the estimated labour demand equations in Modag, those with unknown education were included with primary and lower secondary education. Therefore, we have chosen to do the same in our projections. In the figure, we show employment numbers for this group both with and without workers with unknown education, but only during the period 2000-07.

According to our projections past trends of increasing employment for skilled labour will continue. Analogously, demand for less-educated workers will decline. Hence, we assume that the relatively flat development in the employment of

primary- and secondary-educated workers will shift in the years ahead. We believe that the stable shares are due to specific problems regarding the registration of immigrants' education. Many new citizens have likely been registered with only primary education when they, in fact, might have had vocational training.

The educational upgrading continues in all sectors of the economy. While about 27% of the employed had a primary or lower secondary education in 2007, this share declines to 18% in 2030. Employees with an upper secondary vocational education increase in percentage points from 25 to 30 in the same period. This rise is particularly connected to the strong employment growth in the private services sector. As explained above, employees with an upper secondary vocational education are mostly regarded as skilled labour, and employees with an upper secondary general education are unskilled labour. Therefore, those with general programmes are expected to decline in numbers in the future, even though they have been increasing in number until 2000. The projections show that this group will decline from 19% of the total employment in 2007 to 13% in 2030. The decline is most evident in the private services sector. Hence, employment in this sector is reorienting towards those with a vocational education, in addition to those with generally higher education.

Modag does not contain any detailed information on employees' fields of education. Thus, we have created a submodel to disaggregate further. In this submodel, we match the NAV National Register of Employers and Employees with the Norwegian register of the population's highest level of education. The match gives us data on industry-specific employment by educational field back to 1986. By calculating education-specific employment shares and assuming a continuing trend in these shares in the private sectors, we are able to project industry-specific employment by field of education by multiplying the shares with the national account employment figures in each industry. In the public sector, we distributed employment into educational fields according to information from three other projection models at Statistics Norway which are designed for this. They are called Makko, Lærermod and Helsemod. Figures 8:4, 8:5 and 8:6 show the projected number of employees at national level by educational field at higher secondary level, lower tertiary level and higher tertiary level, respectively.

Figure 8:4 indicates growth in the employment of persons with vocational education at higher secondary level. The demand for persons with specialisation in electronics, mechanics work and machinery and in other fields is predicted to show the strongest growth. For these fields, employment is projected to increase by nearly 65 000 persons from 2006 to 2030. In 2030, workers with an education in electronics, mechanical work and machinery may constitute the largest group

of vocational education at higher secondary level, with a share of nearly 30%. The demand for candidates with specialisation in electronics, mechanical work and machinery primarily originates from the service sector and the building and construction industry, while the demand for candidates specialising in other fields originates from public sector and private service sector. Further, the employment of persons with specialisation in both nursing and caregiving and building and construction clearly increases throughout the prediction period.

Figure 8:3    **Employment by level of education as a percentage of total employment, 1986-2030**
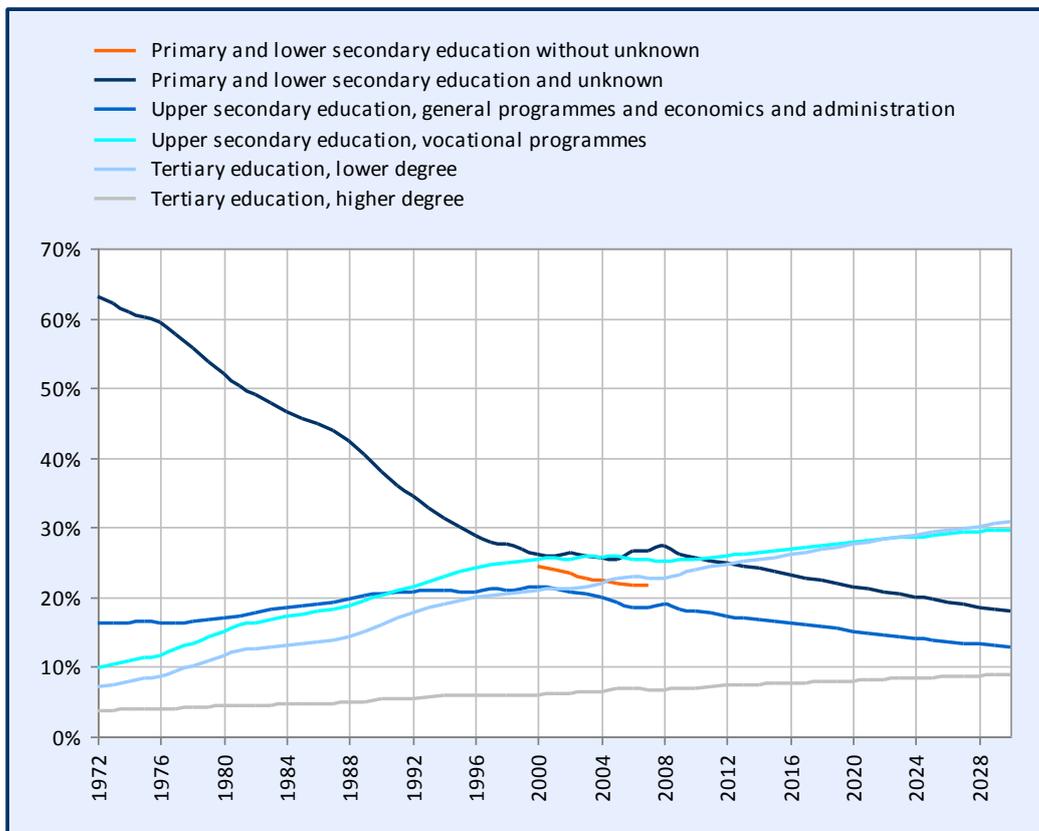


*Source*:    Statistics Norway.

The employment of individuals with general education programmes and economic and administrative education at higher secondary level is, on the other hand, predicted to fall of the order of 45 000 and 30 000, respectively, during the projection period. Accordingly, the employment shares of individuals with general education programmes of a higher secondary level are projected to fall from 12% of total employment in 2006 to about 8% in 2030. For candidates in economics and administration at higher secondary level, the employment share falls from

nearly 8% in 2006 to a little more than 5% in 2030. This development is connected with vocational training being regarded as specialised labour in some of the large private services industries, while general education programmes and economic and administrative education at this level are mainly regarded as unskilled in the labour market.

Figure 8:4    **Employment by education at upper secondary school level, 1 000 persons**
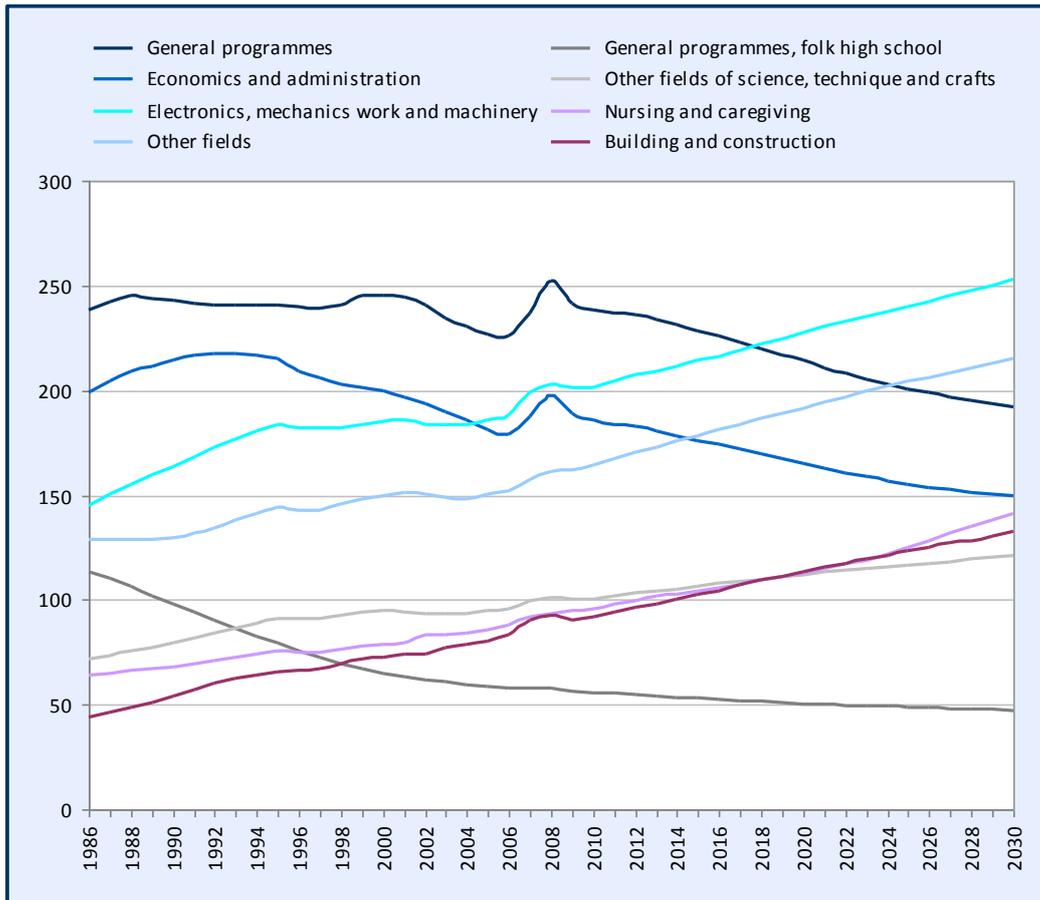


*Source*:    Statistics Norway.

Figure 8:5 shows the development in demand for labour among the fields at lower tertiary level.

The figure indicates employment growth within all fields, particularly for candidates specialising in economics and administration. By 2030, the employment of individuals with this qualification is expected to expand by almost 100 000 persons, making this occupational group the largest at the lower tertiary level. More than one in five individuals holding a lower degree at tertiary level is specialised in economics and administration in this year. The demand for this type of skilled labour may especially grow in the service industry, but the banking

and insurance industry, public sector and the manufacturing industry all demand a large share of the candidates in economics and administration.

Figure 8:5 **Employment by education at tertiary level with a lower degree, 1 000 persons**
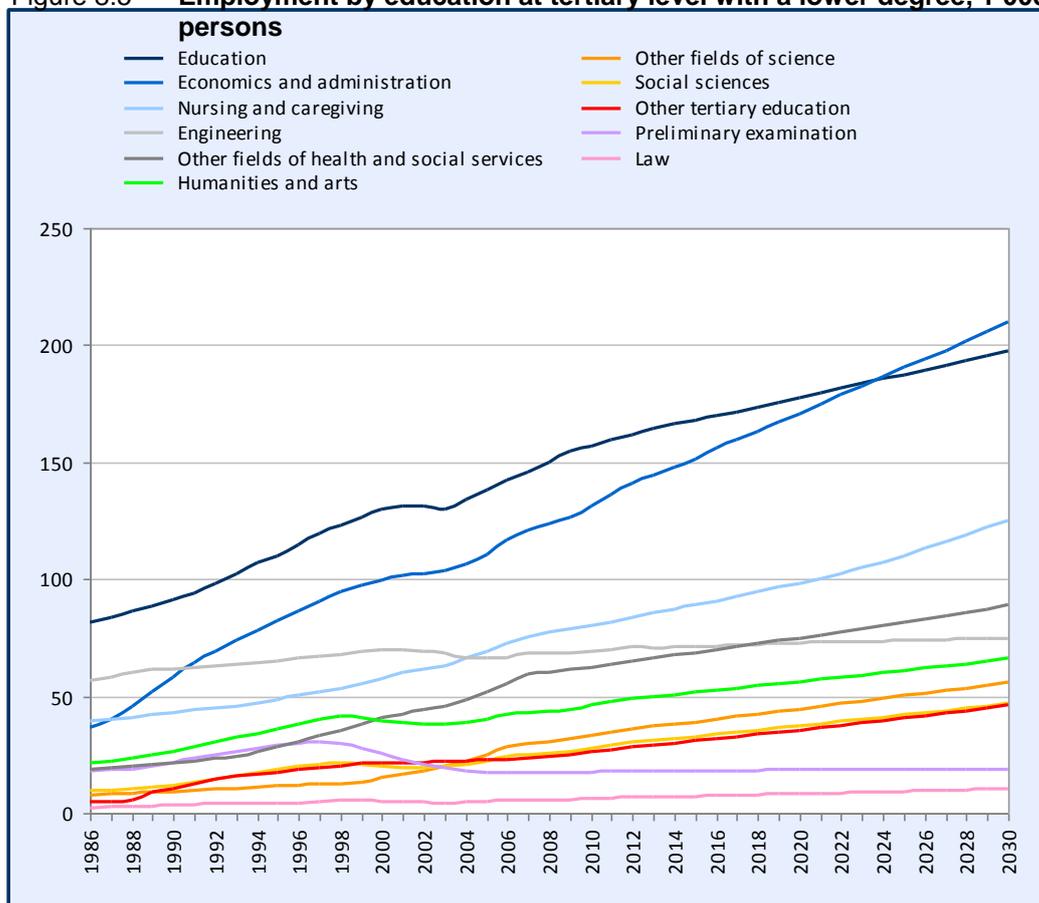


*Source*: Statistics Norway.

There is also a strong increase in demand for teachers and health personnel from the public sector. Moreover, the service sector employs many teachers, and this development is assumed to continue. The employment of persons specialising in education is projected to increase by about 55 000, while the employment of persons specialising in other fields of health and social services and in nursing and caregiving is projected to increase by about 85 000 in total. In addition, the demand for skilled labour specialising in science (excluding engineering) is projected to expand by nearly 30 000 people, increasing its share of total employment of candidates with a lower tertiary education from 5% in 2006 to 6% in 2030. This demand increase mostly stems from the service industry. Employment of candidates with specialisation in humanities and the arts is also

predicted to increase by about 25 000 from 2006 to 2030. The demand increase for this occupational group also primarily stems from the service sector.

Moving on to the employment of persons at the highest educational level, Figure 8:6 shows the development in each educational field. Demand increases markedly within most fields at this level. The growth is most pronounced among individuals specialising in other fields of science, with an employment increase of nearly 20 000 persons. There is also a strong demand for graduate engineers. Counting these two fields together, it may be necessary that 35% of the employees at tertiary level in 2030 hold a degree in science and engineering; in addition, the service sector clearly has the most demand for these skills. In the oil and gas industry, which employs a considerable share of the graduate engineers, the demand for engineers is assumed to fall. This decrease is connected to the production decrease we anticipate in this industry. The growth in the employment of candidates with specialisation in economics and administration has been pronounced in the observation period 1986-2006. We also expect a marked increase for this type of skilled labour in the projection period, mostly stemming from the service sector. From a share of 6% of employees with a higher degree at tertiary level, employment of persons specialising in economics and administration increases to about 10% in 2030. The employment growth of teachers, on the other hand, is predicted to be relatively modest in the following years, while the employment of dentists is expected to stay constant.

## 8.5.   Comparing labour supply with labour demand

To compare labour supply with labour demand, supply is projected by using the dynamic microsimulation model Mosart based on constant educational propensities and labour-market participation rates. Mosart is a dynamic microsimulation model used for projections of demographic development, supply of labour and pension expenditures in Norway, and it is described by Fredriksen (1998). In the past decade, the model has been extensively used in the analyses of effects of the reform of the Norwegian pension system.

From a representative sample of the population in a base year, the model simulates the further life course for each person in this initial population. The life course is simulated by possible transitions from one state to another given by transition probabilities depending on each individual's characteristics. The transition probabilities are estimated from observed transitions in a recent period and are calibrated to match aggregated statistics. Normally, the transition probabilities are kept constant, and the projections then show what will happen if everything continues as recently observed. Alternative scenarios based on

different assumptions may be produced. These alternative scenarios then show the robustness of the reference scenario (sensitivity analyses) and/or consequences of alternative policies.

Figure 8:6    **Employment by education at tertiary level with higher degree, 1 000 persons**
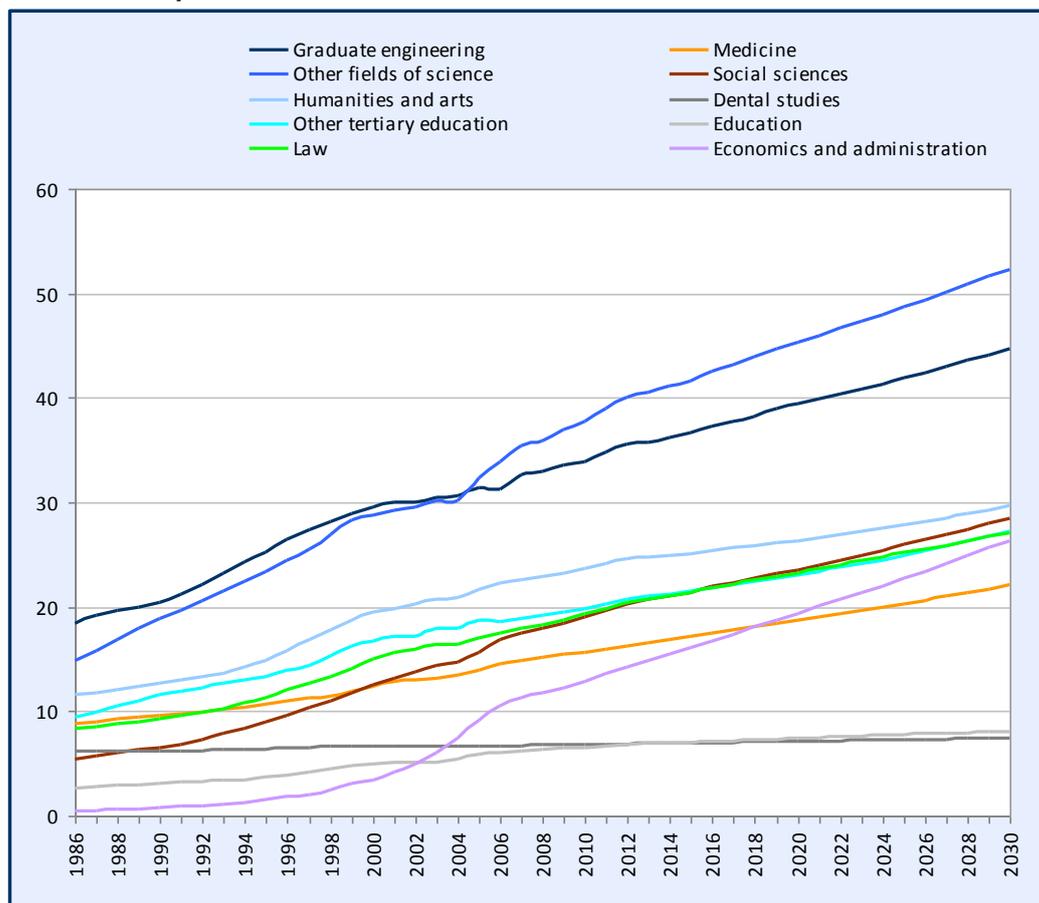


*Source*:   Statistics Norway.

Events included in the simulation are migration, deaths, births, marriages, divorces, educational activities, labour force participation and retirement. Education is included in the model for two reasons. First, at Statistics Norway, there is a long tradition of projecting the number of persons and supply of labour by education, and Mosart has been used for these projections since the beginning of the 1990s. Second, education serves as an important explanatory factor for different kinds of behaviour in the simulation, especially because education may capture the effects from different events during the life course, as well as from fixed characteristics.

Because few persons start and complete a new education after the age of 30 (or even younger), a different level of education among the younger and older workers is one of the main driving forces in the model. With a dynamic microsimulation model, it is also possible to consider that the age for entering the labour market may range between the age of 18 and 30, and some educational activities may take place between the age of 30 and 40. Education seems to be very important for labour-market participation and the age of retirement.

Projections of the population by education as a basis for corresponding projections of labour supply in this paper are based on a representative sample for the Norwegian population that is mainly calibrated to the situation in 2008. Because of the fluctuating propensities to enter education over the business cycle, an average for the years 2004-08 is used. The demographic assumptions are based on Statistics Norway's demographic projections from June 2009. A total fertility rate of 1.9 and net immigration decreasing from about 40 000 persons per year at present to about 20 000 persons per year after 2040 suggest that the size of the younger and middle-aged cohorts stabilises towards 2050.

The results of the projections for the number of persons aged 16 to 74 by level of education are presented in Figure 8:7. A declining trend in the share of persons with primary and lower secondary education from the past decades continues, but to a weaker degree. While 54% of the population in the age range 16 to 74 had this level of education in 1993, the share had fallen to 35% in 2008 and is projected to decrease further to 20% in 2030.

However, the share of persons with higher secondary education increased from 24% in 1993 to 33% in 2008. Due to a rising share of persons completing tertiary education, further growth slows, and the share is projected to reach 37% in 2030. Due to the large expansion of capacity in tertiary education during the 1990s, the number of individuals with this level of education has shown increasing growth since 2000. In 2030, the share of individuals with a lower degree tertiary education aged 16-74 may reach 24%, while the corresponding share of persons with higher tertiary education then may reach 7%.

The level of education for immigrants to Norway is only weakly recorded in Norwegian administrative registers. In a situation where immigration has increased significantly in the past years and is expected to stay at a higher level in the years to come relative to the situation before 2005, the projections with Mosart show a significant increase in the number of individuals with unknown education levels.

Because the labour supply projections from Modag in Section 8:4 are determined from the demand side (with stable unemployment), a comparison with the corresponding labour supply projections from Mosart is an implicit analysis of

125

potential mismatches in the future labour market. To make this comparison we must aggregate the groups identically. While the large and growing group of mainly immigrants is classified with unknown education according to Mosart, those with an unknown education are included among those with primary and lower secondary education in Modag. The two groups with upper secondary education in Modag are further aggregated to correspond with the figures from Mosart. In addition, we adjust the level of labour supply by education in Mosart to the observed level in the base year of Modag (2008) to ensure an identical starting point. Deviations between the two labour supply projections indicate that educational propensities (and capacity if necessary) and/or participation rates need to change to secure a balanced labour market in the future.

Figure 8:7      **Population by level of education by 1 000 persons**
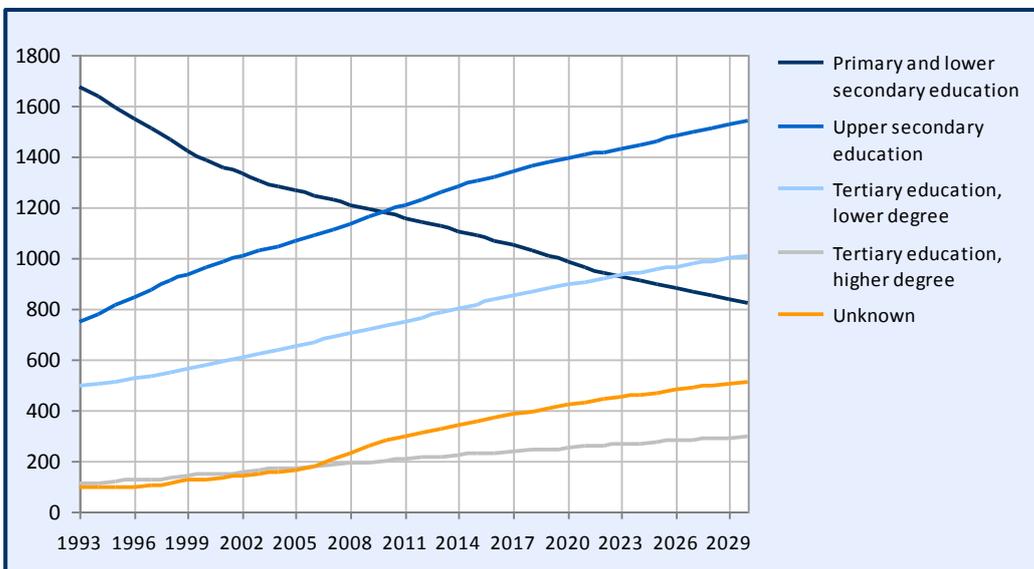


*Source:*   Statistics Norway.

The results are presented in Figure 8:8. The projections show a more rapid increase in demand for labour with a lower degree of tertiary education than the corresponding increase in supply. This means that it could be beneficial to increase capacity in higher education somewhat to meet the excess demand. For higher degree of tertiary education, supply and demand seem to grow more balanced. Also, the projections show a smaller growth in demand for workers with upper secondary education compared to supply, and the decrease in demand for primary educated workers is more pronounced compared to supply. Hence, to avoid future mismatches in the Norwegian labour market, the projections show a need for a more rapid educational upgrade compared to what follows from constant education propensities and participation rates.

Figure 8:8    **Labour supply by education from Modag compared to adjusted labour supply from Mosart**
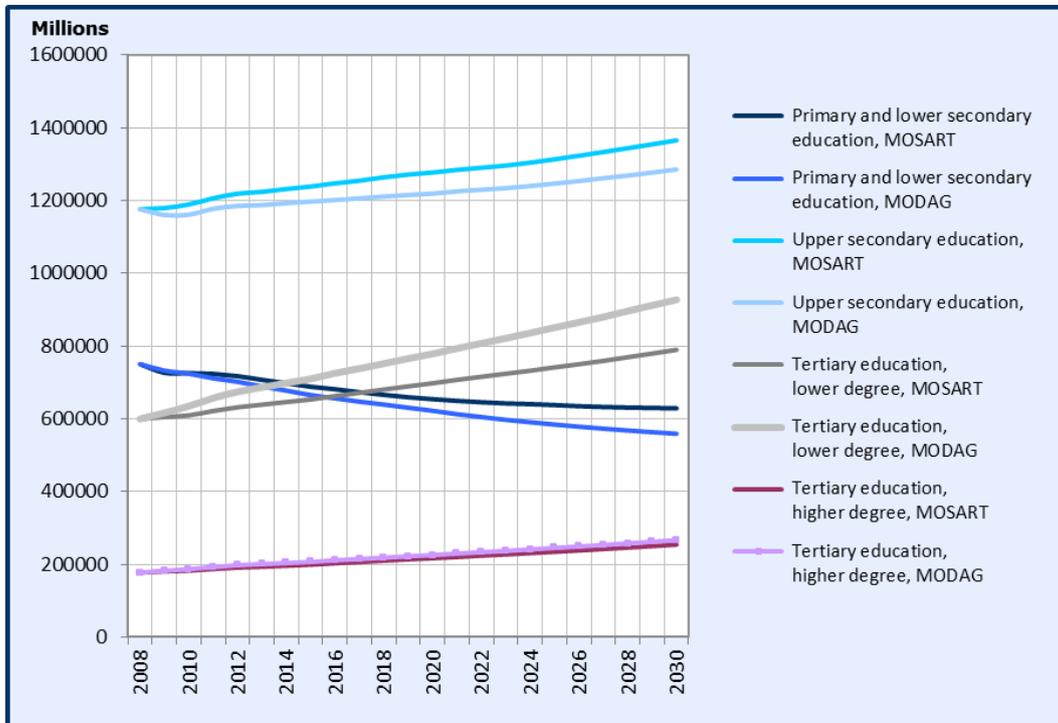


*Source:*    Statistics Norway.

## 8.6.    Concluding remarks

Statistics Norway's projections on future demand and supply of labour by education is an ongoing project. The models are continuously modified and further developed, and new data are considered. The projections are uncertain, because projection period is long and they are based on assumptions that might be discussed. Therefore, the results must be used with caution.

Nevertheless, judged by the response, it seems to be important that such quantitative projections are made. Compared to similar projections in other countries, the models used in the projections in this chapter are well developed for the purpose. To our knowledge, no other projections are made using a macroeconomic model with heterogeneous labour, where relative labour demand depends on relative wages and where relative wages depends on mismatches in the labour market. Possibilities for mismatch are also studied by comparing implied labour supply projections at steady unemployment, with labour supply

projections according to a dynamic microsimulation model assuming constant education propensities and participation rates.

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CHAPTER 9.

# Methods and results of skills demand and supply forecasting — The case of Germany

*Tobias Maier*

In June 2010 detailed results of two new forecasts of the future occupational and qualification structure in Germany were published. One is the (European) Cedefop forecast of *Skills supply and demand in Europe*, and the other the (German) QUBE project on *Occupations and qualifications in the future*. This article gives an introduction to the methods of the QUBE project ([42]) carried out by the Federal Institute for Vocational Education and Training (BIBB) and the Institute for Employment Research (IAB) with the Fraunhofer Institute for Applied Information Technology (FIT) and the Institute of Economic Structures Research (GWS), and compares the QUBE results with those of the Cedefop forecast.

The QUBE project contrasts labour force supply and demand projections for occupational fields by considering occupational mobility. Even though the taxonomy and methods of the QUBE project differ from those of the Cedefop forecasts, both projections rely on similar databases and forecast similar trends for skills demand and supply development in Germany ([43]).

## 9.1. Introduction to the methods of BIBB-IAB qualification and occupational field projections ([44])

To identify potential future problem areas in qualification levels and occupations, demand and supply forecasts in the BIBB-IAB projections are based on the same

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([42]) Information on the project is available at: www.qube-projekt.de (in German only).

([43]) The BIBB-IAB Qualification and occupational field projections (Helmrich and Zika, 2010) from the QUBE project are coordinated projections of supply and demand in the German labour market up to the year 2025 with the objective of identifying potential future problem areas in qualification levels and occupations. Therefore, the projections on the demand side as well as on the supply side are based on the same data and taxonomy. By considering the occupational flexibility of the labour force, the QUBE consortium is able to contrast demand with supply. However, this kind of balancing has to be assessed cautiously as demand and supply projections do not interact with each other at the current state of the methodology.

([44]) The section is mainly an extract from Helmirch et al. (2010). More detailed information about the methodology of the model set-up can be found at http://www.bibb.de/dokumente/pdf/BIBB-IAB_Qualification_and_Major_Occupational_ Field_Projections.pdf.

data and taxonomy. The data basis as well as the taxonomy will be described in the following. Thereafter, the methods of demand and supply forecasts of the model set-up will be explained.

### 9.1.1. Data basis and taxonomy

Structural information about age, gender and education of the economically active population and persons in employment by occupation and industrial sector has been obtained from several years' microcensus surveys ([45]). For the survey year 2005, it was even possible to reconstruct the 'initial vocational qualification' of the workforce by coding the specialisation of the labour force during their education into an occupational classification. As the microcensus results tend to underestimate the size of the workforce compared to the German system of national accounts (Köhne-Finster and Lingnau, 2008), a structurally neutral upward adjustment of the microcensus figures to the national accounts level was undertaken for the projections.

On the level of occupations, the classifications of BIBB occupational fields (Tiemann et al., 2008) were applied to both the demand and the supply side. These consist of 54 occupational fields which are grouped at the level of the occupational categories (three-digit codes) from the official German classification of occupations 1992 (KldB 92) on the basis of comparable job characteristics and branch dominance. Thus, in contrast to the KldB 92 occupational classification scheme, they show greater intrahomogeneity and, at the same time, greater interheterogeneity in their main focus of activity. Mainly for presentational but also for methodological ([46]) reasons, initially results are only reported on the level of the 12 major occupational fields (MOF), which are similarly based on the BIBB occupational fields (Bott et al., 2010).

On the level of qualifications, the population was differentiated into four skill levels (as measured by highest formal qualification) following the ISCED classification framework, namely:

(a)  people with no vocational qualification (ISCED 1, 2, 3a);
(b)  people with a skilled initial vocational qualification (ISCED 3b, 4);

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([45]) The microcensus provides official representative statistics of the population and the labour market in Germany. A description of the microcensus in English is available at the URL of the German Federal Statistical Office:
http://www.destatis.de/jetspeed/portal/cms/Sites/destatis/Internet/EN/press/abisz/Mikrozensus__e,templateId=renderPrint.psml.

([46]) The sample size for some occupational fields is small, especially if persons in employment are disaggregated by education and/or age and gender.

(c)  people with a master craftsman, technical engineer or a trade and technical
school qualification (ISCED 5b);

(d)  people with an academic degree (ISCED 5a, 6).

The major difference compared with international forecasts or forecasts in
other countries is the distinction between ISCED 3a and 3b (Cedefop, 2010,
p. 109-110), where people with ISCED 3a are assigned to the category 'with no
completed vocational education and training (VET)'. But there is one main reason
for this: even though it might be obvious that people in ISCED 3a have, for
example, higher cognitive competences than people at ISCED 0-2, they do still
not have a vocational specialisation; yet the main focus of the QUBE project is to
identify possible future mismatches on the occupational level. It is therefore
necessary to assign people with ISCED 3a together with ISCED 0-2 into the
category 'no completed VET ([47]).

To make the available structural information for demand and supply
forecasting in Germany clearer, Table 9:1 shows a breakdown of the German
population according to relevance for the labour market. All fields marked light
blue reflect the essential information for the supply forecast: economically active
and inactive population by age, gender, skill level and VET within 12 MOF. The
necessary information for the demand forecast is marked dark blue: persons in
employment within 59 economic sectors and 12 MOF. The distribution of the
labour force from education into employment within 12 MOF is represented by an
occupational flexibility matrix (marked grey). For the forecasting period, the
amount of potential unemployed persons can be derived by simple definition:
labour force minus persons in employment.

### 9.1.2.  Forecasting demand

The demand projection is based upon actual figures for the years from 1996 to
2006 and projects the realised demand (persons in employment) up to 2025 for
59 industrial sectors and 54 occupational fields. Within each occupational field all
persons in employment are disaggregated into four skill levels (highest formal
qualification). The starting point for the demand projection is the workforce
demand projection up to 2025, which was compiled using the IAB/Inforge model

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[47]  ISCED 3a ones are designed to provide direct access to ISCED 5A. They do not
provide a vocational specialisation in comparison to ISCED 3b programmes (ISCED
3c programmes are rare in Germany). The skill classification framework applied in
the projections is therefore not fully comparable with the usual low-, medium- and
highly-skilled classification. Instead, it differentiates between people with 'no
completed VET' (1, 2, 3a), people with a 'completed VET' (ISCED 3b, 4), with a
'higher VET' (ISCED 5b) and people with an 'academic degree' (ISCED 5a, 6).

(Hummel et al., 2010; Meyer et al., 2007) and disaggregated by 59 economic sectors, on the basis of model calculations with the IAB/Inforge model. This is a macro econometric input/output model, constructed on the bottom-up principle and differentiated according to 59 industrial sectors, 59 product groups and 43 types of use. Foreign trade is incorporated endogenously since the model is an integral element of the Ginfors global model (50 countries, 26 product groups) developed by GWS mbH (Meyer and Lutz, 2007). In the labour market, the labour supply and the potential labour force is exogenous. Labour demand is modelled endogenously on an hourly basis, i.e. the volume of labour necessary for production is determined first, and only then converted to a *per capita* figure.

Table 9:1    **Structural information for demand and supply forecasting**

| Supply by age cohorts and gender | Persons aged under 16 (pre-school, general schooling) | Qualification (four skill levels) and VET | VET within 12 MOF (ISCED 3b-6) | | Demand within 59 economic sectors | | | | | | | | | | | | Unemployed | By definition: (labour force) - (persons in employment) | Economically inactive | Following retirement, aged over 65 (some still part of the workforce) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Persons aged over 15 in employment within 12 MOF, disaggregated by 4 skill levels | | | | | | | | | | | | | | | |
| | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | | |
| | | | | 1 | | | | | | | | | | | | | | | | |
| | | | | 2 | | | | | | | | | | | | | | | | |
| | | | | 3 | | | | | | | | | | | | | | | | |
| | | | | 4 | | | | | | | | | | | | | | | | |
| | | | | 5 | | | | | | | | | | | | | | | | |
| | | | | 6 | | | | | | | | | | | | | | | | |
| | | | | 7 | | | | | | | | | | | | | | | | |
| | | | | 8 | | | | | | | | | | | | | | | | |
| | | | | 9 | | Occupational flexibility matrix | | | | | | | | | | | | | | |
| | | | | 10 | | | | | | | | | | | | | | | | |
| | | | | 11 | | | | | | | | | | | | | | | | |
| | | | | 12 | | | | | | | | | | | | | | | | |
| | | | No VET (ISCED 0-3a) | | | | | | | | | | | | | | | | | |
| | | | (Still) in training | | | | | | | | | | | | | | | | | |
| ~ 11.5 million | | | | | ~36.1 million | | | | | | | | | | | | ~ 4.6 million | | ~ 12.4 million | ~ 15.9 million |

> > > > > > > > > > > > > > > > > > age cohorts and status > > > > > > > > > > > > > > > > > > > > >

*Source*:    Microcensus 2005 of the German Federal Statistical Office; own illustration.

### 9.1.3.    **Forecasting supply**

The labour supply projection was calculated with two independent models with the aim of model plurality, both of which, like the demand projection, were based on the same classification schemes and data generation runs. These consist of the BIBB-Demos model from GWS, which has certain points of overlap with the

IAB-Inforge model and the BIBB-FIT model, an established model from FIT, already in use for the well-known forecasts by the Bund-Länder Commission for educational planning and research promotion (BLK, 2001). In addition to the information on educational participation and participation in employment from microcensus data, the absolute change and relative fluctuation of age cohorts, in which women and men are shown separately, are derived from the 12th coordinated population projection ([48]) by the German Federal Statistical Office. Both models allow for the adjustment of the new standard pension age from 65 to 67 but still consider active members of the workforce over this age.

The BIBB-Demos model (Drosdowski et al., 2010) determines the labour supply, considering several interconnected processes. The demographic trend determines the distribution across age-cohorts and gender as well as the size of the potential labour force, namely the number of people aged over 14. Connected to this is the qualification process (four skill levels), which is notable for a rising level of qualification, particularly among women, and which also determines the length of time taken for education. The decision to participate in the workforce is not only age- and gender-specific but also dependent on the formal qualifications achieved. Workforce participation is also subject to changes over time. Based on this information, the choice of an educational specification, an initial vocational training occupation within the determined 54 occupational fields, is made. It is ultimately the outcome of a gender-, qualification- and age-specific distribution.

The BIBB-FIT projection is based on several transition models in which, taking a baseline population as a starting point, future stocks of labour force are modelled by means of entries and exits. The chosen approach thus relies on three basic elements: a population projection, a transition model of the education and training system to quantify the new labour force supply, and an analysis of workforce participation to determine the remainder.

The projection of the new labour force supply from the VET system in terms of four skill levels and 54 occupational fields is based on modelling the VET system including higher education establishments in a way that reflects the numbers enrolled at the individual training establishments as well as the transitions to and from the individual educational establishments and the labour market. This model builds largely on concepts and results from the IAB system of educational accounting (*Bildungsgesamtrechnung*; Reinberg and Hummel, 2002) as well as on the benchmarks of the projection of school pupils and leavers by the Standing Conference of the Ministers for Education and Cultural Affairs of the

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([48]) Both models rely on variant 1-W1 with a net migration flow of +100 000 persons every year.

Länder (*Kultusministerkonferenz*, KMK) and of the KMK projection of university entrants from the year 2009 (KMK, 2009).

The future new labour force supply from the education system and migration is, however, only one of the factors that influence the future qualification structure. It will also increasingly be determined by those who exit from employment. Here, in particular, the assumptions made about future qualification-, age- and gender-specific workforce participation also come to bear. The rapid expansion in workforce participation in past years is extrapolated only moderately in the projection. To differentiate between occupations, classification of both the existing labour force and the new labour force supply according to occupational field was undertaken and extrapolated for the projection period.

### 9.1.4.   Bringing demand and supply together

The microcensus sample 2005 was the first year of the microcensus surveys that allowed the reconstruction of an initial vocational qualification of the labour force by coding the specialisation of persons during their education into the occupational classification scheme KldB 92. Using this information, it was possible to compute shares of people who worked within the MOF they originally trained in — the stayers —  and shares of people who moved away from their initial occupation into another MOF — the movers. This occupational mobility is reflected by an occupational flexibility matrix (see Table 9:1 grey area and Table 9:4) which helps to contrast demand and supply projections. The occupational flexibilities are assumed to be stable for the whole forecasting period ([49]) for four skill levels and three age cohorts (15 to 34, 35 to 49 and 50+; see also Maier et al., 2010). Hence, future participants of the labour force are distributed into the 12 MOF according to their education-specific (initial vocational qualification), skill-specific (highest formal qualification) and age-specific occupational flexibility. The results of the projections are described in the following section.

## 9.2.    Results of the QUBE project

The overall results of the demand and supply forecast can be seen in Table 9:2. Whereas the demand for labour is slightly rising from 2010 until 2020 before it goes down slowly, both supply projections forecast a strong decrease of labour

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([49])  This may seem rather unrealistic in view of changing demand for and supply of skills in the future, but as no long-range information on occupational mobility (from initial vocational qualification) is available for Germany, this is the only possible and most pragmatic approach at the moment.

supply from 2009. A theoretical labour shortage will either occur in 2023 (BIBB-FIT model) or right after the end of the projection period (BIBB-Demos model).

Table 9:2      **Demand and supply of labour (in millions)**

|  | **2005** | **2010** | **2015** | **2020** | **2025** |
|---|---|---|---|---|---|
| Persons in employment (IAB-Inforge) | 38.9 | 39.8 | 40.2 | 40.2 | 39.7 |
| Labour force (15+) BIBB-FIT | 43.3 | 43.2 | 42.5 | 41.2 | 39.3 |
| Labour force (15+) BIBB-Demos | 43.3 | 43.7 | 43.3 | 42.3 | 40.4 |

*Source*:   Helmrich and Zika (2010, p. 19); own illustration.

The demand and supply forecast do not interact with each other. Thus, for example, a shortage of economically active persons has no effect on the persons in employment. This is rather unrealistic as either the demand or supply side is bound to cause reactions on the other side. However, as the necessary adaptive reactions could not yet be quantified, the results may seem 'unrealistic', in total and in some labour market segments toward the end of the forecasting period. Nevertheless, such results can be useful as they help to identify future problem areas if the development of labour supply and demand continues as in the past.

### 9.2.1.      Results on the skills level

Results on the level of skills are presented in Table 9:3. To make the results more comparable to the results of the Cedefop forecast, ISCED 5b and ISCD 5a and 6 are grouped together into one category 'tertiary sector'. Here, the major differences of the supply projections come to bear. Whereas BIBB-Demos extrapolates a long-term qualification trend and, therefore, only a slight increase in persons at ISCED 5 and 6, BIBB-FIT puts a stronger focus on recent developments in the German educational system. The shortened duration of schooling at university-track secondary schools and the resulting double cohorts of school leavers entitled to higher education are reflected in a rising supply of academically qualified new entrants to the workforce, if a constant ratio of university entrants is maintained. Compared to new entrants into the labour force, persons leaving the workforce have a higher share of completed VET (ISCED 3b and 4). In consequence, the supply of persons with ISCED 3b and 4 will diminish in contrast to persons with ISCED 5 and 6.

If the status quo persists, people without completed VET will continue to be affected by high underemployment. For the medium-skilled, the results indicate that there will be a future shortage of labour occurring either between 2015 and 2020 (BIBB-FIT) or towards the end of the projection period (BIBB-Demos). The results do not indicate whether there will be a skill upgrade in the demand of certain jobs or whether the highly-skilled will be employed inadequately if they try

to fill the medium-skilled gap. The status quo forecasts only tell us that there will be either an extremely tight labour market for the highly-skilled (BIBB-Demos) or an oversupply (BIBB-FIT) if the demand for, and supply of, skills develop as in the past but independently from each other.

Table 9:3    **Results of qualification projections (in millions)**

|  | **2005** | **2010** | **2015** | **2020** | **2025** |
|---|---|---|---|---|---|
| **Persons in employment/job opportunities (IAB-Inforge)** | | | | | |
| ISCED 1, 2 and 3a | 5.9 | 5.7 | 5.6 | 5.5 | 5.3 |
| ISCED 3b and 4 | 20.6 | 21.3 | 21.5 | 21.6 | 21.3 |
| ISCED 5a, 5b and 6 | 10.0 | 10.2 | 10.4 | 10.4 | 10.3 |
| (Still) in training but working | 2.3 | 2.5 | 2.7 | 2.7 | 2.7 |
| In total | 38.9 | 39.8 | 40.2 | 40.2 | 39.7 |
| **Labour force (15+) BIBB-FIT** | | | | | |
| ISCED 1, 2 and 3a | 7.3 | 7.1 | 6.7 | 6.3 | 5.8 |
| ISCED 3b and 4 | 23.1 | 22.9 | 22.2 | 21.0 | 19.5 |
| ISCED 5a, 5b and 6 | 10.5 | 11.0 | 11.5 | 11.9 | 12.1 |
| (Still) in training but willing to work | 2.5 | 2.2 | 2.1 | 2.0 | 1.9 |
| In total | 43.3 | 43.2 | 42.5 | 41.2 | 39.3 |
| **Labour force (15+) BIBB-Demos** | | | | | |
| ISCED 1,2 and 3a | 7.3 | 7.3 | 7.1 | 6.9 | 6.6 |
| ISCED 3b and 4 | 23.1 | 23.4 | 23.2 | 22.5 | 21.5 |
| ISCED 5a, 5b and 6 | 10.5 | 10.7 | 10.9 | 10.8 | 10.5 |
| (Still) in training but willing to work | 2.5 | 2.3 | 2.1 | 2.0 | 1.9 |
| In total | 43.3 | 43.7 | 43.3 | 42.3 | 40.4 |

*Source*: Helmrich and Zika (2010, p. 21-26); own illustration.

### 9.2.2.    **Results of occupational field projections**

If we look at the demand for labour in the 12 defined MOF and we consider only persons with a completed educational specialisation for those 12 MOF, we can see that there was already a massive theoretical labour shortage at the beginning of the projection period in 'occupations involving the trading and sales of goods', 'occupations involving traffic, warehousing, transport, security, guarding', 'hotel, restaurant and cleaning occupations' and 'office, commercial service occupations' (see dark blue bars in Figure 9:1). Otherwise, there was also an excess of labour supply in 'processing, manufacturing and repair occupations' and 'technical scientific occupations'. This is possible because occupational flexibilities and persons without a completed VET qualification are not considered in Figure 9:1.

Figure 9:1    **Total demand in MOF and supply of trained persons (ISCED 3b-6)**
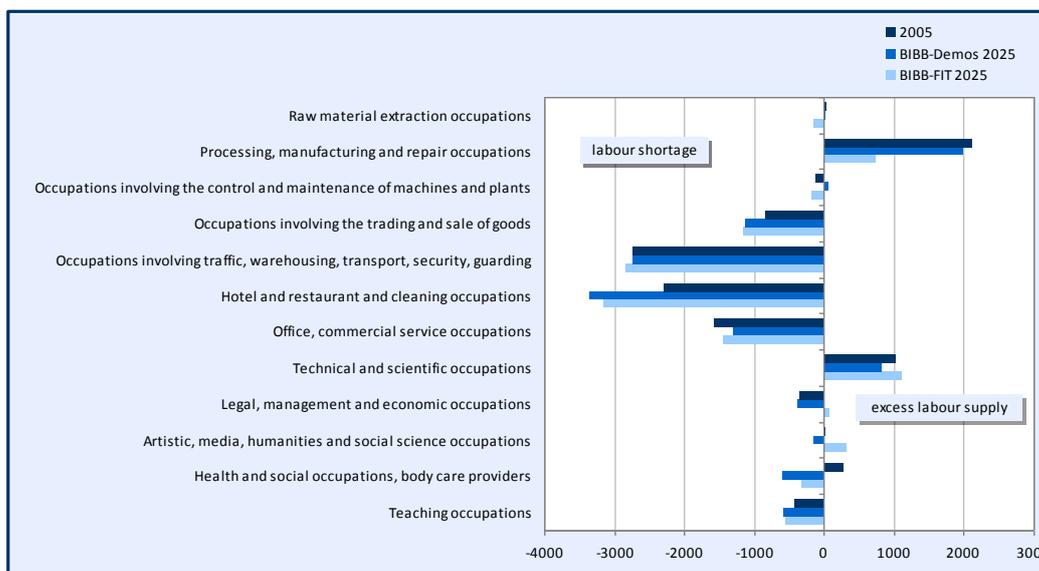


*Source*: BIBB-IAB qualification and occupational field projections, www.qube-projekt.de; own illustration.

The occupational flexibility matrix is an essential tool to compare the results on the demand and supply sides on the occupational level. The mobility matrix (Table 9:4) shows that persons with no completed VET ([50]) (ISCED 0-3a) mainly move into 'processing, manufacturing and repair occupations' (16.1%), 'occupations involving the trading and sales of goods' (11.3%), 'occupations involving traffic, warehousing, transport, security, guarding' (15.1%), 'hotel, restaurant and cleaning occupations' (25.5%) and 'office, commercial service occupations' (10.8%). Except for 'processing, manufacturing and repair occupations', persons with no completed VET mainly move into occupations where the demand could not be satisfied by medium- or highly-skilled persons (Figure 9:1). The great inflow of low-skilled workers into 'processing, manufacturing and repair occupations' goes hand in hand with a great outflow of 15.6% persons originally trained in this MOF into 'occupations involving traffic, warehousing, transport, security, guarding'. The gap between demand and supply in 2005 in 'occupations involving traffic, warehousing, transport, security, guarding', stated in Figure 9:1, was therefore filled by low-skilled persons and persons with vocational education in 'processing, manufacturing and repair occupations'. This also explains the excess labour supply in 'processing, manufacturing and repair occupations': more than half of persons originally trained within this MOF did not work in their MOF, but moved into other

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([50]) People in this category cannot be assigned to a skilled initial vocational qualification.

occupational fields instead. Likewise, in 'technical and scientific occupations', only 52% of the employed persons in 2005 with a technical and scientific background worked within the MOF of 'technical and scientific occupations'. However, the flexibility matrix does not contain information why those people left their trained occupation. Occupational mobility can occur for several reasons, for example unemployment in the occupation people have trained for, or better wages in other occupations (see Maier et al., 2010, p. 156 et seq.). The occupational flexibility matrix thus gives no explanation for the mobilities but makes it possible to show which kinds of opportunities are connected with vocational education in a certain occupation and where competition between occupations can occur.

Considering the occupational mobility processes as computed for the year 2005 the results of occupational projections in 2025 can be interpreted as follows (see Figure 9:2): there will be a possible shortage of labour occurring in 'occupations involving traffic, warehousing, transport, security, guarding', 'hotel, restaurant and cleaning occupations', 'legal, management and economic occupations', 'artistic, media, humanities and social science occupations' and 'health and social occupations, body care providers'. Tight labour market can occur in 'raw material extraction occupations', 'technical and scientific occupations' and 'teaching occupations'. The results have to be assessed with caution as they are not the outcome of an endogenous forecast of demand and supply. Nevertheless, additional information on mobility processes is helpful for a better understanding of the outcome.

Table 9:4 **Occupational mobility (in %)**

| Number of MOF | VET (ISCED 3b-6) in one of the following MOF | Proportional values for change from VET into MOF | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MOF 1 | MOF 2 | MOF 3 | MOF 4 | MOF 5 | MOF 6 | MOF 7 | MOF 8 | MOF 9 | MOF 10 | MOF 11 | MOF 12 | Σ MOF |
| 1 | Raw material extraction occupations | **49.5** | 8.6 | 3.0 | 6.3 | 12.8 | 6.1 | 5.1 | 2.6 | 2.1 | 0.7 | 2.3 | 0.9 | 100 |
| 2 | Processing, manufacturing and repair occupations | 1.9 | **46.3** | 7.8 | 6.2 | 15.6 | 5.7 | 4.2 | 7.4 | 2.0 | 0.9 | 1.5 | 0.5 | 100 |
| 3 | Occupations involving the control and maintenance of machines and plants | 1.3 | 14.0 | **44.3** | 5.2 | 11.9 | 4.7 | 4.4 | 7.8 | 2.0 | 2.4 | 1.7 | 0.4 | 100 |
| 4 | Occupations involving the trading and sale of goods | 0.8 | 2.9 | 1.2 | **50.4** | 6.2 | 9.5 | 19.8 | 1.3 | 3.4 | 1.1 | 3.1 | 0.4 | 100 |
| 5 | Occupations involving traffic, warehousing, transport, security, guarding | 1.1 | 6.1 | 2.0 | 4.3 | **65.3** | 3.8 | 11.5 | 2.2 | 1.4 | 0.5 | 1.3 | 0.5 | 100 |
| 6 | Hotel and restaurant and cleaning occupations | 3.1 | 5.0 | 2.6 | 9.7 | 8.2 | **56.4** | 7.3 | 1.1 | 1.8 | 0.5 | 3.7 | 0.7 | 100 |
| 7 | Office, commercial service occupations | 0.5 | 1.2 | 0.5 | 8.6 | 3.7 | 3.5 | **71.3** | 2.0 | 4.8 | 1.1 | 2.3 | 0.5 | 100 |
| 8 | Technical and scientific occupations | 0.7 | 8.9 | 3.3 | 5.0 | 4.1 | 2.3 | 8.0 | **52.0** | **7.3** | 3.2 | 1.7 | 3.5 | 100 |
| 9 | Legal, management and economic occupations | 0.2 | 0.8 | 0.2 | 7.3 | 2.3 | 1.5 | 26.0 | 4.2 | **49.3** | 4.1 | 1.4 | 2.7 | 100 |
| 10 | Artistic, media, humanities and social science occupations | 0.3 | 2.2 | 0.8 | 6.1 | 2.3 | 2.8 | 10.2 | 5.1 | 5.9 | **46.9** | 4.3 | 13.0 | 100 |
| 11 | Health and social occupations, body care providers | 0.4 | 2.1 | 0.4 | 3.9 | 1.7 | 4.0 | 6.3 | 0.8 | 1.1 | 0.9 | **74.6** | 3.7 | 100 |
| 12 | Teaching occupations | 0.3 | 1.2 | 0.3 | 1.9 | 1.5 | 2.1 | 4.3 | 1.2 | 1.3 | 2.2 | 4.5 | **79.3** | 100 |
| 0a | No completed VET (ISCED 0-3a) | 3.2 | 16.1 | 6.0 | 11.3 | 15.1 | 25.5 | 10.8 | 2.5 | 1.7 | 1.9 | 5.2 | 0.8 | 100 |
| 0b | (Still) at school/in training | 2.1 | 19.8 | 5.4 | 14.5 | 5.8 | 13.0 | 17.2 | 4.8 | 0.7 | 3.1 | 12.2 | 1.3 | 100 |
| In total (share on total employment) | | 2.4 | 13.8 | 5.0 | 11.0 | 9.2 | 10.3 | 17.4 | 8.5 | 4.6 | 3.0 | 11.1 | 3.7 | 100 |

NB: 7.3% of persons with vocational education in 'technical and scientific occupations' move into 'legal, management and economic occupations'.

*Source*: Microcensus 2005 of the German Federal Statistical Office; illustration: Maier et al. (2010, p. 170).

Projections are based on *per capita* data and assuming no adaption of work-time volume for the future, which could help to overcome the theoretical labour shortage in 'occupations involving traffic, warehousing, transport, security, guarding' and 'hotel, restaurant and cleaning occupations'. 'Legal, management and economic occupations' already profit from a great inflow from persons with a different educational background. Therefore, a labour shortage may be countered by a rise in occupational mobility in this occupation. Similar adaption processes may be plausible for 'artistic, media, humanities and social science occupations'. Labour shortage in 'health and social occupations, body care providers' has to be seen in a different light: due to the need for specific education within this MOF and the resulting restricted mobility into and out of these occupations, labour shortage may be avoided only by means of increased numbers of persons vocationally educated in 'health and social occupations, body care providers'.

Figure 9:2 **Demand and supply including occupational mobility (ISCED 0-6)**
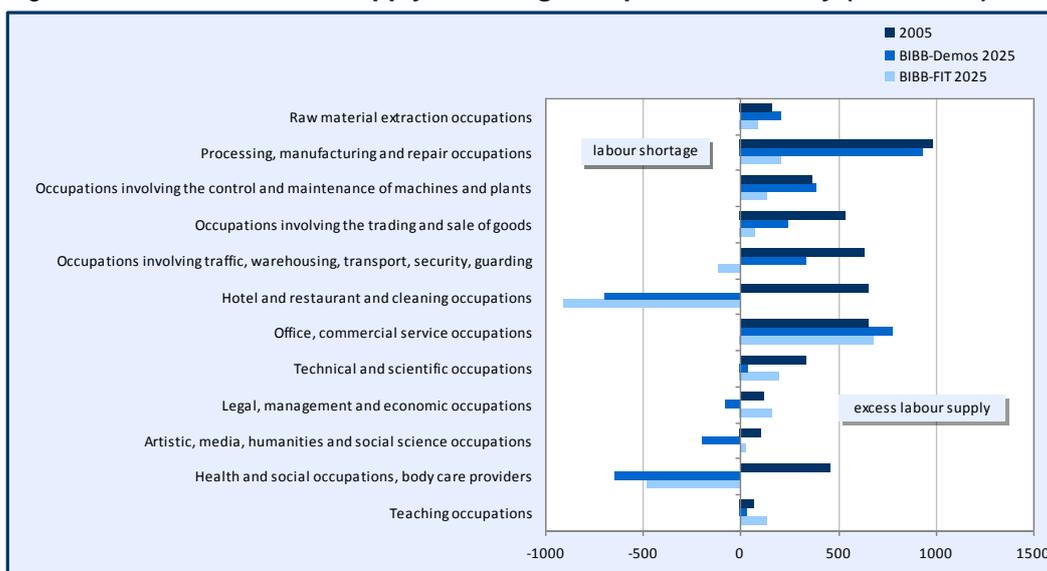


*Source*:  BIBB-IAB qualification and occupational field projections, www.qube-projekt.de; own illustration.

## 9.3. Differences and common trends between Cedefop and BIBB-IAB forecasts

BIBB-IAB qualification and occupational field projections rely on similar data sources as the Cedefop forecasts, namely demographic data, national accounts and the European labour force survey (cf. Cedefop, 2010, p. 24). Information on industries, education, occupation as well as age and gender in the Cedefop forecast are gained from the labour force survey  from Eurostat (Stehrer and

Ward, 2009). The German the labour force survey was carried out as part of the German microcensus (Eurostat, 2007, p. 8). Hence, structural information on occupational choice should be similar. Nevertheless, on the occupational level results cannot be compared as Cedefop uses the ISCO classification and the QUBE project relies on BIBB's occupational fields (Tiemann et al., 2008). Comparisons of the results for Germany therefore have to be drawn based on skill levels.

Table 9:5    **Comparison of results between BIBB-IAB and Cedefop forecasts: demand side**

| Persons in employment/total job openings (2010-20) | Levels (000s) | | | Change (000s) | | Change (%) | |
|---|---|---|---|---|---|---|---|
| | 2000 | 2010 | 2020 | 2000-10 | 2010-20 | 2000-10 | 2010-20 |
| **All qualification** | | | | | | | |
| Cedefop | 39 144 | 39 619 | 39 992 | 475 | 373 | 1.2 | 0.9 |
| IAB-Inforge | 39 144 | 39 788 | 40 230 | 644 | 442 | 1.6 | 1.1 |
| **High qualification** | | | | | | | |
| Cedefop (ISCED 5-6) | 9 928 | 10 330 | 11 116 | 402 | 786 | 4.0 | 7.6 |
| IAB-Inforge (ISCED 5-6) | 9 452 | 10 222 | 10 429 | 770 | 207 | 8.1 | 2.0 |
| **Medium qualification** | | | | | | | |
| Cedefop (ISCED 3-4) | 22 352 | 23 734 | 24 190 | 1 382 | 456 | 6.2 | 1.9 |
| IAB-Inforge (ISCED 3b, 4) | 19 815 | 21 290 | 21 596 | 1 475 | 306 | 7.4 | 1.4 |
| **Low qualification / no completed VET** | | | | | | | |
| Cedefop (ISCED 0-2) | 6 864 | 5 555 | 4 687 | -1 309 | -868 | -19.1 | -15.6 |
| IAB-Inforge (ISCED 0-3a) | 6 121 | 5 738 | 5 479 | -383 | -258 | -6.3 | -4.5 |

*Source*: Cedefop (2010, p. 100-101); Helmrich and Zika (2010, p. 21-26); own illustration.

Table 9:5 presents projected developments of persons in employment in total and by skill level (highest formal qualification). Considering the results for all qualifications it is striking that both forecasts point in the same direction and also project an almost similar trend. In the Cedefop forecast persons with medium qualification have ISCED 3-4, whereas the IAB-Inforge model only includes persons with ISCED 3b and 4 in this category. Hence, ISCED 3a is assigned to the 'no completed VET' category in the IAB-Inforge model and to the medium-skilled in the Cedefop forecasts. Thus, results on the medium and low qualification level are not fully comparable between the two forecasts. This might also be the reason why Cedefop forecasts predict a much more pronounced decrease in persons with a low qualification. The demand for highly-skilled labour, which should be comparable between the two approaches, is forecast to increase more sharply in the Cedefop projection.

With regard to the supply forecasts, the Cedefop forecast assumes in total around 2.3 million fewer persons in the labour force than there were in Germany in 2000. The reason for this can be that either the labour force survey data have not been adjusted to national accounts level like the microcensus in the BIBB-IAB forecasts, which is necessary because for some reason the microcensus tends to put the size of the workforce lower than the German system of national accounts; or persons still at school or in training but members of the workforce have not been included in the total. Looking at the figures in Table 9:3, it seems more plausible that persons still in training have been omitted from the chart in Cedefop (2010, p. 88-89), because the difference is more or less the number that is displayed for people still at school or training, but also members of the workforce in the QUBE project. To compare the projected development of both forecast approaches, it is therefore recommended to look at the percentages of change in Table 9:6 (in bold). On the results in total, the Cedefop forecast seems to be more optimistic about the decrease in the labour force, but in general, all three models projected similar trends. On the supply of highly-skilled persons, the Cedefop forecast is much closer to the BIBB-FIT model than to the BIBB-demos model. The developments of people with medium and low qualifications/'no completed VET' are, again, not fully comparable due to the difference in the category-assignment of ISCED 3a in each approach. This, again, could explain why the supply of low-skilled decreases much more sharply in the Cedefop forecast than in the BIBB-Demos or BIBB-FIT model.

## 9.4.    Conclusion and further development

This chapter introduced the methods of the BIBB-IAB qualification and occupational fields projection. Results of the QUBE project have been reported and a comparison with the results of the Cedefop forecasts has been given. The comparison showed that both forecasting approaches draw on similar data sources and that the results in total and on qualification level point in the same direction. International comparisons of Germany regarding skill specific developments are considered more reliable if they are consistent at national level. While similar developments on the qualification level in the QUBE project and in the Cedefop approach suggest that occupational developments in the BIBB-IAB forecasts could also be used for the national German results within the pan-European approach. This is possible because in the QUBE project, the qualification level is strongly connected with the choice of an occupation (Section 9:1). To promote an international comparison on the occupational level in the future, the QUBE project has set itself the goal of using the new German

classification of occupations 2010 (Wiebke et al., 2010) which is more consistent with the ISCO classification.

Table 9:6    **Comparison of results between BIBB-IAB and Cedefop forecast: supply side**

| Labour force (15+) 2000-20 | Levels (000s) | | | Change (000s) | | Change (%) | |
|---|---|---|---|---|---|---|---|
| | 2000 | 2010 | 2020 | 2000-10 | 2010-20 | 2000-10 | 2010-20 |
| **All qualification** | | | | | | | |
| Cedefop | 39 447 | 41 458 | 40 815 | 2 011 | -643 | **5.1** | **-1.6** |
| BIBB-Demos | 42 175 | 43 658 | 42 254 | 1 483 | -1 404 | **3.5** | **-3.2** |
| BIBB-FIT | 42 175 | 43 152 | 41 180 | 977 | -1 972 | **2.3** | **-4.6** |
| **High qualification** | | | | | | | |
| Cedefop (ISCED 5-6) | 9 663 | 10 287 | 10 960 | 624 | 673 | **6.5** | **6.5** |
| BIBB-Demos (ISCED 5-6) | 9 952 | 10 716 | 10 845 | 764 | 129 | **7.7** | **1.2** |
| BIBB-FIT (ISCED 5-6) | 9 952 | 10 981 | 11 879 | 1 029 | 898 | **10.3** | **8.2** |
| **Medium qualification** | | | | | | | |
| Cedefop (ISCED 3-4) | 22 531 | 24 786 | 24 716 | 2 255 | -70 | **10.0** | **-0.3** |
| BIBB-Demos (ISCED 3b, 4) | 21 784 | 23 390 | 22 549 | 1 606 | -841 | **7.4** | **-3.6** |
| BIBB-FIT (ISCED 3b, 4) | 21 784 | 22 926 | 21 032 | 1 141 | -1 894 | **5.2** | **-8.3** |
| **Low qualification / no completed VET** | | | | | | | |
| Cedefop (ISCED 0-2) | 7 253 | 6 384 | 5 139 | -869 | -1 245 | **-12.0** | **-19.5** |
| BIBB-Demos (ISCED 0-3a) | 6 681 | 7 258 | 6 873 | 577 | -384 | **8.6** | **-5.3** |
| BIBB-FIT (ISCED 0-3a) | 6 681 | 7 082 | 6 274 | 401 | -808 | **6.0** | **-11.4** |

*Source*:    Cedefop (2010, p. 88-89), Helmrich and Zika (2010, p. 21-26); own illustration.

The greatest challenge for further development of the QUBE project will be to implement endogenous balancing processes between demand and supply. This comprises to consider wages, volume of work and a dynamisation of the flexibility matrix, which plays a central role within the forecasting framework. Pan-European steps to manage the interaction and balancing process are therefore expected to improve exchange of ideas between both forecasting approaches.

## Abbreviations

| BIBB | Bundesinstituts für Berufsbildung [Federal Institute for Vocational Education and Training] |
|---|---|
| IAB | Institut für Arbeitsmarkt- und Berufsforschung [Institute for Employment Research] |
| FIT | Fraunhofer-Institut für Angewandte Informationstechnik [Fraunhofer Institute for Applied Information Technology] |
| GWS | Gesellschaft für wirtschaftliche Strukturforschung [Institute of Economic Structures Research] |
| MOF | major occupational fields |

| ISCED | International standard classification of education (1997) |
|-------|-----------------------------------------------------------|
| ISCO  | International standard classification of occupations      |

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CHAPTER 10.

# The FGB-LM model: structure and recent forecasts of the Italian labour-market stocks and flows

*Giuseppe Ciccarone and Massimiliano Tancioni*

This paper describes a microfunded econometric model recently developed by the Fondazione Giacomo Brodolini to produce good quality forecasts of labour-market stock and flows. Some results from a recent application of the model to Italian data are also presented and briefly discussed, focusing on the predicted evolution of the employment stock and of the hiring process in major disaggregation, such as cohorts, educational attainments and professional profiles. The presentation has the main scope to exemplify the potential uses of the model in the evaluation of future labour-market trends and in the simulation of policy options.

## 10.1.  Introduction

In this paper we present the main features of the econometric model developed by the Fondazione Giacomo Brodolini for the Italian labour market (FGB-LM), providing some results of a recent application. This model, which is tailor-made for the simulation and forecasting of the labour-market dynamics at high level of disaggregation, is composed of two main building blocks ([51]). A theory-based core, or pilot, new Keynesian dynamic stochastic general equilibrium (NK-DSGE) model ([52]) describes the evolution of the fundamental macro variables of the system. 'Satellite' blocks of equations, derived from empirical relations, define the breakdown of the employment stocks and flows by sector, region, age, occupation and qualification. The aim of this 'hybrid' model is to devise a formal structure with sound theoretical foundations and, at the same time, able to minimise estimation and forecast errors.

The 'pilot' model structure is thus derived from the solution of constrained maximisation problems by firms and workers under fully specified theoretical hypotheses regarding the market structure, the production technology and

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([51])  A more technical exposition of the FGB-LM model is in Giuli and Tancioni (2009).

([52])  For a technical description of the of NK-DSGE models see, e.g. Smets and Wouters (2003; 2007); Pagan (2003); Erceg et al. (2005); Del Negro et al. (2007); Coenen et al. (2007); Forni et al. (2007) and Christoffel et al. (2009).

individual preferences. The main distinctive feature of the model lies in the hypotheses describing the functioning of the labour market, which is modelled according to the Mortensen and Pissarides (1994) approach, which has recently been introduced into the NK-DSGE modelling apparatus (Blanchard and Galì, 2010; Riggi and Tancioni, 2010).

To improve the forecasting performances, the standard hypothesis of model-consistent expectations is replaced by that of data-consistent expectations, described by a VECM ([53]) structure in which only the cointegration space is identified according to the standard long-term theoretical prediction of balanced growth ([54]). The VECM is estimated and simulated before core model estimation, so as to take expectations as exogenous at the beginning of the forecast.

A further distinctive model feature is the use of estimated empirical relations for the different events of exit from the employment status, defining the aggregate separation rate. By specifying the exit rates as functions of both economic and institutional variables, the model is able to capture the main effects on employment produced by interventions on labour-market regulation and on the social security system.

The other main motivations underlying our modelling approach can be summarised as follows:

(a) lack of long-time series for particular variables and disaggregations (flow data) ([55]) does not make data-intensive methods, such as VARs, a viable option, whereas the possibility to calibrate some parameters in DSGE models allows us not to rely on particularly large samples;

(b) theoretical identification allows us to perform policy simulations, provides optimal policy-making design and improves policy communication transparency.

The model employs macroeconomic data from national and international official sources. In particular, separation and hiring rates (by age, profession, qualification) are obtained from the elementary data of the Italian National Statistical Institute. The model outputs are forecasts for all the model variables:

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([53]) Vector error correction model.

([54]) The joint data density, under the standard hypotheses of stationarity, linearity and normality, has a VAR (vector autoregression) representation and this ensures data consistency. Considering DSGE model stability properties (long-term balanced growth), a VECM ensures consistency among expectational variables and model properties.

([55]) For example, regional historical data are available only on a yearly basis and for a limited period.

macroeconomic aggregates, labour force and employment stocks and flows (separations and hiring) by age, sector, profession, and qualification.

The generalised method of moments is applied for the estimation of the 'pilot' model, whereas the blocks of equations defining the empirical relations are estimated using the FIML ([56]) or the SURE ([57]) estimators.

In Section 10.2 we describe the 'pilot' structure and the relations linking the national and regional levels, together with those defining the state transitions, i.e., labour-market entry and exit flows, and the relations defining the disaggregation represented in the model. Section 10.3 goes briefly into the procedures for estimation and econometric simulation of the model, providing reference to the data used and a concise overview of the information produced by the model. Section 10.4 presents the main model forecasts of the Italian labour-market variables. Section 10.5 concludes.

## 10.2. The model

### 10.2.1. The 'pilot' structure

NK-DSGE models with a Walrasian labour market display a lack of involuntary unemployment. Labour input fluctuations along the cycle are hence fluctuations in hours worked guided by variations in the marginal rates of substitution between work and leisure rather than fluctuations in the extensive margin (i.e. employment fluctuations *tout-court*). These models also face difficulties in replicating the observed comovements between the macroeconomic labour-market variables. The real wage exhibits low volatility, while it is the extensive margin that undergoes the major cyclic fluctuations. Finally, being the real marginal costs the variable driving inflation (which lies at the heart of the New Keynesian Phillips curve), these models lack of inflation persistence because real wages are instantly adjusted to clear the market, determining adjustments of inflation to its steady state value that are far more rapid than suggested by the empirical evidence.

The recent developments of NK-DSGE models have tackled these difficulties through two main theoretical extensions: the introduction of nominal/real rigidities in wage determination (Erceg et al., 2000); the introduction of real frictions in the match between labour supply and demand *à la* Diamond

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([56]) Full information maximum likelihood.

([57]) Seemingly unrelated regression equation.

(1982a, b) and Mortensen and Pissarides (1994) (e.g. Blanchard and Galì, 2010). The first amendment is able to reconcile the dynamic properties of the NK-DSGE models with the principal comovements of the macroeconomic variables over the cycle and to improve the persistence of the convergence processes to the steady state. The second extension focuses on the matching between labour demand and supply, and on the empirical finding that job destruction and job creation coexist in the various phases of the business cycle. According to this approach, the matching of labour demand and supply resulting from the maximising behaviour of firms and households is described by a matching function, whose arguments are the vacancies posted by firms and the number of job-searchers (given by the stock of unemployed in the previous period plus the workers who have seen their working relationship terminated in the present period). Wages, on the other hand, are determined through a Nash bargaining between unions and firms on the surplus generated by the realisation of a match [58]. The main virtue of this approach (in addition to the presence of involuntary unemployment throughout the cycle) lies in the possibility to replicate the main comovements between unemployment and vacancies, and between the flows of job creation and job destruction (Trigari, 2006; 2009).

The FGB-LM model incorporates these two theoretical developments into a unifying DSGE framework. The wage is subject to a real/nominal rigidity which improves the persistence of the convergence processes to the long-term equilibrium; the presence of search and matching frictions allow for the coexistence of processes of destruction and creation of new jobs, the quantitative evaluation of which is the ultimate aim of the approach.

The economic system is populated by three types of agents: households, firms and policy-makers. Households can be rationed in the credit market, giving rise to liquidity constraints that introduce a one-period perspective in consumption choices [59]. We hence assume that only a fraction of the households can borrow and/or lend in the financial markets. The households that

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[58] The presence of hiring costs generates a surplus for every working relationship created.

[59] This hypothesis has been introduced to account for the empirical evidence of consumption dynamics closely correlated with current income, i.e.rule-of-thumb consumption (see, e.g. Campbell and Mankiw, 1989; 1990; 1991; Di Bartolomeo et al., 2011).

cannot do so can only pay for their present consumption with the current disposable income ([60]).

Given our modelling goals, heterogeneity needs to be defined also in terms of gender and age but, for the sake of simplicity, the demographic heterogeneity is formally represented only in the 'satellite' model, where the proportion of each cohort is defined by demographic hypotheses regarding fertility, life expectation and migratory flows.

For improving the consumption persistence observed in the data, the model also assumes the presence of external habits in households' utility from consumption ([61]) (defined in log-linear form, whereas labour disutility is modelled as a constant relative risk aversion, CRRA, function). Utility maximisation under the budget constraint leads to a classical Euler condition in which, for the households able to access the financial markets, the intertemporal allocation of consumption depends on the expected real interest rate and, for the households subject to financial constraints, on a one-period condition depending solely on the current real wage. The aggregation of these first-order conditions determines, together with a standard capital (thus investment) law of motion, the aggregate demand dynamics. As for the labour supply, households are ready to supply their labour services to firms up to the point at which the current real wage equals the marginal rate of substitution between work and consumption.

Intermediate goods are produced by a continuum of firms, each of which produces a differentiated good through a production function with constant returns to scale. Employment in a firm evolves on the basis of the following law of motion:

$$N_t(i) = (1-\delta)N_{t-1}(i) + H_t(i) \tag{1}$$

where $\delta \in (0,1)$ is a separation rate indicating the probability of transition for a worker from the pool of the employed to that of the unemployed and $H_t(i)$ represents the fraction of unemployed workers that are employed by the $i$-th firm in period $t$ (hiring of new labour). As the use of elementary data allows for the identification of different events of separation, completely specified in the simulations (firing, retirement, end of temporary labour contracts, work-related

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([60]) The main consequence of introducing liquidity constraints is a violation of the Barro-Ricardo equivalence which entails the possibility of crowding-in effects in public spending.

([61]) Formally, the hypothesis of habit persistence introduces an autoregressive component in consumption.

injury, mortality and other causes) the separation rate is actually split into six different rates ([62]).

Following the approach of Blanchard and Galì (2010) and Riggi and Tancioni (2010), labour-market frictions are introduced by assuming that hiring costs can be expressed as an increasing function of the job finding rate.

The aggregate resource constraint equates consumption and investment to gross national income minus public spending for goods and services (its trend emerging from an exogenous process) and the quantity of real resources which are employed to hire new labour (hiring costs), given the quantity of employment desired by the firms. Labour hiring thus equals the replacement demand, i.e., the quota which has separated in the previous period, plus the net employment variation ([63]).

The firms' minimisation of costs gives rise to a marginal cost function linking marginal costs to the total costs of labour and to the hiring costs, both normalised by productivity, considering the fact that these costs are not to be borne in the successive period by the firms that have not separated from workers.

Monopolistic competitive firms in the final goods sector aggregate the intermediate goods acquired at their marginal cost and fix their price adding a mark-up to the marginal costs. In each period only a proportion of firms in the final sector can change the price of their differentiated good, setting it at the optimal level (Calvo rule). From the linearisation around the steady state of the first-order condition for profit maximisation the New Keynesian Phillips curve is obtained:

$$\pi_t = \beta E_t \pi_{t+1} + \frac{(1-\theta_p)(1-\beta\theta_p)}{\theta_p} mc_t + \eta_t^{\pi} \tag{2}$$

where $\pi_t$ and $mc_t$ are the log deviations of inflation and of the marginal costs from their steady state values, and $\eta_t^{\pi}$ is a cost-push shock.

The monetary policy authority adopts a Taylor rule on the basis of which the rate of interest gradually adjusts to deviations of inflation and income from their target values.

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([62]) The Cedefop model also considers replacement demand for exits in hiring. However, only permanent separations are considered (Cedefop, 2010).

([63]) In the steady state, and assuming a stationary population, the system would thus see a constant level of employment, with equivalent exit and entry flows (Bagnai et al., 2006).

Under the hypothesis of a balanced budget, taxes finance the purchase of differentiated goods by the public sector, with the trend in public spending assumed to be first-order autoregressive and exogenous.

The hypothesis of sticky wages is introduced by modelling the labour-market similarly to the commodity market. There exists a continuum of differentiated work services indexed in the unit interval, each of which is used by each firm. Every household is specialised in one type of work and sets the nominal wage at which the members of the household are willing to work (alternatively, we may imagine a continuum of monopolistic unions, each of which is representative of a household). Just as happens in the commodity market, in each period only a certain proportion of households/union can renegotiate their wages. This is done in such a way as to maximise the present value of the difference between the real wage and the marginal rate of substitution between labour and leisure time, weighted to consider the probability of not being able to change the wage in some future periods.

The linearisation of the first-order condition for the household/union problem provides the equation describing the wage dynamics:

$$\pi_t^w = \beta E_t \pi_{t+1}^w + \frac{(1-\theta_w)(1-\beta\theta_w)}{\theta_w(1+\varepsilon_w\phi)}\left(sms_t^A - w_t^{real}\right) + \eta_t^{\pi^w} \tag{3}$$

where $\pi_t^{wreal} = \pi_t^w - \pi_t$. A variation in nominal wages positively depends on the (logarithmic) difference between the aggregate marginal rate of substitution $sms_t^A$ and the real wage.

To study the dynamic properties of the model, the system equations are linearised around the steady state that would prevail in the absence of shocks and nominal frictions. To represent the growth of the system, in technical implementation it is assumed that the steady state evolves over time following a linear deterministic trend. A stationary stochastic technology is then assumed around a first-order deterministic trend to capture the long period evolution in technical progress and demography (Smets and Wouters, 2007).

### 10.2.2.    The 'satellite' model

The equations in the 'satellite' model occupy a recursive position *vis-à-vis* the block of structural equations of the 'pilot' model. In the representation of the relations between stocks and flows, consistency between the blocks is guaranteed by applying an equivalent methodological approach in the two blocks (as the second block decomposes the magnitudes of the first one), and by imposing a series of numerical consistency constraints between aggregated and

disaggregated variables. To maximise the forecasting precision of the disaggregation, the relations represented in the 'satellite' block are constructed on eminently statistical and econometric bases, albeit with the constraint of respecting the results of simulation and forecasting at the aggregate level produced by the 'pilot' structure.

For each macroeconomic variable represented in the 'pilot' model, regional disaggregation is obtained through the estimation of a system of $R$ regional auto-regressive distributed lags simultaneous equations ([64]). For the cointegration between national and regional variables (i.e., balanced growth among regions), the auto-regressive distributed lags pattern has a representation in terms of both long-term static relationships and error-correcting dynamic relationships (Pesaran and Shin, 1999). By introducing a linear trend it is possible to deterministically capture the shifting dynamics that may occur in regional evolution. In this case, the presence of cointegration determines a dynamic statistical equilibrium around the linear trend.

Sectoral disaggregation of the macroeconomic variables is achieved estimating a system of $N$ simultaneous equations, which are again defined in auto-regressive distributed lags formulation. To capture the ongoing trends in sector evolution, a second-order trend polynomial, able to represent any quadratic trend, is estimated ([65]).

Simulation and forecasting of disaggregated labour-market exits (outflows) ([66]) are obtained using a consistent extension of the fundamental stock-flow relation (1), which associates the stock of employed in the current period with the stock of employed in the previous period, considering the separation rate and the hiring process (labour matches).

The definition of the six event-specific separation rates — which are assumed to evolve over time and specified in terms of regional, sectoral and cohort disaggregation — requires processing on the elementary data of the Italian National Statistical Institute. As for the separation rate due to biological causes, use is made of the projected survival rates provided by official sources, while for the evolution of the separation rates relative to the end of temporary

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([64]) The autoregressive distributed lag formulation determines a relationship between the dependent variable, its past values (autoregressive component) and the contemporary and past values of the explicative variables (distributed lag component).

([65]) This choice is supported by the historical structural modifications observed in the data.

([66]) Outflows at the aggregate level are obtained by multiplying the stock of employed in the previous period by the separation rate.

contracts, work-related injury and other causes, a second-order time polynomial is estimated and projected to the forecast horizon. A more complex formulation is used to estimate the exit rate due to retirement and firing. In the former case, the rate is assumed to be a function of regulation dummies, which capture the effects of the ongoing and future regulatory modifications on the eligibility conditions for retirement and on the expected pension income, which in turn depends on the cohort-specific life expectation. The separation rate due to firing is assumed to depend on the cyclic phase, defined in terms of the deviation of the growth rate from its long-term value.

The employment stock and flows determined at regional and sectoral level are divided over the various ages using a system of distribution equations [67].

The disaggregation of the stock of employment and of employment requirement by occupation and by qualification is obtained by breaking down these two magnitudes, defined at regional and sectoral levels, with a system of weights assumed to evolve over time, according to a second-order time polynomial.

## 10.3. Estimation, data sources and model output

Different estimators are used to estimate the coefficients of the model. The structural equations defining of the 'pilot' model are estimated by employing the generalised method of moments. The use of this method estimator is justified by the theoretical characterisation of these equations, as it naturally emerges from the optimising approach characterising the first block of the model (Favero, 1996) [68].

With respect to the equations defining the satellite structure, the FIML [69] estimator is generally employed, while using Zellner's (1963) SURE [70] estimator for systems in which the equations have the same construction, such as in the regional disaggregation blocks, to capture the latent correlation in the error structure and improve efficiency. This choice is appropriate to consider the latent cross-correlation otherwise unrepresented in the systematic part of the simultaneous systems.

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[67] For a definition of the distribution function, see Bagnai et al. (2006).

[68] The orthogonality conditions between instruments and the regressions residuals proved to be perfectly consistent with the constraints imposed by the theory.

[69] Full information maximum likelihood.

[70] Seemingly unrelated regression equation.

The 'pilot' model is estimated with quarterly time series for the main macroeconomic aggregates (GDP, private consumption and investment, public consumption, real wages, GDP deflator, short-term interest rate, population, labour force, employment and unemployment rate) which are readily available at both the national and international level from official statistical sources. The marked degree of disaggregation in the output produced by the second block equations calls instead for the use and processing of regional account data and of the elementary labour force survey data of the Italian National Statistical Institute. As for the latter source, the necessary disaggregations are in terms of decomposition by age of the population, of the labour force, of employment and unemployment. Processing of elementary data is also necessary to identify the various modes of exit from work, through which the specific transition rates are obtained. Processing is finally needed to determine the weights to be applied in defining the equations linking the aggregate employment stocks and flows with the distribution by cohort, occupation and qualification.

## 10.4.    Labour-market forecasts for the Italian economy

In this section we present some results provided by a recent application of the FGB-LM model to Italian data. The 'pilot' model is estimated over the sample period 1981:1-2010:2, and the satellite blocks over the sample period 1992:1-2009:4. The forecast considers the period 2010:3-2015:3.

The main exogenous components in the model, i.e., public expenditure, population and total factor productivity, are projected to the forecast horizon using estimated ARIMA [71] processes. The variables controlling for the evolution of the regulatory set-up are held fixed at the last period's observation. Labour force dynamics is described by an auto-regressive distributed lags equation in which population enters as log-term forcing variable and the lagged unemployment rate is an exogenous component entering the VEC [72] representation only. Expectations are obtained by simulating the unrestricted VECM mentioned in the introduction.

### 10.4.1.    The macroeconomic environment

Figure 10:1 reports the historical and forecasted evolution (grey area) of six mayor macroeconomic aggregates expressed in real terms: GDP, private

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[71]  Autoregressive integrated moving average.

[72]  Vector error correction model by Johansen.

consumption, private investment, government expenditure, net export and the real wage.

The picture for GDP indicates a gradual and basically moderate recovery for the forecasted period, mostly due to the post-crisis jump in private investment.

Consumption dynamics is predicted to remain slightly negative in the first half of 2011 and almost flat for the subsequent four periods. Convergence to the (balanced) long-term rate of growth is only achieved in the second half of 2012. The hypothesis of liquidity constraints and thus of non-Ricardian (or rule of thumb) consumers is decisive for explaining the predicted pattern of private consumption. Under this hypothesis, which is decisively supported by the data, the peculiar evolution of consumption can be attributed to the weak dynamics of the real wage. Note that the estimates indicate that nearly 35% of Italian households do not smooth consumption, i.e., a relevant fraction of them makes consumption decisions on the basis of current income.

The presence of liquidity constraints implies a second indirect effect on consumption, related to the fact that, under rule of thumb behaviour in consumption, public expenditure can have crowding-in effects. Since the predicted dynamics of government expenditure is below the balanced growth trend, private consumption is likely to be negatively affected.

The dynamics of net exports indicate a persisting negative balance for a great part of the forecast period, with initial negative effects on aggregate demand.

Table 10:1 summarises the predicted dynamics for these variables (splitting the net export series into its two components, export and import), reporting the annual growth rates for the period 2010-14.

At the time the forecast was made, only the first two quarters of 2010 were known, thus the 2010 annual growth rates are obtained considering the model predictions for the third and fourth quarter. This allows us to evaluate, albeit over a reduced time span, the forecasting performances of the FGB-LM model. Despite the particularly critical time being considered, actually a post-crisis/pre-recovery period, the model showed a good performance, pointing to an annual growth rate of GDP of nearly 1.2%, which is the actual GDP growth rate for 2010 recently certified for Italy by the national statistical office and by international institutions.

The good predictive capabilities of the 'pilot' model are basically confirmed also considering the dynamics of the other variables.

Figure 10:1    **Macroeconomic environment. Forecast period 2010:3-2015:3**
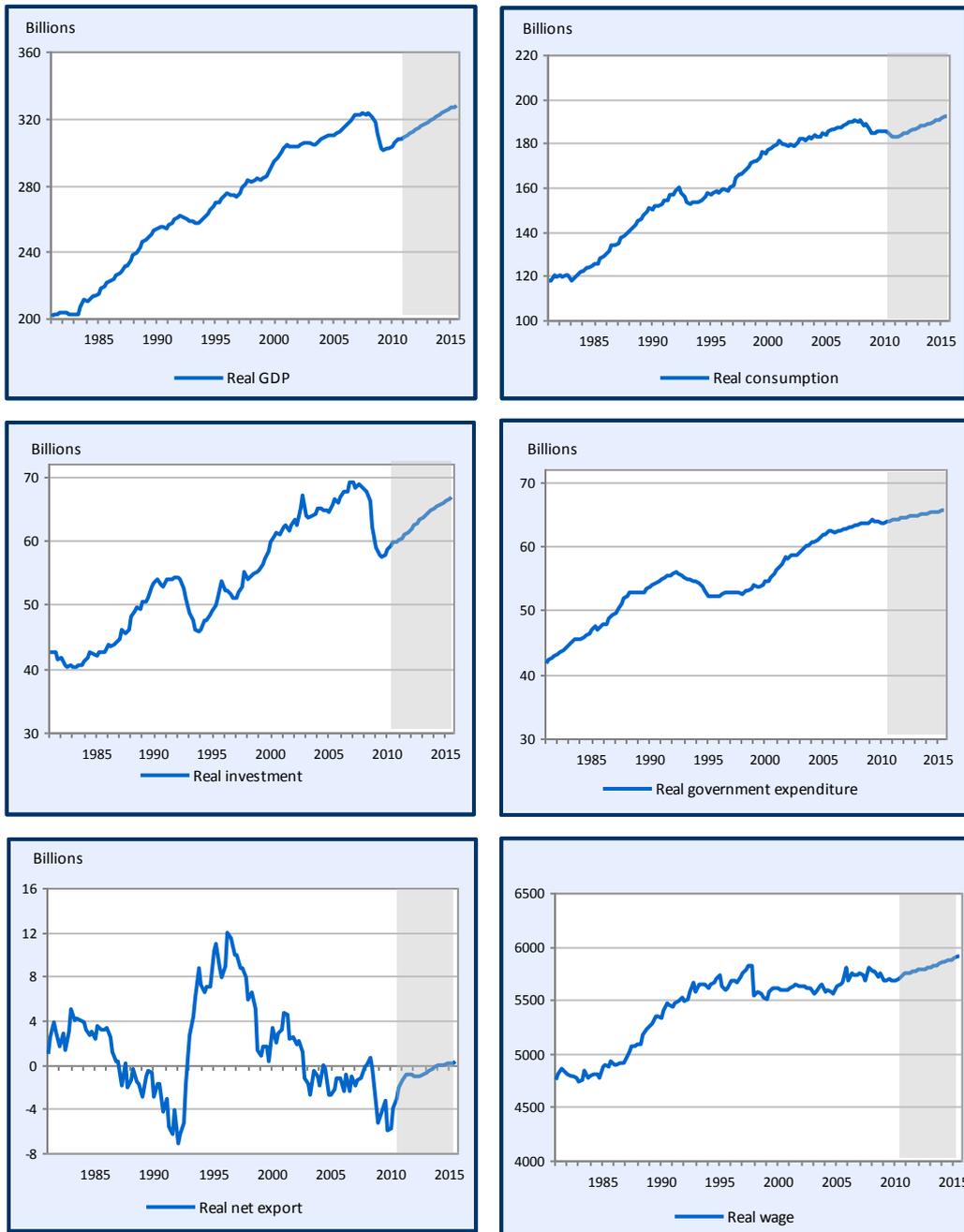


*Source*: FGB-LM model forecasts.

### 10.4.2.    Labour market stocks and flows

Figure 10:2 reports the historical and predicted evolution of the labour force, of employment and of the unemployment rate. Considering the simulation period, after an initial stagnation in the last two quarters of 2010, the labour force is

expected to linearly evolve over its long-term path. Differently, a further moderate reduction is expected for the employment stock until 2011:1, followed by a period of substantial stability or moderate increase until 2012:4. A clear recovery in the employment stock will take place only in the second quarter of 2013.

Table 10:1 **Predicted annual growth rates for the major macroeconomic aggregates**

|      | GDP  | CONS  | INV  | GOV   | EXP  | IMP  | WAGE |
|------|------|-------|------|-------|------|------|------|
| 2010 | 1.26 | -0.32 | 2.45 | -0.19 | 9.18 | 7.35 | 0.34 |
| 2011 | 1.43 | -0.52 | 2.12 | 0.71  | 9.32 | 5.59 | 0.92 |
| 2012 | 1.49 | 1.23  | 3.12 | 0.61  | 2.23 | 2.20 | 0.42 |
| 2013 | 1.49 | 1.13  | 2.69 | 0.56  | 4.18 | 3.49 | 0.60 |
| 2014 | 1.32 | 1.13  | 2.14 | 0.52  | 3.01 | 2.53 | 0.75 |

*Source*: FGB-LM model forecasts.

Given these evolutions, the unemployment rate is expected to increase to nearly 9.5% at the end of 2012 (from 8.7% in 2010:2) and then weakly decrease to nearly 9.2% at the end of the forecast window.

The expected weak performances of the Italian labour market are mostly related to the weakness of the predicted macroeconomic dynamics. The expected average growth rate for GDP in the simulation window is below 1.5%, basically in line with the long-term total factor and labour productivity growth rates. This rules out the possibility of observing a clear process of recovery in the labour market stocks. The expected increases in employment beginning in 2013 must in fact be attributed almost entirely to the increase in the labour force (thus supply) stock.

Concerning the labour market flows, Table 10:2 reports the expected annual outflows and inflows (hiring) in employment for the period 2010-14, distinguishing among the different events of exit and reporting the difference between labour outflows (replacement demand) and hiring (replacement demand plus net employment variation, or expansion demand).

Consistent with the predicted dynamics of the labour-market stocks, the expected evolution of labour hiring is basically explained by that of labour outflows. In other terms, in the next four years hiring is predicted to be mostly driven by replacement demand. Outflows for firing and end of temporary contract are expected to increase in the next years, due to the increase in flexibility and the weak macroeconomic performances (firing) and to the increasing fraction of temporary workers in employment (end of temporary contract). Outflows for retirement are expected to reduce until 2013 and then slightly increase. The initial reduction is due to the ongoing pension reform for which, during the simulation

period, the eligibility conditions for retirement become more restrictive in terms of age and number of years of contribution to the public pension funds. Outflows for un-modelled events are expected to reduce due to the estimated negative trend in the specific exit rate.

Figure 10:2 **Labour market stocks and unemployment rate (2010:3-2015:3)**
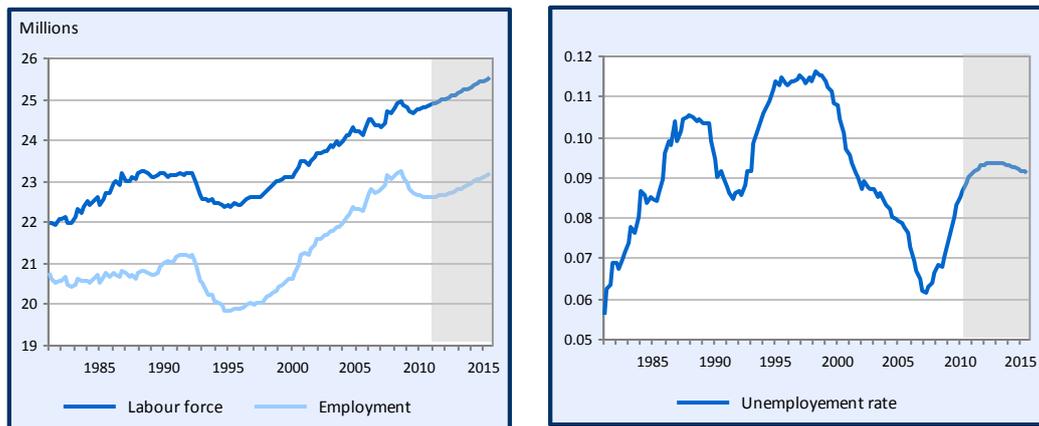


*Source*: FGB-LM model forecasts.

Table 10:2 **Predicted outflows and hiring (thousands), 2010-14**

| | Firing | ETC* | Retirement | Injury | Other | Total out | Hiring | Hiring out |
|---|---|---|---|---|---|---|---|---|
| 2010 | 599 | 1 271 | 638 | 41 | 219 | 2 770 | 2 695 | -74.6 |
| 2011 | 646 | 1 286 | 620 | 41 | 212 | 2 807 | 2 866 | 58.9 |
| 2012 | 709 | 1 328 | 606 | 41 | 197 | 2 883 | 2 964 | 81.3 |
| 2013 | 780 | 1 359 | 605 | 41 | 182 | 2 968 | 3 129 | 161.4 |
| 2014 | 862 | 1 378 | 613 | 41 | 168 | 3 064 | 3 225 | 161.7 |

* ETC — end of temporary contract.
*Source*: FGB-LM model forecasts.

Total outflows (replacement demand) is predicted to be between nearly 2.8 millions in 2010 and 3.1 millions in 2014, a value decisively above that implicit to the Cedefop's forecast for Italy for the period 2010-20 (Cedefop, 2010), suggesting that the average annual replacement demand is of near 0.8 millions. The reason for this difference is that Cedefop-RDMOD considers only permanent outflows, such as retirement, deaths and migrations (Cedefop, 2010), while the FGB-LM model considers also potentially transitory outflows, such as firings and interruptions due to end of temporary contracts ([73]). Considering this major

([73]) Outflows due to end of temporary contracts are not actual dismissals, since part of these contracts are renewed within the period of observation (quarter). Under a more

difference, our forecasts for replacement demand turn basically in line with Cedefop's forecasts for replacement demand.

Hiring of new labour is given by replacement demand (equal to the number of total outflows) plus the variation in employment required by the system (expansion demand). Hiring is slightly below total outflows in 2010 and slightly above in the remaining periods. The last column in Table 10:2 reports the difference between hiring and outflows.

Interestingly, the employment stock variation is on average 3.5% of hiring, thus nearly 96.5% of the job openings is due to replacement demand. The relevance of replacement demand in determining the job openings highlights the informative limitations of analyses targeted only to the evolution of the labour market stocks, and thus the importance of extending the focus of modelling and forecasting to labour market flows.

Figure 10:3 shows the cohort composition of the predicted employment stock and of hiring in 2010:4 and five years later in 2014:4.

Figure 10:3 **Employment and hiring by age class, 2010 and 2014**
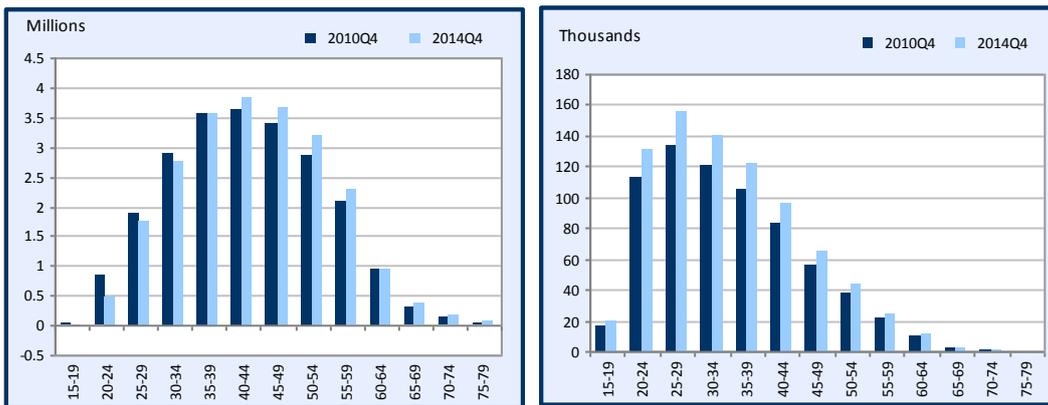


*Source*: FGB-LM model forecasts.

The histograms for the employment stock clearly show the presence of a shift towards the right in the age composition of employment. This shift has two major determinants: the ongoing modifications in eligibility condition for retirement; and the effects of the 2008-09 crisis, that mostly affected younger workers and workers on temporary labour contracts.

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structural perspective, the inclusion of such an important component of outflows can lead to an overvaluation of the replacement demand.

The graph for the cohort composition of hiring highlights an increase in job openings for all the age classes, due in part to the increase in replacement demand and in part to the moderate recovery in employment, thus to the increase in expansion demand.

### 10.4.3. Employment stocks and flows by qualification

Tables 10:3 and 10:4 summarise the evolution of employment and hiring by qualification, respectively, for the period 2010-14. The last row of the employment stock table reports the percentage total change in the forecast interval, while that of the table for hiring reports the average annual variation.

The 12 educational attainments of the Italian labour force survey represented in the model are grouped into six classes for expositional convenience, basically following the ISCED classification:

1) pre-primary and primary education;
2) lower secondary education;
3) upper secondary education;
4) tertiary education;
5) lower post-tertiary education (master, specialisation school);
6) upper post-tertiary education (PhD).

Table 10:3    **Employment stock by qualification (thousands), 2010-14**

| Time | Qualific. 1 | Qualific. 2 | Qualific. 3 | Qualific. 4 | Qualific. 5 | Qualific. 6 |
|------|-------------|-------------|-------------|-------------|-------------|-------------|
| 2010 | 1437 | 7086 | 10146 | 3645 | 239 | 41 |
| 2011 | 1431 | 7058 | 10180 | 3698 | 242 | 41 |
| 2012 | 1425 | 7031 | 10225 | 3763 | 247 | 42 |
| 2013 | 1424 | 7021 | 10306 | 3847 | 253 | 43 |
| 2014 | 1422 | 7004 | 10387 | 3939 | 259 | 44 |
| Δ% | -1.0 | -1.1 | 2.4 | 8.1 | 8.3 | 8.8 |

NB: Δ% indicates the percentage total change from 2010 to 2014.
*Source*: FGB-LM model forecasts.

For a more immediate comprehension of the employment performances of the specific qualification groups, consider that the total employment variation from 2010 to 2014 is predicted to be nearly 2%. This implies that the employment change for the first two qualifications (pre-primary, primary and lower secondary education) — a relevant fraction of the Italian employment stock (nearly 38%) — is predicted to be negative in absolute terms and three percentage points lower than the aggregate change. An increase only slightly above the total change in aggregate employment is predicted for workers with upper secondary education, while for those with tertiary education and over a more than 8% increase is

expected. Following these changes, the fraction of workers with a tertiary education and over is expected to grow from 14.7% in 2010 to 15.6% in 2014.

The evolution of the employment stock for the different education levels is reflected by hiring of new workers by qualification. The increase in replacement and expansion demand determines an increase in hiring for all the qualifications, even if it is heterogeneous among levels.

Table 10:4    **Hiring by qualification (thousands), 2010-14**

| Time | Qualific. 1 | Qualific. 2 | Qualific. 3 | Qualific. 4 | Qualific. 5 | Qualific. 6 |
|------|-------------|-------------|-------------|-------------|-------------|-------------|
| 2010 | 105 | 730 | 1243 | 530 | 72 | 7.7 |
| 2011 | 112 | 777 | 1325 | 568 | 77 | 8.3 |
| 2012 | 115 | 801 | 1369 | 591 | 80 | 8.6 |
| 2013 | 121 | 842 | 1443 | 629 | 85 | 9.3 |
| 2014 | 125 | 864 | 1485 | 653 | 89 | 9.7 |
| *Δ%* | *4.4* | *5.3* | *4.6* | *5.5* | *5.6* | *6.3* |

NB:        Δ% indicates the percent average annual variation in the period 2010-14.
*Source*:    FGB-LM model forecasts.

As compared to an average annual growth rate for hiring close to 4.6% (2011-14), the first three qualifications denote a lower dynamics, while the dynamics of the fourth, fifth and sixth qualifications are above the aggregate dynamics. Hiring of workers with a PhD degree (sixth qualification) requires an average annual growth rate of 6.3%. In 2014, 9 700 top-qualified workers will be required in the place of 7 700 thousand being required in 2010. This result has serious policy implications as it requires important changes in the organisation and financing of the higher education sector ([74]).

To highlight the differences emerging when considering hiring of new labour in the place of the employment stock, Figure 10:4 displays the composition by qualification of the employment stock and of hiring in 2014. Hiring shows lower values than employment for lower qualifications and higher values for higher qualifications, as a result of the fact that hiring is the nearest proxy for the demand for new labour.

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([74]) In our simulation we are not considering the qualification upgrade that would hold even in the presence of a stationary evolution of the composition among sectors of the labour market.

Figure 10:4    **Employment and hiring by qualification, 2014**
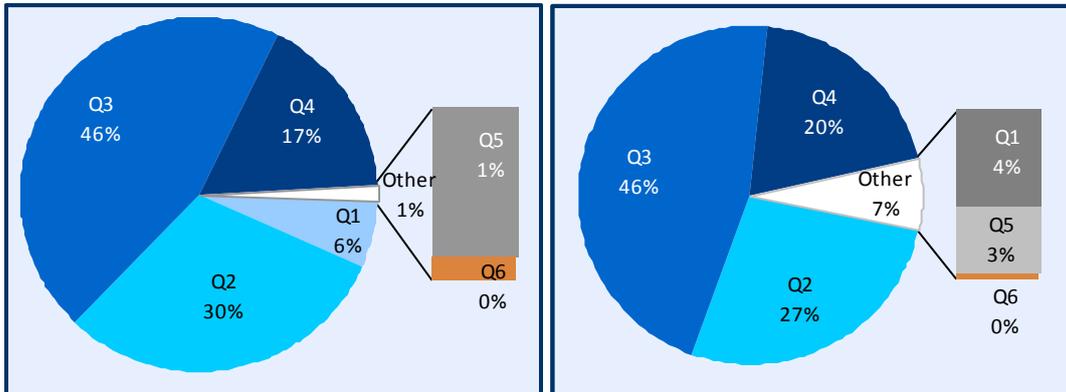


*Source*: FGB-LM model forecasts.

### 10.4.4.    Employment stocks and flows by occupation

Tables 10:5 and 10:6 contain the predicted annual values of the employment stock and of hiring by occupation (or professional profile). Even in this case, the last row of the employment stock table reports the percentage total change in the forecast interval, while that of the table for hiring reports the average annual variation.

To simplify the exposition, the 37 professional profiles observed in the Italian labour force survey and represented in the model are grouped into seven major occupations, broadly following the ISCO classification:

1) legislators, senior officials, managers and entrepreneurs;
2) mathematical, health social and life sciences specialists and
   professionals;
3) technicians and associate professionals;
4) clerks;
5) specialised workers in different fields;
6) machine operators and assemblers;
7) unqualified and elementary occupations.

Compared to the nearly 2% growth in total employment in the five years period considered in the simulation, occupations 2, 3, 4 and 7 are expected to grow above average, while occupations 1, 5 and 6 below average. Substantial reductions are expected for machine operators (sixth occupation) and, to a lesser extent, for specialised workers (fifth occupation).

This prediction is justified by the predicted sectoral dynamics of employment, in which a further contraction of the industrial sectors (where the fifth and sixth professional profiles are more important) and a clear expansion of the service sectors (where the second, third and fourth professions are more represented) are expected.

Table 10:5     **Employment stock by occupation (thousands), 2010-14**

| Time | Occup. 1 | Occup. 2 | Occup. 3 | Occup. 4 | Occup. 5 | Occup. 6 | Occup. 7 |
|------|----------|----------|----------|----------|----------|----------|----------|
| 2010 | 991 | 2504 | 4935 | 2398 | 7442 | 1977 | 2348 |
| 2011 | 991 | 2547 | 4982 | 2416 | 7410 | 1945 | 2363 |
| 2012 | 992 | 2597 | 5039 | 2437 | 7377 | 1909 | 2383 |
| 2013 | 996 | 2662 | 5119 | 2468 | 7362 | 1873 | 2416 |
| 2014 | 999 | 2734 | 5204 | 2500 | 7338 | 1832 | 2451 |
| Δ% | 0.8 | 9.2 | 5.4 | 4.3 | -1.4 | -7.3 | 4.4 |

NB: Δ% indicates the percent average annual variation in the period 2010-14.
*Source*: FGB-LM model forecasts.

The predicted evolution of hiring by occupation confirms the heterogeneity expected for the different professional profiles in the employment stock. In particular, even if the average annual growth rate for the period 2011-14 is in this case expected to be positive for all the job typologies (mostly because of the expected growth in replacement demand), the annual growth rate is above the 4.6% average for hiring in job typologies 2, 3, 4 and 7, and below average for the remaining typologies.

An above average increase is expected for hiring of unqualified/elementary workers, mostly due to the expected recovery in the primary and, to a reduced extent, in sales and household services.

Table 10:6     **Hiring by occupation (thousands), 2010-14**

| Time | Occup. 1 | Occup. 2 | Occup. 3 | Occup. 4 | Occup. 5 | Occup. 6 | Occup. 7 |
|------|----------|----------|----------|----------|----------|----------|----------|
| 2010 | 118 | 297 | 586 | 285 | 889 | 236 | 279 |
| 2011 | 126 | 320 | 629 | 305 | 940 | 248 | 299 |
| 2012 | 129 | 337 | 655 | 317 | 965 | 251 | 310 |
| 2013 | 136 | 361 | 697 | 337 | 1010 | 259 | 329 |
| 2014 | 140 | 380 | 725 | 349 | 1031 | 259 | 342 |
| Δ% | 4.3 | 6.3 | 5.4 | 5.2 | 3.8 | 2.4 | 5.2 |

NB: Δ% indicates the percent average annual variation in the period 2010-14.
*Source*: FGB-LM model forecasts.

The relevant changes predicted for the composition of employment and, in particular, of the hiring process highlight the utility of forecasting tools able to represent these stocks and flows considering their major articulations. The ability to foresee future changes in the composition by qualification and professional profile can in fact provide valuable information for policy-makers interested in the formulation and calibration of the necessary policy actions.

## 10.5.   Conclusions

The paper has provided a general description of the forecasting model developed by the Fondazione Giacomo Brodolini. We have described and motivated the main distinctive characteristics of the model, that is composed of a microfounded 'pilot' NK-DSGE structural model and a 'satellite' second block representing the detailed dynamics of the economy and of the labour market. Sticky wages, hiring costs and involuntary unemployment characterise the labour market. The discussion has addressed the technical choices underlying the estimation of model parameters and has described the data sources used and model output.

We have subsequently presented the results of a recent application of the model in a mid-term forecast up to 2015:3. To improve the readability of the simulation results, a brief presentation of the expected macroeconomic environment has preceded the discussion of the results for the labour market. To simplify the exposition, the attention has mainly focused on the employment stock and the hiring process, detailing their articulation into six major educational attainments and seven major professional profiles.

The evidence provided for the macroeconomic environment has shown the model ability to adapt to the data, and to provide internally consistent results. The 'pilot' model exhibits good estimation capacities which, together with the theoretical transparency of results due to the full specification of the hypotheses on behaviours and technology (the microfundation), hold out considerable promise in forecasting and simulating the effects of both national and regional labour-market policies.

The evidence provided for the stock and flow labour market variables has exemplified some potential directions in the use of the FGB-LM model. These range from the simulation of the labour-market effects of potential policy interventions in the regulatory set-up, such as the modification of the requirements for accessing the public pension system, to the forecasting of qualification and professional needs associated to different scenarios, so as to implement the most appropriate policy actions which are needed to meet the future requirements of the labour market.

## Abbreviation list

| | |
|---|---|
| DSGE | dynamic stochastic general equilibrium |
| FGB-LM model | Fondazione Giacomo Brodolini labour market model |
| GDP | gross domestic product |
| NK-DSGE | new Keynesian dynamic stochastic general equilibrium |
| VECM | vector error correction model |

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CHAPTER 11.

# The forecast of occupational structure of employment in Poland
*Artur Gajdos*

The main purpose of the following paper is comparative presentation of the forecasts of occupational structure of employment in Poland conducted by Cedefop and obtained within the labour demand forecasting system (LDFS) in Poland. LDFS is an expert interactive system that allows analysis and forecasting of time-series-cross-section economic variables, which is used in the research and teaching process at the Chair of Spatial Econometrics at the University of Lodz.

The study also presents suggestions for applying a time-series-cross-section data analysis method in forecasting employment structure in Poland in a regional cross-section (NUTS2). The results obtained indicate that these methods can be used in the forecasting process. The use of location quotient and shift-share analysis allows additional information, which may be used in time-series-cross-section data forecasting in a territorial cross-section. The analyses and forecasts on regional level are at present an inherent element of European Union policy, including measuring cohesion policy effectiveness.

## 11.1.  Introduction

The study concentrates on two main problems. The first is forecasting occupational employment structure at national level and comparing the forecast results obtained within the project *Skills supply and demand in Europe*, and forecasts made in the project *Labour demand forecasting system* in Poland. The other is an analysis of possibility of using the methods of cross-section (as well as spatial) data analysis in the process of occupational employment structure forecasting. Structural analyses require the application of suitable data analysis methods so that obtained results reflect global processes, but also include the specificity of studied objects in cross-section and space. In this context it is reasonable to use methods of time-series-cross-section analysis of statistical data. The use of these methods makes it possible to include in the forecasting process additional information specific for the studied objects, which in the case of uniform treatment of the objects might be omitted.

## 11.2.    Forecast comparison

The comparative analysis of the forecast results is to indicate the conclusions which are essential from the point of view of forecasting process improvement and which enable the modification of the applied methods to achieve better forecast results in the future.

The first step was the comparison of forecast results made in Poland in 2006 with the Cedefop forecasts from 2010 (Cedefop, 2010), and the actual data (labour force survey 2010). Then the forecast results made by Cedefop for 2020 were discussed and compared with employment structure forecasts for 2011-15.

The forecasts generated in 2006 within the labour demand forecasting system (LDFS) in Poland were conducted in the cross-section of major occupational groups with the use of data from labour force survey from 1995-2005. The forecasts included employment cross-section (submajor and minor groups), education level and economic sector. The number of the employed in particular cross-sections was a forecast variable. The project included building an interactive analytical system — LDFS. This is a combination of database, analytical software and internet interface that enables online data analysis.

The system uses MS SQL Server database and Matlab software. Work in the system is based on making analyses (forecasts) using web browser interface. All calculations are server-side, where the database and analytical software are placed. The analyses results are recorded in the database and may be published as a website.

At present the system works with macroeconomic data and data from the labour force survey. The system enables data analysis in the form of time-series-cross-section using methods of time series analysis (linear and non-linear trend models, seasonality, exponential smoothing, single- and multi-equation models, autoregression models and vector-autoregression models). The analyses results are presented as tables and graphs. It is also possible to generate combined forecasts (weighted average from individual forecasts).

The expansion of the system is planned, which will enable analysing data from other sources (e.g. Eurostat database, OECD), the use of spatial data analysis methods, and presentation of data in the form of maps and dynamic data visualisation.

To compare the forecast results for 2010 and evaluate the forecast errors, data published by Eurostat from the labour force survey in major occupational groups cross-section, forecasts published by Cedefop (2010), and forecasts made in 2006 in the LDFS project were used. Nominal differences between observed and predicted values of structure indicators for the major occupational groups were analysed.

Figure 11:1    **LDFS — Structure**
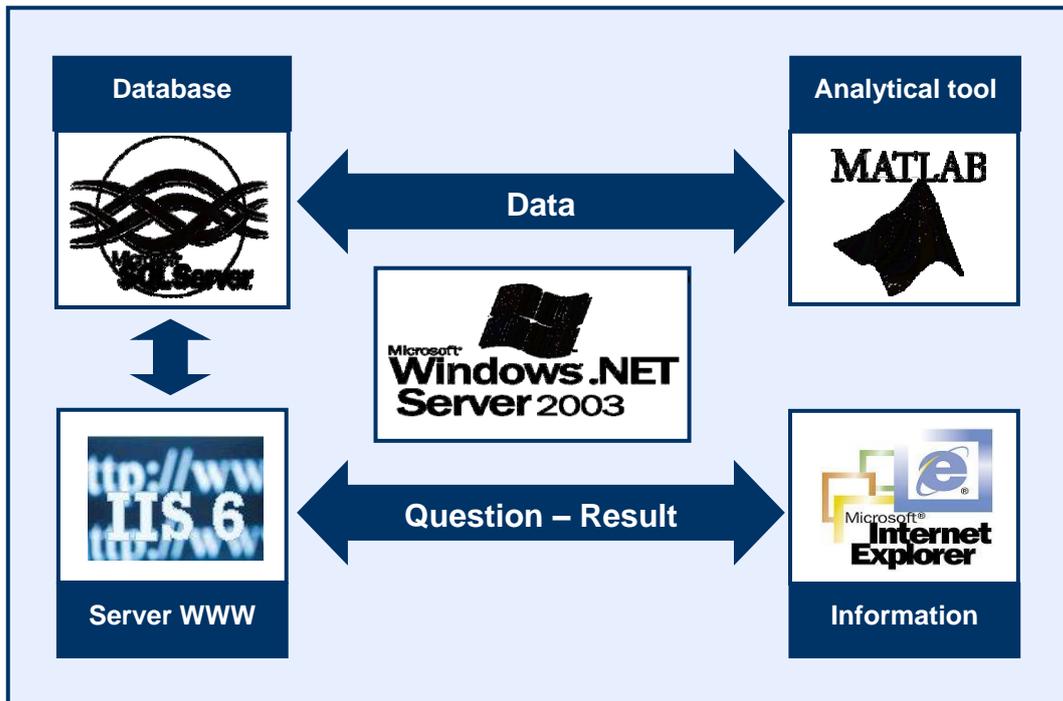


*Source*: Gajdos (2004, p.189).

Figure 11:2    **LDFS — Database**
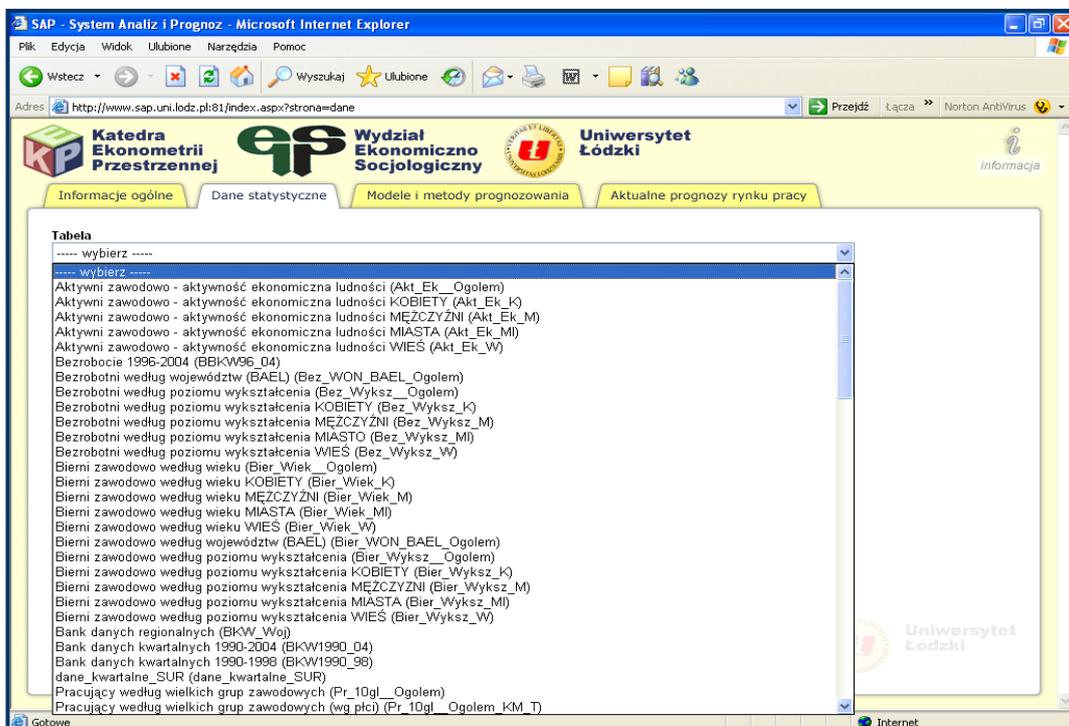


*Source*:    http://www.sap.uni.lodz.pl (10.2.2011).

Figure 11:3   **LDFS — Forecasting**
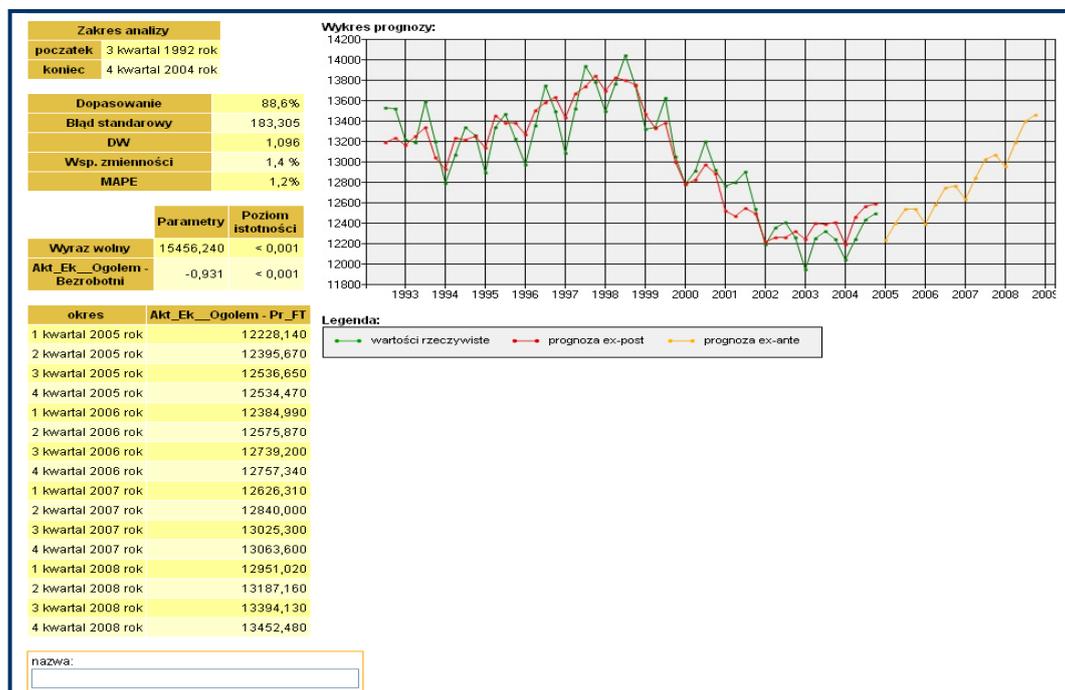
Figure 11:4   **Forecast errors ([a]) in 2010 (major ISCO groups)**
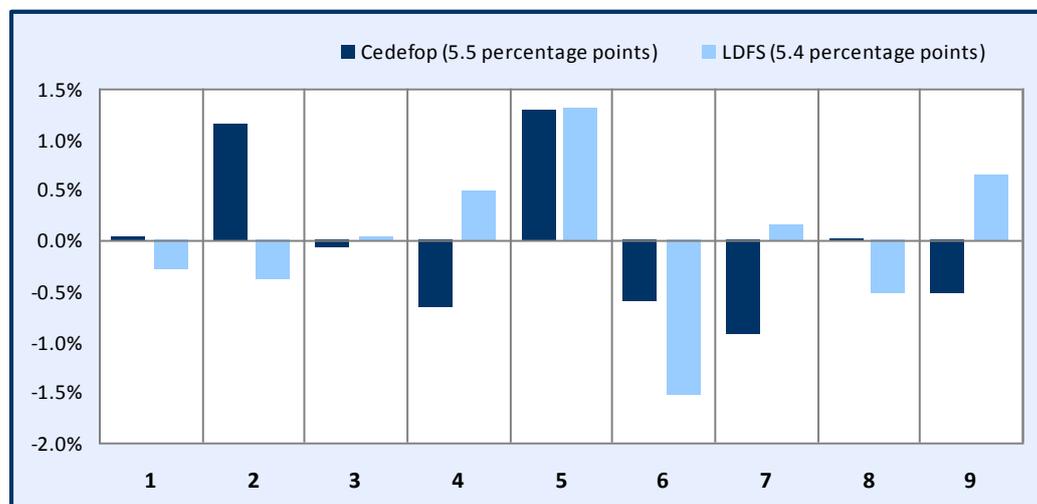


NB: 1-9 = major ISCO groups.
([a]) Percentage error: PE= [(actual value – forecast)/actual value]*100%.
*Source*: Own calculations based on Eurostat, Cedefop and LDFS data.

The highest nominal error values were obtained for groups characterised by the greatest change dynamics between 2000 and 2010. Especially high deviations of predicted values from the observed ones were obtained for the

172

groups of: professionals (2), service workers and shop and market sales workers (5), and skilled agricultural and fishery workers (6).

The sum of absolute errors in all analysed major occupational groups for Cedefop and LDFS forecasts is similar and is about 5.5 percentage points. This indicates a similar forecasting precision in the analysed cases.

In the following year an attempt was made to discuss the forecast results generated by Cedefop for 2020 compared to the forecast of occupational structure of employment in Poland made for the years 2011-15 in LDFS.

The analysis of historical data for 2000-10 made it possible to generate, using a segmented linear trend model, the value of the share of particular major occupational groups between 2011 and 2015. The confrontation of the obtained results with the Cedefop forecasts indicates major occupational groups, for which the forecasts largely differ from the trends observed between 2000 and 2010 and the values predicted in 2011-15.

The most essential differences were observed in the major occupational group of professionals (2) and clerks (4). In the case of professionals the predicted share in the number of the employed in 2020 is close to the value observed in 2010. Due to the importance of this group in the development of modern economy, it should be determined whether a setback of the observed upward tendency for 2000-10 may be expected. In the case of clerks, the forecast for 2020 indicates a high share of this group, much higher than the level observed for 2000-10.

When organising a forecasting process, particular attention should be paid to the occupational groups which undergo the most dynamic changes and the share of which significantly influences the economical development dynamics, and which were characterised by the greatest forecasting errors.

## 11.3.  Regional employment structure analysis (NUTS2)

Between 2000 and 2010 significant differences in the dynamics of changes in the total number of the employed according to provinces (regions) were observed in Poland. Moreover, important differences in the employment structure by region and various directions of this structure changes were identified. Therefore, an attempt to describe regional employment structure was made. On the basis of the share rate analysis it is possible to indicate the regions where the occupational employment structure is similar to the national one: Malopolska province, Pomeranian province, Wielkopolska province, and those where the structure is significantly different: the Lublin region and Silesia.

Figure 11:5    **Cedefop and LDFS — Forecast comparison**
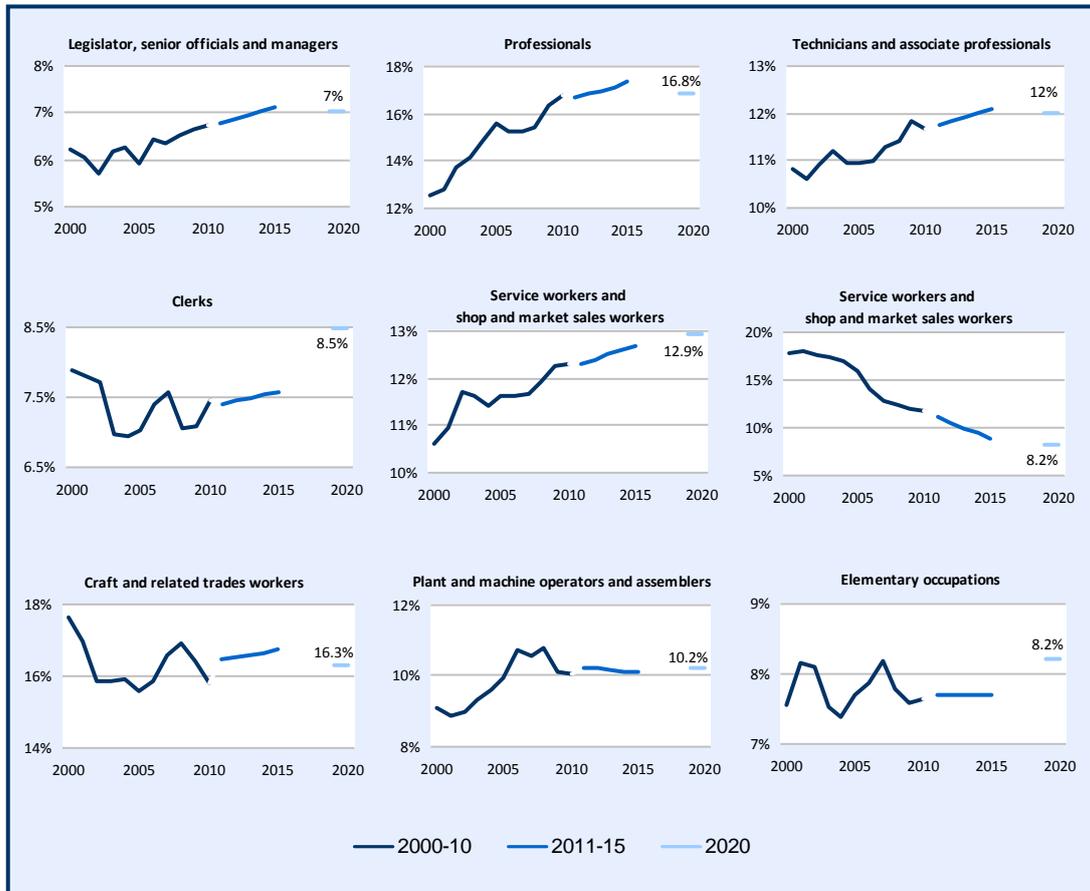


*Source*:    Own calculations based on Eurostat, Cedefop and LDFS data.

One can also observe the structure change processes in various directions leading to a greater and greater structure difference. This study confirmed the thesis about the lack of convergence process in the occupational employment structure. Only a major occupational ISCO group of legislators, senior officials and managers (ISCO 1), craft and related trades workers (ISCO 7) and plant and machine operators and assemblers (ISCO 8) show between 2001 and 2008 a smaller regional differentiation. On the other hand, a major occupational group of skilled agricultural and fishery workers (ISCO 6) shows between 2000 and 2008 a growth of structure differentiation by region. In most other major occupational groups a relatively stable structure differentiation level is observed between regions or differentiation changes have different directions in selected subperiods.

Figure 11:6    **Sigma-convergence, 2000-08**
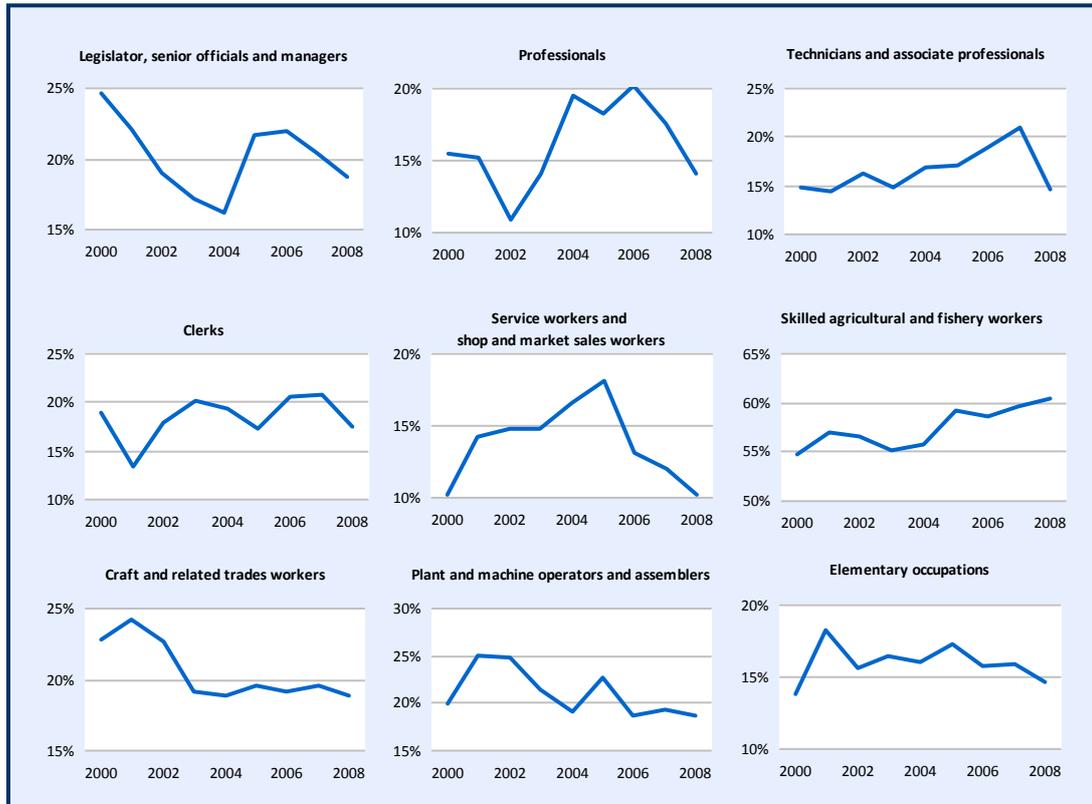


*Source*:    Own calculations based on labour force survey data.

On the basis of regional analysis of occupational structure one may observe a spatial concentration of selected occupational groups. A major occupational group of skilled agricultural and fishery workers (ISCO 6) is concentrated in the eastern part of the country, elementary occupations (ISCO 9) in the north, while plant and machine operators and assemblers (ISCO 8) in the south-west.

Another example of applying a time-series-cross-section data analysis method in the process of describing space and structure is the use of location quotients which enables defining a cross-section variable localisation and spatial object specialisation.

The location quotients analysis in 2008 points out major occupational groups which are not localised (have a similar share in the labour market in most regions), for example clerks, and highly localised groups, for example skilled agricultural and fishery workers.

One may also point out regions which have occupational structure of employment similar to the national one, for example Wielkopolska region, and those where the structure is significantly different, for example Silesia and the Lublin region.

Figure 11:7    **Major occupational groups — Spatial concentration in 2008**
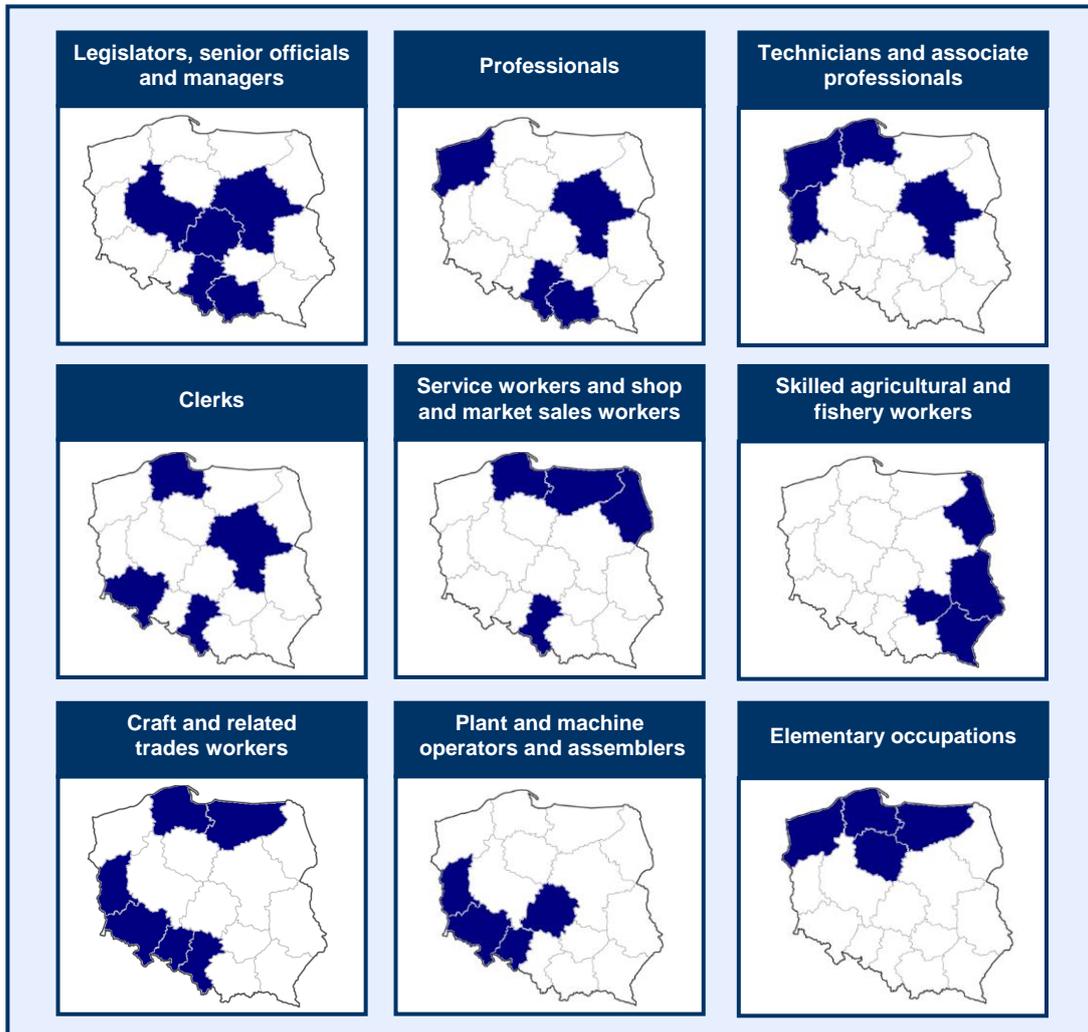


*Source*:    Own calculations based on labour force survey data.

Other methods to be used for comparing structures may be coefficients of structure similarity in statical analysis or shift-share analysis, which enables the separation of structural and geographical factor in dynamic analysis of structural changes (Gajdos, 2011).

The analysis of data from shift-share analysis table enables the indication of regions characterised by change dynamics of the total number of the employed much different from the national average, for example North Pomeranian region, the Mazowsze region, and those where the dynamics is close to the national one, for example Warmia and Mazury province and the Lodz region. It is also possible to distinguish a structural and geographical effect.

Table 11:1    **Location quotients in 2008**

| NUTS2 | Major occupational groups | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |
| Lower Silesia | 0.86 | 0.89 | 1.06 | 1.13 | 1.06 | 0.40 | 1.27 | 1.31 | 0.97 |
| Kujawy-Pomerania | 0.99 | 0.72 | 0.86 | 1.00 | 0.94 | 1.28 | 1.01 | 1.03 | 1.35 |
| Lublin | 0.79 | 0.96 | 0.93 | 0.75 | 0.78 | 2.25 | 0.73 | 0.66 | 1.02 |
| Lubuskie | 0.83 | 1.00 | 1.13 | 0.75 | 1.00 | 0.43 | 1.20 | 1.39 | 1.08 |
| Lodz | 1.11 | 0.97 | 0.83 | 1.07 | 0.88 | 1.21 | 0.86 | 1.19 | 1.05 |
| Malopolska | 1.22 | 1.04 | 0.79 | 0.97 | 0.96 | 1.20 | 0.96 | 0.93 | 1.01 |
| Mazovia | 1.10 | 1.29 | 1.15 | 1.19 | 0.98 | 0.96 | 0.73 | 0.82 | 0.87 |
| Opole | 0.91 | 0.94 | 1.07 | 0.89 | 1.04 | 0.66 | 1.19 | 1.18 | 1.02 |
| Podkarpacie | 0.82 | 0.85 | 0.96 | 0.80 | 0.95 | 1.83 | 0.84 | 1.04 | 0.75 |
| Podlasie | 0.67 | 0.90 | 1.05 | 0.93 | 1.09 | 1.71 | 0.70 | 0.90 | 1.00 |
| Pomerania n | 1.03 | 0.98 | 1.17 | 1.10 | 1.09 | 0.41 | 1.19 | 0.94 | 1.14 |
| Silesia | 1.12 | 1.09 | 1.09 | 1.14 | 1.20 | 0.16 | 1.23 | 1.11 | 0.86 |
| Swietokrzyskie | 0.85 | 0.87 | 0.79 | 0.64 | 0.85 | 1.99 | 1.01 | 0.81 | 0.94 |
| Warmia-Masuria | 0.60 | 0.93 | 1.04 | 0.71 | 1.11 | 0.82 | 1.20 | 1.10 | 1.23 |
| Wielkopolska | 1.19 | 0.79 | 0.85 | 1.01 | 1.02 | 1.00 | 1.17 | 1.04 | 1.03 |
| West Pomerania | 0.94 | 1.16 | 1.29 | 0.94 | 1.04 | 0.31 | 1.15 | 0.85 | 1.29 |

*Source*:   Own calculations based on LFS data.

Table 11:2    **Shift-share analysis in 2004-08 (major ISCO groups)**

| NUTS2 | Change 2004-08 | Total result (region – Poland) | Structural result | Geographical result |
|---|---|---|---|---|
| Lower Silesia | 18.3 | 4.2 | 3.9 | 0.3 |
| Kujawy-Pomerania | 5.2 | -8.9 | 1.2 | -10.0 |
| Lublin | 9.4 | -4.7 | -6.6 | 1.9 |
| Lubuskie | 5.0 | -9.1 | 3.4 | -12.5 |
| Lodz | 16.4 | 2.4 | -0.3 | 2.7 |
| Malopolska | 6.8 | -7.3 | -2.3 | -4.9 |
| Mazovia | 23.7 | 9.7 | -1.2 | 10.9 |
| Opole | 19.5 | 5.4 | 0.4 | 5.0 |
| Podkarpacie | 17.8 | 3.8 | -4.5 | 8.3 |
| Podlasie | 21.1 | 7.0 | -6.6 | 13.6 |
| Pomerania | 22.5 | 8.5 | 2.6 | 5.8 |
| Silesia | 10.9 | -3.1 | 4.8 | -7.9 |
| Swietokrzyskie | 21.5 | 7.5 | -5.6 | 13.1 |
| Warmia-Masuria | 14.4 | 0.4 | 1.5 | -1.2 |
| Wielkopolska | 6.8 | -7.2 | 2.0 | -9.2 |
| West Pomerania | 1.7 | -12.3 | 2.7 | -15.0 |
| **Poland** | **14.0** | | | |

*Source*:   Own calculations based on labour force survey data.

177

The information obtained in the process of time-series-cross-section (spatial) data analysis may be a complementary source of specific, additional information, the use of which in the forecasting process may lead to getting better forecast results. It is possible to apply these methods in the regional structures forecasting process (national), as well as the European level (international).

## 11.4. The forecast of regional occupational structure of employment in Poland

Test results of occupational structure forecasts in the cross-section of major occupational groups in selected provinces are presented below. The Lublin province is a region with the employment structure is significantly different from the rest of the country. Wielkopolska region is characterised by employment structure similar to the national one.

Figure 11:8    **Forecast for major occupational groups — Lublin region**
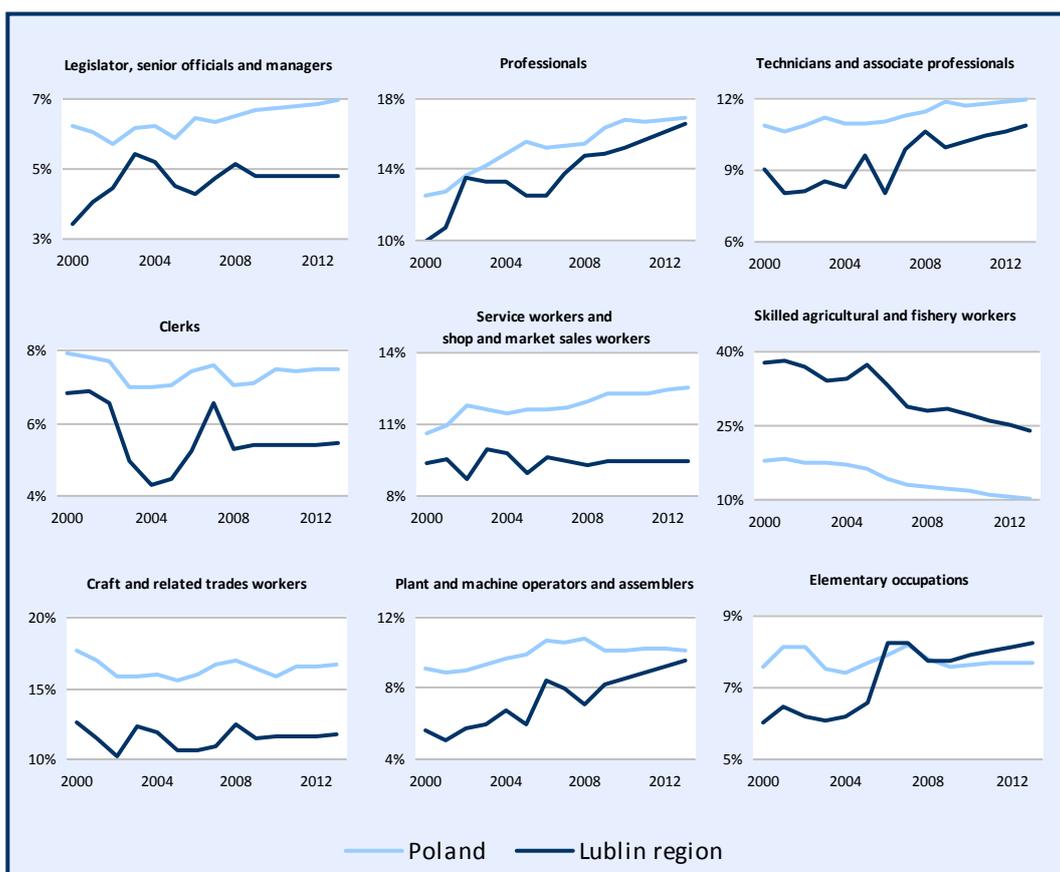


*Source*: Own calculations (LDSF) based on labour force survey data.

Figure 11:9 **Forecast for major occupational groups — Wielkopolska region**
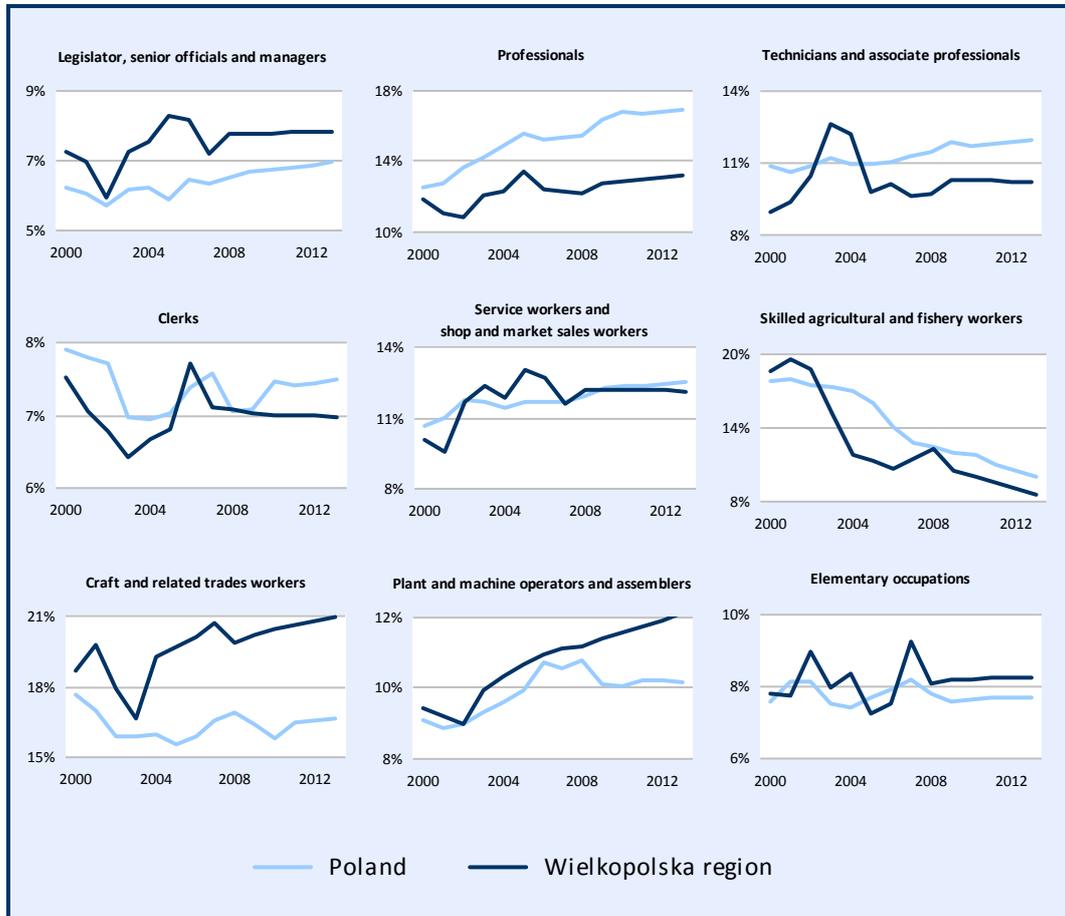


*Source:* Own calculations (LDFS) based on labour force survey data.

## 11.5. Conclusion

The paper identifies important areas concerning improvement of forecasting process quality. It indicates the occupational groups, for which the forecasting must be done in a particularly careful way due to their importance in the economical transformation process (professionals, service workers and agricultural workers).

The paper presents suggestions for using time-series-cross-section data analysis methods for forecasting employment structure in Poland by regions (NUTS2).

The obtained results indicate that these methods can be used in the forecasting process. The application of location quotients and shift-share analysis allows additional information which may be used for time-series-cross-section data forecasting in the territorial cross-section. The analyses and forecasts on

179

regional level are at present an inherent element of the European Union policy, including measuring the effectiveness of cohesion policy.

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CHAPTER 12.

# Forecasting the development of the educational level in Switzerland

*Jacques Babel*

The Swiss Federal Statistical Office (FSO) produces annual forecasts for the entire education system. These would in principle constitute an ideal foundation for the scenarios for the educational level, scenarios for which a new model has just been developed. This stock-flow model also incorporates the international flows of human capital, a phenomenon that should not be neglected in Switzerland.

More than the reliability of the quantitative results of the scenarios for the educational level, detailed analyses show that it is their interpretation that may present some difficulties owing to inconsistencies between the development of the educational level and the flows of new graduates. The political importance of accurately predicting the future development of the skills supply and thus the educational level means that it is essential to ensure that the scenarios for the educational level are consistent with the scenarios for the numbers of pupils and students.

## 12.1.   Overview of the FSO's education forecasts

In the education sector, forecasts play an important role in planning for the education system (budget, etc.) and the first works on this subject in Switzerland date from the 1970s. For 10 years, these have clearly assumed greater importance, with 10-year forecasts being made annually for the entire education system. This forecasting is carried out to very detailed degrees of (regional or institutional) granularity, such as for each university in Switzerland and approximately 30 educational sectors (FSO, 2010a; 2010b; 2011a).

The flows of the education system are represented in greater detail in the model. These flows account as fully as possible for mobility, such as between or within universities, between or within qualifications or various transition periods. The modelling output is produced in the form of rates of transition between many states.

Many outputs are provided by the project, whether in relation to numbers of pupils or students, numbers of qualifications, information about human resources or forward-looking indicators.

Some hypotheses are developed to account for structural phenomena, reforms in progress, upgrading of courses or observed trends and flows of

students from abroad. The quality of the forecasts is subjected to permanent monitoring.

One important consequence of these works is a detailed knowledge of the dynamics of the Swiss education system. The most important result for works on society's future skills requirement is a reliable forecast of the future number of graduates from the Swiss education system.

## 12.2. Educational level forecasts — Model

The scenarios for the educational level have so far formed part of the scenarios for the development of the Swiss population (FSO, 2010d). In these works, demographic scenarios provide input to the works on the scenarios for the educational level. These are then used to determine the future active population of Switzerland for the next 50 years.

In 2009, the forecasting model was completely revised (FSO, 2009). The current form is a multistate hierarchical model (see, e.g. Lutz et al., 1999). This means that in each state a probability of transition to another state is determined. The model is hierarchical in the sense that the educational level can only progress. The states or strata are age, sex, nationality (Swiss or foreign, considering naturalisations via probabilities of transitions) and the highest educational level. For the latter, four levels are being considered from this year, namely levels ISCED 1 (low qualification), 3-4 (medium qualification), 5A (high qualification: universities) and 5B (high qualification: professional education and training). The modelling is fully consistent with the demographic scenarios. Some simplifying assumptions are nevertheless made concerning two minor phenomena in Switzerland as concerns 25-64 year-olds: it is implicitly assumed that mortality for these age groups does not depend on the educational level, as with the immigration or emigration of Swiss nationals.

These works have two further characteristics:

(a) they aim to account as precisely as possible for migratory flows (Section 12.2.1);

(b) although it is a stock-flow model, both the stock and the flow are determined using the Swiss labour force survey (SLFS) (FSO, 2004). This ensures that the model is internally consistent (Section 12.3).

### 12.2.1. Accounting for migration flows by educational level

Particular emphasis is placed on the appropriate treatment of migration, as this has played an important role in Switzerland for many years. Since 2003, a substantial, highly qualified immigration has been observed in this country.

Between 2003 and 2009, the migratory balance averaged 65 000 with, according to the SLFS, 60% of immigrants holding a tertiary-level diploma; that is, distinctly higher proportions than for the 25-64-year-old Swiss population. In contrast, the proportion of immigrants without post-compulsory education was 12%, a distinctly higher level than for the Swiss population of the same age group ([75]).

Another reason for taking full account of migration is the fact that these forecasts are also designed to describe the future population of Switzerland and therefore also the composition of its foreign population.

For immigration, the available data sources are the demographic records, as well as the SLFS, for the educational composition of the population.

There is no quantitative information available concerning emigration. The method used to work out the age composition for the educational level of emigrants therefore consists in comparing the observed development of the age composition of the educational level of Switzerland's foreign population between 2003 (baseline for the model) and 2009 with that predicted by the model for various hypotheses. A very good adjustment is obtained by simply assuming that the educational level by emigrants' age is the same as that of immigrants for those aged 50 years and under (FSO, 2009). This adjustment is much better than if the educational level of emigrants is assumed to be the same as that of the foreign population of the same age. These results correspond with analyses made, for example, by taking emigrants' origin as a basis. They also demonstrate that the highly qualified population currently entering Switzerland is mobile and it is also the population that most commonly emigrates.

These analyses also enable us to assess the 'brain-gain' in Switzerland in recent years and also in some sense to determine how the demand in the labour market for highly qualified workers has been partly met by immigration. It is found that the 'migratory balance' of tertiary-level graduates between 2004 and 2009 stood at 28 000 per year (48 000 arrivals versus 20 000 departures). This figure is highly significant when compared to the approximately 50 000 tertiary-level diplomas awarded annually in Switzerland by the universities or advanced professional training programmes.

This importation of human capital also has had a significant effect on the educational level of Switzerland's foreign population (in six years, a nine-point increase in the proportion of tertiary-level graduates). The proportion of tertiary-

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([75]) The SLFS gives also information on the nationality of the immigrants. It indicates larges differences, with percentages of immigrants with tertiary education ranging from around 70% for instance for German or French citizens, to values around 15% for citizens of several countries (the sample size does not permit to go much in detail).

level graduates in this population is currently reaching the same level as for Swiss nationals, although the probability of foreigners having attended school in Switzerland and having reached tertiary level is distinctly lower than that of the Swiss (FSO, 2010d). The effect of the 'brain-gain' on the proportion of tertiary-level graduates in the entire Swiss population is not insignificant either, ranging from 1-1.5 points over the period under consideration. According to Sheldon and Straubhaar (2008), this immigration has substantially contributed to the increase in productivity and growth in recent years.

### 12.2.2.   Main results of the scenarios for the educational level

The results of the three scenarios considered by FSO for the educational level are described in detail in FSO (2010d). The 'high' scenario assumes an ever-increasing transition to tertiary level (universities or higher vocational training), a continuation in the increase in the educational level of the immigrant population and a high hypothesis on the current rates of transition to tertiary level for foreigners with a gradual reduction in the gap between Swiss nationals and foreigners with respect to the probability of obtaining a diploma at upper secondary or tertiary level. The reference scenario (medium) is based on much more modest hypotheses that are relatively close to a status quo in terms of education. It relies chiefly on the assumption that the upgrading process from upper secondary to tertiary level, which several training and education programmes in teaching, health, social work and the arts have undergone, is coming to an end in Switzerland. To set the baseline rates of transition to tertiary level, the 'low' scenario considers first the uncertainty about the actual relevance of the number of new graduates measured in the labour force survey. It supposes a decrease by 25% of the probability of entering the tertiary level at any age in comparison with the baseline levels adopted in the other scenarios, a very slight decrease in the probability of obtaining an upper secondary diploma and a gradual decline over time of the probability of obtaining a tertiary level diploma, a 'low' hypothesis on the probability for the foreign resident population to obtain a tertiary level degree and a decline in the educational level of the immigrant population.

For the Swiss population as a whole (Figure 12:1), a very strong increase in the educational level is anticipated for the coming years. According to the reference scenario, the proportion of those holding a tertiary-level qualification in the 25-64-year-old population is expected to rise from 35% to 46% in 2020 and from this date to exceed the proportion with an upper secondary-level qualification. The foreign population should witness a similar increase in its proportion of tertiary-level graduates to that of Swiss nationals. The proportion of

those without post-compulsory education among foreigners is also set to decline. However, as a result of the lower probabilities for foreigners than the Swiss of obtaining an upper secondary level or tertiary-level diploma, a base level of 15% of people with no post-compulsory education in this population may subsist over the medium to long term.

Figure 12:1   **2010-60 scenarios for the population development: level of education of population aged 25 to 64 in Switzerland**
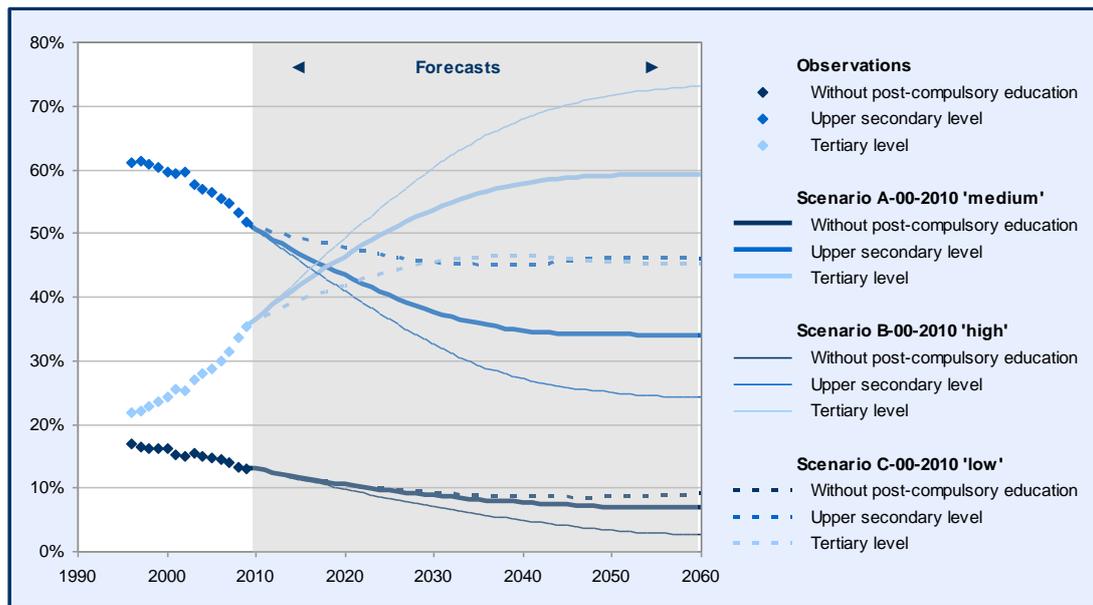


NB:          Forecasts: as in July 2010.
*Source*:    FSO, scenarios for the population development and education prospects.

## 12.2.3.   Comparing the FSO and the Cedefop (2010) forecasts

A comparison between the population's educational level according to the FSO (2010d) and Cedefop (2010) forecasts is made in Figure 12:2. The overall results for 2020 are very similar, differing by only 1 percentage point (for an 11-point increase during the same period) ([76]). In the age composition some major differences are observed. While good agreements are obtained for some age groups, Cedefop (2010) clearly anticipates more graduates among 25-29-year-olds (10 points more than FSO, 2010d) and distinctly fewer among 40-44-year-olds (10 points less). This difference may originate from the fact that the 'flow' of new graduates used by Cedefop (2010) is not completely consistent with the stock, probably with an overestimate by Cedefop (2010) of the proportion of

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([76]) This difference is not really higher than that recorded for 2009 and is probably attributable to slightly different definitions.

tertiary-level diplomas issued in Switzerland to those of 30 years of age and under (Figure 12:1). A similar result is obtained for those without post-compulsory education, with a very good agreement on the overall proportions but major differences in the age distributions.

Figure 12:2 **Percentage of high qualification in the Swiss population, by age**
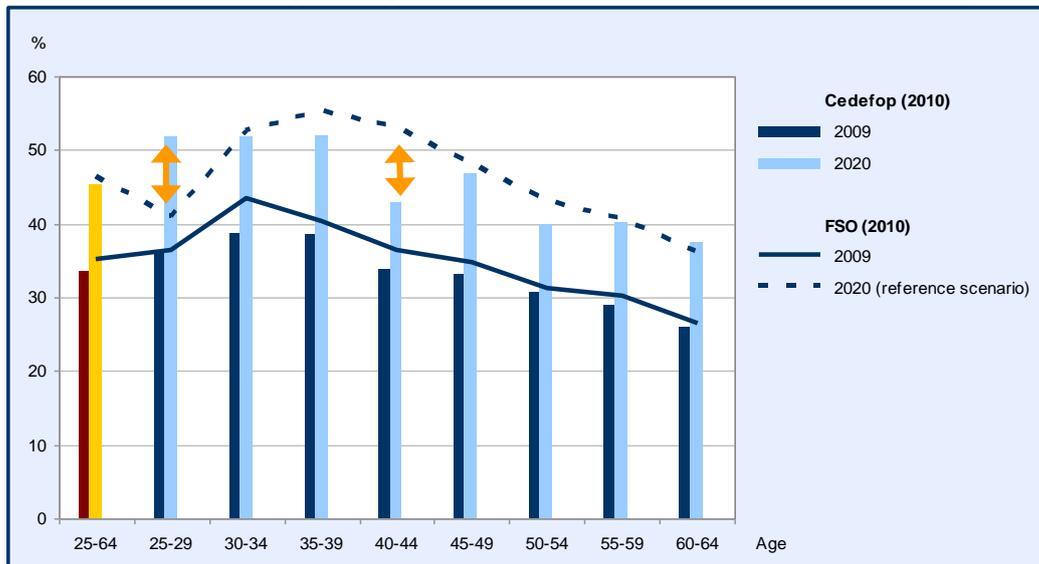


*Source:* FSO, education prospects.

## 12.3. What are the future flows of new graduates?

The correspondence between the FSO (2010a-d) and the Cedefop (2010) forecasts, as well as the extensive preliminary testing, show that neither the forecasting model nor the quality of the projections for the educational level should pose real problems in themselves. Nevertheless, the results of these forecasts raise some questions, in the sense that the high proportion of tertiary-level graduates anticipated for 2020 for the 25-64-year-old population seems at first sight to contradict the picture obtained by examining certain indicators, such as the rate of new tertiary-level graduates in the population, an indicator that currently stands at approximately 50% (FSO, 2011b).

This possible discrepancy, thus, raises several questions concerning the true relevance of the observed educational level, as obtained from responses to the SLFS interviews. Is the development of the educational level (stock) truly compatible with the numbers of new graduates (flow)? How does the educational level that people state that they have compare with the level that we think they have (according to standard definitions)? What exactly do we mean when we

refer to educational level? These questions are not purely methodological because such indicators may form the basis for policy decision-making processes.

The only way to answer these questions is to adopt a common frame of reference and to make a detailed comparison of the flows of new graduates between the various sources. These flows can be obtained specifically in the three following ways:

(a) **SLFS-T**. Using macroscopic data from the SLFS (FSO, 2009): this method consists of 'differentiating' the 'stock' for each category of age, sex or nationality (Swiss or foreign). It, therefore, entails postulating that for a defined population, the development in the number of graduates between two consecutive years provides a good estimate of the number of new graduates in the group analysed. It is of interest because where this measure is possible, it provides by definition distributions of new graduates that are consistent with the development of the educational level. However, it presents many difficulties. To prevent possible bias, the populations analysed must be so defined as to eliminate the migratory or naturalisation effects. Also, this method is only applicable for few study levels or transitions (three educational attainments and two transitions in FSO, 2009);

(b) **SLFS-L**. Using the SLFS panel data: this method consists of drawing on the SLFS panel, i.e. on the longitudinal data, and in measuring the numbers of people who report having made a change or not in higher education completed between consecutive years. It has many advantages over the previous method, such as its capacity to consider many study levels or transitions. It may, however, be susceptible to possible effects of the 'design' of the panel, for example where the method of re-interviewing people in the sample group would cause possible bias;

(c) **EduSys**. Using data from the education system: This method, which provides an objective measure of the population's education, is at first sight the simplest. It consists of considering all the new graduates of the education system using the detailed administrative statistics gathered in the country. In Switzerland, this flow of new graduates cannot truly be determined with great accuracy owing to the possibility of double-counting and sometimes deficient information about age distributions for certain types of diploma. The possibility of small problems of coverage also cannot be excluded.

In the following sections, comparisons are made for different transitions. They are restricted to the population of Swiss nationality, a category for which good-quality comparisons can be made. Several processing stages are

necessary so that the various sources can be compared on a common basis: transformation, calculated or estimated, of the sources into a single period of reference (using the dates of the SLFS interviews as reference), estimates of double-counting (for the upper secondary level and advanced professional training), consistent age definitions and sometimes estimates of the proportions of Swiss nationals. To limit statistical variations, comparisons are made by pooling data on the transitions made between pairs of successive years from the years 2006 to 2008.

12.3.1.1. *From low to medium qualification*

Figure 12:3 presents the numbers of first upper secondary level diplomas obtained, i.e. the transitions made between the low and medium qualification levels according to the Cedefop (2010) categories. The three methods used provide very close results. However, a slightly lower value seems to be obtained for the measurements made using the SLFS panel group for those aged 20 years and over.

Despite these excellent agreements, an uncertainty of around three percentage points remains as regards Swiss nationals who do not obtain any post-compulsory diploma.

Figure 12:3 **Number of degrees awarded in the upper secondary programmes (ISCED 3-4, medium qualification)**
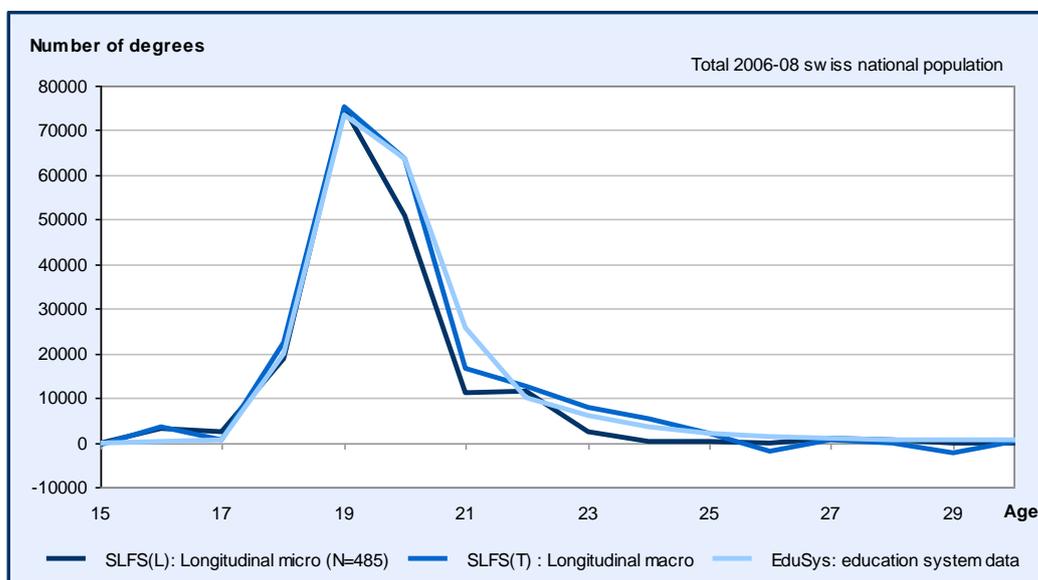


*Source:* FSO, education prospects.

12.3.1.2. *To high qualifications (universities, ISCED 5A/6)*

Given that the SLFS-T method can only be used for the tertiary level as a whole, the comparisons made in this and the following paragraph only concern the results according to SLFS-L and EduSys.

As concerns the Swiss institutions of higher education, the comparison is clearly sounder than for the transitions to the upper secondary level. In fact, the data for the university system allow all the double-counting to be completely removed and require no estimate for the determination according to EduSys. An excellent agreement between methods is obtained concerning the number of transitions between the upper secondary level and the institutions of higher education (Figure 12:4). The total numbers only differ by 9% and the age distributions are very similar.

More surprising is the result obtained for transitions between advanced professional education training (5B) and institutions of higher education (5A). While the creation of the institutions of higher education of applied sciences in the late 1990s is a phenomenon that has resulted in approximately 1 000 diplomas per year being recognised retrospectively and approximately 1 300 new diplomas per year being awarded in institutions of higher education to those who have previously completed professional education training studies, SLFS-L indicates that a five times greater number, namely approximately 10 000 people per year, could have made this transition. Given that the statistics only include continuing education programmes lasting one year full-time (60 ECTS or more), one possible interpretation is that the divergence arises from short continuing education programmes. ([77])

12.3.1.3. *To high qualifications (ISCED 5B, professional education and training)*

The advanced professional training sector (ISCED 5B, professional education and training) is very important in Switzerland because it represents about half of the tertiary-level diplomas issued every year. It is also a highly complex sector because it offers a very broad range of courses, and it is difficult to work out using the education statistics. The situation is also complicated by the fact that certain variables are not always available and recourse has to be made to estimates, especially as concerns age distributions (see also FSO, 2011b). The comparison below, Figure 12:5, between the various sources shows a fairly good agreement for people aged less than 30 years. Above these ages, more people are clearly recorded reporting in the SLFS having obtained a diploma of this type than are measured in the official education statistics.

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([77]) Recent computations based on the new SLFS and the 2010-11 data seem to indicate a better agreement for institutions of higher education than depicted here.

Figure 12:4    **Number of first degrees awarded in the Swiss universities (ISCED 5A-6, high qualifications)**
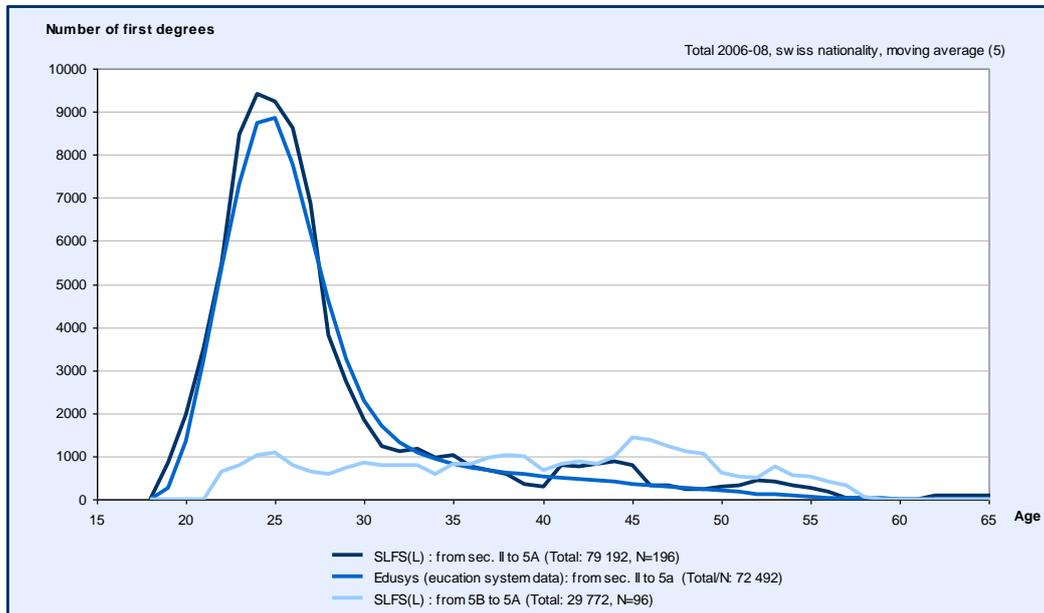


*Source:*   FSO, education prospects.

In total, the number of diplomas differs by 40% and the age distributions are very clearly different. The origin of the differences is currently unknown. There are several possible hypotheses. Given that it seems improbable that there should be a large lacuna in the education statistics concerning courses of a longer duration than one year, one hypothesis may be that the people interviewed in the SLFS are reporting continuing education programmes of short duration in the SLFS.

12.4.   These results obtained using the SLFS-L for the 2006–09 period confirm the results obtained by the FSO (2009) for three educational levels (and therefore with no distinction between ISCED 5A and 5B), but for the period from 1996 to 2008. Next step

The Cedefop (2010) works are very important, specifically because they combine aspects connected with the skills supply with those connected with demand. Given that works on the educational level, and therefore on the supply, may also serve as a basis for strategic considerations, it is important to make combined and consistent forecasts both for the educational level and for the education

system. Depending on the available data it may constitute a challenge, but this work is necessary for several reasons.

(a) these works enable us to develop better hypotheses and therefore better forecasts for the educational level, given that the flows of new graduates stem directly from the scenarios for the education system. Because of this consistency, they can also provide more comprehensible results;

(b) the forecasts are easier for decision-makers to use because it is then possible to connect future developments in the population's educational level with future developments in the numbers of pupils or students.

Figure 12:5 **Number of first degrees from professional education and training programmes (ISCED 5B, high qualification)**
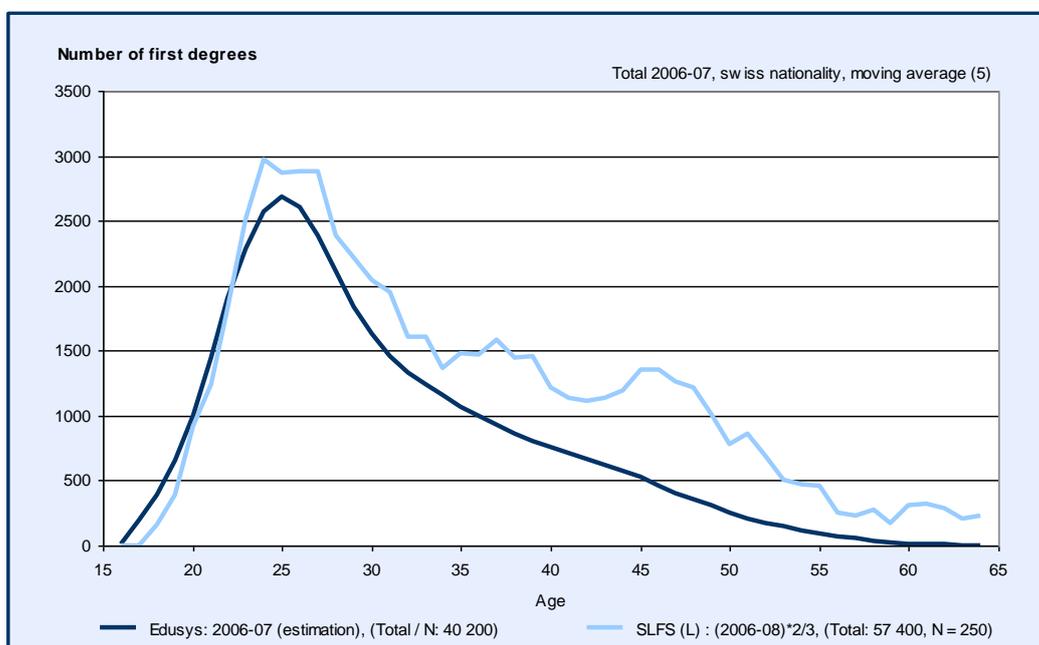


*Source:* FSO, education prospects.

The discrepancies currently recorded in the numbers of diplomas show the difficulties of achieving this objective, for either the future development is inconsistent with and higher than the future outputs in the education system, or the current educational level, which serves as a starting-point, is not compatible with the education system. Figure 12:6 shows the projected future development in the educational level of the Swiss population according to the data source used. The forecast of the number of people without post-compulsory education is very robust in relation to the source used. This is due to the fact that the various sources have a very high consistency and the reduction in the proportion of people without post-compulsory education is principally due to the replacement of the old generations, who have distinctly less education than the young

generations. At the tertiary level, the difference is significant and is reaching around four points towards 2020. This difference concerns both the entire tertiary sector and the university sector.

Figure 12:6    **Level of education of the population of Switzerland as a function of the data source used for the flow**
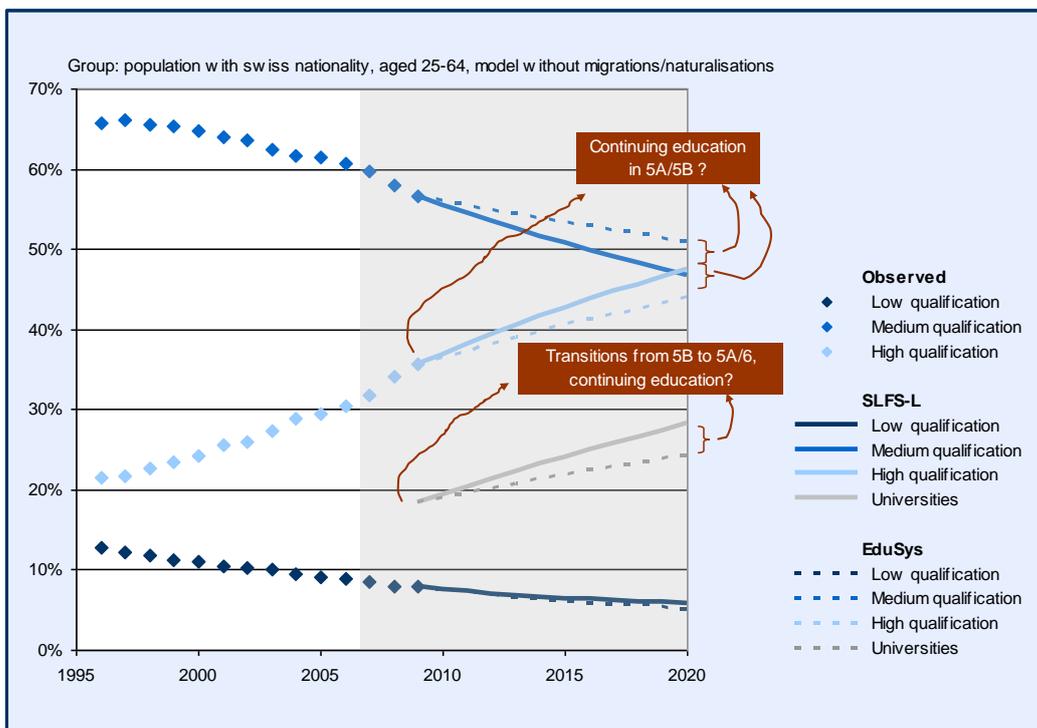
Owing to the limits indicated above, the only possible interpretation currently that is consistent with the education system data is to communicate the higher limits. Accordingly, in 2020 the SLFS should show proportions of tertiary-level graduates of 47% and of university graduates of 28%. The same proportions, calculated consistently with the outputs of the education system, should however remain lower than 44% and 24% respectively.

## 12.5.    Closing remarks

As concerns the educational level, a very good agreement is found with Cedefop (2010) results, if the age composition is abstracted. This discrepancy in the age composition shows that the Cedefop model might perhaps be improved by considering age-related flows that would be consistent with the stock. That

means considering the large proportion of people who, in Switzerland for example, obtain a first tertiary-level diploma after the age of 30 years.

To make good use of results of the scenarios for the educational level, it is important to run controls on the compatibility between the flows causing the developments in the proportions of graduates in the population and those delivered by the education system. In Switzerland detailed comparisons were made by 'differentiating' the 'stock' or taking the SLFS panel data as a basis. These comparisons show appreciable gaps, especially for those over 30 years of age, and indicate that the development of the educational level is faster than it would be based on the numbers of diplomas recorded in the education statistics. It is probable that such inconsistencies between the 'stock' and the flow of new graduates exist in other countries. Comparative works of this kind must also have an impact on the quality of the data sources. It is in fact for this purpose that an additional category was recently introduced in the microcensus of 'basic education and continuing education' that is being carried out in 2011.

As the educational level is a key indicator for the measurement of the stock of human capital, and its future development is at the heart of political considerations, scenarios for the educational level should be consistent with the scenarios for the numbers of pupils and students. In the short term, this can be achieved relatively easily as long as the flows of graduates are consistent according to the various sources. In the long term, this also requires formulating consistent hypotheses between the various models.

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CHAPTER 13.

# Education — Training complementarity in Finland

*Erkki Laukkanen*

Following the division to three qualification levels based on the international standard classification of education (ISCED), the supply of adult education is estimated for the period 1990 to 2006. In the 1990s, adult education and training of better educated was superior to less educated individuals. This was because of education-training complementarity. But in the 2000s, the difference between skill-levels has decreased, since vocational adult education and training of those with low skill-level has relatively increased. Training-training complementarity, instead, has prevailed, i.e. work-oriented training generates more work-oriented training. An explanation to decreased education-training complementarity is the forecasted shortage of qualified employees in the long term. The shortage has motivated redirecting training to those with no vocational education. The lasting training-training complementarity is to be seen as a consequence of this redirecting: upgrading skills of those with no vocational education favours short work-oriented courses.

## 13.1. Study set-up

The situation in Finland is challenging. The education level of young cohorts is higher than older ones. One key reason is that education attainment of younger age groups is among the highest in the world. Today the demarcation line is rather close to 50 years of age. This dichotomy is a consequence of the decisions made in the 1960s and 1970s, when the supply of the secondary and tertiary level education was substantially increased. Educational attainment of people who were educated in the 1970s is considerably better than the educational attainment of people who were educated earlier. Since the 1980s, the basic idea of Finnish adult education has been upgrading, i.e. directing people towards the next higher level of education (Lifelong learning Committee, 1997).

From the policy point of view, it is favourable that this challenge is also recognised among the Finnish population, with rather small differences in assessment between the young and the old, as depicted by Aro et al. (2005). In the data, more than 90% responded affirmatively to several statements concerning the importance of education. On such a consensus it is possible to

constitute policy interventions that otherwise would not be possible. These interventions are targeted at people with no vocational degree.

The results from the last 10 to 15 years are ambiguous. However, adult education has expanded quite well compared to other OECD countries. Every second person takes at least some adult education during 12 months reference time. Especially, the volume of employer-provided training has increased in general, and in the 2000s, the focus has been on those who enter the labour market without a vocational degree.

Since 1994, it has been possible to aim at competence-based qualifications without formal education procedures. In the 2000s, the volume of this system has expanded considerably favouring those with no formal educational qualification. Besides, starting from 2003, and ending in 2009, the lifting campaign focused on lifting the qualifications of the educationally weakest.

The statistics show that most of the vocational adult education and training takes place outside the formal, degree-based education system. In the 1990s, the share of employer-provided training of all vocational training has increased. This is not problematic as such, but since only some employer-provided training is degree-oriented, vocational adult education has not directed people to next higher level of education as planned in the 1980s (Laukkanen, 2010). Formal skills upgrading has not taken place.

In the 2000s, the general picture has changed, as depicted below. Training days for well-educated (skill-level 3) have decreased, days for typically educated (skill-level 2) remained constant, and days for poorly educated (skill-level 1) increased. This may be because of new policy interventions discussed above, but also other reasons, arising from other changes in the labour market, may exist.

Altogether, deviations from the old pattern suggest that education-training complementarity has weakened. In the following this possibility is modelled with data from the Finnish adult education surveys (AES), from 1990, 1995, 2000 and 2006. The methodology is microeconometric. The modelling is based on Heckman's (1972) two step estimator. In step one, selection for training is estimated. In step two, the number of training days is estimated with a selection correction term constructed from the first step estimation. By comparing results for four successive years, it is possible to examine in some detail, what has changed. Finally, as policy conclusions, possible reasons for these changes are discussed.

Figure 13:1    **Days in vocational adult education and training by skill level during the last 12 months**
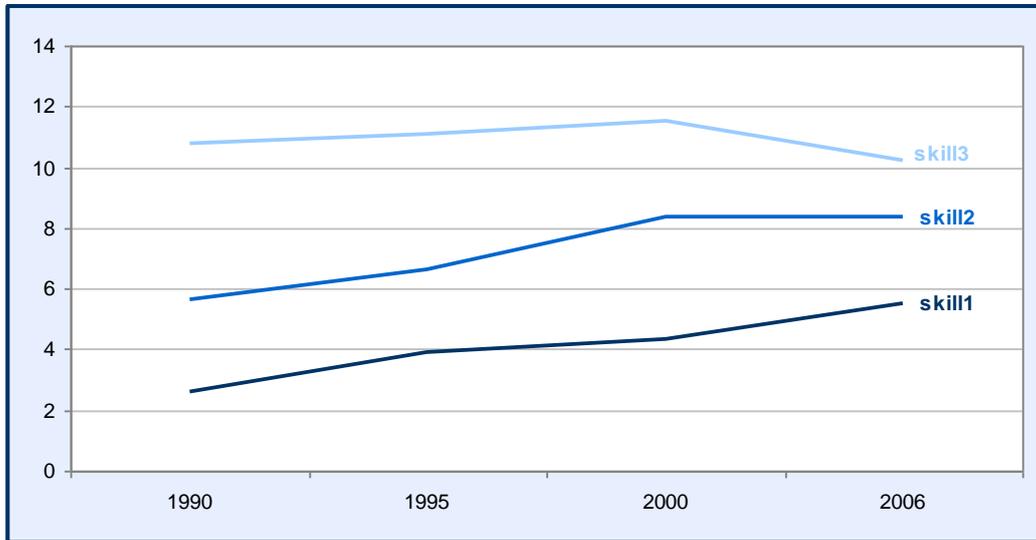


*Source*:    Adult education surveys 1990, 1995, 2000, 2006.

## 13.2.    The literature

How to identify wage effect of training when wages are observed for the trained? This problem of selection bias is well known from other research topics of labour economics and Heckman's (1979) two-step estimation has become the standard method for correcting this problem. The same method is on offer for the correction of selection for training bias in estimation of training days. In the first step, a probit model for positive annual training days is estimated. In the second step, the determinants of training days acquired during the last 12 months are estimated, including a selection correction term formed from the predicted values of the first step model.

Besides this, selection for training and determination of training days are contextual issues. In Finland, around 80% of all vocational training instances and around 50% of all days are employer-provided training, the need of which is assessed in cooperation between employers' and workers' representatives. Assessment includes informal relations arising from the people and tradition, and formal relations, such as meetings of cooperation bodies and documentation of the common understanding regarding the need for training. But the cooperation does not include such specialisation as the use of union learning representatives like in the UK (Davies, 2008).

Thus, direct guidance from outside the undertakings should not much affect the selection for training within undertakings. But then there is the question of

indirect guidance, through collective bargaining. In Finland, collective bargaining takes place between unions, and workplace bargaining is conditional to unions' approval. Moreover, collective agreements are generally binding, i.e. they apply to employees of an unorganised employer too. It follows that with around 70% union density bargaining coverage is 90-95%. This enables an institutional compression of wages, which decreases individuals' incentives to get training, but increases firms' incentives to invest in training (Malchow-Moeller and Skaksen, 2003).

Harcourt and Wood (2003, 2007) go further, and name Finland as a coordinated market economy, as contrasted to a liberal market economy, such as the UK. It is typical that in coordinated market economies, firms resource their internal labour markets by employment protection, which then provides workers with incentives to stay and develop their skills in the firm. In internal labour markets, firm-specific skills are created in the long term, through a combination of training, classroom instruction, work experience, mentoring, induction and other mainly informal processes. For employers this can be costly, but if firms are able to share the costs with workers, as compensation for employment protection, and the government, as compensation for positive externalities, cooperation can induce a superior development in productivity. Thus, in such labour market there should be more training.

Actually, we do not know to which extent the above principles are present in the Finnish labour market. In the EU, the framework concept for discussions like this is flexicurity, a concept seeking some kind of balance between flexibility, underlined by employers, and security, underlined by trade-unions. Within this framework training includes both points of view, flexibility and security, making it difficult to name the actual driver of change. Despite its ambiguities, discussed by Keune (2008) and Rubery et al. (2008), it challenges the values of employment protection, and — at least indirectly —the status of seniority, years with the present employer.

Unfortunately, only few of these aspects are included in the data. This is a general data availability problem. Such a data source that would include all the contextual variables hardly exists.

## 13.3.   The data

In the Cedefop forecasts for skills demand and supply, the focus is on education in general, i.e. there is no division between education at a young age and adult education. In most models the study set-up is based on macroeconomics and time series data. The basic units of data are aggregative in nature. In the case of

adult education and training this is not possible, since the basic units of data are persons and their characteristics.

By means of labour force survey it would be possible to construct time series data for persons. But, unfortunately, training data of the labour force survey are not reliable. As compared to data from Finnish adult education surveys of 1990, 1995, 2000 and 2006, the labour force survey leads to around 10 percentage points lower annual training participation rate. This is because of differences in data collection [78].

The adult education survey includes information on all human capital variables, such as formal, degree-based education, years and nature of work experience as well as adult education. It also includes in-service training [79] , measured by days during the last 12 months. Besides in-service training, paid for by the employer, vocational education and training includes self-motivated training, paid for by the student, and training for labour market reasons, paid for by Ministry of Labour. In the following, training includes all these forms of vocational education and training.

In Table 13:1, there are two sets of data: one for the first step estimation and another for the second step estimation. There are some common variables in both data sets, but the figures differ, since they depict to different samples. The first data set includes those who have had at least some work experience. The second data set includes those who have taken at least some vocational training during the reference year, 12 months before the interview of the adult education survey at given years [80].

From 1990 to 2006 training has expanded from 36 to 46% of the population. Meanwhile, average days of training has increased only from 15.6 to 18.5 days. The standard deviations, however, are large referring to the fact that training is unevenly distributed. The typical range is from 2 to 5 days, especially in the case of in-service training, but then some receive training even 270 days in one year's time. For those employees training is full-time education. The necessary thing to

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[78] In the adult education survey, sample persons' experiences are examined according to an extensive questionnaire and a face-to-face interview. In such case, sample persons may feel some social pressure to report at least some training, however, all relevant activity is reported accurately. In the labour force survey, in-service training is just one issue among tens of others. The survey is done by telephone, without separate expressions of education types and contents. There are no questions about other adult education forms, indicating the relative position of employer provided training. For these differences in data collection, the adult education survey reports higher participation rates for in-service training than the labour force survey.

[79] The Finnish parallel to Anglo-American on-the-job training.

[80] In the following, for reasons of expression, I call all this activity training.

do, when modelling the causality between training days and dependent variables, is to transform days into natural logarithm of days, and thus to make the distribution more normal.

Most of the dependent variables are indicators taking value 1 if the condition holds, and otherwise 0. Besides skill-levels, there are indicators for labour-market position (entrepreneur, wage earner or precarious), type of upgrading and gender. Precarious, as a labour-market position, refers to those without an established position of either an entrepreneur or a wage earner, such as students and unemployed. Forms of training are degree-oriented education and in-service-training, which are not mutually exclusive. In 2000, only around 3% of in-service training was degree-oriented. By 2006, percentage had risen to 13. Considering this, it is possible to estimate that the other education, the comparison group, has decreased from 35% in 1990 to 14% in 2006.

From 1990 to 2006, skill-level 1 has decreased from 19%, while skill-level 3 has increased from 24 to 36%. The rest, from 35 to 44%, are those with skill-level 2, with upper secondary education. This is to be considered as an extensive skills upgrading. However, there is only a limited increase in the number of training courses acquired during working life. From 1990 to 2006 they have increased from 10.3 to 11.4 courses.

## 13.4.  Selection for training

In the first step, I estimated the probability for positive number of training days. In the probit model, the independent variable is marked by one if training days >0, and by zero otherwise. This model is needed for two reasons. First, to show how well the available variables explain selection for training. Second, the predicted values of this estimation are used to form a selection correction term, included in the second step estimation for the number of training days ([81]).

The results of Table 13:2 show that the history of vocational adult education is a key determinant in selection for training. The more courses before the reference year, the more likely there has been training during the reference year as well. But over time, there seems to be a tendency to smaller effect, especially if there have been only few courses prior the reference year. In 2006, one previous course increased the probability of training by 18%, and more than 10

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([81])  If the coefficient estimate then proves to be statistically significant, the term corrects the bias rising from the fact that some people are more probably selected than others, independent of self-selection.

courses by 54%. Thus, training-training complementarity has prevailed, at least in relative terms.

Table 13:1 **The data**

| Variables | 1990 | | 1995 | | 2000 | | 2006 | |
|---|---|---|---|---|---|---|---|---|
| | **Mean** | **Std.d.** | **Mean** | **Std.d.** | **Mean** | **Std.d.** | **Mean** | **Std.d.** |
| **First step** | | | | | | | | |
| Training days > 0 | 0.36 | | 0.37 | | 0.44 | | 0.46 | |
| Male | 0.50 | | 0.50 | | 0.51 | | 0.50 | |
| **Position** | | | | | | | | |
| Entrepreneur | 0.13 | | 0.13 | | 0.11 | | 0.10 | |
| Wage earner | 0.64 | | 0.54 | | 0.59 | | 0.63 | |
| Other | 0.23 | | 0.33 | | 0.30 | | 0.27 | |
| **Skill-level** | | | | | | | | |
| Skill-level 1 | 0.41 | | 0.31 | | 0.27 | | 0.19 | |
| Skill-level 2 | 0.35 | | 0.38 | | 0.40 | | 0.44 | |
| Skill-level 3 | 0.24 | | 0.30 | | 0.33 | | 0.36 | |
| **Previous training** | | | | | | | | |
| 1 course | 0.10 | | 0.08 | | 0.07 | | 0.06 | |
| 2-3 courses | 0.15 | | 0.13 | | 0.13 | | 0.13 | |
| 4-10 courses | 0.20 | | 0.22 | | 0.23 | | 0.23 | |
| >10 courses | 0.27 | | 0.35 | | 0.42 | | 0.44 | |
| *Number of observations* | *3070* | | *3510* | | *2937* | | *4119* | |
| **Second step** | | | | | | | | |
| No of training days | 15.60 | 26.80 | 18.70 | 38.30 | 18.50 | 36.00 | 18.50 | 38.60 |
| Male | 0.49 | | 0.47 | | 0.48 | | 0.45 | |
| Years of age | 39.70 | 9.00 | 40.90 | 9.20 | 41.40 | 9.20 | 40.90 | 10.50 |
| Previous courses | 10.30 | 5.30 | 10.90 | 5.20 | 11.20 | 5.10 | 11.40 | 4.90 |
| **Position** | | | | | | | | |
| Entrepreneur | 0.07 | | 0.09 | | 0.08 | | 0.07 | |
| Wage earner | 0.92 | | 0.81 | | 0.82 | | 0.82 | |
| Precarious | 0.01 | | 0.10 | | 0.10 | | 0.11 | |
| **Skill-level** | | | | | | | | |
| Skill-level 1 | 0.21 | | 0.18 | | 0.14 | | 0.12 | |
| Skill-level 2 | 0.36 | | 0.36 | | 0.37 | | 0.38 | |
| Skill-level 3 | 0.44 | | 0.47 | | 0.48 | | 0.50 | |
| **Training form** | | | | | | | | |
| Degree oriented | 0.10 | | 0.05 | | 0.05 | | 0.17 | |
| In-service-training | 0.61 | | 0.76 | | 0.78 | | 0.79 | |
| Other training | 0.35 | | 0.21 | | 0.20 | | 0.14 | |
| *Number of observations* | *1102* | | *1302* | | *1287* | | *1889* | |

*Source*: Adult education surveys 1990, 1995, 2000, 2006.

Skill-levels matters too, but there changes have taken place only in the 2000s. In the 1990s, those with skill-level 2 had 5 to 6% bigger probability to get training than those at skill-level 1. But in the 2000s, the premium decreased to zero. Also those with skill-level 3 have lost some of their premium, but still in 2006 it was 11% compared with those with skill-level 1.

Also age is relevant. Ageing decreases the probability of training, especially after 54 years, as compared to younger than 35 years of age. And over time, this feature has got stronger suggesting that age discrimination is getting stronger. However, in this respect, the results for year 2006 are not worse than for 2000.

Wage earners have retained their premium relative to entrepreneurs and precarious labour, i.e. those with no established labour-market position. In 2006, wage earners' premium was estimated to be 20% (32-12) compared with entrepreneurs and 32% compared with precarious labour. All the time, excluding year 2000, males' marginal probability for training has been smaller than that for females.

Table 13:2    **Marginal probabilities to positive number of training days (%)**

| Dependents | 1990 | | 1995 | | 2000 | | 2006 | |
|---|---|---|---|---|---|---|---|---|
| | dF/dx | Std. Err. | dF/dx | Std. Err. | dF/dx | Std. Err. | dF/dx | Std. Err. |
| Male | -0.07** | 0.02 | -0.04* | 0.02 | -0.03 | 0.02 | -0.09** | 0.02 |
| CF age < 34 | | | | | | | | |
| Age 35-44 | -0.08** | 0.02 | -0.08** | 0.02 | -0.08** | 0.03 | -0.09** | 0.02 |
| Age 45-54 | -0.11** | 0.02 | -0.11** | 0.02 | -0.15** | 0.03 | -0.16** | 0.02 |
| Age > 54 | -0.20** | 0.02 | -0.25** | 0.02 | -0.37** | 0.02 | -0.34** | 0.02 |
| CF precarious | | | | | | | | |
| Entrepreneur | 0.30** | 0.06 | 0.10 | 0.03 | 0.05 | 0.04 | 0.12** | 0.03 |
| Wage earner | 0.35** | 0.02 | 0.30** | 0.02 | 0.29** | 0.02 | 0.32** | 0.02 |
| CF skill-level 1 | | | | | | | | |
| Skill-level 2 | 0.05** | 0.02 | 0.06* | 0.02 | 0.06* | 0.03 | -0.01 | 0.03 |
| Skill-level 3 | 0.14** | 0.03 | 0.15** | 0.03 | 0.17** | 0.03 | 0.11** | 0.03 |
| CF none | | | | | | | | |
| One previous course | 0.41** | 0.05 | 0.29** | 0.05 | 0.18** | 0.05 | 0.18** | 0.05 |
| 2-3 previous courses | 0.46** | 0.04 | 0.32** | 0.04 | 0.25** | 0.04 | 0.24** | 0.03 |
| 4-10 previous courses | 0.61** | 0.04 | 0.43** | 0.03 | 0.39** | 0.04 | 0.34** | 0.03 |
| >10 previous courses | 0.77** | 0.03 | 0.62** | 0.03 | 0.59** | 0.03 | 0.54** | 0.03 |
| *Number of observations* | *3070* | | *3510* | | *2937* | | *4119* | |
| *Pseudo R2* | *0.40* | | *0.30* | | *0.29* | | *0.24* | |

Robust standard errors, * and ** are statistically significant coefficients at the level of 0.05 and 0.01

CF =  Compared to.

*Source*:    Adult education surveys 1990, 1995, 2000, 2006.

There is one more result to report, about the model itself. The coefficient of determination, Pseudo R2, has decreased over time to almost half. This refers to other latent factors, not available in the data. Thus, the above results are robust only for given data. More detailed data, if they were available, could change the picture.

## 13.5. Training days

In the second step, I estimated the amount of training acquired during one year reference time before the interview round. The estimator is ordinary least squares with robust standard errors. In Table 13:3, the coefficient estimates depict to %, as the independent variable is logarithm of training days. The available dependents explain from 10% in 1990 to 30% in 1995 of the total variation of training days ([82]). Since 1995, there has been a systematic decrease over time, much stronger than in Table 13:2.

The results suggest that males have acquired less training days than females, especially in 1990 and 2006. In the 1990s, the premium for young, less than 34, was significant and increasing. In the 2000s, something has changed, since only those older than 54, have received less training days than the youngest. For entrepreneurs there seems to be a persistent training deficit. They have acquired less training days than wage earners and precarious labour, i.e. those with no established labour-market position. Since 1995 the difference between wage earners and precarious labour, 60 to 90%, has been statistically insignificant or very near to that.

When it comes to skill-levels in the 1990s, those with skill-level 3 acquired 50 to 70% more training days than those with skill-level 1. But even then there were no statistically significant differences between skill-levels 1 and 2. In the 2000s, differences between skill-level 1 and 3 disappeared too. By remodelling, however, I found out that skill-level 3 has become heterogeneous in a way that only the highest third-level education favours training. Bachelors' degrees and such do not. Thus, in the 2000s, education-training complementarity has weakened.

Contrary to this, the number of lifetime courses in vocational adult education and training has retained its significance. From 1990 to 2006, one previous training course increased training days during the reference year by 9 to 11%.

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([82]) The per centage would have been higher if more variables and instruments were used. But I wanted to keep it simple and avoid problems like colinearity between dependent variables.

Thus, 10 courses, which is the average for sample persons in Table 13:1, would double the number of training days. These results, as results in Table 13:2, suggest that training-training complementarity has prevailed.

Perhaps the most interesting impact comes from training forms. In 1995, the first year after a long and deep recession, degree-oriented training tripled the number of training days, as compared to those supplementary, non degree-oriented, training. Since that the difference has decreased to around half. Training days in in-service training have always been fewer than days in supplementary, non degree-oriented, training. Since 1995, this difference has decreased too. But still in 2006, training spells were around half of those in supplementary, non degree-oriented, training ([83]).

Finally, there is the selection correction term. It seems to be necessary for all other years but 2006, since it is statistically significant and positive, i.e. those selected to training are people who typically receive more training days. In other words: in the 1990s, selection for training was not random, but based on the characteristics of the people. In 2006, those characteristics did not anymore affect the number of training days. The delivery of training had become independent of these characteristics.

Now, focusing on the title of this study, how to summarise changes in education — training complementarity and training — training complementarity? In Figure 13:2, I have done it in the following way. I first re-estimated the model of Table 13:3 by substituting years of education for skill-levels, i.e. sill-level 1 is 9 years, skill-level 2 is 12 years, and skill-level 3 is 16 years. Then I dropped off all other variables but the two key variables, years of (formal) education and the number of vocational training courses, and depicted their coefficient estimates as per cent. Thus, the bars express the effect of one more year of (formal) education and one more course of vocational adult education.

Results of Figure 13:2 are in line with results of Table 13:3. Training-training complementarity, as measured by the effect of one more training course before the 12 months reference period on training days acquired during the reference period, has prevailed. From 1990 to 2006 in has been steady in a range from 5 to 6%. On the other hand, education–training complementarity, as measured by the effect of one more year of (formal) education on training days during one year's reference period, is twofold. First, from 1990 to 1995, there was an increase from 6 to around 10%. Then, from 1995 to 2006, there was a decrease to around 3%.

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([83]) I also tested the interaction term of degree-oriented training * in-service training. It proved to be statistically insignificant also for 2006, when degree-oriented in-service training had taken a relevant role as a form of vocational adult education.

Table 13:3    **Determinants of training days (%)**

| Independent: | 1990 | | 1995 | | 2000 | | 2006 | |
|---|---|---|---|---|---|---|---|---|
| days in training | Coef. | Std. Err. | Coef. | Std. Err. | Coef. | Std. Err. | Coef. | Std. Err. |
| **Dependents** | | | | | | | | |
| Male | -0.36** | 0.10 | -0.12 | 0.08 | -0.17 | 0.09 | -0.21* | 0.09 |
| **CF age < 34** | | | | | | | | |
| Age 35-44 | -0.28* | 0.12 | -0.22* | 0.10 | -0.32** | 0.11 | -0.12 | 0.11 |
| Age 45-54 | -0.35* | 0.18 | -0.39** | 0.13 | -0.63** | 0.15 | -0.21 | 0.15 |
| Age > 54 | -1.08** | 0.39 | -1.20** | 0.28 | -1.37** | 0.29 | -0.71* | 0.32 |
| **CF precarious** | | | | | | | | |
| Entrepreneur | -0.37 | 0.37 | -0.91** | 0.19 | -0.84** | 0.22 | -0.88** | 0.20 |
| Wage earner | 0.25 | 0.51 | 0.90** | 0.33 | 0.62 | 0.35 | 0.88* | 0.37 |
| CF skill-level 1 | | | | | | | | |
| Skill-level 2 | 0.11 | 0.09 | 0.13 | 0.09 | 0.13 | 0.11 | -0.09 | 0.10 |
| Skill-level 3 | 0.50** | 0.13 | 0.71** | 0.12 | 0.61** | 0.13 | 0.19 | 0.13 |
| **Previous training** | | | | | | | | |
| No of courses | 0.10** | 0.03 | 0.11** | 0.02 | 0.11** | 0.02 | 0.09** | 0.03 |
| CF other training | | | | | | | | |
| Degree oriented | 0.81** | 0.11 | 2.12** | 0.16 | 1.65** | 0.16 | 0.93** | 0.08 |
| In-service-training | -0.17* | 0.07 | -1.37** | 0.16 | -0.93** | 0.17 | -1.04** | 0.18 |
| **Other** | | | | | | | | |
| Selection correction | 1.57* | 0.65 | 1.46** | 0.44 | 1.56** | 0.48 | 0.99 | 0.58 |
| Constant | 0.07 | 1.04 | 0.02 | 0.69 | 0.01 | 0.77 | 0.51 | 0.84 |
| | | | | | | | | |
| *Number of observations* | *1101* | | *1302* | | *1287* | | *1825* | |
| *Adj R-squared* | *0.10* | | *0.30* | | *0.20* | | *0.15* | |

Robust standard errors, * and ** are statistically significant coefficients at the level of 0.05 and 0.01.
CF =  Compared to.

*Source*:    Adult education surveys 1990, 1995, 2000, 2006.

# Conclusions

Traditionally, the volume of vocational adult education at higher level of education has been superior compared with people with no vocational education and people with upper secondary level education. This is because of education-training complementarity: well educated tend to get more training than others.

In Finland, this has been very true until the end of the 1990s. But in the 2000s, the picture has become more ambiguous. The results suggest that previously acquired positions, such as educational attainment and the number of previous courses in vocational adult education, do not matter as much as before. Education-training complementarity has weakened in both models, in selection for training and in determination of training days. Training-training complementarity has weakened only in selection of training, and only in absolute

Figure 13:2 **Education — training and training — training complementarity over time, as measured by the effect of education years and training courses on training days (%)**
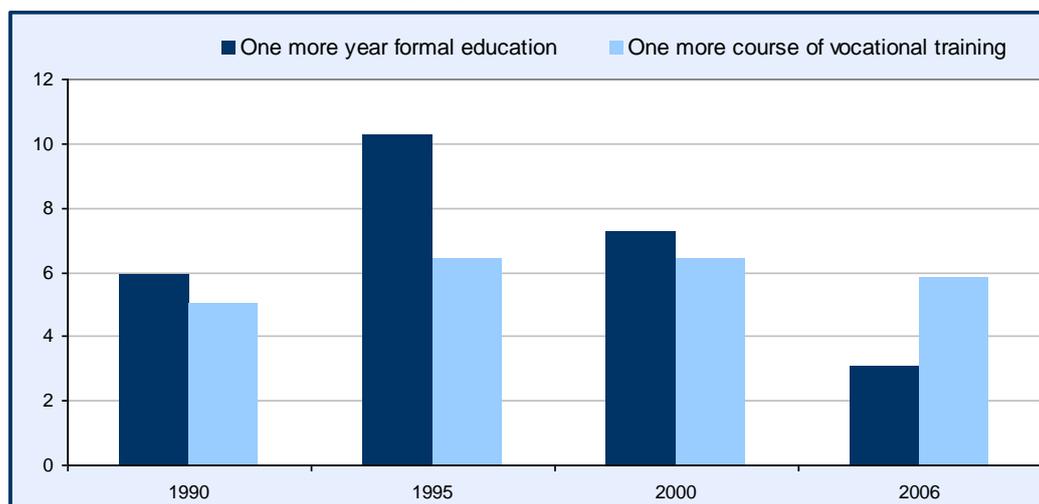


*Source*:   Adult education surveys 1990, 1995, 2000, 2006.

**Why is this?**

Education-training complementarity has probably decreased because of new types of policy interventions, such as the competence-based exams without formal schooling procedures and the so-called lifting campaign, targeted at those with no formal educational qualification. Otherwise it is difficult to explain why coefficients of determination ($R^2$ and Pseudo $R^2$) decrease over time, and especially in the 2000s.

The primary reason for these policy interventions has been the forecasted skill deficit in the long term. To tackle this problem it has been important to equip the low-qualified with competences that enable them to continue until the stipulated pension age. Thus, these new interventions may also be the reason why training-training complementarity has prevailed, i.e. upgrading the low-qualified usually takes form of guiding people to courses, short and long. Besides, there is some evidence that employers have increasingly targeted in-service-training for their key personnel.

Since low-qualified labour is also a productivity problem, fighting labour shortage has been a joint operation for the government and labour-market organisations. Unfortunately, also this consensus seems to be selective in nature. It does not include precarious labour, i.e. those with no established

labour-market position, at least in selection for training. Their training days are around the same as those for wage earners, but the days arise from different training form, such as self-motivated training paid for by themselves. The training days of wage earners are paid for by the employers, at least in the case of in-service-training.

Selection for training and determination of training days are processes that are to be researched more carefully. Data from the adult education survey need to be expanded with variables reflecting the workings of the labour market institutions, especially within workplaces. In this study those few available structural variables, such as seniority and union membership, did not play any significant role. Therefore, it is possible that the supply of vocational adult education and training is not very sensitive to changes in social relations within undertakings. For the supply of in-service-training they probably matter more.

Given the persistent kind of labour shortage, it is possible to forecast that low-qualified remain the focus of adult education and training also in the future. But from these grounds it is not possible to say what will happen to average days in training. It depends on policy evaluations regarding the impacts of training.

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CHAPTER 14.

# How to anticipate the evolution of qualifications and training needs: a regional point of view
*Marie-Béatrice Rochard*

The ORFE 's ([84]) model to anticipate recruitment needs by 2020 is a tool to support decision-making. The calculation method is simple in order for everyone to be able to use the tool. The central hypothesis of the model is that trends continue, unless events modify, accentuate or reverse them. It is a part of all diagnosis and decision supporting tools, and offers the possibility to follow the impact of decisions, allowing to rectify them. If we compare the actual statistics observed with our projections in the previous round (until 2015), the results confirm our predictions. Differences are either linked to cyclical variations, or to some measures taken by regional stakeholders. The results are very close to those predicted by the Cedefop model: increase of qualifications, gaps between recruitment needs and graduates, persistent tensions in certain professions.

## 14.1.  Introduction

Anticipating economic changes has become a central issue for regional stakeholders. The increasing globalisation of our economy, the complexity of processes at work, the acceleration of changes and especially the accentuation of constraints on environment and economic austerity raise questions on how efficient decisions are. Leading a regional forecasting exercise is particularly demanding. It means leading stakeholders who have different interests to share and consider the consequences of their own decisions, to possibly modify them to serve the collective interest. It also implies making a shared diagnosis, determining directions and making choices on possible options. From an institutional point of view, this means the implementation of concerted actions to achieve better results.

This work therefore needs to be rigorous. Stakeholders are not statisticians. Elaborate tools need to be created, that answer well-formulated questions, as well as simple tools, which do not hide the complexity of the observed phenomena. These synthesising tools need to allow everyone to express themselves and to base their analysis on the observed processes. In terms of

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([84]) Observatoire regional formation emploi [Regional observatory of training and employment].

economic observation, there is no 'truth'. Knowledge is acquired by analysing the situation through each stakeholder's point of view, representing different sides of the 'lens of truth': therefore a systemic analysis is favoured.

We excluded the idea of building a macroeconomic model that would use multiple hypotheses that would simultaneously cover for demographical phenomena, demand and supply for qualifications and training. Regional stakeholders are representatives of employees, companies, regional politicians, representatives of State services in the centre region and persons in charge of administrative services that implement regional and national policies among others. They need to capture not only the modelling results but also understand how they were obtained and to analyse the mechanisms at work on which their decisions can have an influence.

Moreover, beyond the forecasting exercise, the region needs detailed facts and figures to follow the results of actions that are undertaken. There is therefore a need for a direct link between the model of employment projection and the diagnosis and monitoring tools. That is how the tools of the Regional Observatory of Employment and Training have been built over time.

In the first part of this chapter, we will present the differences between our approach and macroeconomic models such as the one by Cedefop, and then present our model and the results. Finally we will discuss the relationship and the complementarities of this model with all of the diagnosis and monitoring tools that we offer.

## 14.2.  A specific method

Our method differs from the work of Cedefop and other forecasting models at national level on several points:

(a)  the geographical unit

At regional level, means of action on economic strategy are increasingly limited because of globalisation. Many companies have their headquarters outside the region, often abroad. The challenge for the region is to provide the means to respond, in terms of qualifications, to companies' needs, and thus to implement training courses for young people but also for employees and job-seekers; this can validate their experience or enable them to change jobs so that they can access job opportunities closer to their territory. That is why we chose to analyse the impact of economic changes in the region in terms of employment, recruitment and training needs. With our projections, we are trying to anticipate the impact of job creations during periods of growth, and massive job cuts in times of crisis in the labour market.

We observed that more frequent and stronger cyclical variations have an impact on how trends have evolved in recent years. The steady decline of industrial jobs over the past 20 years was followed by a decrease in the training offered to individuals within industrial jobs, especially since the 2000s. Also, the economic crisis like the one we experienced in 2009 can durably impact regional production capacities, not only because some companies are disappearing definitively from the regional territory, but also because the jobs that are created during periods of growth require more skills than the available supply of people with these qualifications;

(b)    the aim

ORFE's model is a tool to support decision-making. We do not aim at estimating an employment level by 2020 as, for instance, the Cedefop model does. Our tool is also designed to give us an idea of our region on a long-term perspective, and also as a basis for collaborative decision-making and monitoring of decisions;

(c)    the model

We use a very simple model; our calculation methods are easily explained. Everyone can understand what a figure represents. Results serve as a basis for reflection in the framework of the regional plan for vocational training. The simplicity of our assumptions allows everyone to understand them and to express their views. These results are then discussed with regards to the economic decisions that are or may be taken outside of the region, for example national decisions and European recommendations that will impact the organisation and level of regional employment. For example, the reduction of civil servants will strongly impact the region because jobs in the administration, education and health sector represent nearly 30% of regional jobs. We then compare the results with those of other forecasting models at the global (BIPE, 2007), national (CAS PQM, Futurible, 2009) and European (Cedefop) levels, to work with local stakeholders on the impact of different scenarios regarding the state of the region by 2020;

(d)    the scenarios

We build scenarios around a baseline scenario with two variants, one optimistic and one pessimistic.

We found out that it is always difficult for stakeholders who did not directly participate in the development of our model to appropriate the results, especially if they are used to relying on mathematical forecasting models. To minimise the risk of making wrong decisions, they usually prefer to choose the trend hypothesis as the most likely one to which we must prepare. However,

implementing actions to prepare for a trend hypothesis implies that we can be sure that this is the best one or the most desirable.

This was the case in 1960-70, when many forecasting prospective studies were conducted. Employment was strongly growing and the main problem was to quickly adapt to technological developments and production processes to avoid a slowing of growth. Analysing trend changes has allowed for a better adaptation of occupations.

Since 1980-90, globalisation and just-in-time production have altered the situation which has been marked by economic crises. We know today that some manufacturing sectors are in crisis for many years. The question we must ask is whether this evolution is inevitable and if we must adapt. But making decisions to adapt means implementing actions that will exacerbate the trends. The question is more along the lines of *Is this trend desirable?* rather than *What is the scenario that has the greatest chance of being realised?* In more concrete terms, should we remove training courses for manufacturing because it is in crisis, even if it could aggravate the crisis? Or should we think about measures that could curb this trend and encourage growth in certain subsectors? It has therefore become necessary to analyse the conditions for carrying out various scenarios to avoid accelerating negative unwanted trends.

## 14.3. Presentation of the model used in the centre region

ORFE proposes a medium-term employment projection model, which allows understanding how the creation of jobs influences the job market. It offers the possibility of following and reorienting the strategic decisions made as a result [85].

This method of prospective reflection relies on expertise. The work done by ORFE since 2001 allows it to have detailed analysis on the territories, job types and sectors of activity. This model relies on two ORFE tools: the *Cahiers*, that seeks to reveal the trends [86] at work over the last 20 years on employment and training, and the regional indicators of employment and training (IREF) which follows the evolutions on an annual basis [87]. This model was created in 2003,

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[85] This article presents the results of the employment projection model looking forward to 2010, conceived in 2005 and used until 2008 (ORFE, 2005; 2008).

[86] The *Cahiers*: http://www.etoile.regioncentre.fr/ORFE.

[87] The IREF: http://www.etoile.regioncentre.fr/ORFE.

through the work undertaken for the *Plan régional de développement des formations* (PRDF 2003-10) [Regional plan for training development), conducted by the central region of France.

Box 14:1      **The centre region, near the Paris region, between industry and rural life**

The centre region is located south-west of the Paris basin. With 2.3 million inhabitants, it stretches south to Berry (Bourges). There are two major towns along the Loire: Orléans (capital of the region, 116 000 inhabitants) and Tours (142 000 inhabitants). It is the sixth industrial region in France. Overall employment in the regional industry is increasing less rapidly that the national average. While continuing to lose jobs between 2001 and 2006, the industrial sector is well-represented in the region (about 20%). Pharmacy, perfumery and cleaning sectors have 2½ times more employees than average in France. Household equipment, industry, mechanical equipment, chemicals, rubber, plastic are one and a half times larger (about 1.54%).

Yet the industrial sector today is composed of small and medium-sized subcontracting companies, and some larger companies in terms of employees but which are dependent on external headquarters. Furthermore, among the over-represented economic sectors in the region, at least 30% of employees work in the five largest companies in the region, which represents a significant risk in case of recession. Decisions are indeed often taken at an international level according to a global perspective.

The agricultural sector, with a performance of more than 1.5 times the national average, is decreasing in favour of big farms. Regional agricultural products remain little promoted by regional food-processing industries. Employment in the agricultural sector is falling faster that the national average.

The tertiary sector has become increasingly important in the regional economy, but employment is growing slower than the national average.

Overall, employment in the centre region has increased more slowly than the national average since 2000.

### 14.3.1.    The assumptions

As most macroeconomic models are based on a trend hypothesis, we are also referring to a trend hypothesis that allows us to base the discussion in reference to forecasting studies at national and European level. However our regional perspective is different: we propose to discuss the regional trend hypothesis considering that trends have great chances of continuing, unless there are events which could lessen, accentuate or reverse them. The focus of our work is therefore to consider what might change and to focus on leverages on which it is possible to act.

     This comes back to constructing:

(a)    a central trend-based hypothesis based on the idea that 'if all things equal, the trends observed will continue'. Trend projection thus makes it possible to

visualise, in a simple manner, the expected creations or eliminations of employment if no event occurs either unexpectedly or naturally.

(b) two situational hypotheses. With respect to the hypothetical trends, two situational projections are performed, one for a favourable context, the other for an unfavourable context.

As it is always difficult to remove oneself from the present and the recent past to think about the future, these projections rely on the evolutions observed in recent periods. The projections made refer to factual and concrete data, by calling upon recent memory.

The first model proposed projections by 2010. At each reversal (crises and recoveries), we compared employment level observed to the employment level projected according to our assumptions. The projections are similar, even consistent with what was observed in 2005, end of a period of stability. Results are consistent with the trend hypothesis, except in the construction sector that benefited from a reduction in VAT and in operational services, because companies preferred to use temporary work rather than recruit directly after the crisis. In 2007, they are below the trend hypothesis because after the 2001-03 crisis, the region did not regain its previous level of employment. In 2009, the differences are very small compared to the most unfavourable projection. This tool proves to be a real means of monitoring trends and the impact of decision-making.

The model by 2020 identifies three hypotheses:

(a) a stability hypothesis, projection obtained if the region has after the 2009 crisis the growth rate observed between 2001 and 2005 until 2020;

(b) a favourable hypothesis, projection obtained if the growth observed between 2005 and 2007 would continue until 2020. The centre region would then come back to the national average growth. We therefore chose to retain this period, the closest to the French trend, as the favourable period for our projection in the centre region. It also allows to make a link with national projections;

(c) a crisis projection, covering the 2007-09 period.

### 14.3.2. Modelling

Our model is simple. An annual average growth rate must be applied to employment in the base year until year +7 or +10.

Recruitment needs are calculated as the sum of net job creations (employment estimated by the model in 2020 minus employment observed in 2007) and retirement estimations (calculated on two assumptions about

retirement age here: one starting at the age 62 and one at age 65 in 2020). Currently, the French are retiring at the age of 60.

### 14.3.3. The results

*Employment projections*

They show high variations according to the different hypotheses in almost all sectors (Figure 14:1).

Figure 14:1    **Employment projections by 2020**



A0  Agriculture, forestry, fishing
B0  Manufacture of food products, beverages and tobacco
C1  Manufacture of clothing articles and leather products
C2  Publishing, printing and reproduction of recorded media
C3  Manufacture of pharmaceuticals products, perfumes, soap and cleaning preparation
C4  Manufacture of domestic equipment
D0  Manufacture of motor vehicles
E1  Building of ships and boats, manufacture of railway locomotives, rolling stock
E2  Manufacture of metal products, machinery and equipment
E3  Manufacture of electric and electronic equipment
F1  Mining and quarrying except energy producing materials, manufacturing of other non metallic mineral products
F2  Manufacture of textiles
F3  Manufacture of wood, wood products, pulp, paper and paper products
F4  Manufacture of chemicals, rubber, plastic and chemical products
F5  Manufacture of basic metals and fabricated metal products
F6  Manufacture of electric and electronic components
G1  Extraction of coal, crude petroleum, gas and uranium; manufacture of coke, refined petroleum products, and nuclear fuel

G2  Electricity and gas supply; collection and distribution of water
H0  Construction
J1  Sale, maintenance and repair of motor vehicles and motorcycles
J2  Wholesale trade and commission trade
J3  Retail trade, repair of personal and household goods
K0  Transports
L0  Financial activities
M0  Real estate activities
N1  Post and telecommunications
N2  Consultancy and assistance activities
N3  Renting and other business activities
N4  Research and development
P1  Hotels and restaurants
P2  Recreational, cultural and sporting activities
P3  Other personal and domestic services
Q1  Education
Q2  Health, social work
R1  Public administration and defence
R2  Activities of membership organizations and extra

*Net job creations*

For the stability scenario, job creations would be negative for industry. They would be quite moderate in the tertiary sector and construction (Figure 14:2).

The relative growth scenario would generate significant job creations in the sectors of construction, transportation, and services for companies (counselling, assistance and operational services). In education, health-social work and administration, planned job creations are more moderate.

The crisis scenario, a continuation of the trend between 2007 and 2009, shows how important job losses could be in all sectors if such a crisis would happen again.

Figure 14:2 **Net job creations and retirements by 2020**



A0  Agriculture, forestry, fishing
B0  Manufacture of food products, beverages and tobacco
C1  Manufacture of clothing articles and leather products
C2  Publishing, printing and reproduction of recorded media
C3  Manufacture of pharmaceuticals products, perfumes, soap and cleaning preparation
C4  Manufacture of domestic equipment
D0  Manufacture of motor vehicles
E1  Building of ships and boats, manufacture of railway locomotives, rolling stock
E2  Manufacture of metal products, machinery and equipment
E3  Manufacture of electric and electronic equipment
F1  Mining and quarrying except energy producing materials, manufacturing of other non metallic mineral products
F2  Manufacture of textiles
F3  Manufacture of wood, wood products, pulp, paper and paper products
F4  Manufacture of chemicals, rubber, plastic and chemical products
F5  Manufacture of basic metals and fabricated metal products
F6  Manufacture of electric and electronic components
G1  Extraction of coal, crude petroleum, gas and uranium; manufacture of coke, refined petroleum products, and nuclear fuel

G2  Electricity and gas supply; collection and distribution of water
H0  Construction
J1  Sale, maintenance and repair of motor vehicles and motorcycles
J2  Wholesale trade and commission trade
J3  Retail trade, repair of personal and household goods
K0  Transports
L0  Financial activities
M0  Real estate activities
N1  Post and telecommunications
N2  Consultancy and assistance activities
N3  Renting and other business activities
N4  Research and development
P1  Hotels and restaurants
P2  Recreational, cultural and sporting activities
P3  Other personal and domestic services
Q1  Education
Q2  Health, social work
R1  Public administration and defence
R2  Activities of membership organizations and extra territorial activities

*Recruitment needs*

Recruitment needs are calculated by adding net job creations and retirements (Figure 14:3).

In the stability scenario, recruitment needs will be very limited for industry. However, although job creations would remain limited, recruitment needs could be a problem because of retirements in the transportation sector, counselling and

assistance and operational services as well as in construction, trade-retail, health and public administration.

For the relative growth scenario, recruitment needs increase slightly for industry. However, they increase significantly in construction, transportation, counselling and assistance and operational services, under the influence of job creations and retirements.

Finally, in the crisis scenario, there would mainly be job losses in industry, transportation and operational services. The other tertiary sectors would also be impacted but to a lesser extent because retirements would mainly create recruitment needs in trade, health-social work and administration, even if replacing one civil servant in two is considered.

The variation between both ages of retirement shows that recruitment needs change between retirement at 62 and retirement at 65 mainly in the tertiary sector. This is due to early retirement measures that have been widely used by struggling companies of the industrial sector.

### 14.3.4. The main contribution of this model is the identification of a structural lack of qualifications in some sectors

The results of this model and the views of professional branches, such as Pôle Emploi (National Employment Office) and training organisations, have led us to wonder about the nature of jobs that suffer the most from economic shocks. We therefore measured the tension on these jobs with a criterion generally used: the ratio between job vacancies registered at Pôle Emploi and the number of job-seekers (tension rate = supply of jobs/demand for jobs). Knowing that all job vacancies are not submitted to Pôle Emploi, the calculated ratio is underestimated, which further accentuated the observed phenomenon.

We first looked at jobs that were both in tension in 2007, the highest period of growth, and that maintained a high growth rate even in 2009, in the heart of the latest crisis. The persistence of a high growth rate even in times of crisis leads us to describe these shortages as 'structural'. In industry, this concerns maintenance jobs, adjusters and technician jobs (Table 14:1). These are jobs that require a high level of technicality that can only be acquired through initial training, but that were also accessible in the 1970s and 1980s through experience and internal training in large and medium-sized companies. Today, given that the training offers as well as employment stability are decreasing, these tensions pose a real problem.

Figure 14:3 **Recruitment needs (retirement 62/65)**



A0  Agriculture, forestry, fishing
B0  Manufacture of food products, beverages and tobacco
C1  Manufacture of clothing articles and leather products
C2  Publishing, printing and reproduction of recorded media
C3  Manufacture of pharmaceuticals products, perfumes, soap and cleaning preparation
C4  Manufacture of domestic equipment
D0  Manufacture of motor vehicles
E1  Building of ships and boats, manufacture of railway locomotives, rolling stock
E2  Manufacture of metal products, machinery and equipment
E3  Manufacture of electric and electronic equipment
F1  Mining and quarrying except energy producing materials, manufacturing of other non metallic mineral products
F2  Manufacture of textiles
F3  Manufacture of wood, wood products, pulp, paper and paper products
F4  Manufacture of chemicals, rubber, plastic and chemical products
F5  Manufacture of basic metals and fabricated metal products
F6  Manufacture of electric and electronic components
G1  Extraction of coal, crude petroleum, gas and uranium; manufacture of coke, refined petroleum products, and nuclear fuel

G2  Electricity and gas supply; collection and distribution of water
H0  Construction
J1  Sale, maintenance and repair of motor vehicles and motorcycles
J2  Wholesale trade and commission trade
J3  Retail trade, repair of personal and household goods
K0  Transports
L0  Financial activities
M0  Real estate activities
N1  Post and telecommunications
N2  Consultancy and assistance activities
N3  Renting and other business activities
N4  Research and development
P1  Hotels and restaurants
P2  Recreational, cultural and sporting activities
P3  Other personal and domestic services
Q1  Education
Q2  Health, social work
R1  Public administration and defence
R2  Activities of membership organizations and extra territorial activities

Some other jobs are in 'tension' in times of growth (Table 14:2). However, they strongly suffer from the consequences of crises. These jobs are generally accessible to beginners, usually operator jobs. Strong variations discourage young people to choose these jobs and encourage job-seekers to change sectors when they can.

Jobs in the tertiary sector such as nurses and caregivers, for example, are also in 'tension'. This is causing major problems and is likely to rise even more in the forthcoming years because of retirements and an ageing population.

Table 14:1    **Example of 'structural' professions in need**

|  | 2007 | | | 2009 | | |
|---|---|---|---|---|---|---|
|  | Tension rate | Supply | Demand | Tension rate | Supply | Demand |
| 52332-Maintenance technician for thermic, climatic and refrigerating systems | 160.8 | 328 | 204 | 80.9 | 266 | 329 |
| 44313-Adjusters | 145.2 | 228 | 157 | 73.4 | 105 | 143 |
| 44341-Poly-maintenance technician | 128.6 | 562 | 437 | 70.2 | 394 | 561 |
| 52333-Electronic maintenance technician | 121.2 | 292 | 241 | 70.7 | 200 | 283 |
| 52133-Electric and electronic designer | 105.6 | 38 | 36 | 155.2 | 45 | 29 |
| 52231- Production technician for process industries | 102.4 | 126 | 123 | 73.6 | 106 | 144 |
| 51211-Maintenance managerial technician | 95.7 | 89 | 93 | 87.3 | 96 | 110 |

*Source*: Pôle Emploi.

Table 14:2    **Example of 'cyclical' professions in need**

|  | 2007 | | | 2009 | | |
|---|---|---|---|---|---|---|
|  | Tension rate | Supply | Demand | Tension rate | Supply | Demand |
| 44112-Metal cutting out technician | 174.1 | 47 | 27 | 52.4 | 22 | 42 |
| 44211-Operator on automatic machines for electric and electronic production | 157.5 | 230 | 146 | 36.6 | 64 | 175 |
| 45113-Operator on forming machines for plastic and rubber | 144.2 | 274 | 190 | 42.3 | 82 | 194 |
| 44121-Operator-adjuster on machine tools | 126.5 | 1056 | 835 | 22.5 | 261 | 1 162 |
| 45212-Operator on metal production | 125.8 | 83 | 66 | 10.3 | 8 | 78 |
| 52211-Production technician in mechanical construction and metalwork | 107.5 | 57 | 53 | 35.9 | 23 | 64 |
| 44311-Maintenance mechanic | 105.2 | 365 | 347 | 39.7 | 149 | 375 |
| 44132-Solderer | 105.0 | 953 | 908 | 34.6 | 406 | 1 172 |

*Source* : Pôle Emploi.

**14.3.5.    Extension of this model: coordination with other diagnosis and decision-support tools**

The results of this model led us to look at how the consequences of cyclical employment variations could be reflected in the labour market, by employment area (the region is divided in 23 employment areas) and by economic sector (36).

Beyond similarities, we identify specific characteristics that can result in very difficult situations.

So we created the tool to support decision-making to help anticipating economic changes. It is a simple instrument to measure the impact of employment changes in the labour market. These are broken down by employment area and economic sector.

In some areas and some sectors, job offers exceeded job applications in 2007, meaning that the territory or the sector could not cope with too much activity.

In other areas, although net job creations are negative, there is still a significant number of recruitments. Beyond job losses, there may be recruitments either for replacements, retirements or for new investment that can generate a qualification need not found in the company.

These tools show that generally, when a country or an industry is subjected to a very high tension rate, the crisis that follows is marked by job losses. During the subsequent recovery, employment never reaches the previous growth level.

This leads us to confirm that the lack of skills can create a structural maladjustment.

These tools, updated annually, are used to monitor employment changes, recruitments, labour-market changes, tensions and initial training offers.

## 14.4. Global issues at stake: preserving the industrial specificity of the region

### 14.4.1. Coping with higher skills

The ability of a territory to evolve is related to the socioeconomic history of its inhabitants. At the same time that the number of employees has declined in the centre region following the closure of companies and the relocation of workshops, industry has been 'reskilled'. The managerial rate has increased, as well as qualifications for workers, making adjustment more difficult in times of growth.

*Securing career paths to make flexibility and upskilling compatible*

In the centre region, outsourcing was considered an asset given that the low qualification level allowed for a faster professional integration and a greater flexibility in the labour market. The flexibility of employees on which industry was relying came in large part from the low qualifications used in workshops. Today, the issue of skill transferability is raised.

The qualification level for jobs has risen, followed by industrial restructuring. The latter, being accompanied by job losses, has led to a lower attractiveness of industrial training. If we add to this phenomenon the population decline, it is understandable that tensions in the labour market are increasing during economic recoveries; this may prevent companies from taking the opportunity to meet more orders.

For the local authority, the challenge is to promote among companies the awareness of the impact of job losses on youth career paths, and eventually on the loss of regional expertise. Similarly it may play a role in the awareness among the working population on the necessity to be trained to maintain their employability. The training offer would have to diversify to facilitate validations in their various forms.

*Considering outsourcing as a support for economic development*

The strong subcontracting tradition in the region is not necessarily a source of weakness. Some countries that have indeed benefited from subcontracting have acquired a know-how that has gradually made them more competitive than the countries that had provided that subcontracting activity (particularly China). Progressively, contracting companies are undermining their research and development capacity while losing the detailed knowledge of the production process, especially if they are far away.

Thus the challenge for the region is not only to preserve industrial activities but also to develop services including research and development.

### 14.4.2. Serving needs in the tertiary sector

Employment in the tertiary sector is growing more slowly than in the previous period (1990-99). The qualification rate is increasing at the same time as the work organisation normalises and standardises. The challenge then is to qualify employees that would try to integrate the labour market after a period of inactivity, validating skills in particular for individual services. It is also about developing a tertiary sector of higher qualification in order to ensure new activities or complementary activities in vulnerable areas because of their strong industrial representation.

## Conclusion

Our results raise the question of skill transferability. They ask about lifelong learning: initial training but also continuing training. How to detect and develop training that offers the greatest opportunity for skill transferability? It is a research

ORFE: IREF, Indicateurs de la relation emploi-formation en région Centre [IREF, indicators of employment-related training in the Centre region]

**Les domaines professionnels [Professional fields]**

http://www.etoile.regioncentre.fr/GIP/site/etoilepro/accueiletoilepro/ORFE/Emploi/domaine-professionnel,

**Dernières versions des IREF [Latest versions of IREF]**

http://www.etoile.regioncentre.fr/GIP/site/etoilepro/IREF-dernie

CHAPTER 15.

# Matching formal skills in Slovakia — LFS-based evidence ([88])
*Marek Radvanský*

This paper analyses the development of job matching between skill supply (education) and demand (type of work performed) in Slovakia during 1998-2009. This period was chosen according to the quality of data provided by the labour force survey (LFS) database and it also relates to the reform of regional administration in 1997 (rescaling NUTS III regions). The main focus of this paper is the analysis of employees with more higher education than is generally needed or expected by the performed activity (overeducated) and of the share of employees with lower education than is generally expected for the job (undereducated). To our broader analysis, we include only employees older than 25 years so we can avoid major problems with employees with unfinished tertiary education but who are already working at the time. The analysis also does not include members of the armed forces.

## 15.1.   Introduction

The importance of matching skills and jobs across European countries rose during the crisis period. The structure of the Slovak economy is changing dynamically, labour market needs are changing according to this development and the total educational level during the last decade has significantly risen. The dynamics of this progress has to be observed from different angles to help match future skills supply with demand. This concerns for example the adaptation of curricula of tertiary education so that the highest number of graduates use their knowledge and specific skills obtained at university in their jobs. Overeducation and undereducation of the labour force can result in ineffective use of economic potential. Future analysis will cover this inefficiency.

The complexity of this problem from a methodological and statistical point of view is being periodically discussed (Cedefop, 2010a; 2010b). The most suitable data set to analyse skills matching at European level are from the European working conditions survey. The main advantage of this data is highly suitable structure for analysing skills matching at both formal education and informal skill

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level compared to job requirements.  Unfortunately, Slovakia was only included in this survey in 2001 and 2005. The remaining problem is that the latest available data are from 2005 (the 2010 survey has not been evaluated yet). Due to periodicity of the survey in the interval of five years, the data do not show dynamics of structural changes in time.

Another suitable approach to analyse this problem could be the use of widely available data from the national labour force survey (LFS). LFS provides data restricted by their limited informational value, but the advantage of this approach is the availability of LFS on a quarterly basis and their comparability with other surveys of EU countries. With the information provided by LFS we cannot compare the suitability of skills to the job requirements/occupation directly, but we can compare the educational level (growth of formal skills) and the employment in particular working groups. To create a detailed overview of suitability of formal skills in terms of matching education with work, we use specific information obtained by creating cross-tables between the educational level according to the international standard classification of education (ISCED) and job classification according to the international standard classification of occupations (ISCO). This approach was also used in *Measuring quality of employment* (UNECE, 2010).

In terms of methodology the data divided by occupations can be assigned to a particular class of demand for skills. Due to skills upgrading the association between ISCO and ISCED might not be stable over time, especially at more detailed digit classification level.  On main category level this issue can be only hardly considered. For simplification, we will aggregate nine main ISCO classes of occupation (the analysis could be widened to include a more detailed level in next stages) to four specific classes of skills demanded (if we do not include members of armed forces, Table15:1). Focusing on education, skill level 1 generally requires only lower than secondary education, skill level 2 requires secondary education (specialised or general), level 3 requires at least the first stage of tertiary education (bachelor) and level 4 requires a university degree. From an analytical point of view, given the limited use of the first step of tertiary education (bachelor) in Slovakia in the observed period, we can divide the demanded skill level by transforming the ISCO classification into three categories:

(a)  high (ISCO 1-3);

(b)  medium (ISCO 4-8);

(c)  low (ISCO 9).

Table 15:1 **Conversion of occupation classification (ISCO) according to required formal skills level (education)**

| Main class of classification ISCO-08 | Required level of skills (education) |
|---|---|
| High level of skills (education) | |
| 1   Legislators, senior officials and managers | 3 + 4 |
| 2   Professionals | 4 |
| 3   Technicians and associate professionals | 3 |
| Medium level of skills (education) | |
| 4   Clerks | |
| 5   Service workers and shop and market sales workers | |
| 6   Skilled agricultural and fishery workers | 2 |
| 7   Craft and related trades workers | |
| 8   Plant and machine operators and assemblers | |
| Low level of skills (education) | |
| 9   Elementary occupations | 1 |
| Not applied | |
| 0   Armed forces | 1, 2, 3, 4 |

*Source*: Statistical Office of the Slovak Republic and author.

The share of employees in a job that requires low level of skills in Slovakia (ISCO 9) is currently less than 10% of overall employment and a long-term declining trend is also observed (Figure 15:1). In the past, the gender ratio disadvantaged women (in 1994 there was share of elementary educated women higher by eight percentage points than men working population), while currently gender difference in low education level as well as at occupation is less than 2%. Most employees are working in occupations requiring medium level of skills (education). In 2009 it was 55% of all employed persons, while the proportion was significantly higher for men (60.5%) than for women (47.5%). Men usually work in category 7 (qualified workers and craftsmen, 27.6%) and 8 (operators and assemblers of machinery and equipment, 20%). Almost half of women working in the category requiring medium skills, work in category 5 (workers in services and trade) with a total share of 22.7%. The share of the occupations that require higher level of skills, is currently at 35.8% of the total population (employed), which is slightly increasing if one take a long-term view. There is a significantly higher percentage of women in this category; they are mostly employed in category 3 (technicians and professionals) which is mainly determined by the high share of health and educational staff.

Figure 15:1    **Development of employees by the classification of occupation (ISCO)**
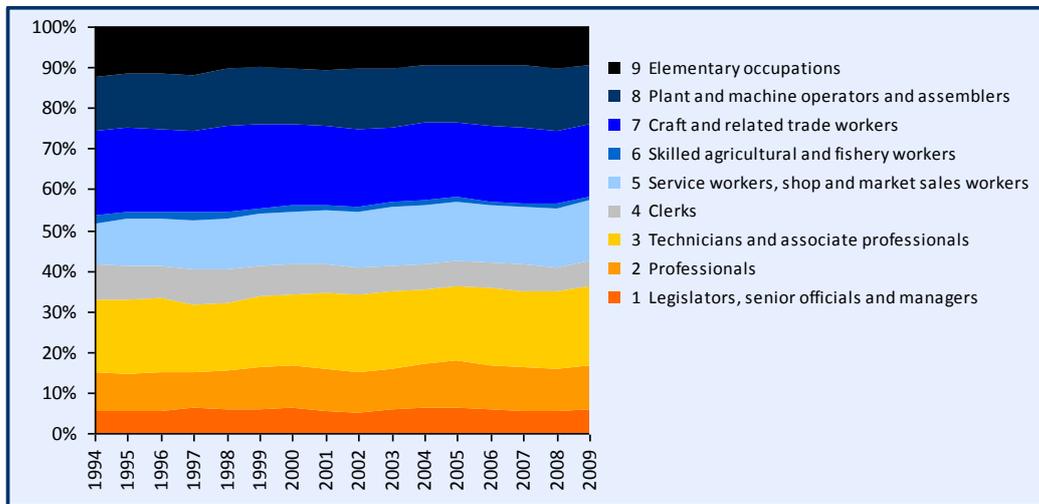


*Source*: Statistical Office of the Slovak Republic and author.

In terms of classification of education the situation is more complicated. Until 2008, the national statistics used a different classification of education; however individual levels can be assigned reversely to six selected levels of classification, while some levels are further divided in sublevels. For the provided analysis we use three levels of attained education (Table 15:2):

(a)   low (ISCED 0-2);

(b)   medium (ISCED 3-4);

(c)   high (ISCED 5-6).

Table 15:2    **Conversion of classification of education classes (ISCED)**

| Class | Original | Description |
|---|---|---|
| Low level of education | | |
| ISCED 0 | 0 | Pre-primary education, without education |
| ISCED 1 | 0 | First stage of basic education |
| ISCED 2-2B | 1,2,3 | Second stage of basic education, lower secondary |
| Medium level of education | | |
| ISCED 3-3B | 4,5,6 | Vocational with A levels |
| ISCED 3C | | Secondary without A levels |
| ISCED 4 | | Post-secondary non-tertiary education |
| High level of education | | |
| ISCED 5-5A | 7 | Bachelor degree |
| ISCED 5B | 8 | Master degree |
| ISCED 6 | 9 | PhD degree |

*Source*: UIPSŠ, Unesco.

In terms of attained education level, Slovakia has a very low share of economically active population with basic education — 5.9%, with slightly higher share of women (6.5%). It has also one of the highest shares (80%) of people with secondary education in Europe and a marginal share of lower secondary education (ISCED 2C), which is not separately observed by national statistics. Nevertheless, possible bias caused by this statistical error is by our estimation not higher than 0.1%. For this reason, the medium level of skills is predominant in all groups of population. There is also more than 14% of economically active population with higher level of education and a higher share of women with high level of education in the total economically active population compared to men. From this perspective it is clear that there are more economically active women with higher education than those with lower level of education in comparison to men.

Figure 15:2    **Development of economically active population classes according to classification of education (ISCED)**
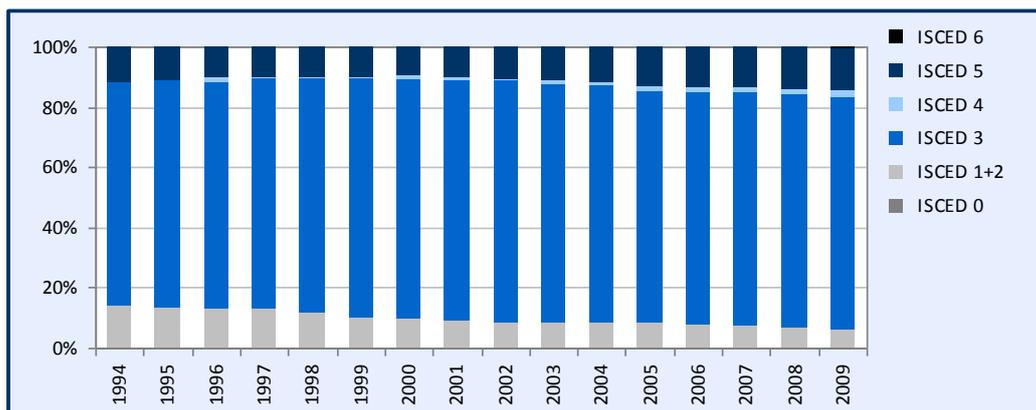


*Source*: Statistical Office of the Slovak Republic and author.

For a basic overview it is necessary to include only four combinations based on two different levels of education (ISCED 1-4, employees with lower/medium education; and ISCED 5-6, employees with higher education) and two groups according to occupation category ISCO (ISCO 1-3, occupation with need of higher level of skills; and ISCO 4-9, occupations with need of lower level of skills). In view of the previous discussion, we will therefore consider separately high level and low together with medium level. Considering the simplification of using information on needed skills only according to occupation classification by ISCO we are aware of a possibility of a problem arising from incompleteness and reduced quality of information, but from analytical point of view, results will be

able to capture sufficiently the current trends, because we are expecting that the error is likely to be constant over time.

Figure 15:3    **Scheme of basic matching skills analyses by level of education**
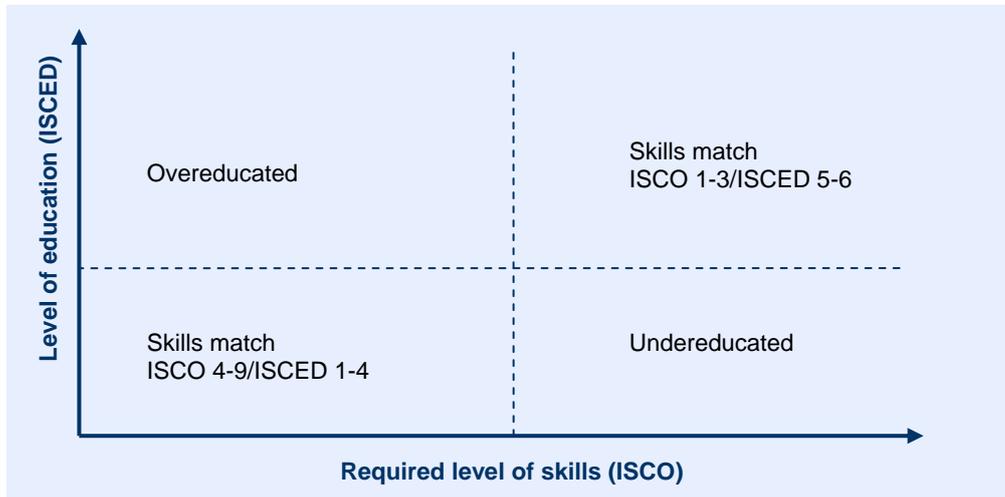


*Source*: Author.

In this chapter we will therefore consider and include several types of information about obtained education level (skills) and type of occupation according to the Slovak labour force survey. Individual data for Slovakia will be used, therefore the analysis includes not only aggregate information about the Slovak labour force and gender differences, but different age groups and regional developments are also considered.

From a methodological point of view we will therefore continue with analysis containing three educational levels and three groups of occupation category based on expected level of skills — low, medium and high. For a better idea of the expected results see Figure 15:4.

For a basic overview of matching formal skills we chose the latest available year — 2009. Despite the fact that this year is, from an employment point of view, strongly influenced by the ongoing crisis, the structural changes in light of previous trends were not significant. We can see in Figure 15:5, that the share of medium level of education (ISCED) is highest which is in line with our previous expectations. From aggregate point of view, the matching of education and skills at national high/high level is slightly over 38%, at medium/medium level almost 92% and at low/low 74%. The rate of underqualification (lower level of education than expected level of skills) is highest at group high/medium. Most of this disproportion is caused by the fact that formal education is not the only way to obtain qualification, on-job training and informal education play a significant role,

especially when considering older employees. A striking fact is the quite high rate of overeducation at low/medium level with a greater proportion of people employed with low education working in occupations requiring medium level of education. It will be important to see the distribution of age groups; we should expect that people with low level of education and longer practice will be employed in occupations with medium skills. From a gender point of view, the biggest differences can be found in the category of undereducated (high/medium). We can assume that this is because of the higher share of medical and teaching staff with a higher ratio of women. Men mainly remain in the medium/medium category.

Figure 15:4 **Scheme of matching analysis of required skills and obtained education level**
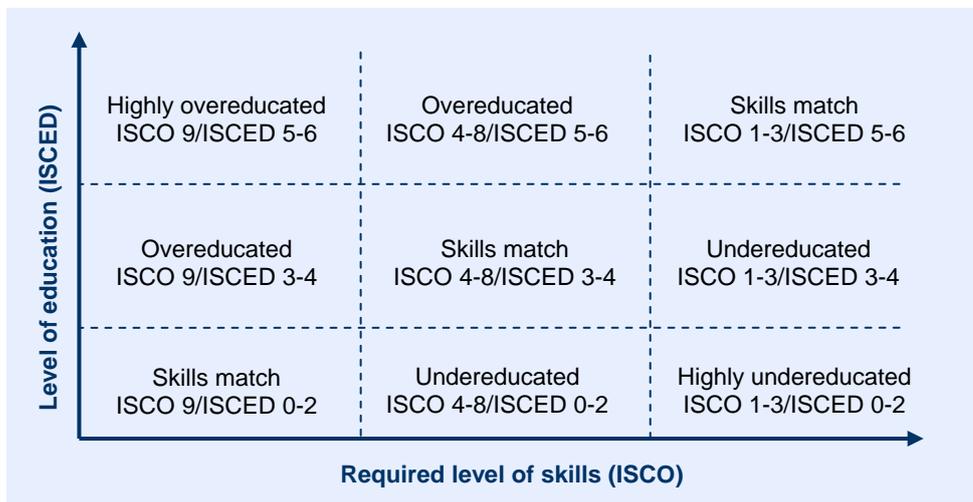


*Source*: Author.

## 15.2. Analysis of skills and education match by age groups

This section is devoted to analysis of matching skills and attained education by age groups. The age group of 15 to 24 years was not included. In this category people who have generally already finished their formal education are included (either secondary or tertiary).

Looking at the group of low education skills match, the rate of people employed in this category declined continuously. The level of education has been rising and the end of the 1990s witnessed two trends: the withdrawal from the labour market of older people with lower education and at the same time a decline in the rate of people with lower than secondary education. These trends

can be best illustrated in the category 55+. Also the total share of the category with lower education and medium level of required skills is declining. In the same category we expect a higher share of older employees who obtained experience (in time) to perform more qualified occupations (with share below 4%).

Figure 15:5 **General overview of formal skills matching (2009) as % of total employment**
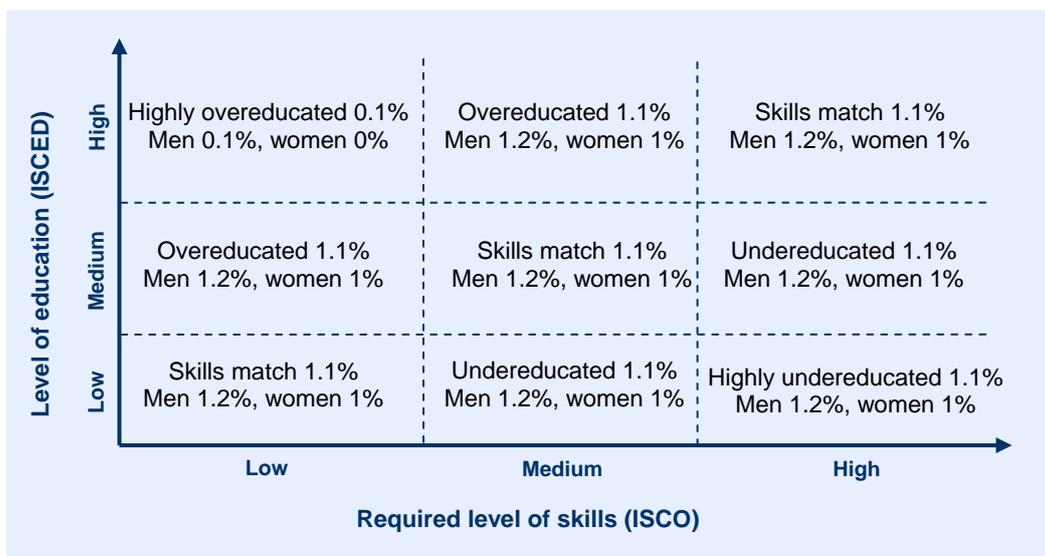


Source: Author.

A relatively stable or slightly different behaviour appears among people with a medium level of skills, who carry out simple work, in view of labour market they are overeducated. By 2004 there was no predominant age group in this category, however recently we perceived a gradual breakdown by age groups. Expected further decline in number of people with lower education will cause a growing share of overeducated. The alternative of increasing overeducation of this category represents potential immigration inflow of people with lower education.

The biggest group, with almost 50% of all employed, are people with medium level of education performing appropriate work thus with suitable occupation. Given the share of this group and quite broad scope with regard to attained education, it would be advisable to subdivide this category and analyse it separately (e.g. vocational and secondary general education). In terms of age groups, we can see gradual decline in differences, with lower share of older employees — who were included in previous categories.

The share of undereducated employees in category medium/high is relatively high (between 20-25 %). A significant proportion of this imbalance could be covered by the extension of the first level of tertiary education (bachelor

degree). Taking a long-term point of view, we can identify a moderately declining trend that can be connected to an increase in the share of the population with tertiary education.

Overeducation in the category higher/medium is on average 1.5%. It is slightly higher among the age group of 25 to 34 years, and we expect that this is related to entry into the labour market and the carrying out of temporary work with lower needs to obtain experience.

The share of category higher/higher is closely related to the number of graduates and the proportion of workers with tertiary education, which is the limiting factor from this perspective (Figure 15:2). In age group 25-34 the number of universities and graduates increased, it almost doubled over the past 10 years. There is a relatively high share in the category 55+ for the longer persistence of highly educated population in the labour market as they have better health and lower level of compensation when retiring.

Considering all groups of matching formal qualification and attained education, the share accounts for 65% of population. Two thirds of employed people have the suitable skills according to their occupation and level of education. The highest rate of matching is among the age group of 25-34.

Figure 15:6 **Share of employees with skills matched according to obtained and required level of education and age group**
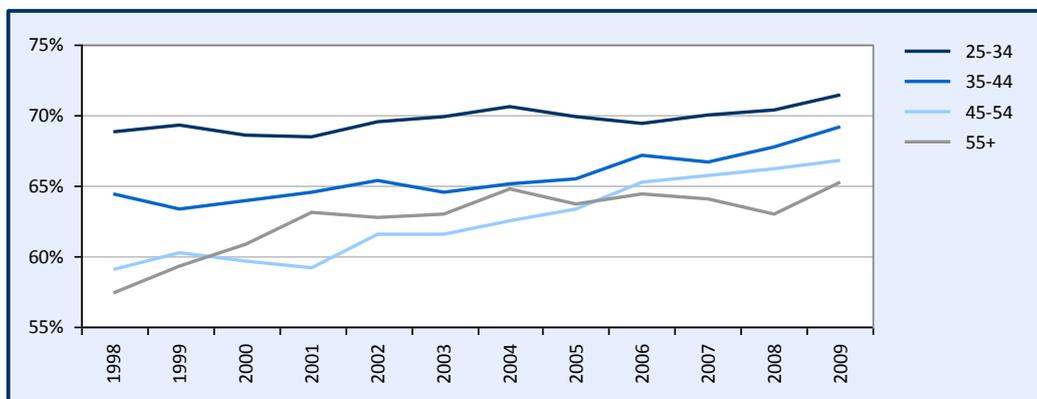


*Source:* Author.

The largest share of undereducated is in group medium/higher. Given the increasing rate of population with tertiary education, we expect further decline in this category (Figure 15:7). The important aspect will be the analysis of individual regions.

The rate of overeducation is relatively stable below 10%. Significant part of this share is people in category medium/lower, because of small number of

people with less than secondary education. In connection with the increasing share of people with tertiary education and lower demand in some sectors, we expect future increase in category higher/medium. Currently it affects roughly 10% of graduates.

Figure 15:7 **Share of employees with lower level of education than required by the actual position by age group — undereducated**
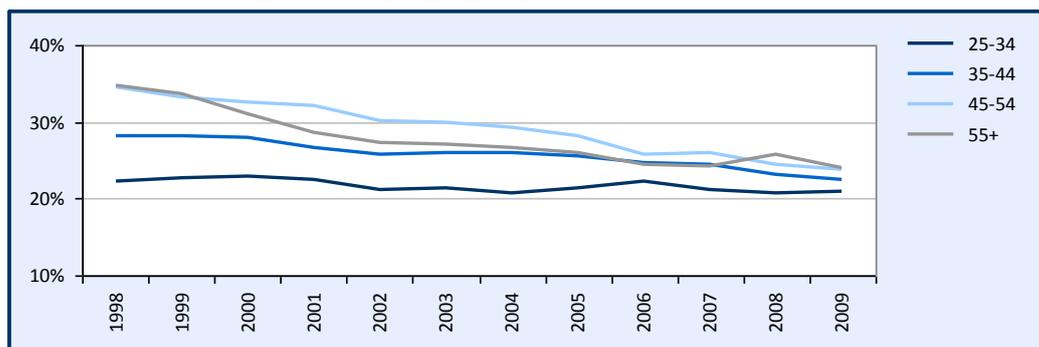


*Source*: Author.

Figure 15:8 **Share of employees with higher level of education than required by the actual position by age group — overeducated**
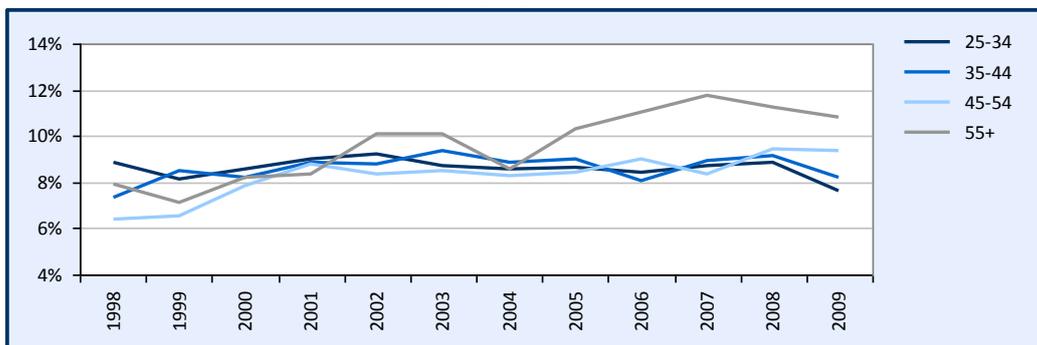


*Source*: Author.

## 15.3. Analysis of expected skills and education match by regions

Analysis of matching of expected skills and attained education by regions has several specificities. The most striking factor is the distribution of economically active population by education. It differs significantly due to differences in population with tertiary education. Largest universities are concentrated in Bratislava region. Significant part of students coming to study also remains in the capital after the end of study. At the same time demand for qualified labour force in the capital city increases. In Bratislava region the share of people with tertiary

education almost double the average of Slovakia and reaches more than 30% (Figure 15:9). In other regions, the share of people with tertiary education is between 12 and 15% and the 15% share is only exceeded in Žilina region. The lowest share of people with tertiary education (12.1%) is surprisingly in Nitra region.

Figure 15:9 **Share of highly educated in the economically active population disaggregated by region**
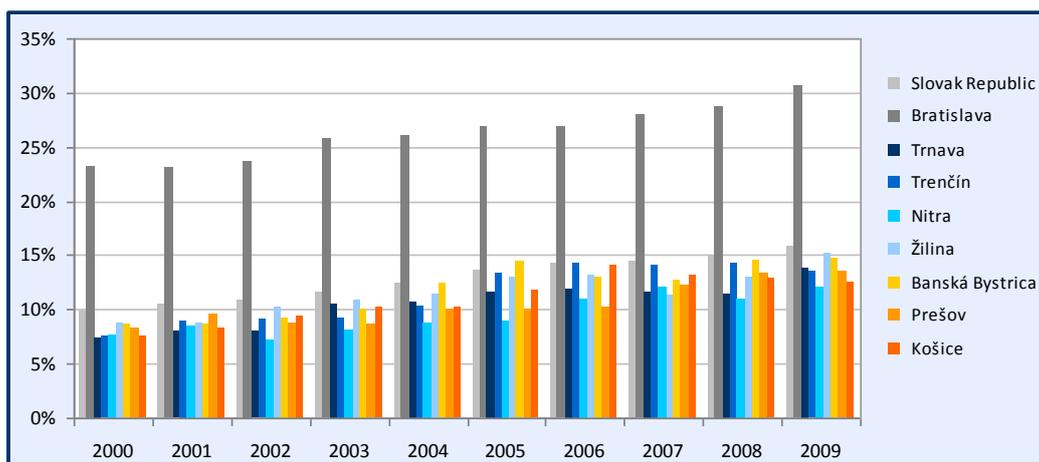


*Source*: Author.

The structure of categories of occupation and the structure of education in individual regions are shown in Figure 15:10. The share of occupations requiring high level of skills is highest in Bratislava region (almost 60%), followed by Banská Bystrica region with 39% and Trnava region with 37%. Other regions have share of occupations requiring high level of skill at 30-35% and the lowest rate is in Prešov region. The rate of occupations requiring medium level of skills ranges between 53 to 60%. The exception is Bratislava region with only 35%, lower than the share of jobs requiring high level of skills. Number of jobs requiring only low level of skills differs from 6% in Bratislava region to 11% in Žilina and Košice regions.

In terms of structure of labour market in particular regions, the share of persons with tertiary education ranges from 14 to 18% with the exception of Bratislava region with 34%. Between 77 to 82% of population in regions attained the medium level of education. Low level of education performs from 2 to 6% of all employed in particular regions. Košice has the lowest share of low education, 2.5%.

Figure 15:10 **Share of jobs according to standard classification of occupations and share of employees according to classification of education at Slovak NUTS III regions (2009)**
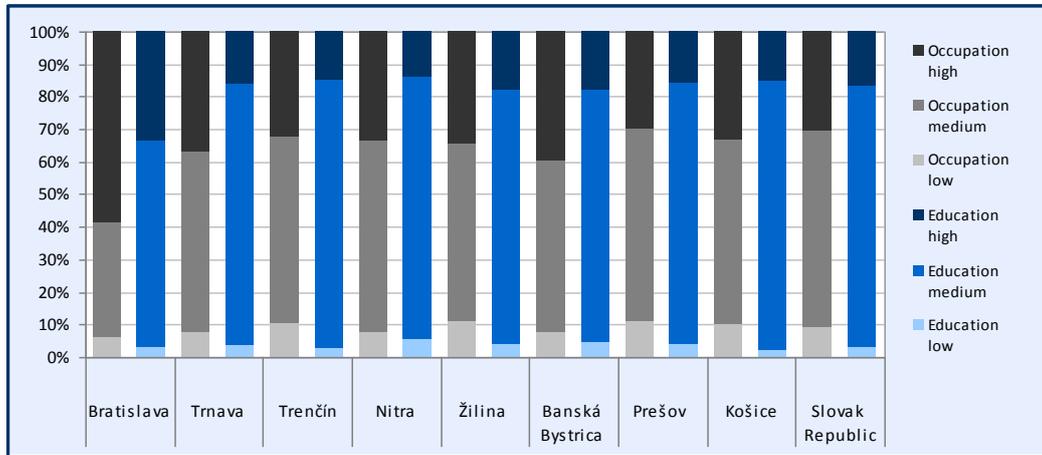


*Source*: Author.

The share of people employed with low level of education and occupied in a job requiring low level of skills (low/low match) declined in all regions during the analysed period. The highest rate of match was in Nitra region, which is determined by higher share of population with lower level of education. Overall, the rate of match was in 2009 in the interval from 1 to 3%. Similar trend could be found in the rate of undereducated at low/medium level. The lowest rate of undereducated is in Prešov and Košice regions, where only few employed with low level of education work in occupations that require medium level of skills. In Prešov region fewer than 25% employees with lower level of education work in occupations requiring medium level of skills, in Košice region this rate is 37.7%. In other regions this rate moves between 45-55%.

Overeducation medium/low skilled employed was stable during the observed period in individual regions. In 2009 in individual regions, the rate of overeducated was from 4 to 9%. The rate of match of employees with medium level of education having a job that requires medium level of skills is moving steadily in range 49-56% of all employed. The exception is Bratislava region with the share of 31%, which is caused by significantly lower rate of people with secondary education on total employment. In Bratislava region 50% of people with secondary education are employed in occupations that require medium skills and 43% in occupations that require high skills. In other regions on average 67% of employed work in jobs with a need of medium skills and only 24% in jobs needing high level of skills.

235

The highest rate of undereducation is thus in category medium/high. The highest rate of secondary-educated employees in jobs requiring high level of skills is in Bratislava region (43%), followed by Banská Bystrica region with the share of 30% and Trnava region with 27.4%. The lowest share is found in Prešov region with less than 20% share. Proportion of this mismatch could be reduced by greater use of first stage of tertiary education which is conditional on the part of people with secondary education gaining more skills (formally). The number of people with bachelor degrees not continuing in further study would be almost the same as the number of graduates.

The situation is markedly different in the rate of overeducation, persons employed with tertiary education (high formal skills) working in jobs that require only medium level of skills, the tertiary education is in this case unimportant. In observed period, we can see slightly increasing trend in overeducated graduates in particular regions. Some of this can be the result of non-availability of adequate job opportunities after coming back from studies. In Slovakia on average every 10th employee with tertiary education works in a position that formally does not require this kind of education. This ratio is lowest in Bratislava region (slightly less than 8%) and highest in Košice region (11.6%).

In individual regions, the ratio of people with tertiary education with jobs requiring high level of skill (match high/high) is slightly increasing. This is the result of increasing number of graduates. This ratio is on average 90% (of tertiary educated), thus the effectiveness of tertiary education is at a relatively high level. In different regions the share of these employees of total number of people employed is around 15%, with exception of Bratislava region with the share of these employees at 31%.

The share of highly overeducated or undereducated employees with the level of education and required skills at high/low and low/high levels does not reach 1% of people employed in the regions of Slovakia. In this respect we will not pay close attention to this.

The share of employed with the match of qualification and work performed has in observed period increased slightly in all regions of Slovakia and is between 64-74 % of all employees. The rate of total undereducation is gradually declining with rising total level of education, the highest remains in Bratislava region at 30% which is caused by the demand for highly educated (tertiary) employees. There are slightly less than 10% of overeducated employees in Slovakia.

## 15.4. Analysis of expected skills and education match by classification of economic activities by SK NACE

An interesting part of present analysis is the analysis of expected skills and education match by classification of economic activities by SK NACE. We analysed seven aggregated sectors at first level of SK NACE as follows:

A, B          Agriculture and fishing

C, D, E      Mining and quarrying, manufacturing, electricity, gas and water supply

F             Construction

G            Wholesale and retail trade, repair of motor vehicles, motorcycles and household goods

H, I         Hotels and restaurants, transport, storage and communication

J, K        Financial intermediation, real estate, renting and business activities

L-O        Public administration, compulsory social security, education, health and social work, other community, social and personal service activities.

The structure of employed by classes of economic activities and the share of employed by classification of education in individual sectors in 2009 is compared in Figure 15:11. In terms of education, the highest share of employed with low qualification is in agriculture and fishing (A, B) (13%), in other sectors the share moves from 1.9% in sales (G) to 4.4% in industry (C, D, E). The lowest share of employees with secondary education is financial services (J, K) at 56.6% and highest in construction (F) with 89%. In terms of tertiary education, the highest share of employees is in financial services (40.9% of all employees in sector J, K) and in public administration with 34.5%.

Looking at required skills by classification of occupations, we can see relatively high demand for employees with medium skills in industry, construction and sales (A to I). The highest demand for employees with higher level of skills (almost two thirds) is in financial services and public services (J to O). Higher demand for low qualified employees (25.6%) can be only found in agriculture and fishing (A, B).

Figure 15:11 **Share of employees according to classification of occupation and classification of education according to selected sectors by SK NACE classification (2009)**
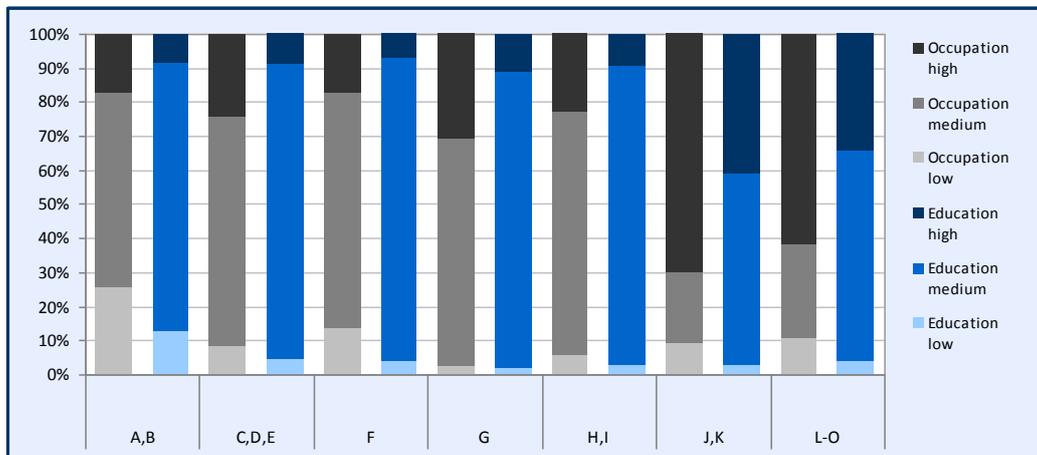


*Source*: Author.

In Slovakia agriculture and fishing differs significantly from other sectors due to their specific needs. This sector has the second lowest share of employees with tertiary education and lowest share of workers with this education, who work in an adequate position requiring high level of skills. Therefore, one third of employees with tertiary education in this sector are overeducated. This fact can also be caused by the number of graduates without adequate opportunities on labour market. Looking at employees with secondary education, we can find significant gender disparities. The match in skills and education at medium/medium level can be found in one half of the employed but this ratio is only one third when it comes to women. The share of women with secondary education performing jobs requiring higher level of skills (17.9%) is almost double the share of men in this category (9.1%). More than a half of women with low level of education work in this sector, while this share is only 39% for men. In total roughly 75% of employees in this sector are men and 25% women.

Mining and quarrying, manufacturing and electricity, gas and water supply (C,D,E) in 2009 is of a similar nature when it comes to structure of required skills and attained education as the whole sector of services and manufacturing (C-I). In this sector there is a low share of people with tertiary education (8.9%). The sector has high share of employees with secondary education and the medium/medium match is 64.1%. From gender perspective the differences in various categories are not significant enough, in total 64% men and 36% women work in this sector.

Figure 15:12 **Formal skills match at mining and quarrying, manufacturing,
electricity, gas and water supply sector (C, D, E), 2009**



| | | Required level of skills (ISCO) | |
|---|---|---|---|
| | Low | Medium | High |
| **High** | Highly overeducated 0%<br>Men 0%, women 0% | Overeducated 0.8%<br>Men 0.8%, women 0.7% | Skills match 8.1%<br>Men 8.9%, women 6.7% |
| **Medium** | Overeducated 6.6%<br>Men 5.1%, women 9.2% | Skills match 64.1%<br>Men 67%, women 58.8% | Undereducated 16.1%<br>Men 14.8%, women 18.3% |
| **Low** | Skills match 1.7%<br>Men 1.3%, women 2.4% | Undereducated 2.6%<br>Men 2%, women 3.8% | Highly undereducated 1.1%<br>Men 1.2%, women 1% |
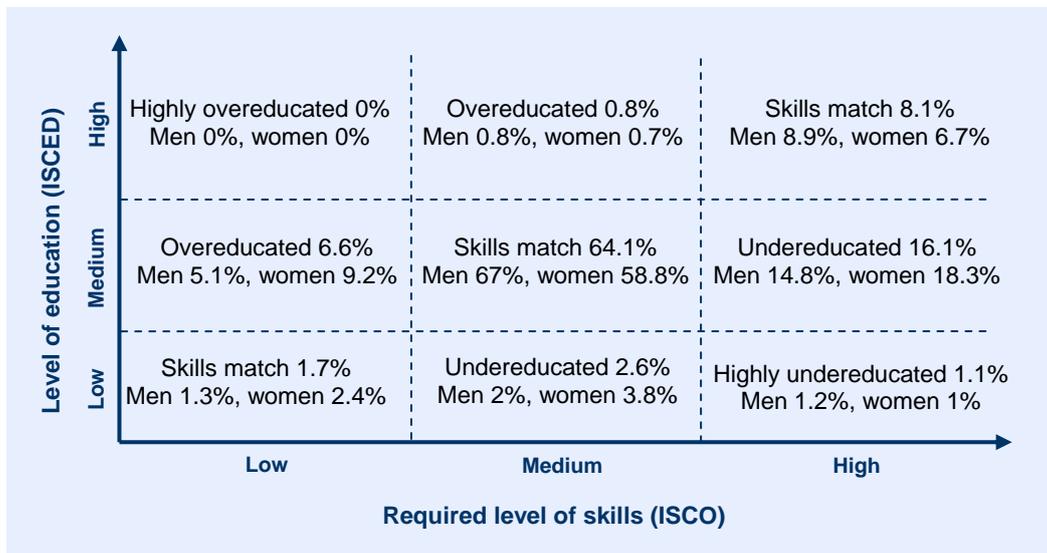
*Source*: Author.

The construction sector is very specific mainly due to gender imbalance. Almost 95% of employees are men and only 5.3% are women. Women work mainly in more qualified positions requiring high level of skills (76.8%). The sector has the highest ratio of employees with secondary education (88.7%) and second highest ratio of medium level of skills required (69%). At the same time it has the second highest share of people employed in auxiliary positions requiring lower level of education (13.9%), second after agriculture.

Wholesale and retail trade has the highest share of people with tertiary education (10.9%) in the whole manufacturing and services sector and these higher positions are mainly taken by men. At the same time it has relatively high share of positions that require high level of skills (30.8%). There is the lowest share of employees with low level of education (1.9%) in wholesale and retail trade and at the same time low level of skills required (2.8%). Globally, more than 60% of employees in this sector are women and less than 40% are men.

Transport and storage sector together with hotels and restaurants (H,I) has the highest share of positions with medium level of skills needed. Men usually work at the medium positions, there is slightly higher share of women in positions that require higher level of skills (24.7% women, 23.6% men), and similar situation is in positions with low level skills needed (7.9% women against 3.8% for men). The ratio of men working in this sector is 60% and a bit less than 40% for women — inverse ratio as in wholesale and retail trade.

Figure 15:13 **Formal skills match in construction sector (F), 2009**



| | | Required level of skills (ISCO) | |
|---|---|---|---|
| **High** | Highly overeducated 0.1%<br>Men 0.1%, women 0% | Overeducated 0.5%<br>Men 0.5%, women 0% | Skills match 6.6%<br>Men 5.2%, women 30.4% |
| **Medium** | Overeducated 11.5%<br>Men 11.7%, women 7.3% | Skills match 66.7%<br>Men 69.7%, women 14.3% | Undereducated 10.5%<br>Men 8.5%, women 46.4% |
| **Low** | Skills match 2.3%<br>Men 2.5%, women 0% | Undereducated 1.8%<br>Men 1.8%, women 1.5% | Highly undereducated 0.1%<br>Men 0.1%, women 0% |

Level of education (ISCED)

Low    Medium    High

*Source*: Author.

The financial sector (J, K) has the highest share of employees in positions that require higher skills (70.1%). In perspective of education attained, we can observe higher ratio of men with tertiary education having adequate position (41.6%). Share of undereducated women is found in this sector (40.4%), while almost two thirds of women with secondary education work in positions with higher skills needed. In this sector there is almost balanced employment of men (48%) and women (52%).

The public services are second after the financial sector, where the ratio of employees in positions with higher skills required is dominant. The structure of employed is similar to those of financial sector (Figure 15:14). In this sector we can find less than 30% of men and more than 70% of women.

The match of skills and education in various sectors moves from 57 to 78%. The lowest rate of match can be found in public services (J, K) and financial services (L-O), mainly due to lack of highly skilled labour force. In these sectors, there is much higher demand for employees with higher education, of which there is shortage in the labour market. On the contrary, there is a different problem in agriculture, where we can observe higher demand for workers with low qualification.

Undereducation in various sectors is closely related to previous information; it applies to sectors with need of highly skilled workers.

In Slovakia overeducation in individual sectors is still relatively small, it reaches on average less than 10%. It is significantly higher only in agriculture

with more than 20% and in construction where there is highest demand for auxiliary and low qualified workers.

Figure 15:14 **Formal skills match public administration (L-O), 2009**
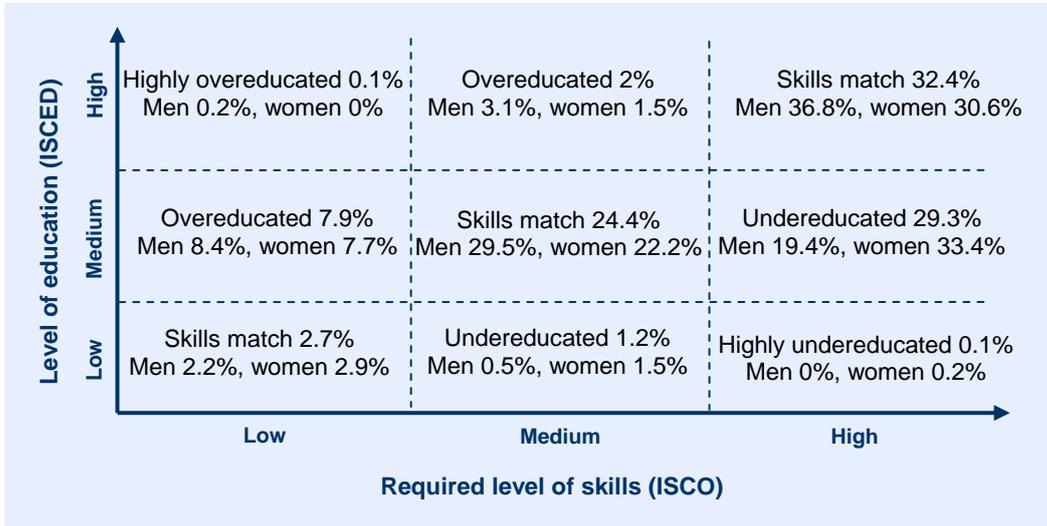


*Source*: Author.

Figure 15:15 **Share of employees with formal skills match by selected SK NACE sector**
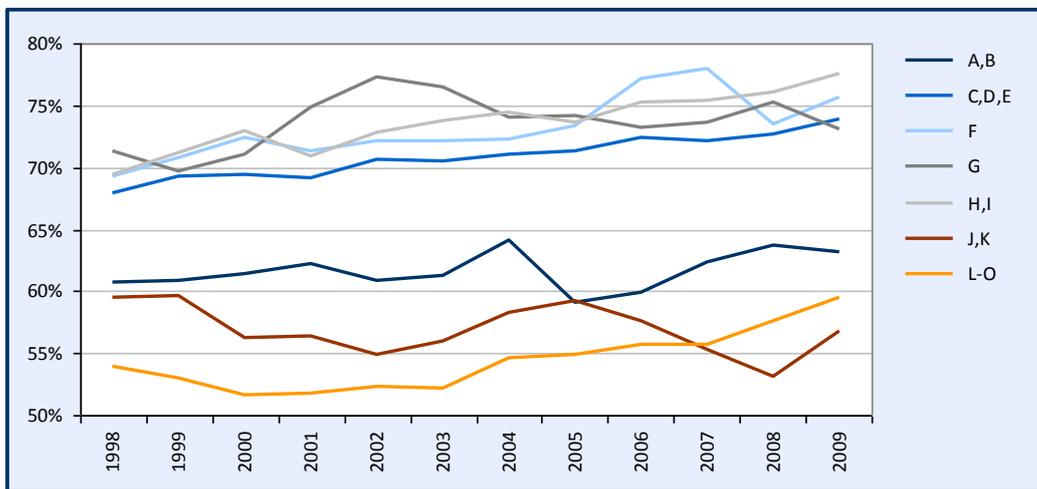


*Source*: Author.

Figure 15:16 **Share of employees with lower education level than required in occupation at selected SK NACE sector — undereducated**
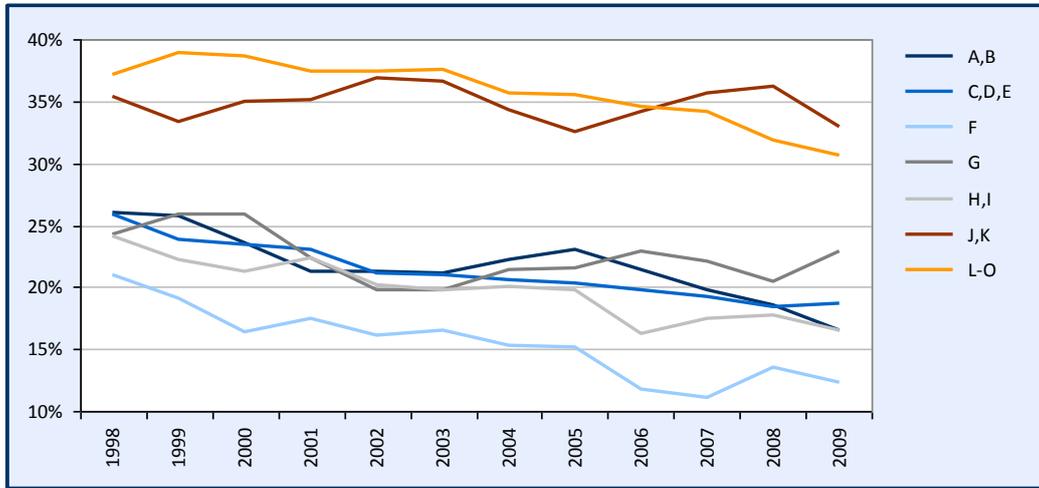


*Source*: Author.

Figure 15:17 **Share of employees with higher education level than required in occupation at selected SK NACE sector — overeducated**
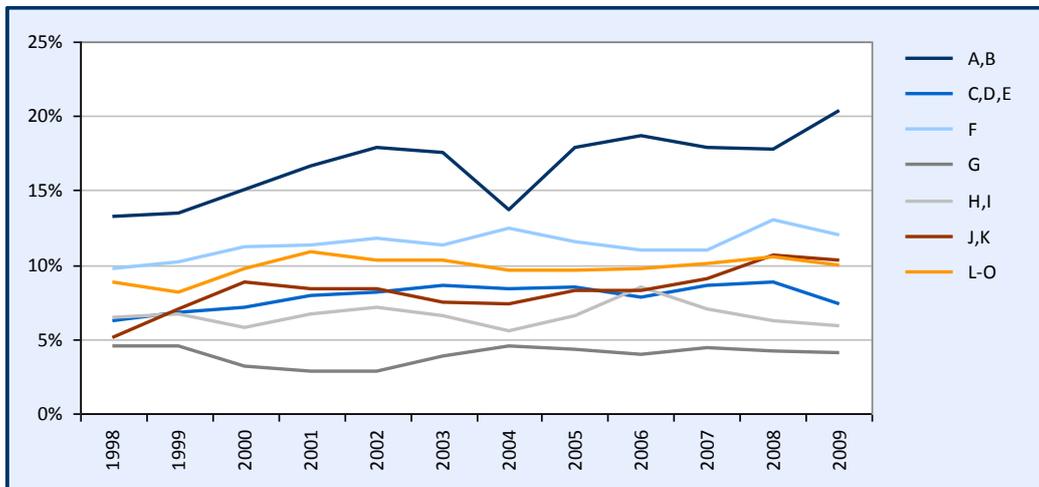


*Source*: Author.

Figure 15:18 shows the overeducation of people with tertiary education in particular sectors. More than 31% of employees with tertiary level of education in agriculture work in positions with lower required qualification, which leads to high inefficiency in this sector. High level of overeducation can also be found in transport and hotels and restaurants sector (H,I), 16.4%, and in wholesale and retail trade, 14.8%.

Figure 15:18 **Share of overqualified with high education, 2009**
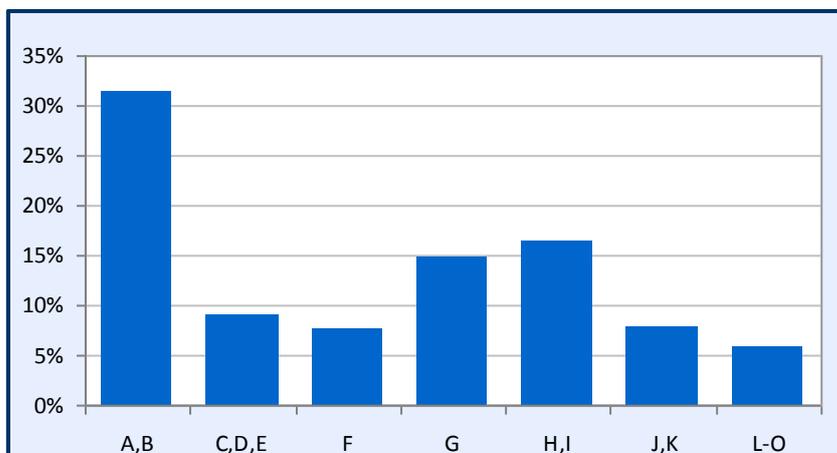


*Source*: Author.

## Summary

The main aim of this paper was to focus on the matching between education and demand for a qualified workforce in the Slovak economy. The analysis was based on cross-tabulation between level of education represented by ISCED and development of classification of occupations ISCO. Problem was simplified from analytical point of view to three levels of occupation, which require specific attained education: high (ISCO 1-3), medium (ISCO 4-8) and low (ISCO 9). Similarly was treated simplification and aggregation of attained education on three levels: high (ISCED 0-2), medium (ISCED 3-4) and low (ISCED 5-6). Gender differentiation was also selected as important factor of employment, especially at sectoral level, where this differentiation was highly significant.

Section 15:1 engaged in a general overview of the dependence between qualification and type of work performed. It was found that in Slovakia almost 50% of overall employment at age 25+ has matched their attained formal qualification and specific demand on medium level (92% of medium educated are providing appropriate jobs and almost 28% of them work in a position which requires higher education — undereducated) and almost 14% on high level of education in general (92% of highly educated have appropriate jobs).

At the same time we should observe high share of underqualification mainly at positions requiring high level of achieved formal skills (education) taken by workers with medium level of education (22% of total employment). These skills could be obtained also informally, but analysis shows that there is necessity for wider use of first grade at tertiary education, bachelor title in Slovakia.

Section 15:2 compared four different age groups, whereas age group 15 to 24 was not considered. An interesting fact observed was the higher share of working groups with higher formal education at category 55+. Despite a lower share of highly educated people at older cohorts, older people stay in the labour market for a longer period and those with lower education have much higher difficulties to be employed after losing their job.

Section 15:3 aimed at the matching of formal skills at regional level (NUTS III). It did not show highly significant differences between self-governed regions, as was shown in the sectoral comparison. Significant differences were only found for Bratislava region where almost a double share of highly educated employees was found compared to the average of other regions. This differentiation is mainly based on the fact that Bratislava is the capital city and a high portion of government institutions reside there. Also, Bratislava represents the financial centre of the country. Main universities are located in this area. From a structural point of view regarding education matching the Banská Bystrica region is performing surprisingly well. This region belongs to the most problematic regions from a socioeconomic point of view with very high level of unemployment.

Section 15:4 analysed differentiation of formal skills match between education and employment from a sectoral point of view using aggregated classification of employment SK NACE. Significant differences not only on aggregate view but also from a gender point of view were found. As an example, the construction sector was mentioned with 95% of male employees, women employed in this sector are mostly in higher positions considering skills needs and required education. Lowest match between needs of education and formal skills of employees is financial sector and public administration sector, where an important disproportion between needs and supply of highly educated workforce was presented.

This paper does not consider unemployment. This slightly affects the results. However, the issue of unemployed could be solved by setting their working skills by last performed job, which is also inaccurate. Major share of unemployed attained only lower qualification level, education and skills. For further analyses more detailed level of medium education should be considered, because most employed are in this category. Also the analysis of different specialisation of higher educated employees should be provided, which could determine more efficient allocation of funding for universities. The use of such analyses can be presented in very simple way in the sector of agriculture. More than 31% of highly educated employees in sector of agriculture actually work in a position, which does not require high education level — they are overeducated. These results

are still not strong from analytical point of view, but show a potential way of thinking.

Provided analyses represent greater simplification of described problem, but they present possibilities and usefulness of such analyses for each Member State. Detailed analyses of education and skills supply and demand at national level using existing methodology could provide more detailed results to national decision sphere than international comparisons. Simplification to three major groups on the side of demand and supply could be partially inaccurate, but from the point of comparison we are expecting their value to be significant.

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CHAPTER 16.

# Internet job search data as a possible source of information on skills demand (with results for Slovak university graduates) ([89])

*Miroslav Štefánik*

This paper examines Internet job search data as a possible source of information on skill demand. It proposes two methods of processing such data. The classical method is based on a content analysis of advertisements, the CV method on a content analysis of CVs uploaded by individuals looking for a job. The analysis is restricted to tertiary education graduates. Based on a representativeness analysis two specific groups in terms of occupation and economic sector are selected. It is technicians in public services and professionals in construction.

Results produced by both methods identified some key skills in relation to selected groups. Despite this, many methodological difficulties arise. These are shortly addressed in the discussion.

## 16.1.  Introduction

Presented paper describes an alternative source of information on demand for skills, which is 'Internet job search data' administrated by website companies. It describes and compares two methods of gathering such data, as well as two possible approaches in exploiting such data. This paper tries to present the restrictions and advantages of these two kinds of analysis. For this purpose we use data which were made available by a company administrating a job search website in Slovakia. The additional cost of getting such data is very low, which makes this source of information significantly cheaper compared to surveys (skills survey, employers' survey, or graduates' survey).

Web pages designed for intermediate job search process usually perform two procedures. The first one is a traditional collection of job advertisements and their display on the web. This is in principle the same as newspapers do for centuries. The second procedure was enabled later; nearly one decade ago, by the advancement of web technologies. It consists of picking the information about the applicants, using a standardised CV form. These CVs are subsequently

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offered to employers looking for an employee. Employers can browse the database with all the attributes (skills) stated in the CV for free. If they find an applicant, who is appropriate for the position they are filling, they pay for the display of contact details, so they can contact the applicant. Companies running the job search websites have information on the attributes in the CVs and also on the number of displays of each CV.

The first way of gathering data is the classical method. The second way is the CV method. Both patterns of Internet mediated job search can be found internationally; there are, therefore, reasons to assume that they could become an international source of information on skills demand. The following text focuses on the comparison of these two procedures as a possible source of information on skills demand. When comparing, we describe shortly the method used to process data from each source. Afterwards we look at the representativeness, so we can asses to what extent the acquired information refers to the whole population. Finally we compare the results.

### 16.1.1. Classical method

Data picked via the classical method which were made available for the analysis contain:

(a) basic information on the job vacancy (position name -string and categorised, location, type of contract, etc.);

(b) requirements of the applicant (level of required education, years of previous experience, required skills -string and categorised, etc.);

(c) information on the company (location, number of employees, business area).

These data will be handled to provide information on skill requirements employers put on employees, when filling open vacancies. For this we basically make two steps. First, we select a specific group (in terms of occupation and sector) for which we would like to identify the skill requirements. Second, we rank required skills according to how often they appear in the advertisements.

For the analysis, all advertisements uploaded during 2009 and 2010 were used.

### 16.1.2. CV method

Data picked up by the CV method which were made available contain information published in standardised CVs on:

(a) gender;

(b) age;

(c) achieved formal level of education (e.g. university and faculty);

(d) work experience;

(e) skills (language skills, economic knowledge, office software, advanced computer skills, etc.);

(f) industry, where the individual is looking for a job;

(g) position, which the individual is desiring;

(h) region, in which the individual is willing to enter a job.

This information is complemented by information on how many times were the contact details of each CV displayed by the employers in 2009.

Disposable data allow constructing a generalised linear model, in which the number of displays becomes the dependent variable and the attributes from the CVs are potential independent variables. Thanks to this, we can rank the skills according to the outcome of such equation.

This technique can also be used separately for particular groups. In comparison to a simple ranking based on frequencies of appearance, which was used when processing the classical method data, construction of a generalised linear model allows us to identify some side effects as for example gender or age. To make the results of both methods comparable we will focus purely on skills.

When using the CV method, we operate with CVs, which were uploaded during 2009 and the number of contact details displays counted within the year 2009. The most common length of CV publication is three months, but it can be prolonged. The length of the publication does not have any significant effect on the number of contact details displays of a CV.

## 16.2. Methodological issues

Lists of working positions and skills from which employers and employees pick when constructing their advertisements, respectively CVs are the same. They comprise over 500 positions and over 160 skills. Such detailed information cannot be used for the analysis. Positions were, therefore, recoded to correspond to nine (1-digit) ISCO groups. This will be complemented with seven identified sectors of economic activity, which can be linked to international statistical classification of economic activities NACE. Nine occupational groups and seven identified sectors allow us to identify 63 specific groups, in which we can focus on the skill requirements. This can be done on classical method data, as well as CV method data ([90]).

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([90]) More than one position may be chosen when completing the CVs and advertisements. In the further analysis, the CVs and advertisements are linked with a

Over 160 skills are grouped into language skills, administrative and economical skills, general computer skills and skills related to particular software or a programming language. All 160 skills from the list cannot be incorporated into a generalised linear model, which has to be constructed when processing the CV method data. Therefore, the model will use only those skills which were the most frequently mentioned in the advertisements targeting the same group.

Due to differences in Internet use across age and educational groups, we can expect some biases in the representation of some groups among the CVs. To avoid possible complication, the analysis therefore focuses only on tertiary education graduates, who present a relatively homogenous group in terms of age and achieved level of education. On the other side, tertiary education graduates are considered to be a disadvantaged group on the Slovak labour market, with higher unemployment rates and lower wages compared to Slovak average. Based on this, we can assume that the requirements applied to the graduates are even stricter and that employers are even pickier, when hiring a graduate, than an experienced employee. On the other hand some positions will drop out from the analysis.

To filter the tertiary education graduates sample among the advertisements we used only those advertisements which stated that the required educational level is tertiary education and that the advertised vacancy can be filled also by a person with zero years of experience. To filter the tertiary education graduates among the CVs, we selected only CVs which declared to have finished tertiary education and did so after the year 2004.

## 16.3.  Representativeness

For further analysis we use data picked up by a company administrating the most popular job search website in Slovakia. The market share of the company is around 80%. This gives us a good prerequisite to acquire relatively representative data.

Assuming ([91]) that the occupational and sector shares of vacancies are similar to the structure of total employment on the Slovak labour market, we will compare the shares of the CVs and advertisements to the structure of overall employment. To achieve better match we will look only at the tertiary education

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particular position according to the most frequent ISCO 1-digit level category. An analogous method was applied also in linking with economic sector.

([91])  This was confirmed also by a previous empirical analysis.

graduates CVs and advertisements, comparing their occupational and economic sector shares to the structure of employment of people with tertiary education. The information on employment structure was obtained from the labour force survey. Unfortunately, we have no information on employment structure of tertiary education graduates, for this reason we use the whole tertiary educated population in employment.

Table 16:1  **Shares of occupational groups of tertiary educated in employment, advertisements and CVs**

| | Labour force survey | | Advertisements | | CVs | |
|---|---|---|---|---|---|---|
| | **Frequency** | **%** | **Frequency** | **%** | **Frequency** | **%** |
| Managers and legislators | 16 144 | 18.19 | 16 758 | 16.65 | 3 125 | 12.65 |
| Professionals | 48 714 | 54.90 | 42 550 | 42.26 | 11 155 | 45.17 |
| Technicians and associate professionals | 16 715 | 18.84 | 21 507 | 21.36 | 4 282 | 17.34 |
| Clerks | 2 723 | 3.07 | 11 622 | 11.54 | 3 886 | 15.73 |
| Service workers | 3 035 | 3.42 | 6 077 | 6.04 | 1 817 | 7.36 |
| Skilled agricultural workers | 40 | 0.05 | 24 | 0.02 | 1 | 0.00 |
| Craft and related trades workers | 393 | 0.44 | 835 | 0.83 | 169 | 0.68 |
| Operators and assemblers | 371 | 0.42 | 286 | 0.28 | 18 | 0.07 |
| Elementary occupations | 593 | 0.67 | 1 018 | 1.01 | 245 | 0.99 |
| Total | 88 728 | 100.00 | 100 677 | 100.00 | 24 698 | 100.00 |

*Source*:   Labour force survey 1998-2009 and web job search data.

Table 16:1 shows the occupational groups which are strongly overrepresented, or underrepresented in the examined population. For example, service workers present only 3.42% of total employment of tertiary educated, but 6.04% of all advertisements referring to tertiary educated and 7.36% of all tertiary educated persons' CVs inquire a job as a service worker.

To assess the ability of classical and CV method to gather data on occupation we will run a chi-square goodness of fit test. The test confirmed that the gathered data fit the overall population of tertiary educated in employment. Both methods proved to provide roughly representative data when looking at nine basic occupational categories.

Besides the occupational perspective, we assess the representativeness of data also in relation to the economic sector. Table 16:2 shows the shares of economic sectors on employment of tertiary educated, advertisements looking for employees with tertiary education and CVs of tertiary educated looking for a job.

Table 16:2 **Shares of economic sectors on employment of tertiary educated, advertisements and CVs**

| | Labour force survey | | Advertisements | | CVs | |
|---|---|---|---|---|---|---|
| | **Frequency** | **%** | **Frequency** | **%** | **Frequency** | **%** |
| Agriculture and mining (A-C) | 1 969 | 2.28 | 2 780 | 2.67 | 356 | 1.39 |
| Industry and utilities (DA-DJ+DN) | 4 490 | 5.19 | 3 512 | 3.37 | 548 | 2.14 |
| Electro-machinery and utilities (DK-DM +E) | 6 590 | 7.62 | 6 345 | 6.10 | 2 138 | 8.34 |
| Construction (F) | 2 983 | 3.45 | 3 431 | 3.30 | 748 | 2.92 |
| Sales (G-H) | 7 120 | 8.23 | 18 258 | 17.54 | 1 798 | 7.01 |
| Services (I-K) | 16 753 | 19.37 | 61 846 | 59.42 | 17 383 | 67.81 |
| Public Services (L-O) | 46 567 | 53.85 | 7 911 | 7.60 | 2 663 | 10.39 |
| Total | 86 472 | 100.00 | 104 083 | 100.00 | 25 634 | 100.00 |

*Source*:　Labour force survey 1998-2009 and web job search data.

The shares of economic sector uncovered huge differences in representation of services and public services. Based on these findings, the conclusion can be made that employers in services and public services do not use Internet job search to fill in vacancies to the same extent as in other sectors. However, applicants looking for jobs adjusted their search, and they are not using Internet job search to look for jobs in these sectors to the same extent as in other sectors. Applicants and employers offering positions use other ways of search than Internet job search. On the other hand both future employers and future employees, know that jobs in (private) services are advertised on the Internet. They, therefore, use Internet job search to look for this kind of jobs/employees to a great extent.

By the combination of nine occupational and seven economic sector categories we can identify 63 various groups. Due to the restriction of the analysis focusing on tertiary education graduates, some combinations of occupational and sector groups become marginal. For example, combinations involving occupations ISCO 6-9, which are dominantly filled by people with lower levels of education. Table 16:3 shows the best represented combinations of occupation and economic sector. These are ranked according to the difference index ([92]).

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([92]) The difference index is counted as: DI=absolute value (labour force survey share-advertisements share)+absolute value (labour force survey share-CV share)/labour force survey share.

Table 16:3 **Selected combinations of occupation and economic sector and their share in the total population**

| Occupation | Economic sector | Labour force survey | | Adver- tisements | | CV | | Differ- ence index |
|---|---|---|---|---|---|---|---|---|
| | | Count | % of Total | Count | % of Total | Count | % of Total | |
| Technicians and associate professionals | Public services (L-O) | 4 854 | 5.7 | 2 945 | 6.7 | 1 180 | 4.8 | 0.18 |
| Professionals | Construction (F) | 1 469 | 1.7 | 956 | 2.2 | 603 | 2.4 | 0.30 |
| Professionals | Industry and utilities (DA-DJ +DN) | 1 364 | 1.6 | 463 | 1.1 | 334 | 1.4 | 0.31 |
| Managers and legislators | Electro-machinery and utilities (DK-DM +E) | 1 284 | 1.5 | 419 | 1.0 | 135 | 0.5 | 0.34 |
| Managers and legislators | Services (I-K) | 3 111 | 3.6 | 2 059 | 4.7 | 2 137 | 8.7 | 0.36 |
| Technicians and associate professionals | Sales (G-H) | 1 994 | 2.3 | 1 349 | 3.1 | 208 | 0.8 | 0.36 |
| Professionals | Sales (G-H) | 1 129 | 1.3 | 342 | 0.8 | 180 | 0.7 | 0.39 |
| Professionals | Electro-machinery and utilities (DK-DM +E) | 2 036 | 2.4 | 1 707 | 3.9 | 1 557 | 6.3 | 0.66 |
| Technicians and associate professionals | Services (I-K) | 4 444 | 5.2 | 3 941 | 9.0 | 2 426 | 9.8 | 0.78 |
| Technicians and associate professionals | Electro-machinery and utilities (DK-DM +E) | 2 790 | 3.3 | 359 | 0.8 | 275 | 1.1 | 0.78 |
| Managers and legislators | Sales (G-H) | 2 883 | 3.4 | 3 241 | 7.4 | 687 | 2.8 | 1.18 |
| Professionals | Public services (L-O) | 33 113 | 38.8 | 1 728 | 3.9 | 1 281 | 5.2 | 1.24 |
| Professionals | Agriculture and mining (A-C) | 558 | 0.7 | 690 | 1.6 | 169 | 0.7 | 1.29 |
| Service workers | Sales (G-H) | 669 | 0.8 | 899 | 2.1 | 465 | 1.9 | 1.64 |
| Clerks | Sales (G-H) | 437 | 0.5 | 694 | 1.6 | 121 | 0.5 | 2.20 |
| Professionals | Services (I-K) | 7 800 | 9.1 | 14 306 | 32.6 | 7 031 | 28.5 | 2.78 |
| Clerks | Services (I-K) | 732 | 0.9 | 3 303 | 7.5 | 3 702 | 15.0 | 7.47 |
| Service workers | Services (I-K) | 329 | 0.4 | 1 478 | 3.4 | 1 227 | 5.0 | 7.55 |

*Source*: Labour force survey 1998-2009 and web job search data.

Table 16:3 shows that there are significant differences between the representation of various groups. For groups in the top of the table, both types of Internet job search data can bring some interesting information on the demand for skills. On the other side groups situated in the bottom of the table, or totally excluded from the table, are not represented sufficiently in the available job search data. The information acquired in relation to these groups is, therefore, less valid. For this reason we will choose only first two groups for further analysis,

in attempt to dig out some information on skills demand within these groups. The underrepresentation of public services disappeared as we focused on technicians in public services. The second, best represented group are professionals in construction.

A more specific analysis of representativeness can be done on the CV method data. These data can be compared with the information on the structure of Slovak university graduates after 2004. This enables us to look at gender, year and university/faculty of graduation. The results of this representativeness analysis were surprisingly good with only one significant bias based on the type of faculty of graduation. Graduates of some faculty types are underrepresented in the sample. The underrepresentation of these faculty types can be explained by the structure of study programmes. There are reasons to assume that, graduates from most of artistic and theological study programmes are using other ways of looking for a job, than web job search. This is valid, for example, for medicine doctors, but not for all medical faculties graduates. Educational faculties graduates are using web job search when looking for a job in other than educational field. On the other side, CVs of economical and technological faculties' graduates are due to opposite reasons overrepresented ([93]).

## 16.4.  Results

Further analysis of skill demand using Internet job search data will always try to focus on a particular group. Its potential in producing information on a more general level is limited. The reasons are partially connected to the representativeness of gathered data. The representativeness analysis was nevertheless useful, when information was provided on which groups are better represented in the Internet job search data and which are more problematic in this context. Internet job search is still in the process of penetrating the labour market. Some particular areas of the labour market are more, some less penetrated. Differences in penetration are an important limitation to the analysis of Internet job search. Despite that, many areas of the labour market can be satisfactorily analysed using the Internet job search data. We will focus our further analysis on two groups selected according to their representation in available job search data. These are:

(a)  technicians and associate professionals in public services;
(b)  professionals in construction.

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([93])  For more specific information on this analysis find Štefánik (2010).

### 16.4.1.    Technicians and associate professionals in public services

Using the classical method to analyse technicians and associate professionals in public services we can see that the most commonly required skills appearing in the advertisements are not surprising. Employers most frequently require skills related to office software such as Microsoft Excel and Word, together with language skills, such as English language. The most surprising are the requirements for skills necessary to operate the cash register and Slovak language skills.

Table 16:4    **Skills frequently mentioned in advertisements looking for technicians in public services**

|  | Responses | % of cases |
|---|---|---|
| **Microsoft Word** | **1 674** | **62.60** |
| **English language** | **1 603** | **59.95** |
| **Microsoft Excel** | **1 568** | **58.64** |
| Internet (e-mail, www) | 1 146 | 42.86 |
| **Microsoft Outlook** | **854** | **31.94** |
| Microsoft PowerPoint | 538 | 20.12 |
| **Microsoft Windows** | **423** | **15.82** |
| **Slovak language** | **207** | **7.74** |
| Lotus Notes | 205 | 7.67 |
| **German language** | **144** | **5.39** |
| Cash register | 31 | 1.16 |
| Open Office | 29 | 1.08 |
| **Business correspondence** | **23** | **0.86** |
| **French language** | **22** | **0.82** |
| Russian language | 22 | 0.82 |
| **Invoicing** | **20** | **0.75** |
| **Warehouse management** | **12** | **0.45** |
| Hungarian language | 11 | 0.41 |
| Double-entry bookkeeping | 10 | 0.37 |
| **Adobe Photoshop** | **10** | **0.37** |
| Microsoft Access | 8 | 0.30 |
| Human resources | 8 | 0.30 |
| UNIX/Linux | 7 | 0.26 |
| **HTML** | **6** | **0.22** |
| Typing | 6 | 0.22 |

NB: Skills mentioned in results of both kinds of analysis are marked in bold.
*Source*: Analysed web job search data.

Skills mentioned in results of both kinds of analysis are marked in bold. The CV method brought fairly different results. Nevertheless, the most frequently mentioned skills from Table 16:4 can also be found in Table 16:5. The contribution of some skills to the attractiveness of a CV, measured by the number of contact details displays, is often negative. This is when the B regression

coefficient is negative. Such situation can be seen for example for Slovak language. This means that CVs which mention their Slovak language skills are less attractive in terms of number of contact details displays. This is valid also for skills in HTML coding; Microsoft Word and Invoicing, when all these skills were mentioned by the advertisements, but in fact are negatively related to the number of displays. This discrepancy can be explained in various ways, one of which can be that these skills are implied for CVs looking for this kind of position and their explicit mentioning is linked with a lack of other skills, which affect the number of contact details displays positively.

Table 16:5    **Skills ranked according to the Wald Chi-Square in the generalised linear model applied to technicians in public services**

|  | B | Standard error | Wald Chi-Square | Sig. |
|---|---|---|---|---|
| **Slovak language** | **-1.723** | **0.051** | **1144.62** | **0.000** |
| SAP | 1.126 | 0.122 | 85.09 | 0.000 |
| Polish language | -1.032 | 0.135 | 58.58 | 0.000 |
| **Microsoft Outlook** | **0.299** | **0.045** | **44.13** | **0.000** |
| LAN/WAN administration | -2.016 | 0.324 | 38.79 | 0.000 |
| Czech language | 0.426 | 0.069 | 38.45 | 0.000 |
| **French language** | **0.495** | **0.080** | **38.16** | **0.000** |
| Internet (e-mail, www) | 0.271 | 0.050 | 29.09 | 0.000 |
| **HTML** | **-1.468** | **0.273** | **28.88** | **0.000** |
| **German language** | **0.223** | **0.044** | **25.76** | **0.000** |
| **Adobe Photoshop** | **0.375** | **0.078** | **22.95** | **0.000** |
| **Microsoft Word** | **-0.548** | **0.115** | **22.80** | **0.000** |
| Adobe Illustrator | -1.577 | 0.338 | 21.76 | 0.000 |
| **English language** | **0.275** | **0.063** | **18.87** | **0.000** |
| Italian language | 0.45 | 0.106 | 18.00 | 0.000 |
| **Invoicing** | **-0.369** | **0.089** | **17.15** | **0.000** |
| PHP | 3.923 | 1.002 | 15.33 | 0.000 |
| .NET | 2.597 | 0.667 | 15.18 | 0.000 |
| **Warehouse management** | **0.427** | **0.114** | **14.13** | **0.000** |
| MS-DOS user | 0.496 | 0.137 | 13.06 | 0.000 |
| **Microsoft Excel** | **0.285** | **0.086** | **11.06** | **0.001** |
| **Microsoft Windows** | **0.147** | **0.046** | **10.35** | **0.001** |
| Client/server administration | 1.511 | 0.474 | 10.19 | 0.001 |
| Windows server administration | -1.765 | 0.646 | 7.46 | 0.006 |
| Adobe InDesign | 0.923 | 0.340 | 7.35 | 0.007 |
| **Business correspondence** | **0.199** | **0.075** | **7.05** | **0.008** |
| Pro/Engineer | 0.661 | 0.257 | 6.64 | 0.010 |

NB: Skills mentioned in results of both kinds of analysis are marked in bold.
*Source*: Analysed web job search data.

The CV analysis ranks the skills according to what difference they make in relation to number of contact details displays. Combined with the results of the classical analysis we can dig out valid information on what employers are looking for.

### 16.4.2. Professionals in construction

Looking at professionals in construction, we can find an increase in importance of specialised skills related to software used in construction business, such as AutoCAD, Cenkros plus, or MicroStation. As compensation, the importance of skills related to general office software, such as Microsoft Word or Excel, is lower compared to previous group. The importance of language skills, which appeared when looking at technicians in public services, was confirmed also when analysing professionals in construction.

Table 16:6    **Skills frequently mentioned in advertisements looking for professionals in construction**

|  | **Responses** | **% of cases** |
|---|---|---|
| Microsoft Excel | 720 | 62.66 |
| Microsoft Word | 718 | 62.49 |
| **English language** | **517** | **45.00** |
| Internet (e-mail, www) | 481 | 41.86 |
| Microsoft Outlook | 421 | 36.64 |
| AutoCAD | 329 | 28.63 |
| **German language** | **182** | **15.84** |
| **Microsoft Windows** | **150** | **13.05** |
| **Microsoft Powerpoint** | **138** | **12.01** |
| **Cenkros plus** | **104** | **9.05** |
| **Slovak language** | **83** | **7.22** |
| OpenOffice | 62 | 5.40 |
| **Invoicing** | **42** | **3.66** |
| Microsoft Access | 32 | 2.79 |
| MicroStation | 31 | 2.70 |
| Business correspondence | 22 | 1.91 |
| Microsoft Project | 19 | 1.65 |

NB: Skills mentioned in results of both kinds of analysis are marked in bold.
*Source*: Analysed web job search data.

Slovak language, Microsoft PowerPoint and Invoicing show negative regression coefficients despite the fact they appeared in the advertisements. This can be ascribed to the wider context of these skills, as we did not include demographic features into the equation to put in as much skills into the equation as possible. Demographic features, such as gender could shed some more light into the explanation of negative contributions of, for example, Invoicing.

Table 16:7 **Skills ranked according to the Wald Chi-Square in the generalised linear model applied to professionals in construction**

| | B | Standard error | Wald Chi-Square | Sig. |
|---|---|---|---|---|
| **Slovak language** | **-1.644** | **0.0545** | **909.41** | **0.000** |
| Internet (e-mail, www) | 0.664 | 0.0553 | 144.03 | 0.000 |
| Hungarian language | 0.565 | 0.0843 | 44.93 | 0.000 |
| **Microsoft Windows** | **0.342** | **0.0531** | **41.39** | **0.000** |
| Lotus Notes | 0.767 | 0.1305 | 34.54 | 0.000 |
| **German language** | **0.316** | **0.0554** | **32.52** | **0.000** |
| SAP | -1.428 | 0.2518 | 32.18 | 0.000 |
| ArchiCAD | -0.376 | 0.0691 | 29.69 | 0.000 |
| Autodesk Revit Architecture | -0.471 | 0.0951 | 24.56 | 0.000 |
| **English language** | **0.537** | **0.1107** | **23.59** | **0.000** |
| CorelDRAW | -0.341 | 0.0757 | 20.26 | 0.000 |
| **Cenkros plus** | **0.280** | **0.0648** | **18.72** | **0.000** |
| PHP | -1.687 | 0.4033 | 17.49 | 0.000 |
| **Microsoft Powerpoint** | **-0.230** | **0.0567** | **16.50** | **0.000** |
| JavaScript | 1.061 | 0.2655 | 15.96 | 0.000 |
| Single-entry bookkeeping | -0.470 | 0.1226 | 14.70 | 0.000 |
| ArCon | -0.524 | 0.1386 | 14.31 | 0.000 |
| Allplan | -0.422 | 0.1137 | 13.79 | 0.000 |
| Adobe Photoshop | 0.206 | 0.0630 | 10.69 | 0.001 |
| Windows server administration | -0.748 | 0.2419 | 9.56 | 0.002 |
| Mac OS | -0.745 | 0.2480 | 9.03 | 0.003 |
| Double-entry bookkeeping | 0.392 | 0.1326 | 8.72 | 0.003 |
| CAD | 0.451 | 0.1543 | 8.54 | 0.003 |
| Client/server administration | 0.736 | 0.2713 | 7.35 | 0.007 |
| **Invoicing** | **-0.215** | **0.0813** | **6.97** | **0.008** |
| Corel Photo-Paint | 0.302 | 0.1274 | 5.61 | 0.018 |

NB: Skills mentioned in results of both kinds of analysis are marked in bold.
*Source*: Analysed web job search data.

It is possible to include variables, such as gender or region in the analysis, nevertheless this project is focused on skills demand identification and the equation was constructed to look at individuals in terms of skills.

## 16.5. Conclusions

This paper tries to introduce two methods of processing Internet job search data. The availability of Internet job search data leads to questions about its possible usage in skill demand analysis. In relation to possible usage of such data, the question of representativeness arises. The representativeness of Internet job search data is limited primarily by the penetration of Internet usage. For this

reason we restricted our analysis to tertiary education graduates, which presents a group with a fairly high level of Internet usage.

Two different methods of picking data present two different sampling methods. The structure of data gathered by both methods was compared to the population of tertiary educated individuals in employment. The comparison was realised in terms of occupation and economic sector. Looking at occupational structure we can find overrepresentation of clerks and service workers and a slight underrepresentation of managers and professionals. Looking at economic sector structure we can find mostly the overrepresentation of services and underrepresentation of public services. The dominant pattern of bias seems to be similar for both, classical as well as CV method. Looking at the combinations of nine occupational and seven economic sector categories some groups appeared to be represented better than others. We picked two of them, which appeared the best in terms of representation and provided results on skills demanded by employees when looking for employees filling positions in this 'occupation-economic sector' group. We selected technicians in public services and professionals in construction and produced results for these two groups using the classical, as well as CV method.

When comparing the classical and CV method of processing Internet job search data we get fairly different results. Skills identified as important by both methods can be considered as crucial. For both cases, these are mainly language skills, with the dominance of English, German and Slovak. For the technicians in public services, the skills identified as important by both methods can be named as general office skills, often related to popular office software such as Microsoft Word, Excel or Outlook. For professionals in construction, general office skills are less important. Crucial skills of this group can be described as specialised skills related to construction. These involve skills necessary to work with graphical software used in construction such as AutoCAD of ArchiCAD, but also office software specialised for construction businesses such as Cenkros plus.

While the classical method brings results directly based on the formulations of employers' needs, the CV method analyses the behaviour of employers, when looking at the number of contact details displays. As a result, the classical method brings more commonly known findings. The CV method tells which skills actually make the difference. Both methods are able to bring more valuable information when looking at a more specific group.

## 16.6.   Discussion

Internet job search data and both compared methods have their limits. In respect to representativeness these limits appear to be fairly similar. Some occupations, and some economic sectors, are underrepresented in the sample of advertisements and CVs. The pattern seems to be the same, when services and clerks and service workers are overrepresented; and when public services and managers and professionals are underrepresented. Similar bias can be observed also when looking at the type of university/faculty of graduation, with artistic, theological and medical faculties being underrepresented in the sample. These biases can be linked to differences in Internet use, in particular when looking for a job. In some fields we can expect further penetration of Internet use and consequential disappearance of particular biases.

In general, classical and CV method showed their ability as sampling methods. They are able to produce valuable information on skill demand for some particular groups. Produced information can be used for example in producing skill profiles (in case of classical method), or identifying skill shortages (in case of CV method).

Information on skill requirements always becomes clearer when looking at a particular group. On the general level the skill requirements can be only vague and roughly defined. One of the advantages of Internet job search data in general are high counts (over 25 000 CVs and over 160 000 advertisements), which allow the analysis to go into more specific groups and to identify their skill requirements more precisely. However, important limits arise precisely due to the very same fact that the data were picked for a different purpose than a skills demand analysis. An example can be drawn as we run into difficulties transforming used occupational categories, created according to the demand of job search company clients, to international classification of occupations (ISCO). Too broad categories, such as account manager had to stay out of the analysis.

Methods of processing data, presented in this paper, show only two possible ways to use Internet job search data. Data contain more information than was used in the proposed analysis. Used data involve information on the position which is going to be filled. This information is categorised when employers uploading the advertisement select from a prepared list of working positions. The data also contain similar information on required skills, which are also picked from an existing list. Besides this categorised information the advertisement contains also a text description of the position and required skills. This information can be stored as a string variable and could be processed as well, but for the analysis we used only the categorised data, which can be processed

easily using quantitative methods. The production of information from string data requires sophisticated methods, but it is possible.

We restricted our analysis to the appearance of a skill, within an advertisement or a CV. The data, after few preparations, allow us to look also at the required level of skill. This is linked to several methodological problems which can be solved.

Both methods also allow us to involve wider context into the analysis. In case of classical method we can further specify the target group for the analysis, for example: 'women professionals in construction'. In case of CV method we can simply involve some more variables (such as gender, age, region, etc.) into the equation.

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CHAPTER 17.

# The protective effect of field-specific and general skills against overeducation under different conditions of labour supply and demand

*Martin Humburg ([94]), Andries de Grip and Rolf van der Velden*

Labour supply and demand imbalances lead to educational mismatch (overeducation) in the labour market. This paper explores the relationship between graduates' skills and the risk of overeducation under different labour demand and supply conditions. We distinguish two types of skills, field-specific and general skills, as well as two labour market segments, the occupational domain of a particular field of study and a general occupational domain. We find that the level of protection field-specific skills offer against the risk of overeducation increases with the degree of slack in the occupational domain of the graduate's field of study. The level of protection general skills offer against the risk of overeducation increases with the degree of slack in the general occupational domain.

## 17.1.  Introduction

Labour supply and demand imbalances lead to educational mismatches in the labour market. When labour supply exceeds demand, workers are at risk of getting jobs for which they are (formally) overeducated. Overeducation has been shown to have negative consequences for societies as a whole, but also for the individuals concerned (Cedefop, 2010; Groot and Maassen van den Brink, 2000; McGuinness, 2006).

In this article, we make use of a unique international college graduate survey in 17 European countries to explore how overeducation is related to labour market entrants' field-specific and general skills. We thereby attempt to make inferences about how the relationship between overeducation and field-specific and general skills is influenced by conditions of labour supply and demand. Our

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hypothesis is that higher job competition and selectivity in times of excess graduate supply causes the protective effect of field-specific and general skills to increase.

The remainder of this article is structured as follows: Section 17:2 presents the conceptual framework. In Section 17:3 we discuss our data and in Section 17:4 we present the results of our analysis. Section 17:5 then concludes.

## 17.2.    Conceptual framework and hypotheses

The risk of overeducation of high and low skilled workers tends to converge in tight labour markets and diverge in slack labour markets. Models brought forward to explain why low skilled workers experience greater cyclical variation in overeducation often refer to increasing job competition or the upgrading of hiring standards during recessions. According to the job competition model (Thurow, 1975), wages are rigid, jobs are ranked according to the level of skills they require and workers are ranked according to their skills. The highest skilled worker is then assigned to the best job, the second highest skilled worker to the second best job, and this process continues until there are either no jobs or no workers left to be assigned. Economic or demographic shocks affect the length of the labour queue and the degree to which low skilled workers have to compete with high skilled workers for particular jobs. When the labour queue is longer than the job queue the low skilled at the bottom of the queue are pushed into unemployment. The occupational upgrading hypothesis (Reder, 1955) proposes a slightly different adjustment mechanism but comes to the same result as the job competition model. While the job competition model is based on the idea that employers passively hire the highest skilled worker available, the occupational upgrading hypothesis assumes that employers actively raise hiring standards in times of excess labour supply. Both models predict that jobs previously available for low skilled workers are filled with higher skilled workers in slack labour markets, pushing the former into unemployment or into jobs for which they are (formally) overeducated. Teulings and Koopmanschap (1989) show that crowding out of workers with lower levels of education by workers with higher levels of education actually took place in the Netherlands during the 1980s, yet, van Ours and Ridder (1995) argue that job competition was limited to higher versus higher vocational educated workers. Devereux (2002) finds that the mean level of education within occupations is increasing during recessions in the US and concludes that this finding is in line with the occupational upgrading hypothesis and the predictions of the job competition model. Keane and Prasad (1993) show

that workers with college degrees were protected from cyclical variation in employment in the US in the 1970s.

Traditionally, studies interested in the differences in the cyclicality of labour market outcomes such as employment and job quality have defined skills as years of schooling or the level of education ([95]). In this article, we are interested in what happens to the risk of overeducation of graduates from higher education if an economic or demographic shock hits the labour market. We therefore focus on skill components that distinguish graduates with the same level of education. We hold the level of education fixed (higher education) and distinguish two types of skills, field-specific and general skills. These skill types have been shown to affect the transition from education to work in terms of wages and the risk of unemployment ([96]), as well as the risk of overeducation ([97]).

Besides distinguishing two skill types, we distinguish two labour market segments: the occupational domain of a particular field of study and the general occupational domain. We assume that a graduate's rank in the occupational domain of his particular field of study is based on his field-specific skills. This labour market segment contains occupations, which require a very specific set of skills, such as medical doctors, pilots, or engineers. In the occupational domain of a particular field of study, field-specific skills are the dominant factor for labour market success because they are instantly deployable and are associated with low costs for further field-specific training. Alternatively, graduates have the choice to work in the general occupational domain. We assume that a graduate's rank in the general occupational domain is based on his general skills. This is because the occupations contained in this labour market segment are broad in nature and require graduates to have low general training costs. Examples of general jobs are trainee programmes in large firms, managing positions or general administrative positions.

The segmentation into a labour market where more field-specific skills are required and a labour market where more general skills are required has important implications for the formulation of our hypotheses. Shocks taking place in the field-specific labour market will affect the relationship between field-specific skills and labour market outcomes whereas shocks in the general labour market will affect the relationship between general skills and labour market outcomes.

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([95]) Devereux (2002); Keane and Prasad (1993); Okun (1981); Teulings and Koopmanschap (1989); van Ours and Ridder (1995).

([96]) Bishop (1995); Campbell and Laughlin (1991); Goux and Maurin (1994); Heijke et al. (2003); Kang and Bishop (1989); Mane (1999); Payne (1995); Ryan (2001).

([97]) Chevalier and Lindley (2009); Verhaest and van der Velden (2010).

When the number of jobs at the tertiary level in the occupational domain of a particular field of study is lower than the number of graduates in this field, due to an economic and/or demographic shock, graduates with the least field-specific skills will not necessarily become unemployed, but they will tend to stream into jobs previously available for medium educated workers of that field. One should therefore be able to observe that the comparative advantage of having high as opposed to low field-specific skills increases with the degree of slack in the labour market. The same mechanism is at work in the occupational domain demanding more general skilled workers. When the degree of slack in these general occupations increases, employers will fill their vacancies with the best workers available and more and more graduates with low levels of general skills will accept jobs previously available for medium educated workers. When aggregate unemployment increases, one should therefore observe an increase in the comparative advantage of having high as opposed to low general skills.

## 17.3.  Data

Figure 17:1 shows that even among college graduates the risk of overeducation is substantial. Our analysis is based on original and representative data from the Reflex and Hegesco surveys among graduates from 17 European countries ([98]). The questionnaire was sent to higher education graduates five years after graduation. Our sample contains 11129 individuals.

In the questionnaire, respondents were asked to rate their skill level on a scale from 1 (very low) to 7 (very high). 'Mastery of own field or discipline' refers to graduates' level of theoretical and practical knowledge in their own field and to the ability to apply this knowledge in practice. We use this skill as an indicator for field-specific skills. 'Analytical thinking' refers to the ability to generalise from a concrete problem to abstract ideas, and to manipulate these ideas in one's mind

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([98]) Reflex was conducted in 2005 among 15 European countries and Japan. Hegesco is the extension of Reflex to four new EU Member States and Turkey conducted in 2009. In our analysis we only focus on European countries to ensure comparability. We excluded Sweden and Portugal because their survey design substantially deviated from the rest of the survey. For the remaining countries, we only include individuals who were less than 36 years old at the time of the survey to avoid unobserved pre-university labour market experience to be influencing the results. Moreover, we exclude all individuals who were not living or working in their home country at the time of the survey or who enrolled in further education after the initial education they reported on. The number of observations per country varies between 382 and 995.

to arrive at a solution, not only to the original problem, but to a whole class of similar problems. This skill matches our definition general skills quite well.

Figure 17:1 **Incidence of overeducation among college graduates five years after graduation (%)**
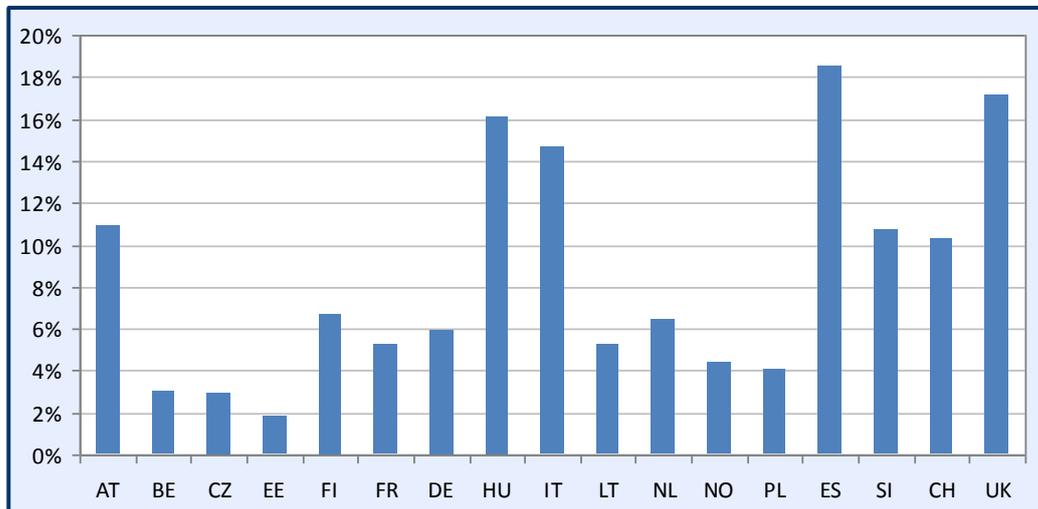


*Source*: Own calculations on the basis of Reflex and Hegesco data set. Data of Hungary, Lithuania, Poland and Slovenia from 2009, the rest of the countries from 2005.

Our definition of the dependent variable is straight forward. We consider graduates overeducated if they indicated that the type of education most appropriate for the job they are doing is below the tertiary level ([99]).

We use the unemployment rate at the time of the surveys as a proxy for labour market conditions. We include two different unemployment rates in our regression: the unemployment rate of the respondent's country (overall unemployment rate) as well as the unemployment rate of the respondent's field of study within that country (unemployment rate of the occupational domain of the field of study). Both unemployment rates are calculated on the basis of the combined Reflex and Hegesco data. Their values per country and field of study are displayed in Table 1 ([100]). Using international variation for the identification of

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([99]) For a discussion on measurement issues in assessing overeducation, see Dolton and Vignoles (2000) and Hartog (2000).

([100]) In the regressions, we include the unemployment rate in the occupational domain of a particular field of study (the field-specific unemployment rate within a country) as the deviation from the overall unemployment rate (the country-level unemployment rate), and we include the overall unemployment rate as the deviation from the unemployment rate of the whole sample. This ensures that both unemployment rates are uncorrelated and has advantages concerning the interpretation of the regression results as pointed out in Section 17:4.

effects of skills and their interaction with labour market conditions has advantages over national studies but also obvious limitations (Cedefop, 2010). The main advantage is that measures generated from international data offer variation usually unavailable within a single country and provide insights into long-term, general equilibrium effects. A clear limitation of cross-country, cross-field evidence is possible omitted country-level and field-level variables, such as institutional differences in ability sorting or employers' beliefs.

As control variables we only use variables which influence the probability of being overeducated because of signalling or network effects but which are not necessarily outcomes of skills. We include gender, age, age squared, a dummy whether the father has higher education, a dummy whether the respondent has a second level higher education degree ([101]), a dummy whether the respondent had study-related work experience during higher education and a dummy whether the respondent had non study-related work experience during higher education.

## 17.4. Results

Figure 17:2 shows a scatter plot of the coefficient of general skills and the overall unemployment rate. The coefficients were obtained by countrywise regressing a dummy variable that takes the value 1 if individuals are overeducated on general skills and the set of control variables described above. The fitted line suggests that the protective effect of general skills against overeducation is higher when aggregate unemployment is higher.

Figure 17:3 presents a scatter plot of the coefficient of field-specific skills and the unemployment rate of the occupational domain of the field of study. The coefficients were obtained by regressing a dummy 1 if overeducated on field-specific skills and a set of control variables per field of study. The fitted line suggests that the protective effect of field-specific skills against overeducation is higher when unemployment in the occupational domain of the field of study is higher.

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([101]) A second level higher education degree is a degree at ISCED 5A allowing direct access to doctoral studies.

Table 17:1 **Overall unemployment rates and unemployment rates in the occupational domain of particular fields of study per country**

|       | Mean | E   | HA   | SJI | BL  | SMC  | EMC | AV   | HW  | S   |
|-------|------|-----|------|-----|-----|------|-----|------|-----|-----|
| AT    | 4.3  | 2.4 | 6.1  | 4.4 | 4.5 | 3.6  | 3.2 | 5.8  | 4.8 | 3.7 |
| BE    | 2.2  | 1.9 | 3.3  | 2.2 | 1.1 | 3.0  | 2.0 | 2.1  | 1.2 | 1.9 |
| CZ    | 2.6  | 3.1 | 3.9  | 1.6 | 1.9 | 2.6  | 2.1 | 2.5  | 2.6 | 2.1 |
| EE    | 1.9  | 1.0 | 2.3  | 1.7 | 1.2 | 1.2  | 1.1 | 2.3  | 2.4 | 2.5 |
| FI    | 4.4  | 4.4 | 4.9  | 3.3 | 4.0 | 4.1  | 3.1 | 3.5  | 5.8 | 6.5 |
| FR    | 7.6  | 6.6 | 10.5 | 8.7 | 8.2 | 9.7  | 5.7 | 7.2  | 5.9 | 7.5 |
| DE    | 4.8  | 4.7 | 5.9  | 4.7 | 4.1 | 7.3  | 4.6 | 4.1  | 3.8 | 4.0 |
| HU    | 5.0  | 6.7 | 4.2  | 5.3 | 4.9 | 4.6  | 4.5 | 4.9  | 4.1 | 5.9 |
| IT    | 7.6  | 9.0 | 10.2 | 9.1 | 7.4 | 8.4  | 3.6 | 8.1  | 6.6 | 7.4 |
| LT    | 3.2  | 3.8 | 4.4  | 2.7 | 2.7 | 2.8  | 2.7 | -    | 2.9 | 3.0 |
| NL    | 4.2  | 2.6 | 6.0  | 4.0 | 3.6 | 6.1  | 3.5 | 4.7  | 2.8 | 4.1 |
| NO    | 2.7  | 2.4 | 3.3  | 3.0 | 2.1 | 2.5  | 2.2 | 2.6  | 2.1 | 3.1 |
| PL    | 2.2  | 3.3 | 2.0  | 1.5 | 2.1 | 2.3  | 1.7 | 2.0  | 1.8 | 1.8 |
| ES    | 8.9  | 9.8 | 12.5 | 9.9 | 7.8 | 10.3 | 5.1 | 11.3 | 7.5 | 8.0 |
| SI    | 3.8  | 3.9 | 4.1  | 3.3 | 3.6 | 3.5  | 2.4 | 5.1  | 1.6 | 5.4 |
| CH    | 4.4  | 3.6 | 5.2  | 5.3 | 4.2 | 6.4  | 3.2 | 4.3  | 3.1 | -   |
| UK    | 3.6  | 2.7 | 5.6  | 3.5 | 3.3 | 2.6  | 3.8 | 4.0  | 2.5 | 3.8 |

NB: Values are posterior means derived from Reflex/Hegesco data. E=Education, HA=Humanities and Arts, SJI=Social Sciences, Journalism and Information, BL=Business, Law, SMC=Science, Mathematics and Computing, EMC=Engineering, Manufacturing and Construction, AV=Agriculture and Veterinary, HW=Health and Welfare, S=Services.

Figure 17:2 **Coefficient of general skills and overall unemployment rate (%)**
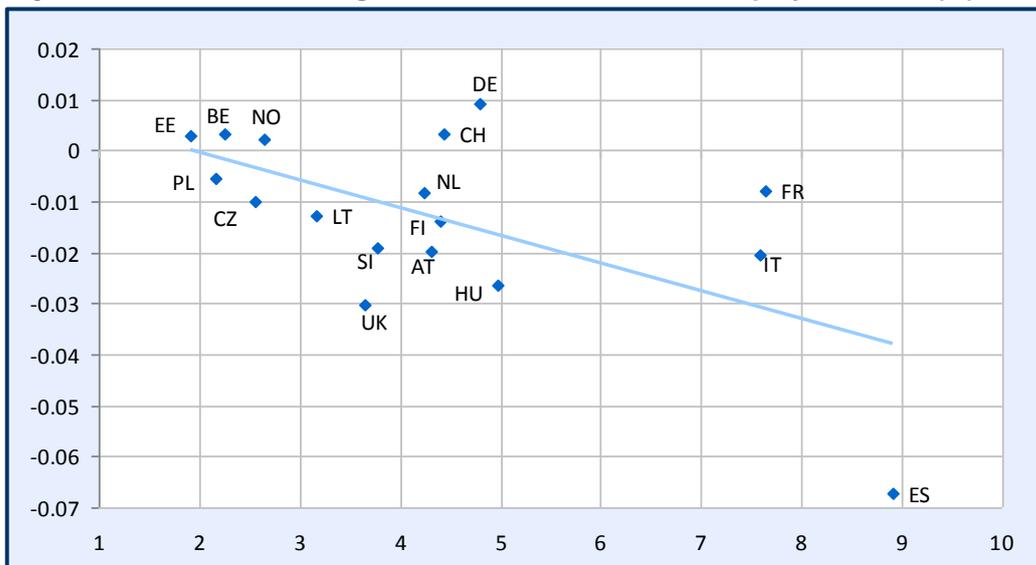


Data: Reflex and Hegesco. AT=Austria, BE=Belgium, CH=Switzerland, CZ=Czech Republic, DE=Germany, EE=Estonia, ES=Spain, FI=Finland, FR=France, HU=Hungary, IT=Italy, LT=Lithuania, NL=Netherlands, NO=Norway, PL=Poland, SI=Slovenia, UK=United Kingdom.

Figure 17:3    **Coefficient of field-specific skills and unemployment rate in occupational domain of field of study**
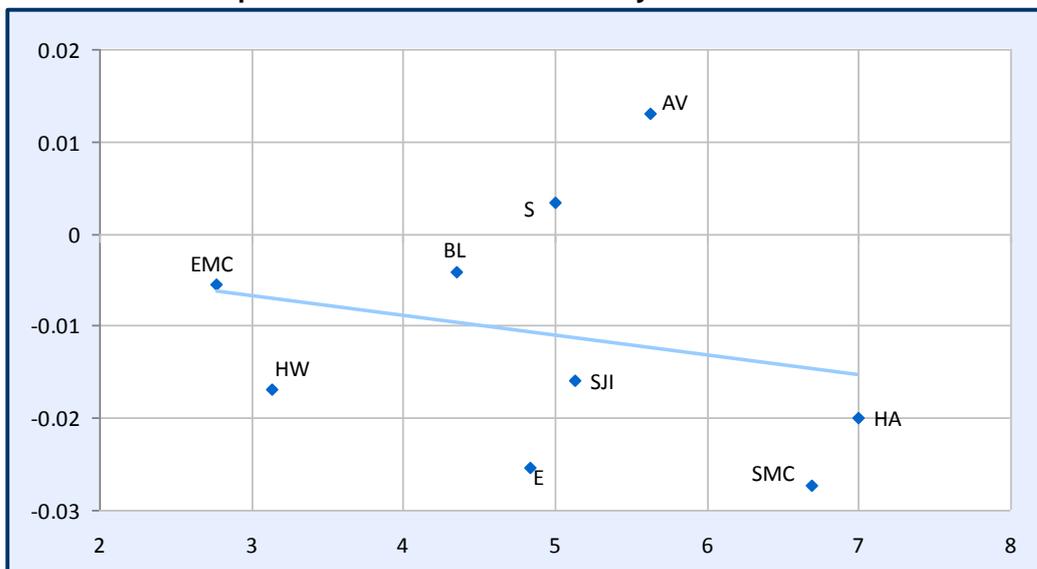


Data:    Reflex and Hegesco. E=Education, HA=Humanities and Arts, SJI=Social Sciences, Journalism and Information, BL=Business, Law, SMC=Science, Mathematics and Computing, EMC=Engineering, Manufacturing and Construction, AV=Agriculture and Veterinary, HW=Health and Welfare, S=Services.

The regression results presented in Table 17:2 confirm that these relationships are statistically significant. Model 1 shows that, on average, both skill types are negatively related to the probability of being overeducated ([102]). Holding all other things constant, a one standard deviation higher endowment of field-specific skills reduces the risk of being overeducated by 1.3%. A one standard deviation higher endowment of general skills reduces the risk of being overeducated by 1.7%. Both unemployment rates are positively related to the probability of being overeducated for one's job. Moreover, as expected, both the coefficient of the interaction of general skills (analytical thinking) and the overall unemployment rate as well as the coefficient of the interaction of field-specific skills (mastery of own field) and the unemployment rate in the occupational domain of the field of study are negative and significant at the 1% level in model 2. This indicates that when the degree of slack in the general occupational

[102] We also tested if graduates working in jobs that match their level of education have higher skills because they receive more training than those who are overeducated (van Smoorenburg and van der Velden, 2000). We therefore reran our estimation once with hours of training in the past four weeks and once with a dummy indicating the participation in training in the last 12 months to take account of the effect of training on skills. Including these variables did not substantially change the coefficients of our variables of interest, indicating that our skill variables are not picking up training effects.

domain increases, the level of protection against the risk of overeducation general skills offer graduates also increases.

Table 17:2 **Linear probability model of being overeducated five years after graduation**

|  | Model 1 | Model 2 |
|---|---|---|
| Mastery of own field (standardised) | -0.013*** (0.003) | -0.014*** (0.003) |
| Analytical thinking (standardised) | -0.017*** (0.003) | -0.019*** (0.003) |
| Overall unemployment rate | 0.016*** (0.001) | 0.016*** (0.001) |
| Unemployment rate in occupational domain of field of study | 0.013*** (0.003) | 0.013*** (0.003) |
| Overall unemployment rate X Analytical thinking | | -0.007*** (0.002) |
| Unemployment rate in occupational domain of field of study X Mastery of own field | | -0.008*** (0.003) |
| Controls | yes | yes |
| R² | 0.040 | 0.043 |
| N | 11 129 | 11 129 |

NB:  Coefficients reported are estimates from a linear regression of a dummy 1 if overeducated on our independent variables, robust standard errors in parentheses (significance levels *** 0.01, ** 0.05, * 0.1).
Controls included are gender, age, age squared, father having higher education, respondent having a second level degree, study related work experience during higher education, and non study related work experience during higher education.
Data: Reflex/Hegesco.

Moreover, the level of protection against the risk of overeducation field-specific skills offer graduates increases when the unemployment rate in the occupational domain of the field of study rises.

## 17.5.  Conclusion

In this article, we investigated the relationship between graduates' field-specific and general skills and the risk of being employed in a job for which they are overeducated.

One of the main arguments brought forward by this paper is that two labour market segments can be distinguished: a labour market segment where field-specific skills determine the allocation of graduates to jobs (the occupational domain of a particular field of study) and a labour market segment where general skills determine the allocation of graduates to jobs (the general occupational domain). From this followed that heterogeneity concerning the effect of field-

specific skills on overeducation should stem from variation in excess supply of graduates in the occupational domain of the corresponding field of study whereas heterogeneity concerning the effect of general skills on overeducation should stem from variation in excess supply of graduates in the general occupational domain.

We found that graduates with low levels of field-specific or general skills experience greater cyclical variation in job quality (overeducation). More precisely, the probability of being overeducated of graduates with high and low levels of field-specific skills converges when unemployment in the occupational domain of the field of study is low and diverges when the degree of slack in this specific labour market segment rises. The probability of being overeducated of graduates with high and low levels of general skills converges when overall unemployment is low and diverges when general unemployment rises.

Besides looking at differences in the cyclical employment and job quality variation between graduates with different skill endowments, we explored the average relationship between field-specific and general skills and graduates' probability of being overeducated. Our study showed that skills matter. Graduates with high field-specific skills as well as graduates with high general skills (or both) were more often allocated to jobs matching their level of education than graduates with low levels of field-specific and general skills.

The results of our study are encouraging. We realise, however, that the effects we find could be driven by institutional differences between countries or fields of study. We therefore think that using cross-sectional data to test our conceptual framework can only be a first step. Further research exploiting cyclical variation within fields and within countries over time is needed to better establish causality.

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# Building on skills forecasts — Comparing methods and applications

## Conference proceedings

This publication is based on contributions to the international expert conference, *Building on the skills forecast: comparing methods and applications*, organised by Cedefop in February 2011, which brought together a forum of more than 60 researchers and experts in labour-market analysis. This inspiring and constructive event aimed at sharing the latest insights on how Cedefop's forecasting results are used at national level, and what other (innovative) activities are taking place in individual Member States.

The publication helps to identify the challenges and offer solutions to skills and labour-market forecasting in general and to Cedefop projections in particular; it also discusses various national approaches, methods and results and their comparisons. It provides sound evidence and suggests innovative ways of thinking about future skills needs and supply. The findings will inspire further development of Cedefop methodology used to project future skill demand and supply.

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