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**Coping with changes in
international
classifications of sectors
and occupations**

Application in skills forecasting



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Europe 123, 570 01 Thessaloniki (Pylea), GREECE
PO Box 22427, 551 02 Thessaloniki, GREECE
Tel. +30 2310490111, Fax +30 2310490020
E-mail: info@cedefop.europa.eu
www.cedefop.europa.eu

Joachim James Calleja, *Director*
Barbara Dorn, *Chair of the Governing Board*

Foreword

Cedefop skills supply and demand forecasts are widely recognised as a valuable source of labour market information. The forecasts are unique, as they allow comparison of future trends in skills supply and demand across the European Union (EU) Member States. They provide a sound basis for discussion among experts, professionals and key stakeholders about education, labour market and skill development in the EU. The results have informed national and European policies, such as New skills for new jobs, under the Europe 2020 strategy. The results are also one of the key building stones of the European skills panorama.

The usefulness of the forecast results rests on high quality methodology and high quality data, collected consistently in a historical time series reasonably comparable across countries. Despite the model's sophistication and the plausibility of the assumptions, without good data the results produced will have limited practical relevance. To produce the necessary cross-country comparable database, Cedefop combines different sources of information (mainly national accounts and the EU labour force survey) and uses international standards and classifications.

The standards used to classify sectors and occupations (NACE and ISCO) have been significantly redesigned in recent years. Both standards not only changed their approach to how sectors and occupations should be classified, but also introduced different groupings. This resulted in improvement and updating of the respective classifications but severely affected the consistency of time series.

This publication focuses on how changes to sectoral and occupational classifications were treated to produce the database required for Cedefop's skills supply and demand forecasts. It describes breaks in time series caused by these changes and presents solutions adopted to overcome them. Similar exercises were also carried out in different Member States. However, the extra efforts made to maintain cross country comparability of the data make this exercise unique. I hope this publication will prove useful to statisticians, labour market economists and skill forecasting experts who face similar challenges.

Joachim James Calleja
Director

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Table of contents

Foreword.....	1
Acknowledgements	2
Table of contents.....	3
List of tables figures and boxes	4
Executive summary	6
1. Introduction	9
2. Skills database challenges	11
2.1. The change in the classification of sectors	12
2.2. The challenge for occupation data.....	15
2.3. Challenge for historical time series	19
3. The shift from ISCO-88 to ISCO-08	24
3.1. Mapping occupation categories	24
3.2. Initial analyses of trends	29
3.3. Employment composition changes in occupation groups.....	33
3.4. Changes in sectors.....	35
3.5. Reclassification of occupations at ISCO two-digit level.....	37
3.6. Projecting future changes in occupations	40
4. Forecasting skills demand: developing revised projections.....	50
4.1. Developing occupation structure projections within industries	50
4.2. Presenting and interpreting the new projections	51
5. Conclusions	55
List of abbreviations	57
References	58
ANNEX 1. General limits of the LFS-based database	60
ANNEX 2. Cedefop pan-European forecasting model of skills supply and demand.....	62
ANNEX 3. Detailed results of employment share analysis.....	66

List of tables, figures and boxes

Figures

1. Employment shares by occupation for EU-28 (% total), 2008-11	30
2. Employment shares for selected occupations, 2010 and 2011 (% total) (2010 based on ISCO-88 and 2011 on ISCO-08)	32
3. Share of women in employment in ISCO one-digit occupations in the EU-28, 2008-11 (% total)	33
4. Share of employment accounted for by those with tertiary education in ISCO one-digit occupation groups in the EU-28, 2008-11 (% total employed)	34
5. Share of employment accounted for by ICT professionals according to ISCO-88 in 2010 and ISCO-08 in 2011 (% total employed)	45
6. Share of employment accounted for by business and administration professionals according to ISCO-88 in 2010 and ISCO-08 in 2011 (% total employed).....	45
7. Share of employment accounted for by legal professionals according to ISCO-88 in 2010 and ISCO-08 in 2011 (% total employed)	46
8. Share of employment accounted for by social and religious professionals according to ISCO-88 in 2010 and ISCO-08 in 2011 (% total employed).....	46
9. Share of employment accounted for by social and religious professionals (group 245 in ISCO-88 in 2010 and groups 264 and 265 in ISCO-08 in 2011) (% total employed)	47

Tables

1. Employment classified by NACE Rev.2 and NACE Rev.1.1 in EU-28, 2008	13
2. Comparing ISCO-08 and ISCO-88	17
3. New occupation categories (as used in in the forecasts)	20
4. Comparison of old and new occupation categories.....	22
5. Reclassification of occupations between one-digit groups in ISCO-08 compared with ISCO-88	26
6. The division of employment according to ISCO-88 and ISCO-08 in the EU-28, 2008-11 (thousands)	29
7. Occupation composition of employment in selected NACE two-digit sectors in the EU-28: difference between 2010 and 2011 (percentage point difference).....	36
8. Total number of employed and shares of employment by ISCO two- digit occupation group in 2010 and 2011	38
9. Link between ISCO-08 and ISCO-88 to identify past trends for projection purposes	42
10. Division of electrotechnology engineers (ISCO-08 215) and link with ISCO-88	48

11. Composition of health associate professionals (ISCO-08 32) and link to ISCO-88	49
12. Shift-share analysis of occupation changes using ISCO-08 categories, 2000-13 (UK).....	53
13. Shift-share analysis of occupation changes using ISCO-08 categories, 2013-25 (UK).....	54

Box

1. Creating the new ISCO-08 database	23
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Executive summary

Good, reliable and consistent time series are the basis for any kind of economic forecasting. Skills forecasting requires even more sophisticated information on occupation structure within sectors or qualification (education) structure within occupations. It requires combining data from national accounts (NAs) and the labour force survey (LFS), with both methodologies differing in their internal logics and elements captured. Cedefop puts significant effort into the process of developing sound methodology and ensuring reliable data for skills forecasting.

Combining the data involves different statistical techniques and treatment of issues such as 'double jobbing' and the distinction between residence and workplace. Doing this on a pan-European level involves relying on different international standards; those related to sectoral classification and occupation classification underwent substantial changes in the past few years. These changes were not related only to the internal structure of major, submajor and other categories but also internal logics of how companies or workers will be classified to different sectors or occupations.

One of the changes of internal logic within NACE Rev.2 was focus on the tasks or activities rather than type of the output. The difficulty of mapping certain jobs from the old to the new classification system was that many of the activities concerned were previously not distinguished; this affected only a small number of jobs. Greater difficulties were caused by more detailed division of many service sectors which grew in terms of employment in recent years. The mapping of sector, however, was made easier as the data for both classifications were available at least for two years (2008, 2009).

Despite availability of data in both old and new classifications for two years, building time series requires other relatively strong assumptions. One such assumption is that the time trends observed in previous sectoral groups are applied equally across the new ones. This applies mainly to those 'new' sectors which were previously part of the bigger segments. A similar case is when the 'old' sectors were aggregated to form a new one; often not all the groups were aggregated and it was difficult to distinguish appropriate shares.

The internal logic of the new occupation standards (ISCO-88) brought changes at the level of major group (one-digit level). The previous 27 submajor groups were extended to 43 and redistributed across different major groups. However, international statistical authorities did not provide any reliable information on how to map information between new and old classification. Although such information is available in few Member States, these cases were

mostly based on national classifications and so not too useful for production of cross-country comparable time series.

The reason for production of complete historical time series was the need to capture the future time trends as much as possible. The new estimates produced by the forecasting models maximise the use of available LFS data. Analysis is based on comparing time trends, employment counts and shares in the years 2010 (using ISCO-88) and 2011 (using ISCO-08). The procedure applies 'best fit approach' to obtain the best possible results; such analyses are considered as rather rough but, in the absence of more detailed information, the only option.

Initial analyses on one-digit level confirmed our expectations. The trends between 2008 and 2010 did not signal any major change in the occupation structure. However, this structure was significantly changed between 2010 and 2011 when the new occupation classification was introduced. Gains were recorded in occupations professionals and service and sales. The major decline was in the group managers. From this simple analysis we can conclude that the introduction of ISCO-88 resulted in significant changes in the occupation structure.

Looking at changes in the most affected groups by country, we see difference both in size and direction. For example the highest difference in managers occurred in Greece, Ireland and the UK. This may arise from reclassifying small shop owners in Greece and different types of managers without specific managerial tasks in Ireland and the UK. Very little change in the managers group was observed in Latvia. As with the EU level, the major changes occurred between 2010 and 2011 rather than between 2008 and 2010.

Similar analyses focused on the different personal characteristics of the people employed in occupations. The share of women increased in professionals (ISCO 2) and elementary occupations (ISCO 9) but decreased in technicians and associate professionals (ISCO 3) and in service and sales workers (ISCO 5). Changes can also be seen in the education composition of the employed. The share of highly qualified increased in managers and service and sales, but declined in professionals. This can be connected to segmentation of some occupations which were shifted from one group to another. It was confirmed that reclassification has altered the gender and qualification composition of occupations.

The new occupation classification brought significant changes in the division of employment between occupations within individual sectors. The main issue here was reclassification of one occupation group to another. When looking at the disaggregation at two-digit level the differences were even more significant, as many occupations were split into two or in some case three groups. The

limited knowledge about the possible trends in such newly-created occupation groups brings certain uncertainty into the forecasts.

There are two main ways to treat the changes in the classifications in producing the forecast. A relatively simple solution is to take the structure from 2011 and to assume that this will be the same in the future; the simplicity of this approach is the absence of the need to estimate past trends, so there is no need to capture differences between two classifications. The major disadvantage is in the assumption of constant trends within sectors, though it is hard to believe that this stays constant across time.

The second approach is more accurate but more complex, based on assumption that past trends continue into the future. This approach needs detailed understanding of the changes imposed by the change of classifications, the starting point being to try finding the 'best fit' between categories in the new and old classifications. This should be followed by a closer look at the detailed categories and jobs classified within. Although still not perfect, this approach has the merit of being based on historical observation rather than assumptions of constant trends.

The reworked historical trends were taken into the skills forecasts, with the initial forecast produced at the ISCO-88 disaggregation. The differences between historical trends in ISCO-88 and ISCO-08 were then introduced for the whole period of the forecasts. The new procedures were developed and the output files were adjusted accordingly. This report details the implementation of the chosen approach. It describes breaks in time series caused by these classifications changes and presents solutions we have adopted to overcome them.

CHAPTER 1.

Introduction

The key dispute in any labour market analysis is using two different methodologies – labour force survey (LFS) and national accounts (NA).

The LFS conducted across the EU provide an invaluable source of information on employment broken down by industry and occupation. The advantage of the surveys is that they are conducted on a much more frequent basis than a typical census. The structure is considered useful for producing occupation employment projections within the industries identified in macroeconomic models.

Estimates of employment in national accounts integrate all available sources of information (including LFS). The main concept makes national accounts estimates more robust and more consistent with other variables such as output and compensation of employees (wages, salaries and social contributions). Consequently, these estimates are more suitable for building economic models. Cedefop puts significant resources into the treatment of methodological differences to obtain data of highest possible quality. The methods are under continuous development within the framework of skills supply and demand forecast (Cedefop, 2012).

Creating a consistent labour market database became even more complicated with the introduction of new sectoral classification and occupational classification (NACE Rev.2 and ISCO-08). This seriously harmed the consistency of the time series. While the adoption of new NACE was at least partially treated by producing data for two years in both (old and new) classifications this was not the case when adopting of new ISCO. As this happened in the time of economic downturn, maintaining the consistency of time series became even more complicated.

The unique nature of the Cedefop skills supply and demand forecasts is in trying to use a single methodology based on harmonised data sets. The changes in both key classification standards affected this exercise considerably and this work is based on the effort put into the treating the impacts. It is described in detail in the background papers (mainly Stehrer and Ward, 2013; Wilson et al., 2013b). We hope the methodology Cedefop has developed will be of value to all those dealing with labour market analysis.

The main challenges and their treatment related to the adoption of new NACE and ISCO are described in Chapter 2. Treatment of the changes in NACE is relatively easy and straightforward as the data published in the previous years

in both classifications enabled the construction of mapping matrixes. This was not the case in the adoption of ISCO, so the issue of the adoption of new occupation standards is more problematic. Chapter 2 captures the initial solution but the adoption of new ISCO became even more problematic as it allowed many national statistical offices to change how different occupations were classified. Challenges based on this and more detailed analysis of the transition between ISCO-08 and ISCO-88 are the subject of Chapter 3. The impacts of the changes within ISCO on the overall forecasting process are described in Chapter 4. Chapter 5 concludes.

CHAPTER 2.

Skills database challenges

The approach used to generate Cedefop skills forecasts involves constructing a coherent set of historical data on the changing education requirements associated within the selected time frame (Cedefop, 2012). In practice it means 'marrying' macroeconomic data on employment with survey data on employment in the different occupations and on the people concerned. More specifically, data from the national accounts are brought together with data from the EU-LFS carried out on a quarterly basis in all the countries covered by the projections.

The LFS is based on the information provided by a representative, though relatively small, sample of households in each country. This raises a range of data issues when they are used to construct a consistent time series and are used to identify employment trends disaggregated by occupation. These relate mainly to the sample nature of the data, and changes in the methods used to collect them. The most severe issue at present is how data are classified to sectors and occupations, as well as education attainment levels. In many cases, the data need to be adjusted to correct for breaks in the series.

A great deal of effort went into this task in the previous phase of the present project and has been described in the reports produced during this period (see, for example, Stehrer and Ward, 2010; 2012). Two new sources of breaks in the series have arisen which are much more difficult to handle than those encountered, and largely overcome, in the previous years. These are changes to the common systems of classification of employment by sectors and occupation. The changes made make it difficult to construct a consistent data series of sufficient length to be useful in analysing past trends in the structure of jobs.

The first of the specified impacts is caused by the Eurostat revision of the statistical classification of economic activities NACE (Eurostat, 2008). The NACE Rev.2 system was introduced and affected the LFS in 2008. The second impact is the change in the system of classifying occupations from ISCO-88 to ISCO-08 which occurred in 2011 (ILO, 2012). Revisions of both classifications were based on completely different internal philosophy to previous ones. The difficulties caused, as well as the potential ways of adjustment and overcoming them, are described below.

2.1. The change in the classification of sectors

The shift from the NACE Rev.1 classification of sectors to NACE Rev.2 involves a wholesale change in the philosophy of how output and employment should be categorised. Specifically, the system was changed from one based on the kinds of goods and service produced to one based on the tasks or activities entailed. This means that, for example, administrative activities or the repair of goods were separately distinguished from production. Therefore, it became difficult to map certain jobs from one system of classification to another because previously activities involved were not distinguished, even at a very detailed level of disaggregation.

While, in many cases, the number of jobs affected by this change is relatively small, it still presents a major problem in constructing a consistent series spanning the year in which the changes took place. The opportunity was taken to introduce another, more severe change. This revision introduced more detailed division of some of the service sectors which were relatively aggregated and had become large over time. This was particularly the case for other business activities (NACE 74 under NACE Rev.1.1) which was divided between many new sectors at two-digit level (Table 1).

The difficulty of mapping jobs was made easier by the Eurostat decision to request countries to classify data on both the old and the new basis for two years (2008 and 2009). Using these overlapping data, it is possible, approximately at least, to create a data series for employment which spans the change in classification. For the four countries for which data are missing ⁽¹⁾, it was possible to base the mapping on the data for a similar country or group of countries. For many of the NACE sectors at two-digit level, the classification was much the same in the new system as in the old or the changes affected only a small number of jobs.

Nevertheless, for several sectors which were previously aggregated, there are potential problems of going too far back in time to build an historical series. Any such construction needs to be based on the assumption that the trends observed in the previously aggregated sector apply equally to the new disaggregated sectors. While this might not be a significant source of error if the series is carried back a year or two, it is likely to become serious and potentially give rise to misleading results if the series is carried back for many years. This applies especially to the sectors which, under NACE Rev.1.1, were previously part of a larger aggregated sector.

⁽¹⁾ Data on both bases were not provided for Bulgaria, Poland, Slovenia and Sweden.

Table 1. Employment classified by NACE Rev.2 and NACE Rev.1.1 in EU-28, 2008

NACE Rev.2		NACE Rev.1.1	
1	Crop, animal production, hunting	1	Agriculture, hunting + related
2	Forestry and logging	2	Forestry and logging
3	Fishing and aquaculture	5	Fishing and aquaculture
5	Mining of coal and lignite	10	Mining of coal; extraction of peat
6	Extraction of oil, natural gas	11	Extraction of oil, natural gas
7	Mining of metal ores	13	Mining of metal ores
		12	Mining of uranium and thorium ores
8	Other mining and quarrying	14	Other mining and quarrying
9	Mining support service activities	11	Extraction of oil, natural gas
		14	Other mining and quarrying
10	Manufacture of food prods	15	Manufacture of food and drink
11	Manufacture of beverages		
12	Manufacture of tobacco prods	16	Manufacture of tobacco prods
13	Manufacture of textiles	17	Manufacture of textiles
14	Manufacture of wearing apparel	18	Manufacture of wearing apparel
		17	Manufacture of textiles
15	Manuf. of leather + related prods	19	Manuf. of leather + related prods
16	Manuf. of wood + wood prods	20	Manuf. of wood + wood prods
17	Manuf. of paper+ paper prods	21	Manuf. of paper+ paper prods
18	Printing + reprod. of recorded media	22	Printing + reprod. of recorded media
19	Manuf. of coke, refined petrol prods	23	Manuf. of coke, refined petrol prods
20	Manuf. of chemicals, chemical prods		
21	Manuf. of pharmaceuticals	24	Manuf. of chemicals, chemical prods
22	Manuf. of rubber and plastic prods	25	Manuf. of rubber and plastic prods
23	Manuf. of non-metal mineral prods	26	Manuf. of non-metallic mineral prods
24	Manuf. of basic metals	27	Manuf. of basic metals
25	Manuf. of metal prods	28	Manuf. of fabricated metal prods
26	Manuf. of computer, electronics	32	Manuf. of radio, TV, comms equip.
		33	Manuf. of medical + other instruments
		30	Manuf. of office machinery, computers
		31	Manuf. of electrical machinery n.e.c.
27	Manufacture of electrical equip.	31	Manuf. of electrical machinery n.e.c.
		29	Manuf. of machinery, equip. n.e.c.
28	Manufacture of machinery n.e.c.		
29	Manufacture of motor vehicles	34	Manufacture of motor vehicles
30	Manuf. of other transport equip.	35	Manuf. of other transport equip.
31	Manufacture of furniture		
32	Other manufacturing	36	Manuf. of furniture; manuf. n.e.c.
		33	Manuf. of medical + other instruments
33	Repair, installation of machinery	29	Manuf. of machinery, equip. n.e.c.
		35	Manuf. of other transport equip.
		28	Manuf. of fabricated metal prods
		33	Manuf. of medical + other instruments
		31	Manuf. of electrical machinery n.e.c.
35	Electricity, gas, steam, air cond.	40	Electricity, gas, steam, hot water
36	Water collection, treatment, supply	41	Collection, distribution of water
37	Sewerage		
38	Waste collection, treatment	90	Sewage, refuse disposal, sanitation
39	Other waste management	37	Recycling
		90	Sewage, refuse disposal, sanitation
41	Construction of buildings	45	Construction
		45	Construction
42	Civil engineering	70	Real estate activities
43	Specialised construction activities		
45	Vehicle sales+ repair	45	Construction
46	Wholesale trade	50	Sale, maintenance, repair of vehicles
47	Retail trade,	51	Wholesale trade
		52	Retail trade

NACE Rev.2		NACE Rev.1.1	
49	Land transport, pipelines	60	Land transport; pipelines
50	Water transport	61	Water transport
51	Air transport	62	Air transport
52	Warehousing, support for transport	63	Supporting transport; travel agents
53	Postal and courier activities	64	Post and telecommunications
55	Accommodation	55	Hotels and restaurants
56	Food and drink service activities	22	Printing + reprod. of recorded media
58	Publishing activities	72	Computer and related activities
59	Movie, TV programme production	92	Recreation, cultural, sport activities
60	Broadcasting activities	22	Printing + reprod. of recorded media
61	Telecommunications	72	Computer and related activities
62	Computer programming	64	Post and telecommunications
63	Information service activities	72	Computer and related activities
64	Financial services	92	Recreation, cultural, sport activities
65	Insurance, pension funding	74	Other business activities
66	Activities auxiliary to fin. services	65	Financial services
68	Real estate activities	66	Insurance, pension funding
69	Legal and accounting activities	67	Activities auxiliary to fin. services
70	Head offices, management consult.	70	Real estate activities
71	Architectural + engineering activities	74	Other business activities
72	Scientific R&D	73	Research and development
73	Advertising + market research	74	Other business activities
74	Other prof., scientific, tech activities	85	Health and social work
75	Veterinary activities	71	Renting of machinery + equip.
77	Rental and leasing activities	74	Other business activities
78	Employment activities	63	Supporting transport, travel agents
79	Travel agents, tour operators	74	Other business activities
80	Security, investigation activities	1	Agriculture, hunting + related
81	Building, landscape services	74	Other business activities
82	Office admin + other bus. support	75	Public administration and defence
84	Public admin. and defence	80	Education
85	Education	85	Health and social work
86	Human health activities	92	Recreation, cultural, sport activities
87	Residential care activities	91	Activities of membership orgs. n.e.c.
88	Social work activities	52	Retail trade
90	Creative arts, entertainment	72	Computer and related activities
91	Libraries, museums, culture activities	36	Manuf. of furniture; manuf. n.e.c.
92	Gambling and betting activities	32	Manuf. of radio, TV, comms equip.
93	Sports and recreation activities	93	Other service activities
94	Activities of membership orgs	95	Private households with employed
95	Computers, household goods repair	97	Services for household own use
96	Other personal service activities	95	Private households with employed
97	Domestic personnel in households	96	Goods for household own use
98	Goods + services for household use	99	Extra-territorial organisations
99	Extra-territorial organisations		

NB: The table shows the % of total employed in the NACE Rev.2 two-digit sectors in 2008 and the % in each case covered by the NACE Rev.1 sectors. Shaded sectors are those where employment is divided between more than one NACE Rev.2 sector. n.e.c. = not elsewhere classified.

Source: Eurostat: EU-LFS.

The sector 'other business activities' can serve as an example. The jobs in this sector are divided between as many as 10 NACE Rev.2 two-digit sectors (Table 1). Most of the sectors in question are newly created, at least at two-digit sectoral level (such as information services, legal and accounting activities, head office and management consultancy activities; architectural and engineering activities; and advertising and market research activities). Although some were previously defined at three- or four-digit level, there few cases of an exact match between these and the new sectors. Even if such a match existed, there is lack of historical data at this level of disaggregation.

It is implausible to assume that the past development of other sectors can be the same as the other business activities sector of which they were part. For example, security and investigation activities are unlikely to show the same historical trends in employment and in types of job as, say, other professional, scientific and technical activities. A similar difficulty, if less extreme, applies to many other sectors which used to be combined and which again are unlikely to have developed in the same way as the sector with which they were previously combined so far as jobs are concerned (such as chemicals and pharmaceuticals, postal services and telecommunications, and human health activities, residential care activities and social work activities).

A similar problem also arises when 'old' sectors have been aggregated from new ones which, in principle, should be easier to deal with. The frequent exception is when only parts of the jobs in the former sector are shifted to the new one, as in manufacture of computers and electronic equipment, and repair and installation of machinery. It is difficult to map the sectoral division of jobs under the new classification from available data. For some sectors it might be plausible to carry the series backwards by assuming the changes occurring are the same as for the aggregated ones.

2.2. The challenge for occupation data

The EU-LFS data provide the key source of information on employment by occupation and qualification that is used to measure skills. The way in which information is classified in the LFS has changed in 2011 with a shift to the new ISCO-08 system (ILO, 2012). The internal logic of new occupational classification⁽²⁾ reflects more the skills and tasks rather than job titles,

⁽²⁾ In later text the expression 'new occupational classification' or 'new classification' refers to ISCO-08. The expression 'old occupational classification' or 'old classification' refers to ISCO-88.

significantly different from the old ISCO-88. It is subsequently reflected in the change in the actual structure in number and compositions of all levels (major groups, submajor groups, minor groups and unit groups).

As consistency of the time series is the crucial element of forecasting modelling, having good mapping between categories in old and new classifications is essential. Unfortunately Eurostat has not provided any official cross country reliable mapping from old to new systems. Although such maps are available for some individual countries (such as the UK) these are based on their own national systems of classification not necessarily consistent ISCO. The only possibility was to develop an own mapping system adopting some strong assumptions.

Table 2 summarises the differences between the major and submajor groups within the old and new occupational classifications. A detailed comparison for 27 occupations has been made to provide a link between classifications; this is described in detail later. Table 2 also presents the raw LFS data estimates for 2010 and 2011, for the whole EU, using the old and new classifications. These are simple aggregations, with a best match to the nearest corresponding old ISCO-88 two-digit categories (of which there were 27, excluding #01 armed forces).

There have been major shifts even within major groups (one-digit) categories. This reflects reallocation of occupations between categories from old to new systems. For example, in ISCO-08 #2 professionals there is a 3.3 percentage point difference in the share of people employed compared to the corresponding ISCO-08 category. Similar issues arise for other major groups and at the level of the 27 occupations similar differences emerge. The identified differences for EU-28 are only the peak of the iceberg. At country level these differences are often even larger, and even more so when looking at individual industries ⁽³⁾.

⁽³⁾ Analyses similar to those in Table 2 were performed for each industry in each individual country and are the subject of later text.

Table 2. Comparing ISCO-08 and ISCO-88

Old ISCO-88				2010			New ISCO-08				2011		
1-digit	Title	2-digit	Title	Level	Share (in %)		1-digit	Title	2-digit	Title	Level	Share (in %)	
0	Armed forces	01	Armed forces	1 407	0.7	0.7	0	Armed forces	01	Commissioned armed forces officers	291	0.1	0.6
									02	Non-commissioned armed forces officers	342	0.2	
									03	Armed forces occupations, other ranks	671	0.3	
1	Managers	11	Legislators and senior officials	359	0.2	8.4	1	Managers	11	Chief executives, senior officials and legislators	1 741	0.8	6.1
		12	Corporate managers	10 105	4.7				12	Administrative and commercial managers	3 784	1.8	
		13	General managers	7 501	3.5				13	Production and specialised services managers	3 890	1.8	
				0	0.0				14	Hospitality, retail and other services managers	3 591	1.7	
2	Professionals	21	Physical, mathematical and engineering science professionals	7 719	3.6	14.5	2	Professionals	21	Science and engineering professionals	6 451	3.0	18.0
		22	Life science and health professionals	4 098	1.9				22	Health professionals	5 788	2.7	
		23	Teaching professionals	8 966	4.2				23	Teaching professionals	10 662	5.0	
		24	Other professionals	10 368	4.8				24	Business and administration professionals	6 831	3.2	
				0	0.0				25	Information and communications technology professionals	3 160	1.5	
				0	0.0				26	Legal, social and cultural professionals	5 600	2.6	
3	Technicians and associate professionals	31	Physical and engineering science associate professionals	7 997	3.7	16.4	3	Technicians and associate professionals	31	Science and engineering associate professionals	7 928	3.7	15.5
		32	Life science and health associate professionals	6 057	2.8				32	Health associate professionals	5 489	2.6	
		33	Teaching associate professionals	2 780	1.3				33	Business and administration associate professionals	14 667	6.8	
		34	Other associate professionals	18 461	8.6				34	Legal, social, cultural and related associate professionals	3 595	1.7	
				0	0.0				35	Information and communications technicians	1 553	0.7	
4	Clerical support workers	41	Office clerks	18 491	8.6	10.7	4	Clerical support workers	41	General and keyboard clerks	6 993	3.3	9.9
		42	Customer services clerks	4 391	2.1				42	Customer services clerks	4 648	2.2	
				0	0.0				43	Numerical and material recording clerks	6 057	2.8	
				0	0.0				44	Other clerical support workers	3 529	1.6	
5	Service and sales workers	51	Personal and protective services workers	19 502	9.1	14.2	5	Service and sales workers	51	Personal service workers	9 799	4.6	17.1

Coping with changes in international classifications of sectors and occupations

Old ISCO-88				2010			New ISCO-08				2011		
		52	Models, salespersons and demonstrators	10 949	5.1				52	Sales workers	15 735	7.3	
				0	0.0				53	Personal care workers	7 639	3.6	
				0	0.0				54	Protective services workers	3 498	1.6	
6	Skilled agricultural, forestry and fishery workers	61	Market-oriented skilled agricultural and fishery workers	8 680	4.1	4.1	6	Skilled agricultural, forestry and fishery workers	61	Market-oriented skilled agricultural workers	7 662	3.6	4.0
		62	Subsistence agricultural and fishery workers	0	0.0				62	Market-oriented skilled forestry, fishing and hunting workers	353	0.2	
				0	0.0				63	Subsistence farmers, fishers, hunters and gatherers	480	0.2	
7	Craft and related trades workers	71	Extraction and building trades workers	12 093	5.7	13.1	7	Craft and related trades workers	71	Building and related trades workers, excluding electricians	9 189	4.3	12.4
		72	Metal, machinery and related trades workers	10 397	4.9				72	Metal, machinery and related trades workers	8 289	3.9	
		73	Precision, handicraft, printing and related trades workers	1 127	0.5				73	Handicraft and printing workers	1 252	0.6	
		74	Other craft and related trades workers	4 197	2.0				74	Electrical and electronic trades workers	3 202	1.5	
				0	0.0				75	Food processing, wood working, garment and other craft and related trades workers	4 506	2.1	
8	Plant and machine operators, and assemblers	81	Stationary plant and related operators	2 136	1.0	8.2	8	Plant and machine operators, and assemblers	81	Stationary plant and machine operators	5 213	2.4	7.5
		82	Machine operators and assemblers	6 332	3.0				82	Assemblers	1 676	0.8	
		83	Drivers and mobile plant operators	9 084	4.2				83	Drivers and mobile plant operators	9 192	4.3	
9	Elementary occupations	91	Sales and services elementary occupations	13 170	6.2	9.7	9	Elementary occupations	91	Cleaners and helpers	7 978	3.7	9.3
		92	Agricultural, fishery and related labourers	1 635	0.8				92	Agricultural, forestry and fishery labourers	1 756	0.8	
		93	Labourers in mining, construction, manufacturing and transport	5 869	2.7				93	Labourers in mining, construction, manufacturing and transport	6 393	3.0	
					0.0				94	Food preparation assistants	1 484	0.7	
					0.0				95	Street and related sales and service workers	206	0.1	
					0.0				96	Refuse workers and other elementary workers	2 171	1.0	

NB: Shading expresses the final aggregation of groups.

Source: Stehrer et al. (2013).

Only such comparison provides reliable information on the differences between the two systems of classification. The latest available historical estimates are taken from the LFS data as provided by Eurostat. Estimates for 2011 are compared with the old projections for 2011 based on the old ISCO-88 (as produced in the previous round of projections). The differences are much the same as those comparing 2011 with 2010 using the raw LFS data as there was little change between the two years in the old projections (i.e. the occupation employment shares within industries were stable over time).

2.3. Challenge for historical time series

The rationale for producing a complete historical time series based on the new ISCO-08 is the need to observe general time trends and compare forecasting estimates with the historical data. The new estimates are based on maximising use of the available but limited LFS data to tell a coherent story. Information on employment shares within industries has been extracted at disaggregated level from a macroeconomic model. The multisector/multicountry model covers all EU Member States ⁽⁴⁾ and is disaggregated to 41 sectors partially compatible with NACE Rev.2 ⁽⁵⁾ (for more details see Cedefop, 2012).

For presentation purposes and ease of analysis, the two-digit level of ISCO-08 has been aggregated to a similar set of 27 occupations to those used in the previous round of projections (as shown in Table 3 and 4). This enables a simple one-to-one mapping between the 27 new ISCO-08 categories and the nearest equivalent based on ISCO-88. Currently there is no relevant information available on trends for the two-digit categories within these new broad groups; this makes obtaining more detailed disaggregation close to impossible. As more data become available in the near future it is planned to extend the results to the full set of 40 submajor occupation groups as defined in ISCO-08.

⁽⁴⁾ The full set of forecasting results is also available for Iceland, the former Yugoslav Republic of Macedonia (FYROM), Norway, Switzerland and Turkey.

⁽⁵⁾ The partial compatibility is ensured at the one-digit level. Cedefop is also putting effort into mapping results to the new NACE Rev.2 codes. However, due to the basic modelling structure (for details see Cedefop, 2012), full conversion to the new sectoral classification is limited.

Table 3. **New occupation categories (as used in in the forecasts)**

New ID No	New ISCO-08 two-digit categories
1	01. Armed forces
2	11. Chief executives, senior officials and legislators
3	12. Administrative and commercial managers
4	13 & 14. Managers in services
5	21. Science and engineering professionals
6	22. Health professionals
7	23. Teaching professionals
8	24, 25, & 26. Business and other professionals
9	31 & 35. Science and engineering associate professionals
10	32. Health associate professionals
11	33. Business and administration associate professionals
12	34. Legal, social, cultural and related associate professionals
13	41, 43 & 44 General office clerks
14	42. Customer services clerks
15	51, 53 & 54 Personal, care & protective service
16	52. Sales workers
17	61, 62 & 63 Agricultural workers
18	71. Building and related trades workers, excluding electricians
19	72 & 74. Metal, machinery and electrical trades
20	73. Handicraft and printing workers
21	75. Food processing, wood working, garment and other craft and related trades
22	81. Stationary plant and machine operators
23	82. Assemblers
24	83. Drivers and mobile plant operators
25	91, 94, 95 & 96. Cleaners, refuse, street and related service occupations
26	92. Agricultural, forestry and fishery labourers
27	93. Labourers in mining, construction, manufacturing and transport

Source: Stehrer et al. (2013).

The procedure applying ‘best fit’ change was applied for the historical data to obtain the best possible time series. This method is based on the idea that what is assumed to apply for one major occupation group in the ISCO-88 is assumed to hold equally for the same major group in ISCO-08 (e.g. #2 professionals). This is only a crude assumption, but there is no real alternative until more and better data are available. Differences in 2011 are then applied to all other years in a proportionate fashion. All adjusted occupation employment shares within industries are between 0 and 100% and their sum is 100% (Box 1).

At this stage of the work it is difficult to assess how alternative simple adjustments (such as adding a constant, or a proportional factor) might affect the estimates. Adding a constant number to certain occupation group requires subtracting it from somewhere else to maintain overall totals. The difficulty here is that it is not clear which occupation groups should be chosen as ‘donors’. A RAS

process can be used to arrive at the desired aggregates ⁽⁶⁾, making it possible to make the best use of the available data ⁽⁷⁾. There is no particular problem going back in time as there is no alternative to compare the estimates based on the new ISCO-08 against.

⁽⁶⁾ RAS is an iterative process used to reconcile row and column totals of a two-dimensional data array with some target figures. For general information on RAS methods see David and Haring, 1974; Toha, 1998; Miller and Blair, 2009; Lahr and Mesnard, 2004.

⁽⁷⁾ There is a case for adding a further step to ensure that the aggregate numbers for each country (summing across industries) are broadly consistent with overall occupation patterns for 2011 in the LFS (using a RAS process). It is planned to implement this in 2014.

Table 4. Comparison of old and new occupation categories

ISCO-08 categories		ISCO-88 categories	
01	Armed forces	01	Armed forces
11	Chief executives, senior officials and legislators	11	Legislators and senior officials
12	Administrative and commercial managers	12	Corporate managers
13 & 14	Managers in services	13	General managers
21	Science and engineering professionals	21	Physical, mathematical and engineering science professionals
22	Health professionals	22	Life science and health professionals
23	Teaching professionals	23	Teaching professionals
24, 25 & 26	Business and other professionals	24	Other professionals
31 & 35	Science and engineering associate professionals	31	Physical and engineering science associate professionals
32	Health associate professionals	32	Life science and health associate professionals
33	Business and administration associate professionals	33	Teaching associate professionals
34	Legal, social, cultural and related associate professionals	34	Other associate professionals
41, 43 & 44	General office clerks	41	Office clerks
42	Customer services clerks	42	Customer services clerks
51, 53 & 54	Personal, care & protective service	51	Personal and protective services workers
52	Sales workers	52	Models, salespersons and demonstrators
61, 62 & 63	Agricultural workers	61 & 62	Market-oriented skilled agricultural and fishery workers & subsistence agricultural and fishery workers
71	Building and related trades workers, excluding electricians	71	Extraction and building trades workers
72 & 74	Metal, machinery and electrical trades	72	Metal, machinery and related trades workers
73	Handicraft and printing workers	73	Precision, handicraft, printing and related trades workers
75	Food processing, wood working, garment and other craft and related trades	74	Other craft and related trades workers
81	Stationary plant and machine operators	81	Stationary plant and related operators
82	Assemblers	82	Machine operators and assemblers
83	Drivers and mobile plant operators	83	Drivers and mobile plant operators
91, 94, 95 & 96	Cleaners, refuse, street and related service occupations	91	Sales and services elementary occupations
92	Agricultural, forestry and fishery labourers	92	Agricultural, fishery and related labourers
93	Labourers in mining, construction, manufacturing and transport	93	Labourers in mining, construction, manufacturing and transport

NB: There are some name differences compared with some of the old 28 ISCO-08 categories. The 27 new ISCO-08 categories are defined using ISCO-08 two-digit categories as shown in the tables. The old ISCO-88 categories 61 & 62, market-oriented skilled agricultural and fishery workers and subsistence agricultural and fishery workers respectively, have been combined into the new ISCO-08 category 61, 62 & 63 agricultural workers (new ID No 17 in Table 2).

Box 1. Creating the new ISCO-08 database

- (a) The ISCO-08 data set is formed by:
 - (i) LFS data for 2011 on employment by industry and occupation, the latter classified by ISCO-08;
 - (ii) the old Cedefop employment database which was based on a combination of employment by industries (as produced by macroeconomic model) and the previous set of employment by industry and occupation for the LFS (this time classified using ISCO-88).
- (b) The latter is the employment database as presented in the previous set of standard Cedefop country workbooks (*) (covering the years 1970-2025).
- (c) The old and new demand data sets were then spliced together using a programme written in the Python language.
- (d) To facilitate the splicing, the new LFS employment data in 1a were aggregated from 41 two-digit ISCO-08 occupations to 27 categories, corresponding as closely as possible to the nearest ISCO-88 equivalent.
- (e) New occupation shares at the 27 occupation group level were then calculated for each of 41 industries and applied to the old industry employment totals from E3ME (as in 1b above).
- (f) These shares were then compared with projected shares for 2011 using the old data in 1b. The differences between the old and new shares were calculated for each country and industry.
- (g) Occupation shares within industries were then calculated for all the other years by adding this difference for 2011 back and forward for all years.
- (h) Constraints were put into place to ensure that the shares would stay between 0 and 100%, and that the sum of all shares equals 100%, creating a set of adjusted data shares.
- (i) These adjusted data were then applied to the E3ME industry employment levels to generate the employment estimates by occupation based on the new ISCO-08.
- (j) The adjusted demand data were placed into an Excel pivot table alongside the unadjusted numbers (for final checks).

(*) Country workbooks are a set of MS Excel sheets containing detailed results of skills supply and demand forecasts. These workbooks are available upon request from Cedefop.

CHAPTER 3.

The shift from ISCO-88 to ISCO-08

In contrast to changes in sectoral classification, the correspondence between the two systems of occupational classification was not provided even at a very detailed level of disaggregation (such as ISCO four-digit level), not even for a single year. This makes in the occupational classification more challenging and means that it is difficult to convert data from one classification to the other in a satisfactory way. National data may be available for some countries, which could enable mapping between the two classification systems but this is mostly not the case. Cedefop has developed its own mapping to produce consistent forecasting results.

3.1. Mapping occupation categories

The solution as described provides easy but only partial and temporary answer. Obtaining full size mapping is more problematic as the change involves an increase from 27 to 43 submajor groups (as shown in Table 5). Also, many national statistical offices took this opportunity to reconsider the way they classified certain jobs at national level, so some jobs might be shifted from one ISCO occupation group to another even there has been no change in the definition of the group to which it was previously classified. This is understandable as the nature of jobs and the tasks can change over time, in some cases radically.

Let us use nurses ⁽⁸⁾ as an example. Their tasks are becoming more demanding in terms of the skills required and there are changes in the way that the provision of healthcare is organised. As a result, what was previously classified as a service job under ISCO 5 might become more accurately classified as a professional or associate professional job under ISCO 2 or 3. In the UK, for example, nursing has increasingly become an all-graduate profession; non-graduates are employed in various occupations that support nurses. If the evolution is gradual, it may not become apparent until a change in the classification takes place.

⁽⁸⁾ Nursing is classified to ISCO 2, 3 or 5 in different countries.

In many cases, national systems of classifying occupations remain intact, reflecting the historical development of the economy. Also, the way jobs or occupations were thought about often differs among countries, so national systems are still important and remain the initial way in which data on occupations are classified. They are converted to the ISCO as international standard before being reported to Eurostat using mapping from one system to the other. The mapping from the national systems should consider explicitly the mapping from the old ISCO.

Since the ISCO-88 was introduced in 1994 there has been relatively little discussion and debate between EU Member States about the way particular jobs should be classified. As a result, there was insufficient harmonisation across countries and different criteria were adopted for classifying the same jobs. Managerial jobs were a particular problem since there was no agreement, and no clear guidance, on what constituted a manager. The relative number of people classified as managers (ISCO 1) under ISCO-88 varies markedly across countries, depending on whether managing one person or managing a small business was sufficient to be so classified (over 15% of total employment in the UK in 2010 but under 6% in Germany). The division between professionals (ISCO 2) and associate professionals (ISCO 3) was equally problematic. There was no common way adopted of dividing teachers between ISCO 23 (teaching professionals) and ISCO 33 (teaching associate professionals) or nurses between ISCO 22 (health professionals) and ISCO 32 (health associate professions). In the latter case, nurses were even classified largely to ISCO 51 (personal services, including caring) in some countries.

The ISCO-08 system has attempted to resolve the above problems and to classify occupations in a more coherent way. It takes into account the nature of the job and the skills required. There has been considerably more deliberation and discussion about the new system aiming to achieve closer harmonisation. The fact that occupations are likely to be more consistently classified across countries than previously, however, does not help to construct a coherent time series extending backwards. This is mainly because it implies that the changes in classification are even more significant as a result, since they involve not only the shift to the classification but also a more basic reclassification of particular jobs.

As indicated in Table 2, while there are changes at ISCO two-digit level, the occupation groups identified at one-digit level in both ISCO-88 and ISCO-08 use the same names. These changes are summarised in Table 3 which shows the shifts of particular occupations between major groups. It also shows the three- or four-digit categories from which jobs have been moved. As is evident in all cases except four, the shift concerns only part of a category and not the whole. This

makes it extremely difficult to map from the former classification system to the new one, since the data for the jobs shifted are not available under the old classification system.

Table 5 **Reclassification of occupations between one-digit groups in ISCO-08 compared with ISCO-88**

Inclusions	Exclusions
ISCO 1: Managers	
<ul style="list-style-type: none"> • Health service managers (from 223*) • Elderly care managers (from 223*) (from professionals) 	<ul style="list-style-type: none"> • Shopkeepers (to service workers) • Agricultural managers (to agricultural workers) • Film, TV, stage directors (to professionals) • Construction supervisors (to associate professionals)
ISCO 2: Professionals	
<ul style="list-style-type: none"> • Decorators + commercial designers (from 347*) • Health technicians, medical assistants, opticians (from 322/324*) • Primary + pre-primary teachers (from 331, 332, 330) • Other teaching associate professionals (from 334*) • Finance dealers (from 341*) • Technical + commercial sales reps (From 341*) • Clowns, musicians, acrobats (from 341*) (all from associate professionals) 	<ul style="list-style-type: none"> • Health service managers • Nursing professionals (to associate professionals) • Business service agents (to associate professionals)
ISCO 3: Associate professionals and technicians	
<ul style="list-style-type: none"> • Mining supervisors, manufacturing supervisors + plant controllers (from machine operators) (from 711*, 811*, 827*, etc.) • Construction supervisors (from managers + skilled manual) (from 122*, 712*) • Precision instrument makers (from 731*) (from skilled manual) • Chemical processing plant controllers (from 815*) • Nursing associate professionals (from professionals) (from 223*) • Medical record technicians (from clerks) (from 414*) • Ambulance workers (from service workers) (from 513*) • Business service agents (from professionals) (from 241*) • Office supervisors (from clerks) (from 411*) • Legal + medical secretaries (from clerks) (from 411*) • Chefs (from service workers) (from 512*) 	<ul style="list-style-type: none"> • Decorators + commercial designers • Health technicians, medical assistants, opticians • Primary + pre-primary teachers • Other teaching associate professionals • Finance dealers • Technical + commercial sales reps • Clowns, musicians, acrobats (all to professionals) • Travel consultants (all to clerks) • Driving instructors (all to service workers)
ISCO 4: Clerks	
<ul style="list-style-type: none"> • Travel consultants (from associate professionals) (from 3414) 	<ul style="list-style-type: none"> • Office supervisors (to associate professionals) • Legal + medical secretaries (to associate professionals) • Cashiers + ticket clerks (to service workers)

Inclusions	Exclusions
ISCO 5: Sales and service workers	
<ul style="list-style-type: none"> • Building caretakers (from 9141) • Animal care workers (from agricultural workers) (from 612*) • Driving instructors (from associate professionals) (from 334*) • Shopkeepers (from managers) (from 131*) • Street food vendors (from elementary workers) (from 9111) • Cashiers and ticket clerks (from clerks) (from 421*) • Door-to-door telephone sales persons (from elementary workers) (from 911*) • Security guards (from elementary workers) (from 915*) 	<ul style="list-style-type: none"> • Chefs (to associate professionals) • Ambulance workers (to associate professionals) • Fast food preparers (to elementary workers)
ISCO 6: Agricultural workers	
<ul style="list-style-type: none"> • General agricultural managers included in 61+62 (from managers) (from 131*) 	<ul style="list-style-type: none"> • Animal care workers (to service workers) • Underwater divers (to skilled manual) • Gardeners, nursery workers (to elementary workers)
ISCO 7: Skilled manual workers	
<ul style="list-style-type: none"> • Metal working machine-tool setter (from 821*) • Print machine operators (from 825*) • Book-binding machine operators (from 825*) (from machine operators) • Wood machine operators (from machine operators) (from 824*) • Underwater divers (from agricultural workers) (from 615*) • Product testers + graders (from 315*) (from associate professionals) 	<ul style="list-style-type: none"> • Mining, construction supervisors • Medical + dental technicians (to associate professionals) • Photographic machine operators • Weaving machine operators (to machine operators) • Miners and quarry workers (to machine operators)
ISCO 8: Machine operators, assemblers	
<ul style="list-style-type: none"> • Miners and quarry workers (from 711*) • Photographic machine operators (from 7344) • Weaving machine operators (from skilled manual) (from 743*) 	<ul style="list-style-type: none"> • Manufacturing supervisors (to associate professionals) • Process controllers (to associate professionals) • Metal working machine-tool setter • Print machine operators • Book-binding machine operators (to skilled manual) • Wood machine operators (to skilled manual)
ISCO 9: Elementary occupations	
<ul style="list-style-type: none"> • Gardeners, nursery workers (from agricultural workers) (from 611*) • Fast food preparers (from service workers) (from 512*) 	<ul style="list-style-type: none"> • Door-to-door telephone sales persons • Security guards (both to sales and service workers)

NB: Figures in brackets indicate the ISCO three- or four-digit category from which jobs have been moved. An * indicates that only part of the category has been moved. Where the whole category has been moved, this invariably applies at four-digit classification level and consequently, the four-digit category concerned is indicated.

Source: Eurostat.

Even when a complete ISCO four-digit category has been moved (as with the four cases in the table) data required to identify changes over the years before 2011 are available only for few countries (and not including any of the largest five Member States). In the light of these shifts in classification – and neglecting any reclassification of particular jobs themselves (i.e. whether or not jobs were classified appropriately in all cases under ISCO-88) – the following changes in the relative numbers employed in the ISCO one-digit ⁽⁹⁾ groups would be expected:

- (a) ISCO 1: a net decline in the number employed, with more jobs being moved out than are moved in (the number of health service or elderly care managers should be relatively small and the number of shopkeepers relatively large, though many of these may already have been classified to ISCO 5 as sales and services workers);
- (b) ISCO 2: a net increase in the number employed, with the inclusion of many teachers, in particular, outweighing the exclusion of some nursing professionals (though again it depends on how many of both groups were previously classified differently);
- (c) ISCO 3: possibly a net reduction, though with so many jobs being shifted either in or out, it is difficult to be sure;
- (d) ISCO 4: difficult to judge but possibly a net reduction depending on the relative number of jobs classified as travel consultants as opposed to the jobs in occupations moved out;
- (e) ISCO 5: a net increase, with the inclusion of shopkeepers, street vendors, outweighing the exclusion of chefs, ambulance workers;
- (f) ISCO 6: difficult to judge, the net change being likely to depend on the size of the agriculture sectors and on how many managers were already classified to this category;
- (g) ISCO 7: difficult to judge, though there is unlikely to be a large change in either direction;
- (h) ISCO 8: a net reduction, with relatively few jobs being included and a relatively large number being excluded;
- (i) ISCO 9: difficult to judge, but probably a net reduction.

⁽⁹⁾ The more detailed breakdown at the two-digit level (three new categories are distinguished: commissioned officers, non-commissioned officers, and other ranks) is also acknowledged in the category armed forces. However, no changes at this level in the classification of the armed forces were considered, as this occupation stands aside from the focus of Cedefop forecasts.

3.2. Initial analyses of trends

There are no data for the change-over year 2011 on the same basis. The rough indication of the effect of the classification change can be obtained from the growth between 2010 and 2011. The main assumption is that the number employed in the different ISCO one-digit groups tends not to change too much between adjacent years; this is supported by the experience over the years 2008-10. Despite the recession which struck Europe during this period, there was comparatively little change in the number employed in the different occupation groups at one-digit level. Between 2010 and 2011, however, the number employed in major groups changed significantly (Table 6):

- (a) managers declined by 28%;
- (b) number employed as professionals increased by 24%;
- (c) number employed as service and sales workers increased by 20%;
- (d) relatively large changes in the number of clerks and plant and machinery operators ⁽¹⁰⁾.

Table 6. **The division of employment according to ISCO-88 and ISCO-08 in the EU-28, 2008-11 (thousands)**

	Employed (thousands)				% change		
	ISCO-88			ISCO-08			
	2008	2009	2010	2011	2008-09	2009-10	2010-11
Armed forces	1 353	1 311	1 407	1 305	-3.1	7.3	-7.2
Managers	18 274	18 004	17 965	13 006	-1.5	-0.2	-27.6
Professionals	30 258	30 953	31 228	38 566	2.3	0.9	23.5
Technicians, associate professionals	35 843	35 401	35 295	33 232	-1.2	-0.3	-5.8
Clerical support workers	23 377	23 282	22 882	21 227	-0.4	-1.7	-7.2
Service and sales workers	30 074	30 073	30 451	36 672	0	1.3	20.4
Agricultural, forestry, fishery workers	8 905	9 004	8 911	8 498	1.1	-1	-4.6
Craft and related trades workers	30 887	28 930	27 973	26 438	-6.3	-3.3	-5.5
Plant, machine operators, assemblers	18 780	17 738	17 603	16 080	-5.5	-0.8	-8.7
Elementary occupations	21 534	20 555	20 771	19 987	-4.5	1.1	-3.8
Total	220 066	216 005	215 633	-1.8	-0.3	0.2	

NB: The figures for 2008-10 are based on ISCO-88 and the figures for 2011 on ISCO-08. The figures for the individual occupations do not sum to the total because of the inclusion of non-specified in the latter.

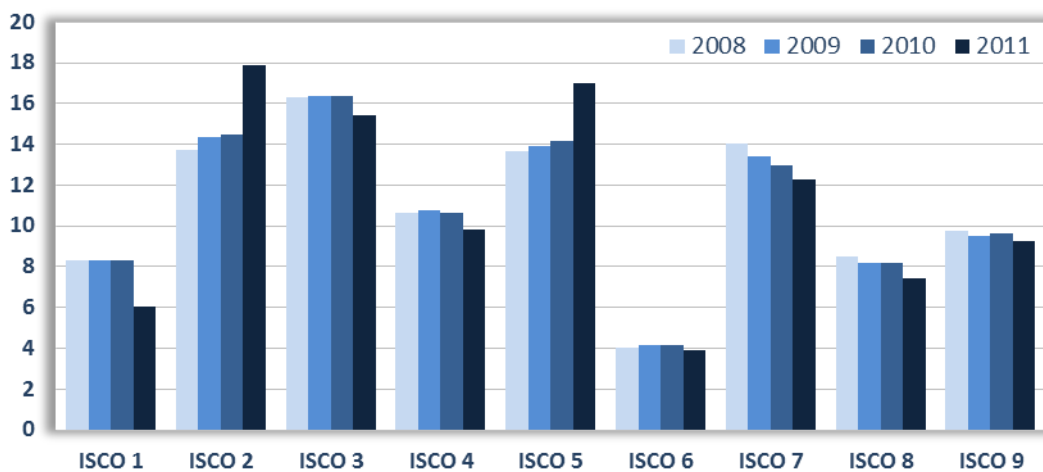
Source: Eurostat, EU-LFS.

These changes are reflected in major shifts in the share of employment accounted for by the different groups. In particular, the share of managers (ISCO 1) declined from 8% of the total employed to only around 6%, while the

⁽¹⁰⁾ The period 2008-11 was chosen as data are available for all countries based on NACE Rev.2.

share of professionals (ISCO 2) increased from 14% to 16% and service and sales workers (ISCO 5) from 14% to 16% (Figure 1). The counterpart of the latter two increases was a decline in the shares of technicians and associate professionals (ISCO 3 by 1 percentage point) and that of clerks (ISCO 4), craft and related workers (ISCO 7) and plant, machine operators and assemblers (ISCO 8) by just under 1 percentage point. In the last three groups, however, there has been a downward trend in employment for several years making it difficult to identify the effect of the change in classification.

Figure 1. **Employment shares by occupation for EU-28 (% total), 2008-11**



NB: Data for 2008-10 are based on ISCO-88 and data for 2011 on ISCO-08.

Source: Eurostat, EU-LFS.

The changes in individual countries do not conform in all cases to the trends outlined above; many cases show marked differences. To bring out the differences between countries more clearly, Figure 2 highlights the changes in the share of employment. Three occupation groups ⁽¹⁾ which show the largest shifts as a result of the reclassification are used as an example: managers, professionals and service and sales workers. The changes in shares of total employment of the three groups between 2010 and 2011 are unsurprisingly in the same direction for most countries but not for all. In Portugal and Romania, there was a small increase in the share of managers between the two years rather than a reduction. In Belgium, there was a reduction in the share of professionals rather than an increase.

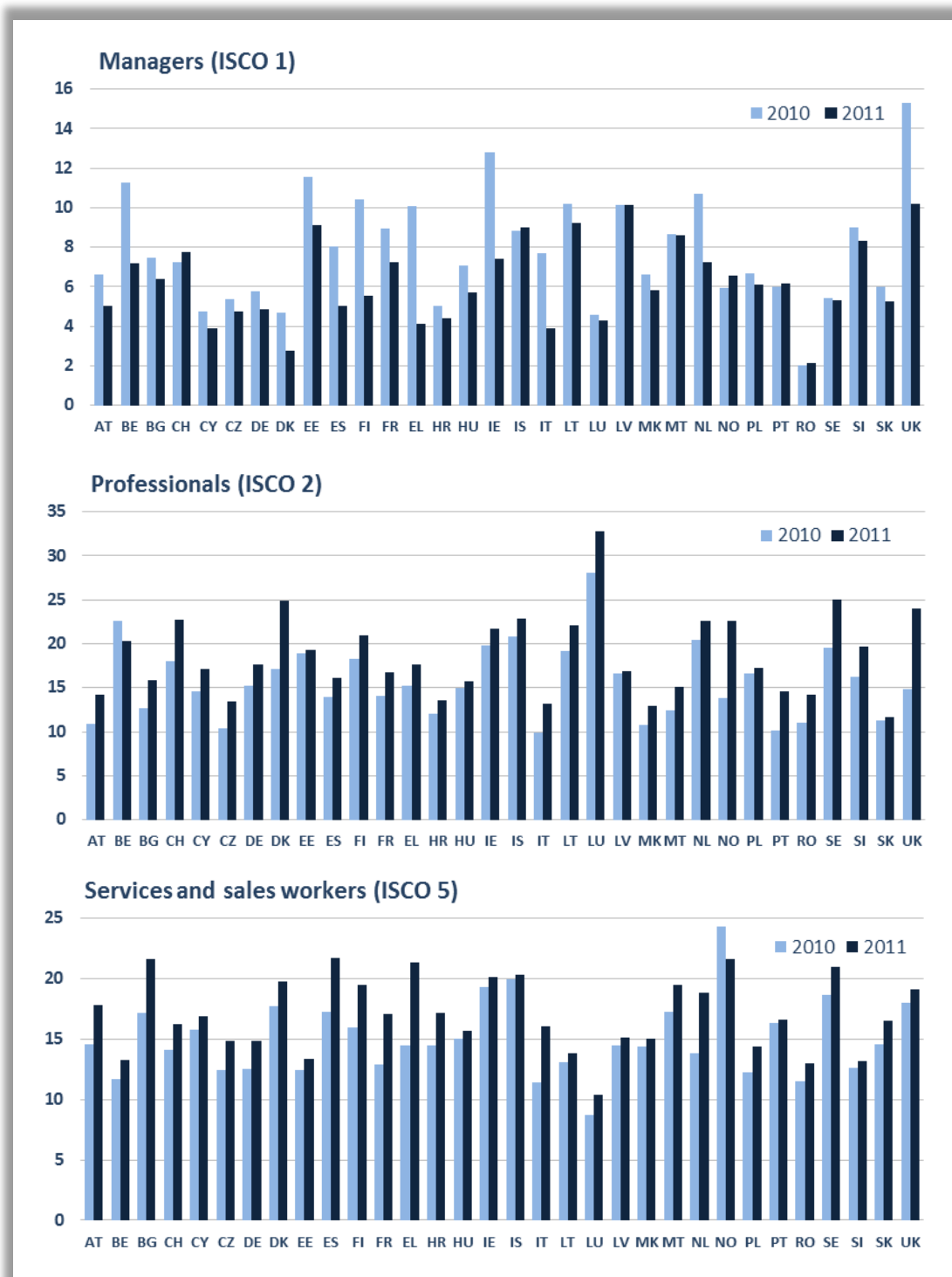
⁽¹⁾ Tables with detailed data from this exercise are available in Annex 3.

Even where the direction of change is the same, there are substantial differences in the magnitude of changes in shares across countries. For managers, the change ranges from -6 percentage points in Greece and over 5 percentage points in Ireland and the UK to only 0.1 of a percentage point in Latvia and Sweden. The range for professionals is from over 9 percentage points in the UK to 0.1 of a percentage point in Latvia; for sales and services workers, it is from almost 7 percentage points in Greece to only around 0.5 of a percentage point in Slovenia and around 0.3 of a percentage point in Portugal.

The scale of these changes is partly linked to the size of the change for managers, to the extent that they reflect a shift of small shop-keepers from the former to the latter. The relationship, however, is by no means uniform, as evidenced by the relatively small increases in the share of sales and service workers in Ireland and the UK despite the large reductions in the share of managers. In both cases, therefore, the relatively large proportion of those in employment classified to ISCO 1 before the switch was due to other reasons. In the UK, there seems to have been a significant shift from managers to professionals, while in Ireland the shift to professionals was much smaller and was more to technicians (ISCO 3). In both cases, the shifts might reflect the overemphasis on supervisory responsibilities of the jobs concerned under ISCO-88.

Comparison of the breakdown in employment between occupations indicates that there was no common pattern across countries. The shifts which occurred in the kinds of job which were moved from one ISCO one-digit category to another differ significantly. This could be because of significant differences in the relative number of people employed in the occupations which shifted between ISCO one-digit groups as a result of the reclassification. However, it is equally, if not more likely, that the differences reflect the different ways in which particular occupations – and not just those which were shifted between groups in the reclassification – were classified under ISCO-88.

Figure 2. **Employment shares for selected occupations, 2010 and 2011 (% total)**
(2010 based on ISCO-88 and 2011 on ISCO-08)



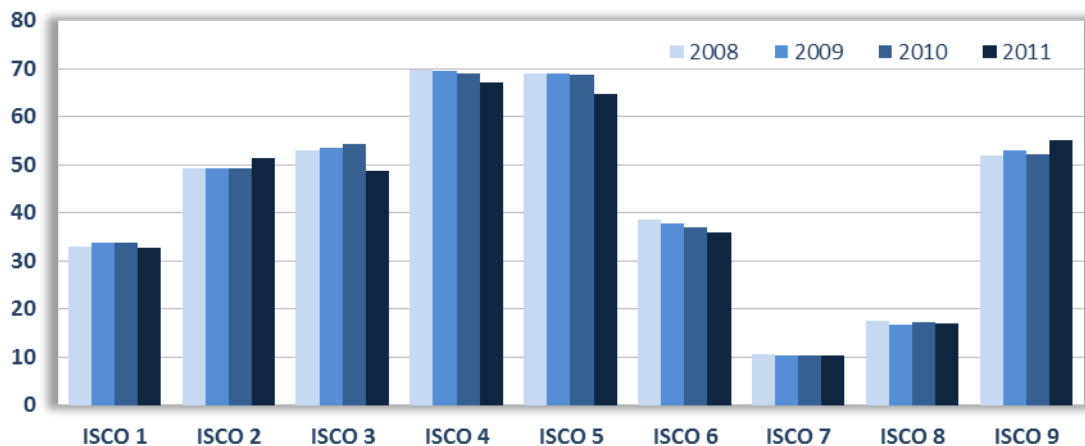
NB: Data for 2010 are based on ISCO-88 and data for 2011 on ISCO-08.

Source: Eurostat, EU-LFS.

3.3. Employment composition changes in occupation groups

A related issue is the extent to which the shift in employment between ISCO one-digit groups is accompanied by a change in the composition of their workforces, in particular, by sex, age and education attainment. The question is whether or not the occupations which have shifted between groups have a different employment composition in these terms and, accordingly, lead to a change in the overall composition of employment in the reclassified groups. For example, if the small shopkeepers reclassified from manager to service and sales workers were predominantly women – or at least more so than the managers not reclassified – this would tend to reduce the share of women in the former and increase it in the latter after the reclassification.

Figure 3. **Share of women in employment in ISCO one-digit occupations in the EU-28, 2008-11 (% total)**



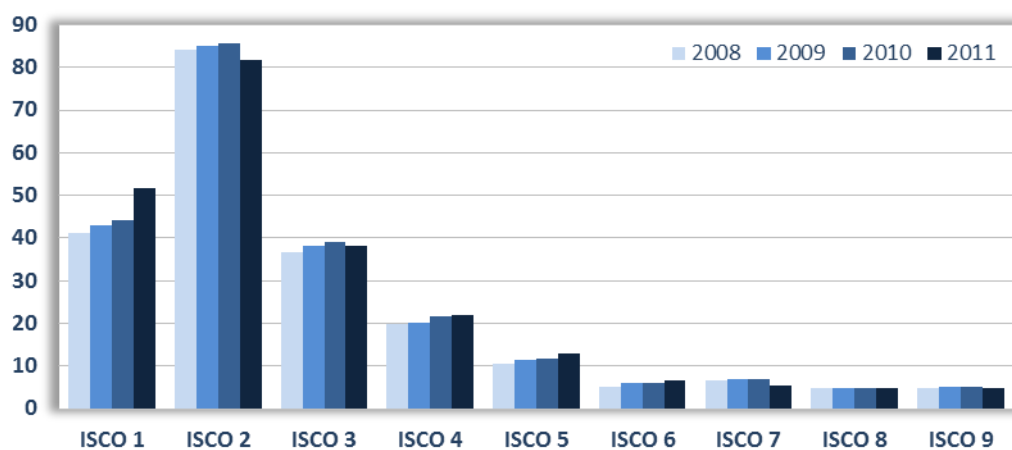
NB: Data for 2008-10 are based on ISCO-88 and data for 2011 on ISCO-08.

Source: Eurostat, EU-LFS.

Reclassification seems to have altered the gender composition of employment in most of the reclassified ISCO one-digit groups, at least on average across the EU. The share of women increased in ISCO 2 and ISCO 9 but reduced in ISCO 3 and ISCO 5 (Figure 3). This presumably reflects the shift of teachers from associate professional status to professional status, many of whom are likely to be women, and the shift of security guards, most of whom are likely to be men, from ISCO 9 to ISCO 5. The shift of small shopkeepers from ISCO 1 to ISCO 5 may also involve a significant number of women. In this case, however, their share of those concerned, while being larger than among other managers (causing the share of women among the ISCO 1 group to decline),

may be smaller than among service and sales workers, causing their share of this group to decline as well. Bigger differences are evident at country level ⁽¹²⁾. For example, the share of women among managers increased from 23% to 28%. (in Finland from 29% to 33%, while in Greece it declined from 30% to 23%). Also in Finland, the share of women in the professional group (ISCO 2) increased from 45% to 55%; this reflects the predominance of women among the teachers and others reclassified from the associate professional group (ISCO 3), their share of which declined from 57% to 47%.

Figure 4. **Share of employment accounted for by those with tertiary education in ISCO one-digit occupation groups in the EU-28, 2008-11 (% total employed)**



NB: Data for 2008-10 are based on ISCO-88 and data for 2011 on ISCO-08.

Source: Eurostat, EU-LFS.

Similar changes are evident in the educational composition of the workforce. In particular, the share of managers (ISCO 1) accounted for by those with tertiary education increased significantly by the reclassification. The share of highly qualified in service and sales workers also increased, reflecting the shift of small shopkeepers from the former group to the latter (Figure 4). Conversely, the share of people with tertiary education employed as professionals (ISCO 2) reduced by the reclassification, with fewer of those shifting from the associate professional group (ISCO 3). The proportion seems to be similar to those remaining in the latter group, or perhaps slightly smaller. Therefore there is not much change in the share with tertiary education in this group. For the other occupation groups, there seems little change in the relative number of those employed with tertiary

⁽¹²⁾ Tables with detailed data from this exercise are available in Annex 3.

education except in the case of the craft and related worker group (ISCO 7). The proportion in this group is reduced, most probably reflecting the reclassification of some jobs (medical and dental technicians, especially) to associate professionals.

3.4. Changes in sectors

The effect of the change in the classification of occupations is also evident in the division of employment between occupations within individual sectors. Table 7 highlights the sectors where the change had a marked effect on this division at one-digit occupation level, where shares change by more than 5 percentage points. In mining the shift in jobs between occupation categories mainly occurred between craft and related trades workers (ISCO 7), which declined, and plant and machine operators and assemblers (ISCO 8), which increased. In water collection and sewerage, the share of the latter occupation group declined and that of associate professionals and technicians (ISCO 3) increased markedly. For the other, mostly service, sectors the shift was mainly between professionals (ISCO 2) and associate professionals and technicians, though some other shifts are evident, such as between associate professionals and clerks (ISCO 4) in the case of insurance and travel agents.

Table 7. **Occupation composition of employment in selected NACE two-digit sectors in the EU-28: difference between 2010 and 2011 (percentage point difference)**

		ISCO 1	ISCO 2	ISCO 3	ISCO 4	ISCO 5	ISCO 6	ISCO 7	ISCO 8	ISCO 9
5	Mining of coal and lignite	0.7	-0.7	0.1	-0.1	0.9		-31.3	30.0	0.5
7	Mining of metal ores	0.5	-1.9	4.0	-2.1	0.7		-13.2	15.5	-3.6
9	Mining support service activities	-4.0	6.2	2.2	-2.3	-0.2		-10.5	7.8	0.9
18	Printing and reproduction of recorded media	-1.7	5.4	-2.7	0.2	0.5		13.0	-12.9	-2.1
36	Water collection, treatment and supply	-1.1	0.7	12.9	1.1	0.3	-0.2	-2.3	-10.0	-0.9
37	Sewerage and other waste activities	-2.2	0.7	11.9	1.1	0.7	0.1	-1.8	-11.3	0.7
39	Management services	-12.1	9.7	1.4	-2.9	4.4	-0.2	-0.7	1.8	-0.1
47	Retail trade	-10.1	1.2	-3.6	-4.8	17.5	-0.4	0.1	0.0	0.3
58	Publishing activities, film, video, TV	-1.7	11.1	-9.4	2.4	1.1	0.0	0.2	-1.7	-2.4
59	Programme production, etc. activities	-1.8	10.4	-9.2	-3.1	4.8	0.0	-2.1	0.0	0.1
60	Broadcasting activities	-1.2	19.4	-11.7	-3.4	0.5	0.0	-2.1	0.2	-0.3
65	Insurance, pension funding	-3.7	2.7	-11.3	12.4	1.4		0.0	-0.1	-1.1
66	Activities auxiliary to financial services	-3.6	12.2	-15.9	6.5	1.0	0.0	0.0	0.0	-0.4
70	Head offices, management consultancy	-4.0	10.0	-1.9	-3.5	0.8	-0.1	-0.5	-0.1	-0.4
73	Advertising and market research	-5.3	15.6	-12.6	0.7	2.7		-0.2	0.5	-1.2
74	Other professional, scientific activities	-3.8	19.5	-15.0	0.2	1.6	-0.1	-1.7	-0.3	-0.4
79	Travel agents, tour operators	-5.7	2.6	-12.8	12.7	4.6	0.0	-0.6	-0.3	-0.1
80	Security and investigation activities	-1.3	1.5	0.4	-0.5	27.0	0.0	-0.1	0.0	-26.7
86	Human health activities	-0.7	12.7	-4.6	-2.4	-4.7	0.0	-0.2	-0.2	0.1
90	Creative, arts, entertainment activities	-0.5	12.3	-7.8	-1.9	0.9	-0.1	-1.5	-0.4	-1.2
97	Activities of households as employers	0.0	0.4	0.3	-0.2	10.5	-0.9	-0.5	0.3	-10.0

NB: Data for 2010 are based on ISCO-88 and data for 2011 on ISCO-08.

Source: Eurostat, EU-LFS.

3.5. Reclassification of occupations at ISCO two-digit level

The discussion above has centred on the change in classification at one-digit occupation level. The modelling of employment developments and the projection of trends in occupation structure are carried out at ISCO two-digit level; the effects of reclassification are inevitably larger at this level of detail. Also, the number of two-digit occupation categories has increased to 43, as many occupations have been split into two or, in some cases, three. Along with this split, certain jobs have been shifted between ISCO two-digit categories. Some shifts are also the result of reconsideration of how particular jobs should be classified.

The reaggregation of employment in the ISCO-08 two-digit occupation categories which have been split does not necessarily give a sum which is the same as the combined categories as defined under ISCO-88. This is illustrated in Table 8 which sets out the two-digit structure of occupations according to the old and the new classifications. The table shows the number of people employed in each of the two-digit categories in 2010 according to the old system and in 2011 according to the new system. The fact that occupations are described in the same way does not necessarily mean that they are composed of the same jobs. For example, the number of customer service clerks, classified under the same name and code number in 2011 as in 2010, appears to have increased by 6% between the two years; this is just about possible but highly unlikely given that there was very little change in total employment. Similarly, the number of teachers, who are aggregated into a single category in ISCO-08 having been split between two in ISCO-88, seems to have declined by almost 10% between 2010 and 2011, which is even less plausible.

Even leaving this problem aside, the division of what were previously single occupation categories into two or more raises practical issues over what to take as the basis for projections of jobs in future years. Current projections are based on changes over the past, on the trends which are identifiable over previous years; there is no other sound way of estimating what is likely to happen in the coming years apart from using historical developments as a guide. The question arises, therefore, in cases where occupation categories have been subdivided, of what should be assumed about past changes to provide a basis for estimating prospective changes.

Table 8. Total number of employed and shares of employment by ISCO two-digit occupation group in 2010 and 2011

			2010 (ISCO-88)						2011 (ISCO-08)		
			Thousand	% Total	% Group				Thousand	% Total	% Group
0	1	Armed forces	1 407	0.7	100	01	Commissioned armed forces officers	291	0.1	22.3	
						02	Non-commissioned armed forces officers	342	0.2	26.2	
						03	Armed forces occupations, other ranks	671	0.3	51.5	
1	11	Legislators and senior officials	359	0.2	2	11	Chief executives, senior officials, legislators	1 741	0.8	13.4	
	12	Corporate managers	10 105	4.7	56.2	12	Administrative and commercial managers	3 784	1.8	29.1	
	13	General managers	7 501	3.5	41.8	13	Production, specialised services managers	3 890	1.8	29.9	
						14	Hospitality, retail, other services managers	3 591	1.7	27.6	
2	21	Physical, maths, engineering, science professionals	7 719	3.6	24.8	21	Science and engineering professionals	6 451	3	16.8	
	22	Life science and health professionals	4 098	1.9	13.2	22	Health professionals	5 788	2.7	15	
	23	Teaching professionals	8 966	4.2	28.8	23	Teaching professionals	10 662	5	27.7	
	24	Other professionals	10 368	4.8	33.3	24	Business and administration professionals	6 831	3.2	17.7	
						25	ICT professionals	3 160	1.5	8.2	
						26	Legal, social and cultural professionals	5 600	2.6	14.5	
3	31	Physical, engineering science associate professionals	7 997	3.7	22.7	31	Science, engineering associate professionals	7 928	3.7	23.9	
	32	Life science and health associate professionals	6 057	2.8	17.2	32	Health associate professionals	5 489	2.6	16.5	
	33	Teaching associate professionals	2 780	1.3	7.9	33	Business, admin. associate professionals	14 667	6.8	44.1	
	34	Other associate professionals	18 461	8.6	52.3	34	Legal, social, related associate professionals	3 595	1.7	10.8	
						35	ICT technicians	1 553	0.7	4.7	
4	41	Office clerks	18 491	8.6	80.8	41	General and keyboard clerks	6 993	3.3	32.9	
	42	Customer services clerks	4 391	2.1	19.2	42	Customer services clerks	4 648	2.2	21.9	
						43	Numerical and material recording clerks	6 057	2.8	28.5	
						44	Other clerical support workers	3 529	1.6	16.6	
5	51	Personal, protective services workers	19 502	9.1	64	51	Personal service workers	9 799	4.6	26.7	
	52	Models, salespersons, demonstrators	10 949	5.1	36	52	Sales workers	15 735	7.3	42.9	
						53	Personal care workers	7 639	3.6	20.8	
						54	Protective services workers	3 498	1.6	9.5	

			2010 (ISCO-88)						2011 (ISCO-08)		
			Thousand	% Total	% Group				Thousand	% Total	% Group
6	61	Market-oriented agricultural, fishery	8 680	4.1	100	61	Market-oriented skilled agricultural workers	7 662	3.6	90.2	
	62	Subsistence agricultural, fishery	0	0	0	62	Market-oriented forestry, fishing, hunting	353	0.2	4.2	
						63	Subsistence farmers, fishers, hunters	480	0.2	5.7	
7	71	Extraction and building trades workers	12 093	5.7	43.5	71	Building, related trades workers, excl. electricians	9 189	4.3	34.8	
	72	Metal, machinery, related trades	10 397	4.9	37.4	72	Metal, machinery and related trades workers	8 289	3.9	31.4	
	73	Precision, handicraft, printing and related trades workers	1 127	0.5	4.1	73	Handicraft and printing workers	1 252	0.6	4.7	
	74	Other craft and related trades	4 197	2	15.1	74	Electrical and electronic trades workers	3 202	1.5	12.1	
						75	Food processing, wood -working, garment, craft, related trades	4 506	2.1	17	
8	81	Stationary plant, related operators	2 136	1	12.2	81	Stationary plant and machine operators	5 213	2.4	32.4	
	82	Machine operators and assemblers	6 332	3	36.1	82	Assemblers	1 676	0.8	10.4	
	83	Drivers and mobile plant operators	9 084	4.2	51.8	83	Drivers and mobile plant operators	9 192	4.3	57.2	
9	91	Sales, services elementary occupations	13 170	6.2	63.7	91	Cleaners and helpers	7 978	3.7	39.9	
	92	Agricultural, fishery, related labourers	1 635	0.8	7.9	92	Agricultural, forestry and fishery labourers	1 756	0.8	8.8	
	93	Labourers in mining, construction, manufacturing and transport	5 869	2.7	28.4	93	Labourers in mining, construction, manufacturing, transport	6 393	3	32	
						94	Food preparation assistants	1 484	0.7	7.4	
						95	Street and related sales and service workers	206	0.1	1	
						96	Refuse and other elementary workers	2 171	1	10.9	

Source: Stehrer et al. (2013).

3.6. Projecting future changes in occupations

The above changes in the classifications of industries and occupations severely impacted the consistency of the time series. Lack of knowledge about past changes in the division of employment between occupations makes development of skills forecasts difficult and there are only two practical ways of generating future projections of the occupation structure of employment given the prevailing situation. The first is relatively simple but produces results not comparable with the past. The second is more difficult but results are more consistent over time, although these are still not perfect.

The simple solution is to take the structure of occupations in 2011 as given by the ISCO-08 classification and to assume that this remains constant in the individual sectors distinguished. The simplicity of this approach is in not trying to estimate the links between ISCO-08 and the previous system of classification: estimation of past trends in employment in the new occupation categories is not involved. The major disadvantage is that the assumption of constant occupation shares within each of the NACE two-digit sectors is at odds with the evidence.

This indicates that there has been a marked trend over the past for the structure of occupations to shift towards higher level jobs. For example the share of employment of professionals and associate professionals increased at the expense of lower level jobs, such as clerks in service sectors and skilled and semi-skilled manual workers (those classified to ISCO 7 and 8) in manufacturing. 'Shift-share' analysis based on ISCO-88 data indicates that this is predominantly due to changes in the occupation composition of employment within sectors. This means that shift of employment between sectors (to the relative growth of sectors in which higher level occupations are more important) account for a relatively small part of the overall trend. Since the neutral assumption to make for projection purposes is that this trend continues in future years, to assume that the division of employment between occupations remains constant is implicitly to assume that this trend comes to an end – that the future will not be like the past – for no reason apart from simplicity.

The second way forward has the merit of being based on historical experience. It assumes assume that past trends continue into the future. This approach undertakes the difficult task of trying to identify the changing division of employment between the different ISCO two-digit categories. The starting-point is to align the ISCO-08 categories as closely as possible with the ISCO-88 ones, which means combining the latter as necessary. Table 9 shows the results of doing this. The share of employment accounted for by the different occupation categories in 2011 after alignment is not necessarily the same as defined according to ISCO-88 in 2010; this is mainly because of the shifts in jobs

between. In some cases, the difference is relatively large but where the two figures are very similar, this does not necessarily mean that they relate to the same jobs; reclassification may have led to similar numbers of jobs being shifted out as were shifted in.

It may well be the case that past trends shown by the aligned categories may differ from those evident for the ISCO-88 categories. For example, the change in the share of employment accounted for by administrative and commercial managers over the years before 2011 may not be the same as for corporate managers as defined under ISCO-88, who are only around 40% as numerous. Despite the uncertainty about the similarity in past trends ⁽¹³⁾ shown by the ISCO-08 and ISCO-88 categories, there is no other viable option but to follow this approach if past trends in occupation shares of employment are to be explicitly taken into account when making projections of skill needs. The approach at least has the merit of being based on historical observation rather than on assumptions about future trends, which are simply guesses about how these shares might change in the future.

⁽¹³⁾ We have considered linear trends. We consider this a satisfactory tool given the subject of analysis.

Table 9. Link between ISCO-08 and ISCO-88 to identify past trends for projection purposes

ISCO-88 classification		Proposed aggregation ISCO-08		ISCO-08 classification		ISCO-88 % total	ISCO-08 % total
0	Armed forces	0	Armed forces	1	Commissioned armed forces officers	0.7	0.6
				2	Non-commissioned armed forces officers		
				3	Armed forces occupations, other ranks		
11	Legislators and senior officials	11	Chief executives and senior officials	11	Chief executives, senior officials and legislators	0.2	0.8
12	Corporate managers	12	Administrative and commercial managers	12	Administrative and commercial managers	4.7	1.8
13	General managers	13+14	Production and services managers	13	Production and specialised services managers	3.5	3.5
				14	Hospitality, retail and other services managers		
21	Physical, maths, engineering science professionals	21+25	Science, engineering, ICT professionals	21	Science and engineering professionals	3.6	4.5
22	Life science and health professionals	22	Health professionals	22	Health professionals	1.9	2.6
23	Teaching professionals	23	Teaching professionals	23	Teaching professionals	4.2	5.0
24	Other professionals	24+26	Business and other professionals	24	Business and administration professionals	4.8	5.8
				25	ICT professionals		
				26	Legal, social and cultural professionals		
31	Physical, engineering science assoc. professionals	31+35	Science, engineering, ICT associate professionals	31	Science and engineering associate professionals	3.7	4.4
32	Life science and health associate professionals	32	Health associate professionals	32	Health associate professionals	2.8	2.6
33	Teaching associate professionals			33	Business and administration associate professionals	1.3	
34	Other associate professionals	33+34	Business, admin, legal, other associate professionals	34	Legal, social, cultural, related associate professionals	8.6	8.5
				35	ICT technicians		
41	Office clerks	41+43 +44	General office clerks	41	General and keyboard clerks	8.6	7.7
42	Customer services clerks	42	Customer services clerks	42	Customer services clerks	2.1	2.2
				43	Numerical and material recording clerks		
				44	Other clerical support workers		
51	Personal and protective services workers	51+53 +54	Personal, care, protective services	51	Personal service workers	9.1	9.7

ISCO-88 classification		Proposed aggregation ISCO-08		ISCO-08 classification		ISCO-88 % total	ISCO-08 % total
52	Models, salespersons, demonstrators	52	Sales workers	52	Sales workers	5.1	7.3
				53	Personal care workers		
				54	Protective services workers		
61	Market-oriented agricultural, fishery workers	61+62	Market-oriented skilled agricultural workers	61	Market-oriented skilled agricultural workers	4.1	3.7
62	Subsistence agricultural and fishery workers	63	Subsistence farmers	62	Market-oriented forestry, fishing, hunting workers	0.0	0.2
				63	Subsistence farmers, fishers, hunters and gatherers		
71	Extraction and building trades workers	71	Building and related trades workers, excl. electricians	71	Building and related trades workers, excl. electricians	5.7	4.3
72	Metal, machinery and related trades workers	72+74	Metal, machinery and electrical trades	72	Metal, machinery and related trades workers	4.9	5.3
73	Precision, handicraft, printing, related trades workers	73	Handicraft and printing workers	73	Handicraft and printing workers	0.5	0.6
74	Other craft and related trades workers	75	Food processing, wood working, garment, other craft, related trades	74	Electrical and electronic trades workers	2	2.1
				75	Food processing, wood working, garment, other craft, related trades		
81	Stationary plant and related operators	81	Stationary plant and machine operators	81	Stationary plant and machine operators	1	2.4
82	Machine operators and assemblers	82	Assemblers	82	Assemblers	3	0.8
83	Drivers and mobile plant operators	83	Drivers and mobile plant operators	83	Drivers and mobile plant operators	4.2	4.3
91	Sales and services elementary occupations	91+94+95+96	Cleaners, street, related sales and services workers	91	Cleaners and helpers	6.2	5.5
92	Agricultural, fishery and related labourers	92	Agricultural, forestry and fishery labourers	92	Agricultural, forestry and fishery labourers	0.8	0.8
93	Labourers in mining, construction, manufacturing, transport	93	Labourers in mining, construction, manufacturing, transport	93	Labourers in mining, construction, manufacturing and transport	2.7	3
				94	Food preparation assistants		
				95	Street and related sales and service workers		
				96	Refuse workers and other elementary workers		

NB: The shares of total employment under ISCO-88 relate to 2010, those under ISCO-08 to 2011.

Source: Eurostat, EU-LFS.

A major drawback of the aggregation approach, however, is that it fails to take advantage of the more detailed breakdown of occupations provided by the ISCO-08 classification, which is often more rational and informative. These include, the separation of ICT professionals from science and engineering professionals, of business and administration professionals from legal, social and cultural professionals, and of protective service workers from personal service workers and the counterpart separation of jobs. These are in some cases quite different, involving different training and career paths.

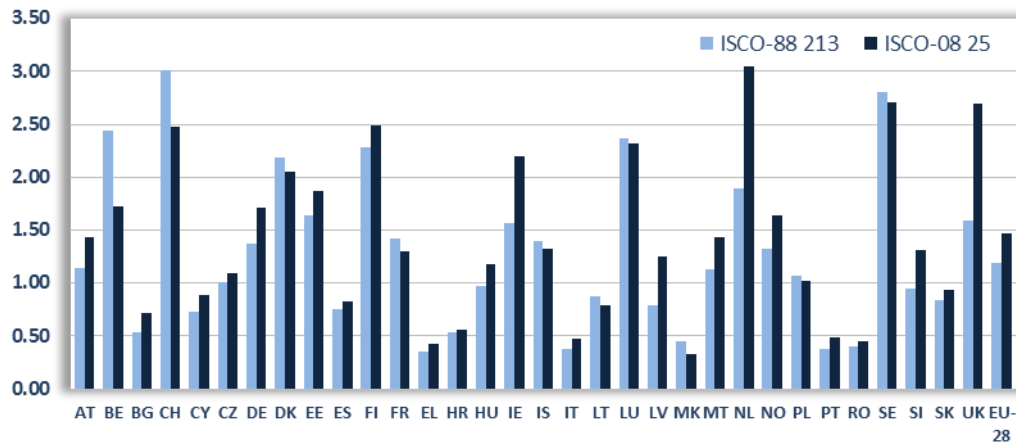
Some inroads into resolving this difficulty can be made by breaking the data down further into ISCO three-digit occupations, enabling, in many cases, the ISCO-08-based data to be matched with the ISCO-88-based data at a more detailed level. At three-digit level, ICT professionals can be distinguished from science and engineering professionals in the ISCO-88 classification (the former being classified under ISCO 213, the latter under ISCO 211, 212 and 214). However, a comparison of the share of employment accounted for by ICT professionals in 2011 according to ISCO-08 (classified under ISCO 25) with that accounted for by ICT professionals in 2010 according to ISCO-88 (classified under ISCO 213) across European countries shows some marked differences despite the two seeming to cover the same occupations.

For the EU-28, therefore, the ISCO-08 classification shows an average share of overall employment which is around 23% larger for 2011 than the share shown by ISCO-88 for 2010 (Figure 5). For the UK, the share shown by the ISCO-08 data is 70% larger; for the Netherlands, 60% larger. By contrast, for Belgium, the ISCO-08 share is almost 30% smaller than the ISCO-88 share and it is also smaller, if less so, in several other countries, including Denmark, France and Switzerland. The extent of the variation raises a question mark over whether the ISCO-88 data for Belgium, the Netherlands and the UK, and possibly several other countries, are likely to give a reliable indication of how the share of employment of ICT professionals, as defined by the new classification, changed over past years.

A similar picture emerges for business and administration professionals who can be distinguished in the ISCO-88 (broadly as ISCO 241) with that shown by the ISCO-08 data in 2011 for ostensibly much the same occupations (ISCO 24). The latter includes some jobs (such as security and finance dealers and technical and commercial sales representatives) which were not previously included in the category, so the number employed as business and administration professionals would be expected to be larger under the new classification than under the old. This is the case for the EU-28 as a whole and for all countries apart from Croatia, but the scale of the difference varies substantially (Figure 6), which raises the

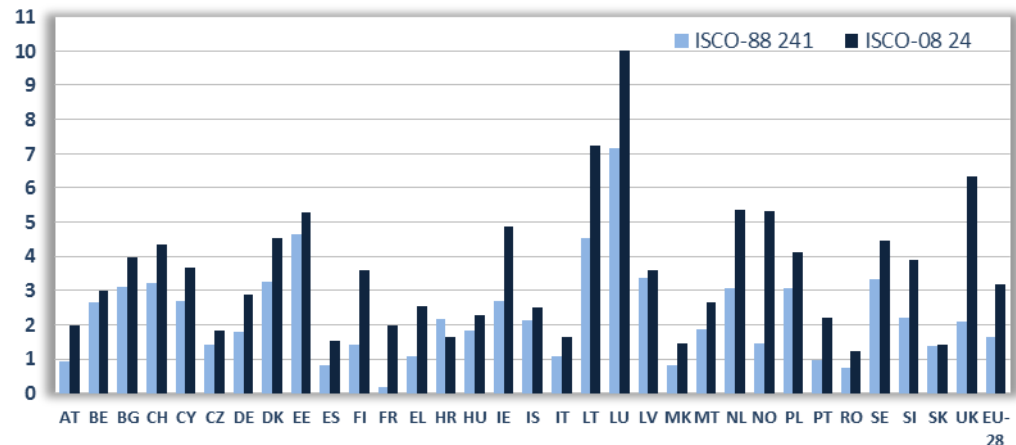
same question over the reliability of basing future changes on past trends as indicated by the ISCO-88. This is particularly so in countries such as Norway or the UK, where the ISCO-08 share of employment is over three times larger than the ISCO-88 share or France, where it is over 10 times larger.

Figure 5. **Share of employment accounted for by ICT professionals according to ISCO-88 in 2010 and ISCO-08 in 2011 (% total employed)**



Source: Stehrer et al. (2013).

Figure 6. **Share of employment accounted for by business and administration professionals according to ISCO-88 in 2010 and ISCO-08 in 2011 (% total employed)**

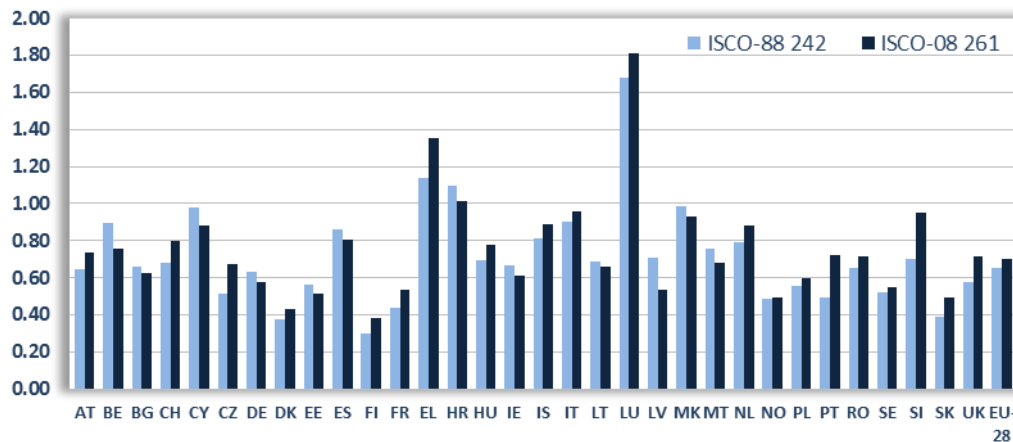


Source: Stehrer et al. (2013).

For legal professionals, there seems to be much closer correspondence between the relevant ISCO-08 and ISCO-88. The analyses in this case were provided at ISCO three-digit level (ISCO-88 242 and ISCO-08 261) where the descriptions of the occupations included seems identical in the two cases. While, on average, there is relatively little difference between the shares of employment

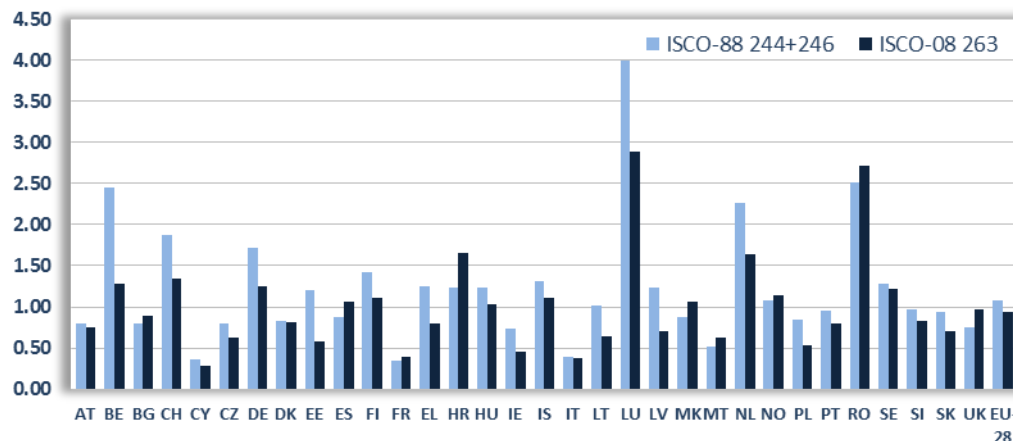
shown by the two (only 7%), this is not the case in all countries. In Slovenia, the difference is 37% and in Portugal, 47%; in both cases the 2011 share according to ISCO-08 is larger than the 2010 share according to ISCO-88 (Figure 7). In the Czech Republic, the difference is also over 30%, while in France, Slovakia, Finland and the UK, it is well over 20%. In all cases, the ISCO-08 share is larger than the ISCO-88 one. In 11 countries, in contrast, the former is smaller than the latter: in Belgium, 16% smaller, and in Latvia, 25% smaller.

Figure 7. **Share of employment accounted for by legal professionals according to ISCO-88 in 2010 and ISCO-08 in 2011 (% total employed)**



Source: Stehrer et al. (2013).

Figure 8. **Share of employment accounted for by social and religious professionals according to ISCO-88 in 2010 and ISCO-08 in 2011 (% total employed)**



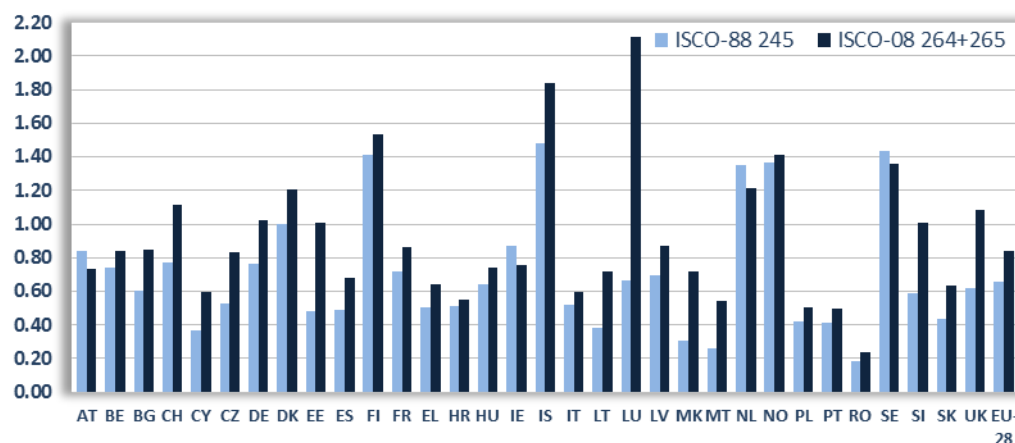
Source: Stehrer et al. (2013).

The correspondence between social and religious professionals under the two systems of classification (two three-digit categories under ISCO-88 (244 and 246), one under ISCO-08 (263)) is slightly less close. The group of philologists,

translators and interpreters (2444 in ISCO-88) is no longer included, but the average EU share of employment accounted is only slightly smaller under the new system than under the old (13% smaller) (Figure 8). Nevertheless, the differences in individual countries are much larger, amounting to over 35% in Ireland, Greece, Lithuania and Poland, over 40% in Latvia and around 50% in both Belgium and Estonia. In all cases, the ISCO-08 figure is smaller than the ISCO-88 one. In several countries, however, the ISCO-08 share is larger: in Croatia and the UK, over 30% larger.

The final example concerns writers and creative performing artists, who are separated into two three-digit groups in ISCO-08 (264 and 265) but are combined in one in ISCO-88 (245). For this group the correspondence between the two classifications is much less close because the new classification covers occupations (such as nightclub musicians, circus artists or TV announcers) that were included elsewhere in ISCO-88. The share of employment of this group is, therefore, on average in the EU-28, 28% larger according to ISCO-08 than according to ISCO-88 (Figure 9). In Slovenia and the UK, however, the share according to ISCO-08 is over 70% larger, in Lithuania, almost 90% larger, in Estonia, FYROM and Malta, over twice as large and in Luxembourg, over three times as large. By contrast, in Ireland, the Netherlands, Austria and Sweden, the share of employment according to ISCO-08 is smaller than shown by ISCO-88.

Figure 9. **Share of employment accounted for by social and religious professionals (group 245 in ISCO-88 in 2010 and groups 264 and 265 in ISCO-08 in 2011) (% total employed)**



Source: Stehrer et al. (2013).

From these analyses, there is a serious question in many countries whether it is valid to use the historical data on the number employed as indicated by the ISCO-88 to identify past trends in the share of employment. Moreover, for several

occupation groups there is no close link between the new and old systems of classification, even at three-digit level. This is illustrated by what are called electrotechnology engineers – or electrical and electronics engineers – who are distinguished as a separate group in the ISCO-08 classification. This should reflect the growing importance of this group but extracting them from ISCO 88 is hard as they are combined with several other kinds of engineer (Table 9).

Table 10. **Division of electrotechnology engineers (ISCO-08 215) and link with ISCO-88**

	ISCO-08		ISCO-88
215	Electrotechnology engineers	214	Architects, engineers and related
2151	Electrical engineers	2143	Electrical engineers
2152	Electronics engineers	2144	Electronics, telecoms engineers
2153	Telecoms engineers		
		2141	Architects, town/traffic planners
		2142	Civil engineers
		2145	Mechanical engineers
		2146	Chemical engineers
		2147	Mining engineers, metallurgists and related
		2148	Cartographers, surveyors
		2149	Architects, engineers and related n.e.c.

NB: Shaded area presents the final analysed grouping; n.e.c. = not elsewhere classified.

Source: Stehrer et al. (2013).

The question, therefore, arises as to whether it is possible to estimate past trends for this group from the behaviour of the ISCO-88 214 group as a whole. Since this is the only level for which LFS data are available for most of the countries, it is questionable whether the changes in employment over the past shown by the occupations not covered by ISCO-08 215 (such as mechanical engineers or mining engineers) can be assumed to be similar to those shown by the occupations covered. For some countries, data are available in the EU-LFS at four-digit level that would enable these other occupations to be split off from electrotechnology engineers. Full alignment between the two classifications would still not be possible, since telecommunication engineers cannot be separately distinguished in ISCO-88.

Electrotechnology engineers is a new group of occupations distinguished in the new classification system; it could be difficult to relate to the previous system and build a link between the two to carry the new series back in time. The difficulty, however, is not confined to new groups of this kind. As noted at several points above, even where the name of a particular occupation group is the same in the ISCO-08 classification as in the previous one, in many cases, the jobs included are not the same. This can be illustrated by the ISCO two-digit category

of health associate professionals, category 32 under both ISCO-08 and ISCO-88 (Table 11).

The new category comprises the same number of ISCO four-digit groups as under ISCO-88, but the occupations now included were previously distributed across five different ISCO two-digit categories, in addition to ISCO 32, under the previous classification: ISCO 22, 31, 41, 51 and 73. In most cases (15 of the 21 groups) only part of the group as defined under ISCO-08 corresponds to the ISCO-88 group. This is true even at four-digit level and reconstructing the new ISCO two-digit category in the old system is a problem. This is by no means the only category to which this kind of difficulty applies.

Trying to resolve these difficulties – or at least minimising them – requires detailed understanding of the two data sets: employment classified by occupation under the new ISCO-08 and under the former ISCO-88. This needs to focus on the quantitative differences between the two, not just those of definition or concept. It must also take special account of the data for the years after 2011 as they become available and of what they reveal about occupation trends on the new classification. This will be a major task over the next two years.

Table 11. **Composition of health associate professionals (ISCO-08 32) and link to ISCO-88**

ISCO-08		ISCO-88		
Medical imaging, therapeutic equipment technicians	3211	3133		Medical equipment operators
Medical and pathology laboratory technicians	3212	3211	P	Life science technicians
Pharmaceutical technicians and assistants	3213	3228		Pharmaceutical assistants
Medical and dental prosthetic technicians	3214	7311	P	Precision instrument makers, repairers
Nursing associate professionals	3221	2230	P	Nursing and midwifery professionals
Nursing associate professionals	3221	3231		Nursing associate professionals
Midwifery associate professionals	3222	2230	P	Nursing and midwifery professionals
Midwifery associate professionals	3222	3232		Midwifery associate professionals
Traditional + complementary medicine associate profs	3230	3241	P	Traditional medicine practitioners
Veterinary technicians and assistants	3240	3227		Veterinary assistants
Dental assistants and therapists	3251	3225		Dental assistants
Medical records and health information technicians	3252	4143	P	Coding, proofreading and related clerks
Community health workers	3253	3221	P	Medical assistants
Dispensing opticians	3254	3224	P	Optometrists and opticians
Physiotherapy technicians and assistants	3255	3226	P	Physiotherapists + related associate profs
Medical assistants	3256	3221	P	Medical assistants
Environmental + occupational health inspectors	3257	3152	P	Safety, health and quality inspectors
Environmental + occupational health inspectors	3257	3222	P	Sanitarians
Ambulance workers	3258	5132	P	Institution-based personal care workers
Health associate professionals n.e.c.	3259	3226	P	Physiotherapists + related associate profs
Health associate professionals n.e.c.	3259	3229	P	Modern health associate profs n.e.c.

NB: n.e.c. = not elsewhere classified.

Source: Stehrer et al. (2013).

CHAPTER 4.

Forecasting skills demand: developing revised projections

This section provides a brief description of how Cedefop skills supply and demand projections are developed using the data described in previous chapters. The main focus is on how the described changes impacted the overall production of skills supply and demand forecasts. The key features of the modelling framework are described in Annex 2, with more in details in Cedefop (2012). Further explanation of the development of the current projections can be found in Wilson et al. (2013a).

4.1. Developing occupation structure projections within industries

One strategy for producing occupation employment projections within industries starts with a set of forecasts based on constant shares from 2011. This provides a clear-cut benchmark, solid foundation and useful starting point for any analysis. If shares within industries at a detailed level are assumed fixed, sectoral macroeconomic projections can be used to generate a scenario. However, to assume fixed shares within industries from 2011 onwards would be to ignore all the previous work completed over the past four years.

The procedure outlined in Chapter 3 for the historical period is the 'best fit' change and can be applied to obtain consistent results. It helps to highlight how much things are expected to change based on previous patterns of change observed within industries for the nearest equivalent old ISCO-88 category. It is not necessary to develop an alternative fixed share scenario: the fixed share option is simply part of the analysis of the benchmark results, using a standard shift-share analysis. These shift-share sheets are now built in to the country workbooks ⁽¹⁴⁾.

An alternative would be to use growth rates or percentage point changes in shares taken from the ISCO-88 data (from the smoothed series) but at different

⁽¹⁴⁾ Country workbooks are a set of MS Excel sheets containing detailed results of skills supply and demand forecasts. These workbooks are available upon request from Cedefop.

levels of aggregation. This could be done first at one-digit level, possibly combined with the use of constant shares for the two-digit occupations. Trends in some of the one-digit categories could be further used if trends in the two-digit categories are regarded as unreliable (such as categories 62 and 63 in ISCO-08). This is still rather crude (for example, the growth rate of all those in group 6, agricultural, forestry and fishery workers in ISCO-88 is assumed to hold for group 6, agricultural workers in ISCO-08), but underlying assumptions can be made clear. Such detailed investigations can provide more hints on how to adapt the growth rates; changes can then be implemented for the projections more generally. These issues and possibilities will be explored in the future as additional data based on ISCO-08 become available.

The current ISCO-08 country workbooks provide results for options 1 and 2 as standard (see especially the shift-share sheet). The new times series (history and forecasts) in the workbooks reflect the new ISCO-08 estimates of the structure of employment by occupation within industries in 2011 from the LFS, but maintains the time series patterns from the ISCO-88 results. For the main results, the 40 ISCO-08 two-digit categories have been combined into 27 new occupation categories (as shown in Table 3) ⁽¹⁵⁾.

To achieve this, as described in more detail in Chapter 2, the estimated differences in 2011 between the projected shares based on ISCO-88 and the new estimates based on ISCO-08 have been applied to the whole historical and projected database based on ISCO-88 to create a new version based on ISCO-08. Checks are imposed for shares going negative (or exceeding 100%) but this only occurs in a very few cases. Where it does, the shares are constrained and the sum of shares across occupations is adjusted to equal 100%. This makes the best use of the available data.

4.2. Presenting and interpreting the new projections

This section gives examples of the new projections, focusing on occupations, and using the UK as an example. A broader overview for all countries is given in (Wilson et al., 2013b). The revised projection based on ISCO-08, with the simple mapping from 'old' to 'new' described in Chapter 3, is compared with an assumption of fixed occupation shares within industries.

⁽¹⁵⁾ In the next year of the programme, it is planned to explore the possibility of developing additional detail down to the full 40 categories of the ISCO-08 two-digit level. This will only be carried through subject to data quality checks; results are not included in the current set of workbooks.

The default position (as presented in the new ISCO-08 country workbooks) takes account of all the previous work on changing skills demand patterns over the past four years. This provides a detailed view about how things are changing within each industry, based on the previous analysis using ISCO-88 data. The procedure adopted to translate this into ISCO-08 categories applies the 'best fit' change, with the patterns of change for #2.1 physical, mathematical and engineering science professionals in ISCO-88 assumed to hold for #2 science and engineering professionals in ISCO-08. This is a crude assumption, but until there is anything better to work with there is no real alternative.

Tables 12 and 13 summarise some typical results for the UK ⁽¹⁶⁾. The historical data and the projections have been transformed based on ISCO-08. For the projections, the shift-share analysis allows comparison of the default projections with the alternative of 'fixed shares' within industries to be explored. If the occupation effect is set at zero (changes only allowing for the scale and industry effect included) this gives the projected levels based on that assumption.

The country workbooks include graphics in the shift-share sheet which compare the two alternatives:

- (a) the default, which assumes changes in line with the old ISCO-88 two-digit categories within industries;
- (b) the 'fixed share' alternative (in which employment shares by occupation within each industry are fixed at 2011 levels).

The shift-share analysis based on both ISCO-08 and ISCO-88 data suggests that industry effects account for only a relatively small part of occupation change; making fixed shares within industries the default assumption is not plausible. The default assumption seems to produce the more plausible projections, although in a few cases this may need to be reassessed. Feedback for individual country experts (ICEs) will be used to help judge what is most appropriate.

Given the methodology adopted, the results by occupation are broadly in line with previous projections but now focused on the new ISCO-08 categories. As new data emerge based on ISCO-08, it will be possible to reassess and modify these results.

A shift-share analysis has also been introduced for qualifications. In this case the results are based on the unconstrained demand estimates in the demand workbooks. Further analysis, based on the constrained results which appear in the imbalances workbooks, will be added in due course. The constrained results ensure that the employment patterns by qualification are consistent with the numbers available from the supply side.

⁽¹⁶⁾ The three component parts sum to the total % change, or 100% of the total change: for example, $-42.1 = 7.6 - 43.5 - 6.2$ in line 1 of Table 12. The scale effect is a constant % of the opening stock for each occupation.

Table 12. Shift-share analysis of occupation changes using ISCO-08 categories, 2000-13 (UK)

SOC2010 submajor groups							Components of change					
	Base year 000s	2000 % share	Target year 000s	2013 % share	Change 000s	2000-13 %	Scale effect		Occupation effect		Industry mix effect	
							000s	%	000s	%	000s	%
01. Armed forces	111	0.4	64	0.2	-47	-42.1	8	7.6	-48	-43.5	-7	-6.2
11. Chief executives, senior officials and legislators	121	0.4	63	0.2	-58	-47.8	9	7.6	-76	-62.6	9	7.2
12. Administrative and commercial managers	755	2.7	693	2.3	-61	-8.1	57	7.6	-112	-14.8	-7	-0.9
13, 14. Managers in services	1 748	6.3	2 385	8.0	637	36.4	133	7.6	554	31.7	-50	-2.9
21. Science and engineering professionals	1 013	3.7	971	3.3	-41	-4.1	77	7.6	-104	-10.3	-14	-1.4
22. Health professionals	981	3.6	1 053	3.5	71	7.3	75	7.6	-198	-20.2	195	19.9
23. Teaching professionals	1 094	4.0	1 122	3.8	28	2.6	83	7.6	-202	-18.5	148	13.5
24, 25, 26. Business and other professionals	2 878	10.4	3 538	11.9	660	22.9	219	7.6	345	12.0	97	3.4
31, 35. Science and engineering associate professionals	569	2.1	710	2.4	141	24.7	43	7.6	117	20.6	-20	-3.5
32. Health associate professionals	201	0.7	420	1.4	219	108.7	15	7.6	177	88.1	26	12.9
33. Business and administration associate professionals	1 742	6.3	1 918	6.5	176	10.1	132	7.6	54	3.1	-10	-0.6
34. Legal, social, cultural and related associate professionals	389	1.4	826	2.8	437	112.3	30	7.6	376	96.6	31	8.1
41, 43, 44. General office clerks	2 610	9.5	1 731	5.8	-879	-33.7	198	7.6	-1 038	-39.8	-40	-1.5
42. Customer services clerks	1 112	4.0	1 219	4.1	107	9.6	84	7.6	-10	-0.9	33	2.9
51, 53, 54. Personal, care, protective service	2 983	10.8	3 765	12.7	782	26.2	226	7.6	219	7.3	337	11.3
52. Sales workers	1 853	6.7	2 104	7.1	251	13.6	141	7.6	191	10.3	-80	-4.3
61, 62, 63. Agricultural workers	287	1.0	397	1.3	110	38.1	22	7.6	78	27.1	10	3.4
71. Building and related trades workers, excluding electricians	958	3.5	1 023	3.4	65	6.8	73	7.6	21	2.2	-29	-3.0
72, 74. Metal, machinery and electrical trades	1 283	4.6	921	3.1	-363	-28.3	97	7.6	-212	-16.6	-248	-19.3
73. Handicraft and printing workers	250	0.9	133	0.4	-117	-46.7	19	7.6	-68	-27.3	-68	-27.0
75. Food processing, wood working, garment and other craft and related trades	443	1.6	274	0.9	-170	-38.3	34	7.6	-68	-15.4	-135	-30.4
81. Stationary plant and machine operators	460	1.7	332	1.1	-128	-27.8	35	7.6	-10	-2.2	-153	-33.2
82. Assemblers	266	1.0	79	0.3	-187	-70.2	20	7.6	-95	-35.7	-112	-42.1
83. Drivers and mobile plant operators	877	3.2	1 076	3.6	199	22.6	67	7.6	141	16.1	-9	-1.1
91, 94, 95, 96. Cleaners, refuse, street and related service occupations	1 757	6.4	1 649	5.6	-109	-6.2	133	7.6	-413	-23.5	170	9.7
92. Agricultural, forestry and fishery labourers	132	0.5	118	0.4	-15	-11.0	10	7.6	-21	-16.2	-3	-2.4
93. Labourers in mining, construction, manufacturing and transport	732	2.7	1 118	3.8	386	52.7	56	7.6	403	55.0	-72	-9.9
All occupations	27 607	100.0	29 703	100.0	2 096	7.6						

Sources: IER estimates, Wilson et al. (2013a).

Table 13. Shift-share analysis of occupation changes using ISCO-08 categories, 2013-25 (UK)

SOC2010 submajor groups							Components of change					
	Base year 000s	2013 % share	Target year 000s	2025 % share	Change 000s	2013-25 %	Scale effect		Occupation effect		Industry mix effect	
							000s	%	000s	%	000s	%
01. Armed forces	64	0.2	37	0.1	-27	-41.8	4	6.3	-28	-42.9	-3	-5.2
11. Chief executives, senior officials and legislators	63	0.2	54	0.2	-9	-14.6	4	6.3	-14	-22.3	1	1.4
12. Administrative and commercial managers	693	2.3	569	1.8	-124	-17.9	44	6.3	-186	-26.8	19	2.7
13, 14. Managers in services	2 385	8.0	3 136	9.9	751	31.5	150	6.3	591	24.8	10	0.4
21. Science and engineering professionals	971	3.3	861	2.7	-110	-11.3	61	6.3	-181	-18.6	10	1.0
22. Health professionals	1 053	3.5	1 085	3.4	33	3.1	66	6.3	-46	-4.4	13	1.2
23. Teaching professionals	1 122	3.8	862	2.7	-260	-23.2	71	6.3	-266	-23.7	-64	-5.7
24, 25, 26. Business and other professionals	3 538	11.9	3 747	11.9	209	5.9	223	6.3	-70	-2.0	56	1.6
31, 35. Science and engineering associate professionals	710	2.4	777	2.5	66	9.4	45	6.3	18	2.6	3	0.5
32. Health associate professionals	420	1.4	913	2.9	493	117.4	26	6.3	462	110.1	4	1.0
33. Business and administration associate professionals	1 918	6.5	1 981	6.3	63	3.3	121	6.3	-58	-3.0	1	0.0
34. Legal, social, cultural and related associate professionals	826	2.8	1 494	4.7	667	80.8	52	6.3	603	72.9	13	1.5
41, 43, 44. General office clerks	1 731	5.8	983	3.1	-748	-43.2	109	6.3	-863	-49.8	6	0.3
42. Customer services clerks	1 219	4.1	1 295	4.1	76	6.2	77	6.3	-19	-1.6	18	1.5
51, 53, 54. Personal, care, protective service	3 765	12.7	3 802	12.0	37	1.0	237	6.3	-231	-6.1	30	0.8
52. Sales workers	2 104	7.1	2 112	6.7	8	0.4	133	6.3	-87	-4.1	-38	-1.8
61, 62, 63. Agricultural workers	397	1.3	538	1.7	142	35.7	25	6.3	138	34.8	-21	-5.4
71. Building and related trades workers, excluding electricians	1 023	3.4	1 120	3.5	98	9.5	64	6.3	-28	-2.8	62	6.0
72, 74. Metal, machinery and electrical trades	921	3.1	730	2.3	-191	-20.7	58	6.3	-228	-24.8	-21	-2.3
73. Handicraft and printing workers	133	0.4	102	0.3	-31	-23.2	8	6.3	-34	-25.4	-6	-4.2
75. Food processing, wood working, garment and other craft and related trades	274	0.9	279	0.9	5	2.0	17	6.3	1	0.3	-12	-4.6
81. Stationary plant and machine operators	332	1.1	350	1.1	18	5.6	21	6.3	28	8.5	-30	-9.2
82. Assemblers	79	0.3	133	0.4	53	67.3	5	6.3	50	63.0	-2	-2.0
83. Drivers and mobile plant operators	1 076	3.6	1 037	3.3	-39	-3.6	68	6.3	-51	-4.7	-56	-5.2
91, 94, 95, 96. Cleaners, refuse, street and related service occupations	1 649	5.6	1 467	4.6	-181	-11.0	104	6.3	-337	-20.5	52	3.1
92. Agricultural, forestry and fishery labourers	118	0.4	97	0.3	-21	-18.1	7	6.3	-9	-7.8	-20	-16.6
93. Labourers in mining, construction, manufacturing and transport	1 118	3.8	2 012	6.4	894	80.0	70	6.3	846	75.7	-23	-2.0
All occupations	29 703	100.0	31 575	100.0	1 873	6.3						

Sources: IER estimates, Wilson et al. (2013a).

CHAPTER 5.

Conclusions

The latest developments in sectoral and occupational classifications had a serious impact on the consistency of the time series, which is a prerequisite for the good forecasting results and comparisons of future trends with the past. This paper has highlighted the technical difficulties caused by shifting to the new classifications. Despite problems, given the prevailing state of knowledge and currently available data, there is no real alternative to using the old system of occupational classification.

This is the case even though the previous system of classification differs to a significant extent from the new one, so it is uncertain how far data on this basis give a reliable indication of trends in the structure of occupations as defined in ISCO-08. Using historical data when generating projections has the merit that the relative importance of different occupations tends to change over time. The only other option would be to use the new classification and to assume that the structure of occupations remains unchanged within industries in the coming years and that past trends come to an end. Previous observations suggest this is most unlikely.

Our preferred option is to base projections on the trends shown by the ISCO-88 data. However, there are several important implications, in particular the need to make clear that this is being done and that there is uncertainty about the validity of the historical trends. This is mainly identified because of the difference between the old and new classifications. There is also a need to set out the trends in the occupation shares of employment. These are to be calculated underlying the projections so that users of the latter can consider their plausibility.

Due to the limitations of the approach adopted, there is a need to carry out more detailed investigation of the historical data on occupations to look for possible ways of improving the basis of the projections. This might involve exploring the trends in individual sectors, which in some cases may offer closer correspondence between the two classifications, or examining the changes shown by four-digit data on occupations. It also involves checking whether there are countries where overlapping data were collected according to both ISCO classifications for 2011 and where serious attempts have been made to reconcile the two.

Analysing in some detail new data based on ISCO-08 as they are made available, and the possible divergence with the projections made with our method

based on the previous historical trends, can be of value. A word of caution, however, is in order: on past experience it is likely to take time for the new system to 'bed down'. This will allow those responsible for the LFS in the different countries to get used to it and to decide how particular jobs should be classified. The data for the first year or two might not be fully reliable and the changes shown might be due more to statistical factors than genuine shifts in the structure of occupations.

It is planned to address these issues in the next round of projections on skills supply and demand. This will involve use of new LFS data as they emerge (2012 and 2013 data will become available in 2014). It will also involve exploration of more detailed categories to the full two-digit level of ISCO-08 and to the three-digit level as far as the data will allow.

List of abbreviations

EU-LFS	European labour force survey
ISCED	international standard classification of education
ISCO	international standard classification of occupations
ISCO-08	international standard classification of occupations, approved in 2008
ISCO-88	international standard classification of occupations, approved in 1988
LFS	labour force survey
NA	national account
NACE	nomenclature statistique des activités économiques dans la Communauté Européenne [statistical classification of economic activities in the European Community]
NACE Rev.2	nomenclature statistique des activités économiques dans la Communauté Européenne [statistical classification of economic activities in the European Community Revision 2 adopted in December 2006]

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ANNEX 1.

General limits of the LFS-based database

Data in the Cedefop skill database are based on a combination of EU-LFS data and other sources (including national accounts data). 'The EU labour force survey, like all sample surveys, is based upon a sample of the target population. LFS results are, therefore, subject to the usual types of errors associated with sampling techniques. Based upon the sample design and size in the individual Member States, Eurostat implements basic guidelines intended to avoid publication of figures which are statistically unreliable' ⁽¹⁷⁾.

The general limits of LFS data for all countries can be found in Table A1, which sets out a summary. This highlights that, for all countries, estimates based on small sample numbers need to be treated with caution.

'Values for groups of countries in the table are calculated as the maximum of the values of the countries belonging to the group. EU and euro area are to be understood in their current composition. Values for other country groups can be derived in the same way. Figures less than those in column A [...] should not be published; by convention, a dot or full stop is used instead. Figures less than those given in column B but greater than those in column A should only be published with a warning concerning their reliability. By convention, they appear between brackets. In most cases, data released by Eurostat conforms to these rules. In some circumstances data may be provided to researchers without the modifications described [...]. This is done to enable them deriving their own aggregated tables in the course of their analysis. Once the aggregations have been finalised, the guidelines outlined above have to be observed again. Compliance with this principle is to be considered as a condition of the release of data in this form. The csv-file Reliability_limits.csv issued by Eurostat contains all quarterly, annual average, yearly and ad-hoc-module limits' ⁽¹⁸⁾.

⁽¹⁷⁾ Eurostat, EU-LFS annual_average results: reliability limits from 1998 onwards. http://epp.eurostat.ec.europa.eu/portal/page/portal/employment_unemployment_lfs/documents/reliab_annual_average_from_1998_onwards.htm [accessed 21.5.2014].

⁽¹⁸⁾ Idem.

Table A1. Limits for estimates from the EU-LFS (limits for annual averages of quarterly data)

COUNTRY	YEAR																																
	1998		1999		2000		2001		2002		2003		2004		2005		2006		2007		2008		2009		2010		2011		2012		2013		
	LIMIT_A	LIMIT_B	LIMIT_A	LIMIT_B	LIMIT_A	LIMIT_B	LIMIT_A	LIMIT_B	LIMIT_A	LIMIT_B	LIMIT_A	LIMIT_B	LIMIT_A	LIMIT_B	LIMIT_A	LIMIT_B	LIMIT_A	LIMIT_B	LIMIT_A	LIMIT_B	LIMIT_A	LIMIT_B	LIMIT_A	LIMIT_B	LIMIT_A	LIMIT_B	LIMIT_A	LIMIT_B	LIMIT_A	LIMIT_B			
EU	11000	26000	11000	26000	11000	26000	11000	26000	11000	26000	7500	23000	7500	23000	7500	22500	7500	22500	7500	22500	7500	22500	6500	15000	6500	15000	6500	15000	6500	15000	6500	15000	
EURO AREA	11000	26000	11000	26000	11000	26000	11000	26000	11000	26000	7500	15000	7500	15000	7500	15000	7500	15000	7500	15000	7500	15000	6500	13000	5500	11000	5500	11000	5500	11000	5000	6000	
BE			2000	5000	2000	5000	2000	5000	2000	5000	2000	5000	2000	5000	2000	5000	2000	5000	2000	5000	2000	5000	2000	5000	2000	5000	2000	5000	2000	5000	2000	5000	
BG					3500	8000	3500	8000	3500	8000	3500	8000	3500	8000	3500	8000	3500	8000	4000	9000	3500	7500	3500	7500	3500	7500	3500	7500	3500	7500	3500	7500	
CZ	750	3000	750	3000	750	3000	750	3000	750	3000	750	3000	750	3000	500	3000	500	3000	500	3000	500	3000	500	3000	500	3000	500	3000	500	3000	500	3000	
DK			2000	4000	2000	4000	2000	4000	2000	4000	2000	4000	2000	4000	2000	4000	2000	4000	2000	4000	2000	4000	2000	4000	2000	4000	2000	4000	2000	4000	2000	4000	
DE														5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000		
EE					1250	2500	1250	2500	1250	2500	1250	2500	1250	2500	1700	3800	1700	3800	1300	3800	1275	2950	1350	3125	1325	3050	1100	2600	1100	2600	1100	2600	
IE					1900	3100	1900	3100	1900	3100	1900	3100	1900	3100	1900	3100	1900	3100	1900	3100	1900	3100	1900	3100	1900	3100	1900	3100	1900	3100	1900	3100	
EL	1300	3500	1300	3500	1300	3500	1300	3500	1300	3500	1300	3500	1300	3500	1300	3500	1300	3500	1300	3500	1300	3500	1300	3500	1300	3500	1300	3500	1300	3500	1300	3500	
ES	1000	5000	1000	5000	1000	5000	1000	5000	1000	5000	1000	5000	1000	5000	1000	5000	1000	5000	1000	5000	1000	5000	1000	5000	1000	5000	1000	5000	1000	5000	1000	5000	
FR	11000	26000	11000	26000	11000	26000	11000	26000	11000	26000	7500	15000	7500	15000	7500	15000	7500	15000	7500	15000	7500	15000	6500	13000	5500	11000	5500	11000	5500	11000	5000	6000	
HR																			1000	10000	1000	10000	1000	10000	1000	10000	1000	10000	1000	10000	1000	10000	
IT	1500	2500	1500	2500	1500	2500	1500	2500	1500	2500	1500	2500	1500	2500	1500	2500	1500	2500	1500	2500	1500	2500	1500	2500	1500	2500	1500	2500	1500	2500	1500	2500	
CY														500	1500	500	1500	500	1500	500	1500	500	1500	500	1500	500	1500	500	1500	500	1500	500	1500
LV																																	
LT									1300	2100	1300	2100	1300	2100	1300	2100	1300	2100	1300	2100	1800	2900	1800	2900	2000	3200	1900	3100	1900	3100	1900	3100	
LU									5800	23000	5800	23000	5700	22500	7400	22500	5300	22500	5900	22500	5900	22500	4500	8000	4500	8000	4500	8000	4500	8000	4500	8000	
HU			2600	4800	2600	4800	2600	4800	2600	4800	2600	4800	2600	4800	2600	4800	2600	4800	2600	4800	2600	4800	2600	4800	2600	4800	2600	4800	2600	4800	2600	4800	
MT									450	900	450	900	450	900	450	900	450	900	450	900	450	900	375	750	375	750	375	750	375	750	375	750	
NL					1500	7000	1500	2500	1500	2500	1500	2500	1500	2500	1500	2500	1500	2500	1500	2500	1500	2500	1500	2500	1500	2500	1500	2500	1500	2500	1500	2500	
AT	4000	8000	3000	6000	3000	6000	3000	6000	3000	6000	3000	6000	3000	6000	3000	6000	3000	6000	3000	6000	3000	6000	3000	6000	3000	6000	3000	6000	3000	6000	3000	6000	
PL			5100	17000	5000	15000	5000	15000	5000	15000	5000	15000	5000	15000	5000	15000	5000	15000	5000	15000	5000	15000	5000	15000	5000	15000	5000	15000	5000	15000	5000	15000	
PT	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	
RO			2000	14000	2000	14000	2000	14000	2000	14000	2000	14000	2000	14000	6500	11500	6500	11500	6500	11500	6500	11500	6500	11500	6500	11500	6500	11500	6500	11500	6500	11500	
SI			500	4000	500	4000	500	4000	500	4000	500	4000	500	4000	500	4000	500	4000	500	4000	500	4000	500	4000	500	4000	500	4000	500	4000	500	4000	
SK	2000	3000	2000	3000	2000	3000	2000	3000	2000	3000	2000	3000	2000	3000	2000	3000	2000	3000	2000	3000	2000	3000	2000	3000	2000	3000	2000	3000	2000	3000	2000	3000	
FI	2000	4000	2000	4000	2000	4000	2000	4000	2000	4000	2000	4000	2000	4000	2000	4000	2000	4000	2000	4000	2000	4000	2000	4000	2000	4000	2000	4000	2000	4000	2000	4000	
SE			9000	9000	9000	9000	9000	2500	3500	2500	3500	2500	3500	2500	3500	2500	3500	2500	3500	2500	3500	2500	3500	1000	2000	1000	2000	1000	2000	1000	2000		
UK					4000	10000	4000	10000	4000	10000	4000	10000	4000	10000	4000	10000	4000	10000	4000	10000	4000	10000	4000	10000	4000	10000	4000	10000	4000	10000	4000	10000	
IS														500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500		
NO					1500	5000	1500	5000	1500	5000	1500	5000	1500	5000	1000	2000	1000	2000	1000	2000	1000	2000	1000	2000	1000	2000	1000	2000	1000	2000	1000	2000	
CH																																	
MK																																	
TR																																	

Source: Eurostat, EU-LFS annual average results - reliability limits from 1998 onwards. For further details see:

http://epp.eurostat.ec.europa.eu/portal/page/portal/employment_unemployment_lfs/documents/reliab_annual_average_from_1998_onwards.htm

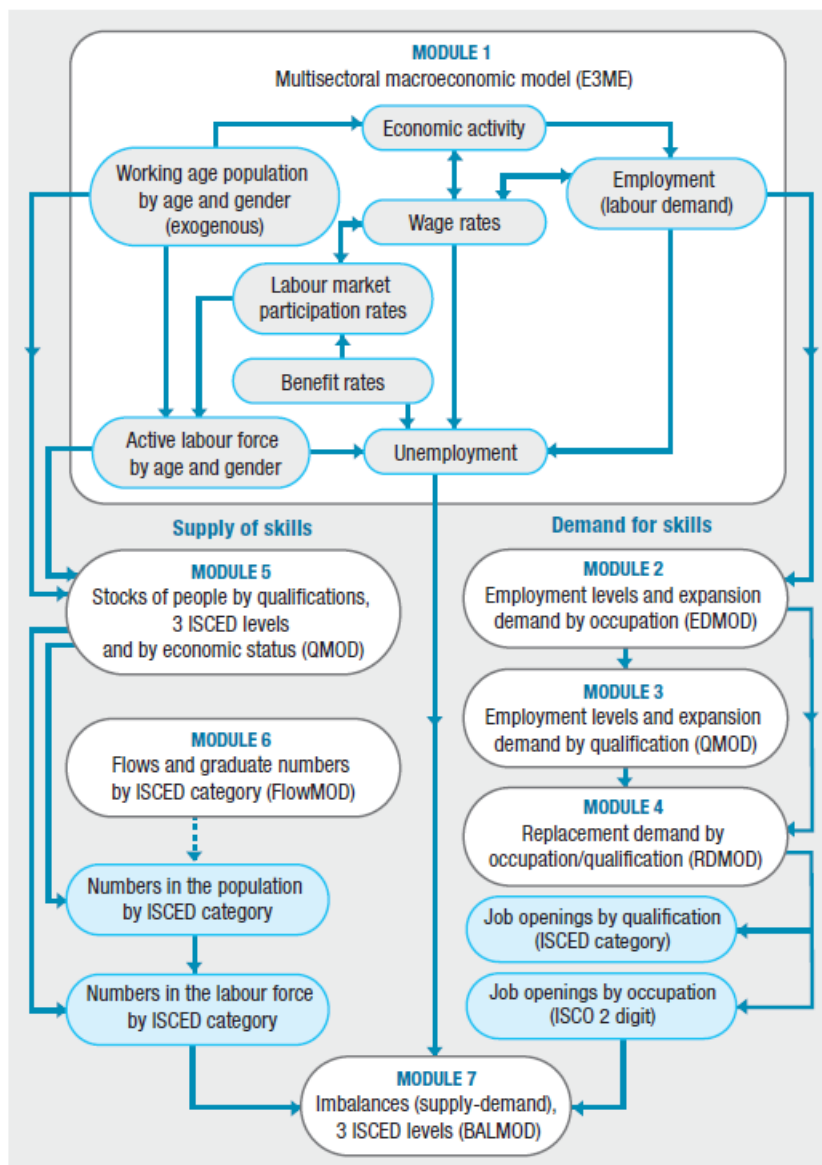
ANNEX 2.

Cedefop pan-European forecasting model of skills supply and demand

The modelling framework used to produce Cedefop's future skills supply and demand projections for the European economy is relatively complex ⁽¹⁹⁾. It is based on several interconnected modules comprising of different labour market elements (Figure A1). This allows for the refinement of different modelling approaches used for projecting occupations, qualification structures and replacement demand. It also allows for improvement or replacement of data for particular countries or sectors when there are specific concerns about data quality and their robustness. Each module is associated with its specific database. This framework has been designed to promote further development, customisation and addition of new elements to the overall modelling exercise.

The information used to generate the labour demand and supply forecasts is based on official data sources. The database draws primarily on Eurostat sources, especially demographic data, national accounts, the LFS and additional data on flows of those acquiring and attaining qualifications. The LFS data, in particular, are subject to considerable scrutiny and analysis to avoid discontinuities and other problems. An important task in this respect is customisation of the LFS data to obtain detailed employment trends by occupation and qualification as well as for different labour supply estimates. Employment data are provided by national accounts, which are used for the overall modelling of macroeconomic and structural trends. Current changes of key classifications (introduction of NACE Rev.2 and ISCO-08) are taken into account in the modelling framework.

⁽¹⁹⁾ The modelling framework has been designed and developed in cooperation with the Institute of Employment Research, University of Warwick, and is described in detail in Cedefop, 2012.

Figure A1. **Conceptual framework of modelling skills supply and demand**

Source: Cedefop (2010, p. 33; cited in Cedefop, 2012).

The demand side involves four main elements (modules). The underlying macroeconomic module (E3ME model) produces a set of multisectoral macroeconomic forecasts⁽²⁰⁾. This delivers a set of consistent sectoral projections, which are transparent in terms of the assumptions made about the

⁽²⁰⁾ The E3ME model is developed by Cambridge econometrics. More information on this model is available in Cedefop, 2012 or at: <http://www.camecon.com/EnergyEnvironment/EnergyEnvironmentEurope/ModellingCapability/E3ME.aspx>

main external influences on the various countries (including technological change and the impact of global competition). This model combines the features of an annual medium-term sectoral model, estimated by formal econometric methods, with the some input-output modelling elements. It can be used for dynamic policy simulations and for forecasting and projecting macroeconomic variables over the medium and long term.

An occupation model (EDMOD) focuses on producing estimates of expansion demand (employment growth) within sectors adopting common classifications and data sources. EDMOD is based on EU-LFS data, the main advantage of which is that data collection is conducted frequently, adopting standardised sets of questions and systems of classification. While there are still some differences across countries, the EU-LFS provides a broadly consistent set of data which can be used for producing occupation employment projections within the industries identified in macroeconomic models such as E3ME.

The qualifications module (QUALMOD), also using EU-LFS data as the main source of information, focuses on qualification intensities within occupations. QUALMOD translates occupation employment projections into anticipated demand for three measures of skills, defined by the three broad levels of formal qualifications consistent with the international standard classification of education (ISCED) ⁽²¹⁾.

The replacement demand module (RDMOD) has been built to reflect the crucial importance of considering not only changing occupation employment levels but also the need to replace those leaving the workforce because of retirement, net migration and occupation mobility. Estimating replacement demand is not straightforward and is quite sensitive to the data sources used. Information on age and gender structure is required because many labour market flows, especially retirements and occupation mobility, are age- and gender-specific. Age structures also vary significantly by occupation. While older individuals tend to leave the labour market due to retirement, younger people change occupations more frequently, form families or migrate within regions or countries.

The supply side focuses on producing medium-term projections of skills supply, as measured by the highest qualification attained (consistent with the levels as defined in the QUALMOD module) defined by five-year age bands and gender. The models on the supply side produce consistent pan-European skills supply projections, using existing data (skills measured by qualifications) which

⁽²¹⁾ Low qualification equals ISCED 1 and 2; medium qualification = ISCED 3 and 4; high qualification = ISCED 5 and 6.

are compatible with the projections of skills demand (focusing on qualifications). Ideally, the modelling and forecasting of the supply of qualifications requires a detailed and comprehensive stock-flow model, with behavioural links which can be used to predict the distribution of people in the total population and labour force by qualification.

The main values of labour supply are modelled within an augmented E3ME model as a function of economic activity, real wage rates, unemployment rates and benefit rates. At present, model parameters are estimated for labour market participation in each country by gender and separately for different age groups. This is of key importance for modelling education participation and attainment since these are known to be age-specific. This expanded model framework is then used to create a detailed set of baseline projections for labour supply, disaggregated by country, age group and gender and covering a 10- to 15-year period. This forms a key input to the analysis of the supply of qualifications and skills and provides the link between economic activity and labour market supply.

The main motivation for the development of skills supply and demand forecasts is to identify potential labour market imbalances and skill mismatches. The final reconciliation and balancing of the supply and demand projections is undertaken by the module BALMOD. The aim of this module is to reconcile skills supply and skills demand projections, focusing on qualifications. However, comparing current demand and supply projections is problematic for both practical and theoretical reasons. Unless the two sets of results are based on common data sets and are carried out simultaneously, they cannot be directly compared. There are also various other conceptual and methodological issues regarding imbalances that need to be considered. Using a RAS procedure, BALMOD distributes the available supply of people with qualifications to the jobs on offer, making certain assumptions about patterns of unemployment for the three qualification categories (high, medium and low).

The results produced by the Cedefop skill forecast model and key exogenous variables are the subject of continuous dialogue with experts from individual countries who have better insight into labour market trends and data sources in their own countries. The use of such a network of national experts (the Skillsnet network) increases efficiency and transparency and ensures the robustness of the national empirical results.

ANNEX 3.

Detailed results of employment share analysis

Table A2. Employment shares by occupation (% total employed), 2010 and 2011

	ISCO 1		ISCO 2		ISCO 3		ISCO 4		ISCO 5		ISCO 6		ISCO 7		ISCO 8		ISCO 9	
	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
AT	6.6	5.1	10.9	14.2	20.5	18.7	13.1	11.0	14.5	17.8	4.8	5.0	13.1	13.8	5.3	5.8	10.9	8.5
BE	11.3	7.2	22.6	20.3	11.5	15.9	13.9	13.8	11.7	13.3	1.7	1.3	9.8	10.9	7.4	6.6	9.3	10.1
BG	7.5	6.4	12.6	15.9	9.9	8.1	7.5	6.6	17.2	21.6	4.2	3.9	13.9	13.9	13.6	12.9	12.6	9.8
CH	7.3	7.8	18.0	22.8	22.3	18.2	10.3	9.4	14.1	16.2	3.4	2.9	13.9	13.8	4.3	4.1	5.8	4.4
CY	4.8	3.9	14.7	17.2	12.7	12.9	13.8	11.5	15.8	16.9	2.0	2.1	12.5	11.6	5.0	5.2	17.9	17.7
CZ	5.3	4.8	10.4	13.4	24.9	18.5	7.9	9.6	12.4	14.8	1.4	1.4	17.4	18.0	15.0	13.8	5.0	5.4
DE	5.8	4.8	15.3	17.6	21.4	20.2	11.9	11.9	12.5	14.9	1.7	1.5	14.6	12.8	6.9	6.3	8.0	8.6
DK	4.7	2.7	17.1	24.9	23.5	16.5	9.5	8.9	17.7	19.7	2.1	2.0	9.1	8.9	5.3	5.3	10.5	10.6
EE	11.6	9.1	18.9	19.4	12.3	12.9	6.0	5.4	12.4	13.3	1.6	2.0	12.6	15.5	14.3	13.1	9.6	8.9
ES	8.1	5.0	13.9	16.1	12.7	11.2	9.5	10.1	17.2	21.6	2.5	2.5	12.9	12.3	8.7	7.9	13.9	12.8
FI	10.4	5.5	18.3	21.0	16.9	16.4	6.3	7.0	15.9	19.4	4.1	4.0	11.5	11.4	8.1	8.1	7.9	6.5
FR	8.9	7.2	14.0	16.8	18.8	20.4	11.4	9.6	12.9	17.1	3.6	2.8	10.8	8.4	8.6	6.7	9.7	9.8
EL	10.1	4.1	15.3	17.7	8.9	7.9	10.8	10.4	14.5	21.3	11.4	11.5	12.7	12.0	7.2	6.3	7.7	7.2
HR	5.0	4.4	12.0	13.6	15.1	12.7	11.6	10.4	14.5	17.1	12.3	12.1	11.5	11.6	9.8	9.7	7.3	7.4
HU	7.1	5.7	14.9	15.8	13.1	14.1	9.3	8.0	15.0	15.7	2.6	2.8	16.5	15.2	12.1	13.6	8.7	8.7
IE	12.8	7.4	19.8	21.7	7.0	10.5	13.2	10.5	19.3	20.1	3.3	3.6	9.6	10.0	6.6	6.1	7.4	9.1
IS	8.8	9.0	20.9	22.9	17.7	16.4	5.9	4.2	20.0	20.3	4.4	4.6	12.0	12.4	4.6	4.6	5.7	5.5
IT	7.7	3.9	9.9	13.2	20.1	17.4	12.7	12.5	11.4	16.1	2.2	2.5	16.2	15.8	8.0	7.4	10.6	10.3
LT	10.2	9.2	19.2	22.2	13.1	11.6	4.6	4.2	13.1	13.8	6.5	6.2	14.1	13.2	10.5	11.6	8.3	7.7
LU	4.6	4.3	28.1	32.7	22.1	18.3	11.5	9.9	8.7	10.4	1.7	1.9	8.4	8.7	4.9	4.7	8.6	7.7
LV	10.2	10.1	16.7	16.8	13.4	12.3	5.9	5.6	14.4	15.1	4.2	3.7	11.8	12.2	9.7	9.4	13.3	14.3
MK	6.6	5.8	10.8	12.9	9.5	10.3	7.5	6.7	14.4	15.0	0.4	0.8	12.6	11.7	11.9	12.2	25.4	23.6

	ISCO 1		ISCO 2		ISCO 3		ISCO 4		ISCO 5		ISCO 6		ISCO 7		ISCO 8		ISCO 9	
	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
MT	8.7	8.6	12.4	15.1	15.2	14.1	12.4	11.5	17.2	19.5	1.2	1.1	11.7	11.7	8.1	7.4	12.2	9.9
NL	10.7	7.3	20.4	22.6	18.2	16.3	11.6	10.1	13.8	18.8	1.3	2.5	8.1	8.8	5.3	4.1	8.6	7.8
NO	5.9	6.6	13.9	22.6	25.2	16.1	6.6	6.9	24.3	21.6	2.1	2.3	10.2	9.7	7.1	6.4	4.3	4.1
PL	6.7	6.1	16.7	17.3	11.6	11.1	7.4	6.7	12.2	14.4	11.4	11.3	15.8	15.4	10.0	10.2	7.6	7.0
PT	6.0	6.2	10.1	14.6	9.9	9.0	9.4	8.5	16.3	16.6	8.1	7.5	18.6	16.4	8.3	8.6	12.8	12.1
RO	2.0	2.1	11.0	14.2	9.2	6.9	4.7	4.3	11.5	13.0	23.2	22.1	15.5	15.8	10.5	10.4	11.5	10.4
SE	5.4	5.3	19.6	25.0	21.2	16.2	8.0	6.0	18.7	20.9	2.0	1.8	9.7	10.8	9.1	8.1	5.9	5.2
SI	9.0	8.3	16.2	19.6	16.2	14.1	8.5	7.5	12.6	13.1	4.8	4.6	10.6	13.9	13.0	9.5	8.0	8.1
SK	6.0	5.3	11.3	11.6	20.1	18.9	6.3	6.8	14.6	16.5	0.7	0.7	16.8	17.4	15.1	13.6	8.5	8.7
TR	8.4		7.2		6.0		6.9		12.3		20.2		13.7		10.4		15.0	
UK	15.3	10.2	14.8	24.0	12.5	12.3	12.5	10.0	18.0	19.1	1.2	1.1	8.7	8.4	6.0	5.2	10.2	9.1
EU-28	8.3	6.0	14.5	17.9	16.4	15.4	10.6	9.8	14.1	17.0	4.1	3.9	13.0	12.3	8.2	7.5	9.6	9.3

NB: Data for 2008-10 are based on ISCO-88 and for 2011 on ISCO-08.

Croatia is not included in the EU totals, but it is too small to make any perceptible difference.

Source: Eurostat, EU-LFS.

Table A3. Share of women by ISCO one-digit occupation group, 2010 and 2011 (% total employed)

	ISCO 1		ISCO 2		ISCO 3		ISCO 4		ISCO 5		ISCO 6		ISCO 7		ISCO 8		ISCO 9	
	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
AT	28.7	27.2	46.4	50.9	47.7	43.9	70	72.6	73	68.3	47.1	43.3	7	9.4	12.9	13.2	55.5	61.1
BE	34.2	29.9	56.4	53.7	37.8	42.5	65	62.7	67.4	66.1	24.2	19.9	6	5.5	16.2	12.8	54.4	64
BG	34.5	38.2	68.4	70.2	56.2	45.2	76.2	72.1	59.6	59.8	41.1	39.7	26.4	25	26.3	25.1	43.9	39.9
CH	33.4	32.9	35.5	44.5	56.2	49.1	70.8	68.9	67.5	66.7	29.3	26.6	13.5	14.7	15.7	18	64.2	67.8
CY	13.7	15	53.3	56.9	47.3	47	78.2	75.1	60	58.1	25.5	22.8	6	3.8	7.8	8.2	61.6	65.2
CZ	27.8	26.3	47.4	56.2	52.7	43.1	75.3	77.4	66	63.8	32	34.6	9.4	10.4	26.7	24.7	60.2	65.7
DE	30.1	28.1	40.7	44.6	60.8	55.1	67.3	66.7	74.5	66.5	28.8	21.6	9.7	9.3	13.9	15.6	52.9	60
DK	22.9	27.9	44.6	54.4	56.9	46.7	71.7	67.9	71.9	65	16.9	14.7	4.8	5.8	16.3	14.9	42	46.7
EE	36.8	36.2	70.3	67.9	65.5	57.9	76.6	73.9	76.2	77.4	41.9	36.8	9.4	12.2	29.6	31.8	61.7	59.3
ES	33.2	29	55	54.8	47	37.7	65.5	64.7	64.8	61.5	20.1	22.6	7	7.7	14.3	12.5	56.9	62.2
FI	28.5	32.6	50.1	48	61	58	76.6	74.6	80.9	73.2	37.3	33.1	9.3	7.6	16.9	15.9	55	60.8
FR	38.6	39.4	44.8	48.6	52.7	45.6	74.4	71.5	72.9	69.3	24	25.5	8.7	9.2	19.2	16.6	65.8	58.7
EL	29.7	23.1	50.6	50.7	50.2	48.5	59.2	56.1	54.5	47.9	42.1	42.7	8	8.3	8.2	7.8	54.3	56.5
HR	26.8	24.8	56.6	61.2	49.8	41.9	69	67.8	62.3	58.9	52.4	50.5	4.9	7.9	25.9	25.5	52.4	54
HU	36.4	40.3	56	53.3	64	61.5	75.2	78.2	60.2	58.4	26	28.9	12.6	9.6	28.2	31.7	55.5	53.1
IE	39.1	33.5	55.7	55.5	47.7	46.5	72.5	79.7	66.7	66.6	6.1	6.1	5.1	8	14.6	14	38.6	37.8
IS	34.1	40.2	60	59.2	58.3	59.8	81.6	83.3	60.1	61.2	19.7	12.8	8.9	10.8	10.7	12	49.4	48.2
IT	32.8	25.1	46.2	54.9	48.4	39.7	60.2	61.9	58.7	57.6	23	21.6	11.5	10.8	17.1	18.3	52.5	49.8
LT	40.8	38.9	70.7	71	67.1	60.4	75.6	74.9	74.2	72.2	43.9	44.7	24.9	20.4	17.3	23.5	54.7	54
LU	24.1	23.5	42.6	45	49	49.2	54.9	52.9	63.9	61.8	23.3	21.3	5	3.5	7.4	5.5	67.5	74
LV	41.1	45.5	68.5	67.6	61.6	63.1	80.2	81.2	76.3	74	41	38.6	19.2	22.2	12.6	9.1	50.8	50.1
MK	27.9	27.9	50.7	52.8	49.8	46.8	50.5	50.2	42.1	42.4	18.4	21	9.6	12.5	45.7	43.9	39.3	41
MT	22.9	23.5	49	48.2	41.2	29.2	58	59.3	43.7	48.9	7.2	3.5	2.2	4.8	24.1	24.4	22.9	24.7
NL	27.6	29.9	46.3	46.3	54.6	49.3	69.9	66	69.9	70.1	26.3	23.3	4.9	5.5	11.3	11.2	46	47.8
NO	34.4	32	45.8	54.2	55.2	39.6	61.8	63.2	68.3	71.5	17.3	21.6	5	4.7	14.5	11.4	59.7	58.9
PL	36.3	38.5	65	62.9	53.8	54.2	66.4	63.9	66	63.4	45.3	43.9	12.7	12.4	13.6	14.1	54.8	57.1
PT	32.3	33.1	58	57.7	46.3	40.4	63.2	65	67.5	63.3	44.8	40.8	19.4	15.9	21.9	29.1	66.9	73.3
RO	32.4	31.2	51.3	57.9	63.1	51.7	69.9	68.3	63.9	61.3	48.3	48.7	20.8	21.8	24	23.5	41.2	46

	ISCO 1		ISCO 2		ISCO 3		ISCO 4		ISCO 5		ISCO 6		ISCO 7		ISCO 8		ISCO 9	
	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
SE	31.4	34.6	50.6	57.6	52.1	43.8	67.7	69.7	73.4	69.7	25.1	22.8	5.6	6.3	15.3	14.6	48.7	55.5
SI	34.8	38.3	59.8	61.6	51.5	51.3	62.7	59.1	62.7	62.1	40.3	35.6	7.7	10.1	28.9	27.3	58	59.5
SK	34.7	31	58.3	58.4	60.4	57.5	67.8	68.9	68.8	65.7	29.5	20.8	10.9	10.7	25.3	23.4	42.1	48.1
UK	35.8	33.9	45.4	47.1	53.1	53.6	75.9	69.5	71.6	67.1	11.2	10.6	3.5	5.3	13.3	10.9	38.2	44.9
EU-27	33.8	32.7	49.3	51.5	54.2	48.8	69	67.2	68.7	64.7	36.9	35.9	10.2	10.3	17.1	17	52.3	55.2
EU-28	8.3	6.0	14.5	17.9	16.4	15.4	10.6	9.8	14.1	17.0	4.1	3.9	13.0	12.3	8.2	7.5	9.6	9.3

NB: Data for 2008-10 are based on ISCO-88 and for 2011 on ISCO-08.

Source: Eurostat, EU-LF

Coping with changes in international classifications of sectors and occupations

Application in skills forecasting

Reliable and consistent time series are essential to any kind of economic forecasting. Skills forecasting needs to combine data from national accounts and labour force surveys, with the pan-European dimension of Cedefop's skills supply and demand forecasts, relying on different international classification standards. Sectoral classification (NACE) and occupational classification (ISCO) standards underwent substantial changes in recent years, related not only to internal structure but also the logic of how companies or workers are classified. It is natural that changes to key classification standards had significant impact on this pan-European exercise but Cedefop has developed methodology to overcome this problem and to find the best match between the old and new classifications. This publication details Cedefop's action, which should also have value for those dealing with labour market analysis at national level.

Europe 123, 570 01 Thessaloniki (Pylea), GREECE
Postal address: PO Box 22427, 551 02 Thessaloniki, GREECE
Tel. +30 2310490111, Fax +30 2310490020
E-mail: info@cedefop.europa.eu

visit our portal www.cedefop.europa.eu

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