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A revision of potential indicators and sub-indicators for monitoring

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Towards a new benchmark on adult skills for sustainable growth: A revision of potential indicators and sub-indicators for monitoring

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1. Introduction

Skills development is extremely important for building the "virtuous circle" in which the quality of education and training stimulates innovation, investment, technological change, enterprise development, economic diversification and competitiveness needed for economies to accelerate the creation of more and more productive jobs and, ultimately, sustainable growth. This is the idea behind the Europe 2020 Strategy (EU2020) of a smart, sustainable and inclusive economy. However, the rapid changes occurring in the EU economy and society such as increasing global competition, the skill-biased technological change or the ageing of population make sometimes difficult to find the right people for the right jobs these days. Although some theories support the idea of a temporary or only individual phenomenon, empirical evidence shows that educational and skill mismatch in Europe is pervasive (Cedefop 2010), widespread and persistent, suggesting some structural causation with the labour market structure (Brynin 2002).[1]

Within this framework, indicators and benchmarks on adult skills are of a great importance so as to better understand skill development and monitor the progress of the implementation of EU2020 strategy across Member States. This approach should also contribute the provision of solid and robust policy advice to investment and reform in education and training (European Commission, 2013).

Thus, this paper aims to provide a framework for the collection of statistical indicators and sub-indicators on adult skills. This information can be used to monitor skill development among EU countries while comparing its progress with the agreed target and EU average performance. A preliminary list of indicators is proposed based on data availability. Some discussion on their appropriateness is also presented in line with the Joint Assessment Framework methodology (JAF). The conceptual framework and approach build upon the work of OECD et al. (2013) in developing indicators of skills in the context of developing countries.

The rest of the paper is structured as follows. In the next section, we present and discuss the core indicator for monitoring adult skills, based on the recently released Survey of Adult Skills (PIAAC). Some

[1] A review made by Groot and Maassen van den Brink (2000) over 20 years of research on overeducation in Europe and USA further suggests that the rate of overeducation has not changed significantly in the period between 1970s and 1990s.

discussion is also provided on the choice of sub-groups. In Section 3, the conceptual framework is presented together with the necessary criteria to decide on the choice of sub-indicators. A list of sub-indicators is also presented with a detailed inventory of data availability and appropriateness. A proposal following JAF methodology is presented in Section 4. Finally, conclusions are presented in Section 5.

2. Measuring Adult skills (the "building up" of an indicator of adult skills)

In the past few decades, it has largely been discussed that the benefits from education to society go beyond the economic domain. This is nothing new since in the ancient Greece, Plato and Aristotle already claimed the key role of education for personal fulfilment and social well-being and, nowadays, both economist of neoclassical tradition and their opponents agree on the role of human capital in the creation of growth. Accordingly, research strongly supports this understanding, revealing that education not only provides individuals' knowledge and skills to perform better in the labour market and promote growth, but education also contributes the socialisation in modern societies. Knowledge puts people in a position to take well-informed decisions about the future, to assume responsibility for these decisions and to judge how their personal behaviour will affect future generations, helping individuals and society to be more stable and resilient in times of change.

Although educational attainment is without doubt a reasonable candidate to proxy individuals' competences, this does not necessarily imply that the individual possesses the skills required for the job. As argued by OECD, *'more education does not automatically translate into better skills'*. In effect, new job requirements are rapidly emerging in the labour market with a greater demand for more information-processing and high-level cognitive skills, while the skill gaps between different educational level (in particular between tertiary graduates and upper secondary graduates) vary considerably among countries but also within countries (among individuals with similar qualifications). This might be due to the loss of skills through time as an effect of ageing, or might be the result of change in the type and quality of education provided in the same country (OECD 2013). This is the reason why the measurement of adult skills and not simply educational attainment is considered a superior and more reliable approach to the actual abilities/competencies owned by the individual in a specific point in time.

The recently released Survey of Adult Skills (PIAAC) was designed to provide insights into the availability of some key skills. In particular, it directly measures proficiency in several information-processing skills – namely literacy, numeracy and problem solving in technology-rich environments, as well as traditional educational attainment variables. Thus, PIAAC data offers a unique opportunity for measuring individual skills.

2.1. The PIAAC survey

The Programme for the International Assessment of Adult Competencies is an international survey that measures key cognitive and workplace skills needed for individuals to participate in society and for economies to prosper. Using household's interviews, the survey assesses the skills of about 150,000 working age adults (16-65) surveyed in 24 countries. The survey is the outcome of collaboration among the participating countries, the OECD secretariat, the European Commission and an international consortium led by Educational Testing Service (ETS) (OECD, 2013).

As mentioned earlier, PIAAC assessed skills in literacy, numeracy and problem solving in technology-rich environments (solving problems in a computer environment). The proficiency that respondents showed in the three indicated skills is measured on a scale from 0 to 500 points (proficiency scales), which is divided into proficiency levels (from below 1 to 6 for literacy and numeracy; from below 1 to 4 for problem solving). The proficiency levels describe the attributes of the tasks that adults with particular proficiency scores can typically successfully complete (see OECD, 2013 for further details) and are defined by distinct value ranges on the proficiency scales. Hence, using the proficiency levels, the skills of an individual or a group can also be described by the proficiency level at which the score points are located. According to OECD, the proficiency levels are not intended to describe standards in a sense of defining levels that are appropriate for specific purposes; however, some inferences about skills levels and e.g. job requirements should be possible. This leaves two main measures for reporting the levels of skills of the population: **mean score points** on the proficiency scale and the **share of the population** that performs on a **certain proficiency level**.

Following DG EAC discussion paper, it is proposed to focus on the share of the population that performs on a certain proficiency level. In comparison to a measure composed of mean proficiency scores, which needs a more detailed knowledge of the reader about the way the Survey of Adult Skills (PIAAC) measures these skills, reporting proficiency levels and population's shares has some advantages:

- Comparing shares of the population is easy to comprehend
- A small number of 'proficiency levels' that describe abilities in ascending order are easy to understand as well
- The "can do"- way of describing the proficiency levels by the OECD relates to the experience of the reader
- It leans on the definition of the existing benchmark for low achievers, which is based on the widely known PISA survey
- The measure is used for reporting the results of the Survey of Adult Skills (PIAAC) by OECD itself

Contextual questionnaires further collected a broad range of information, including not only educational attainment but also family background, linguistic background, outcome variables and how skills are used at work and in other contexts, such as the home and the community.

Table 1 below reports the number of individuals participating in each EU country.

Table 1: Number of individuals participating in the survey by country

Country	Frequency	Country	Frequency
Austria (AT)	5130	Ireland (IE)	5983
Belgium (BE Fl)	5463	Italy (IT)	4621
Cyprus (CY)	5053	The Netherlands (NL)	5170
Czech Republic (CZ)	6102	Poland (PL)	9366
Denmark (DK)	7328	Slovak Republic (SK)	5723
Estonia (EE)	7632	Spain (ES)	6055
Finland (FI)	5464	Sweden (SE)	4469
France (FR)	6993	England/Northern Ireland (UK)	8892
Germany (DE)	5465	Total (EU 17)	104909

2.2. Proposed core indicators on adult skills based on PIAAC data

The European Union has repeatedly addressed the problem of low achievement in general, meaning low skills of young people, early leaving from education and low formal qualifications, by monitoring it through indicators and benchmarks (the *'early school leavers*' Europe 2020 headline target, the *'low achievers*' benchmark, which measures the share of students performing *below* PISA level 2 and the former 'Upper secondary education' benchmark) and establishing respective policies to help the relevant groups. The overall aim behind these policies was to ensure that a big as possible share of young Europeans leave initial education with qualifications and skills that allow for a smooth transition into the labour market and full participation in society.

However, analysis from organisations like OECD and CEDEFOP showed that one of the main trends in European labour markets is the continuing increase in skills demand at the high end, meaning the number and the share of jobs that require high qualifications and skills has been increasing in recent decades and is expected to grow further. Satisfying this growing skills demand will be important to continuing economic growth in filling well-paid and qualified job vacancies. Equally are the skills demands in existing jobs expected to change increasingly due to economic and technological changes; apart from the job holders' readiness to actively maintain and upgrade their skills this requires a sound foundation of basic skills that continuing training can build on.

The two options proposed for measuring adults' skills at EU level and across countries are:

1. **Focus on those who achieve better** (High achievers). Share of the working age population with at least reasonably high skills (Levels 3 and higher for literacy and numeracy, level 2 and higher for problem solving in technology rich environments).

2. **Focus on the low achievers** (Low achievers). Share of the working age population with low skills (Level 1 and lower for literacy, numeracy and 'not taken the test' for problem solving in technology rich environments)[2].

Figures 2 below provides some interesting results on the relationship between these two indicators across countries since we observe that countries like IT and ES are far from the EU18 average ranking significantly high in low skill achievers and extremely low on their high skill counterparts.3 On the contrary, countries like FI, NL, SE or DK provide a large share of high achievers both in literacy and numeracy while they also report a well below EU18 average share of low achievers.

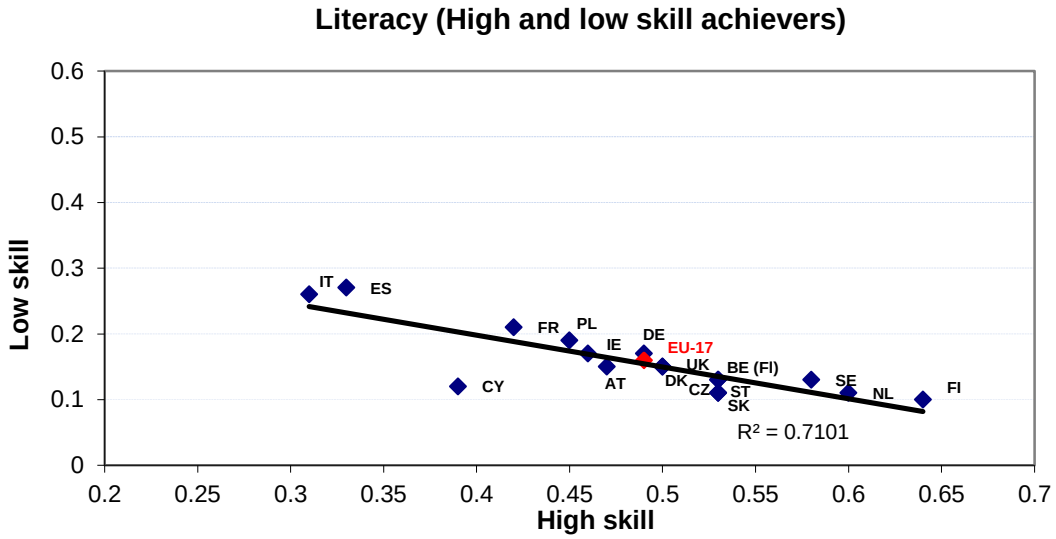


Figure 2a. Share of population with low and high skills in literacy

[2] For the literacy and numeracy results, countries are ranked in order of their share of the population performing at Level 1 or lower. The share of the population that did not take the test due to language problems is excluded from the results, which has an impact on the ranking. Had the ordering been done according to the share of those at levels 2-5 (which is the complement to 'level 1 and below'), the ranking would have been different. This problem occurs mainly in Belgium (Flanders) and Cyprus. Nothing can be said about the skills of that group that did not take the test. But, as the Survey was implemented in Flanders only in Dutch and in Cyprus only in Greek, it can be assumed - without detailed information being available – that the group mainly consisted of French speakers and speakers of Turkish respectively.

[3] Given the specificities of problem solving skills, we only focus in numeracy and literacy skills in this paper

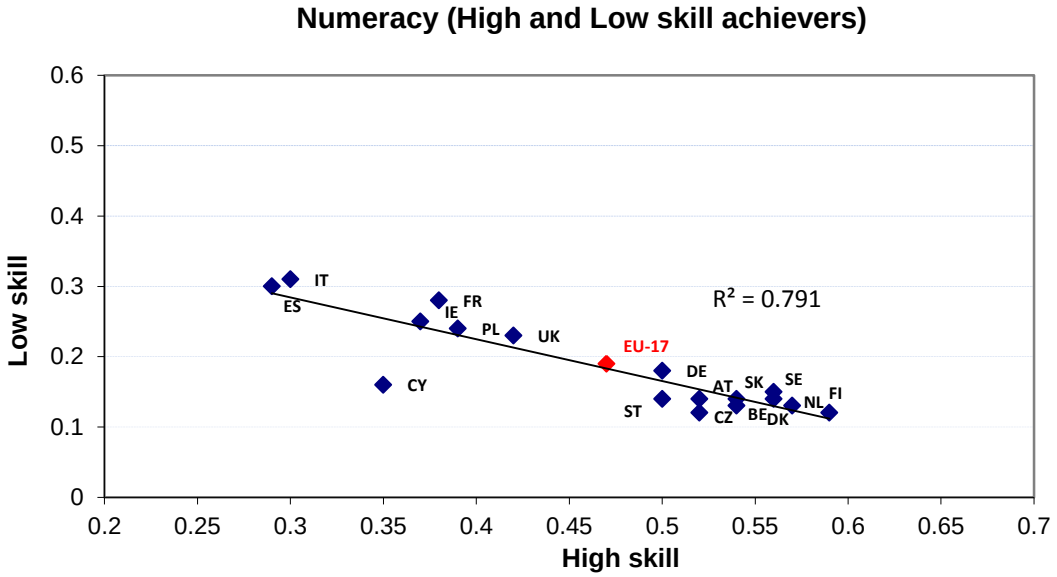


Figure 2b. Share of population with low and high skills in numeracy

Until now, none of the two options appears to have significant advantages as concerns policy relevance and or explanatory value. Thus, we continue the discussion keeping both of them for further more in depth discussion. Furthermore, in line with the Council conclusions, the options described below focus on the whole population at working age tested in the Survey of Adult Skills (PIAAC) from 16-64 years. While the impact of formal education might be better reflected in the younger age group (e.g. 16-29 years), the broader age range also reflects skills gains and losses throughout the respective lifespan, including in particular the impact of the working life; thus it is more relevant for policy issues such as maintaining and improving skills and adult education.

2.2. Discussion on sub-groups.

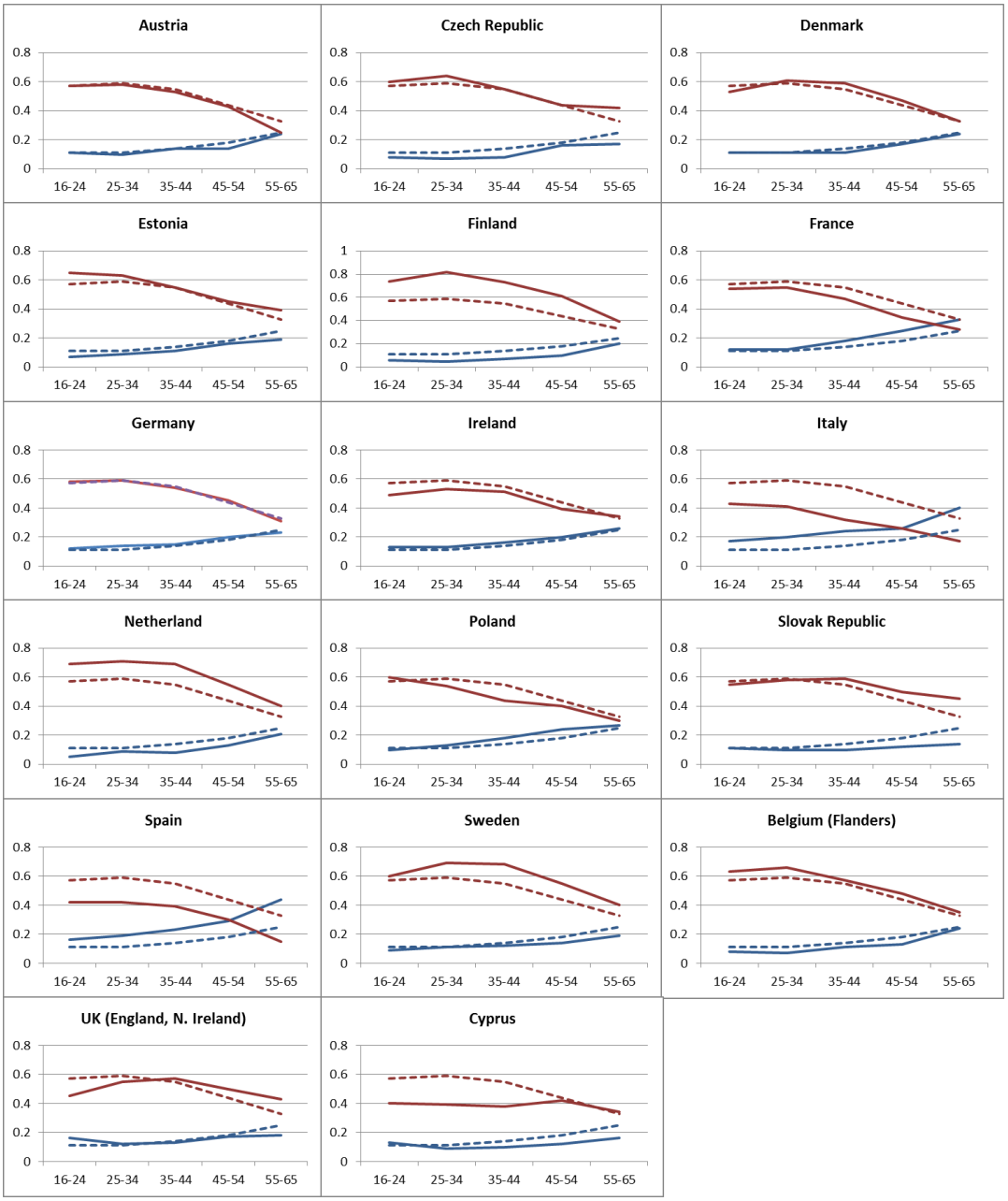
When looking into the socio-economic characteristics that may explain different behavior in individuals' occupational mismatch, **age** comes up as the first straightforward candidate. Thus, we plot by age groups (i.e. 16-24; 25-34; 35-44; 45-54; 55-65) and for both the percentage of low skill and high skill achievers (see Figure 3). The red solid line represents the percentage of high achievers, while the blue solid one represents its low counterparts for each country. Dotted lines represent the EU17 weighted average percentages.

One common feature among almost all countries is that high skill achievers are more represented in all age groups than low skill ones[4]. However, high skills seem to be more represented by the younger

4 Except for Spain and Italy where there is a higher representation of low skill achievers than their high skill counterparts among the oldest age group category (55-65).

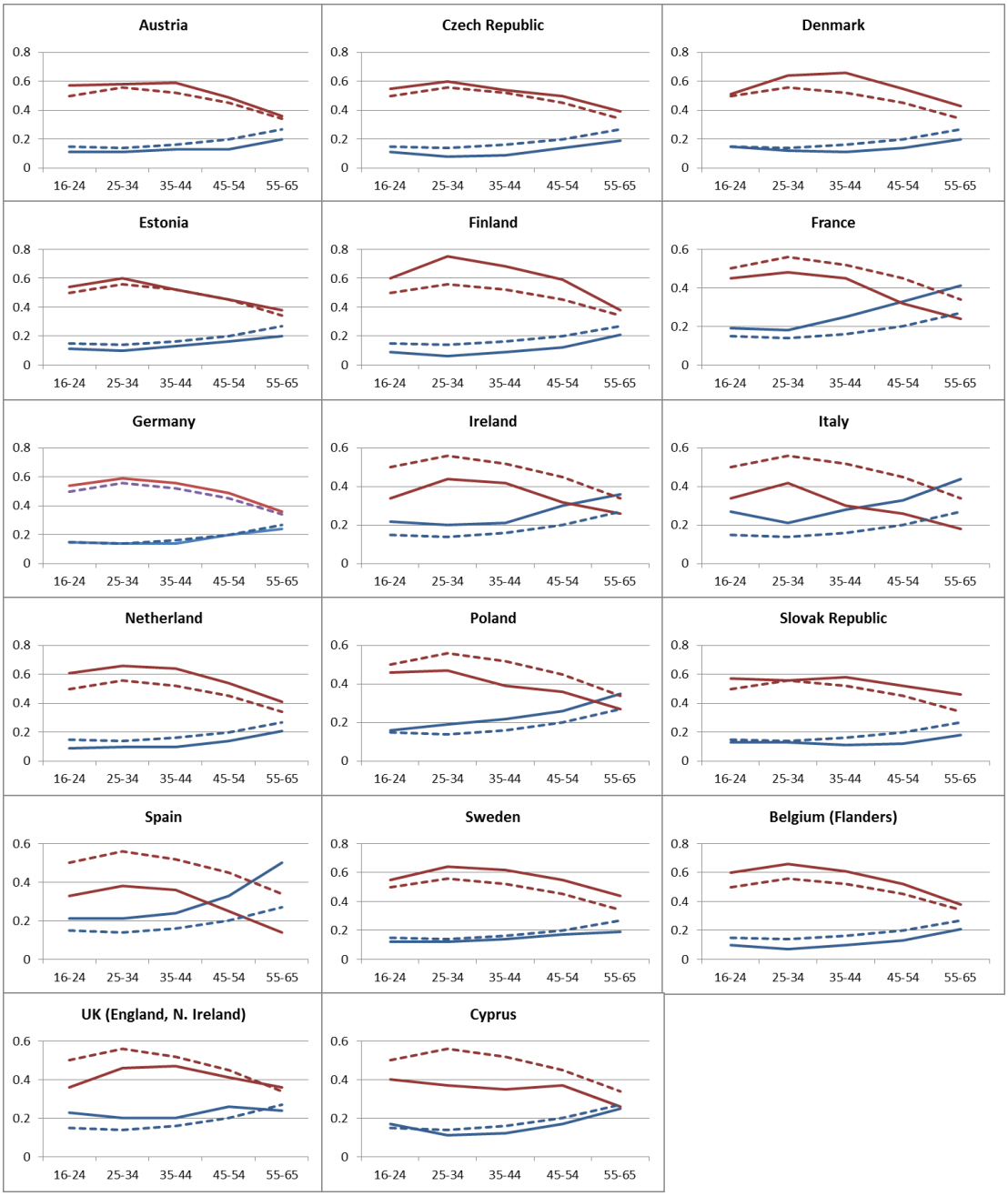
cohorts with a decreasing trend while low skill individuals tend to be overrepresented among the older age group. Compared to EU 17 weighted average, Finland, Sweden, the Netherland and to a lesser extent Belgium (Fl) have a higher percentage of high skill individuals and a lower percentage of low skill ones in all age groups. The opposite direction is true for France, Ireland and Poland and with significant differences for Italy and Spain. These Figure confirms what the literature on skills has found, i.e. that skills deteriorate and become obsolete with age.

Figure 3: Low and High Skill achievers in literacy by Age (EU 17 average in dotted lines)



In general, the trend is similar for both numeracy and literacy (Figures 3 and 4), however, it is worth highlighting that the over-representation of low skill individuals as opposed to high skill ones begins at a earlier age group in countries like Italy, and Spain (35-44) and France (45-54).

Figure 4: Low and High Skill achievers in numeracy by Age (EU 17 average in dotted lines)



Given the differences observed at the different age groups, there is no reason for excluding a specific segment in the composition of the indicator. Instead, age groups could be taken into account as a sub-group.

We also consider **gender** as a potential sub-group in order to find out whether there exist significant differences between males and females (see **Table 2**). In general, there is a larger proportion of high skill males both in numeracy and literacy than women across all EU countries considered except for Finland,

Estonia and Cyprus where the proportion of high skilled in literacy is higher among females, however the difference is greater for numeracy across all countries. (0.1 percentage point for numeracy compared to 0.02 for literacy for EU 17). On the other side, while for low skill individuals, the pattern is that there is a larger proportion of females, the proportion of low skill individuals in literacy segregated by gender does not follow a common pattern across countries. Thus, while the proportion of female low skilled is higher than their male counterparts in AT, BE, DE, NL, ES or UK; the opposite is true in CY, CZ, DK, EE, FI, FR, IT, PO, or SK.

Table 2. Distribution in the categories by gender

		Numeracy		Literacy	
Country	**Gender**	**Low skill**	**High skill**	**Low skill**	**High skill**
Austria	Male	0.11	0.58	0.14	0.5
	Female	0.16	0.46	0.16	0.44
Belgium	Male	0.1	0.61	0.12	0.55
	Female	0.16	0.48	0.15	0.5
Cyprus	Male	0.13	0.37	0.12	0.37
	Female	0.18	0.33	0.11	0.4
Czech Republic	Male	0.1	0.56	0.12	0.54
	Female	0.15	0.47	0.11	0.53
Denmark	Male	0.14	0.6	0.17	0.51
	Female	0.15	0.51	0.14	0.49
Estonia	Male	0.13	0.53	0.13	0.52
	Female	0.15	0.47	0.12	0.54
Finland	Male	0.11	0.63	0.11	0.62
	Female	0.13	0.54	0.1	0.66
France	Male	0.25	0.43	0.21	0.42
	Female	0.3	0.34	0.2	0.43
Germany	Male	0.14	0.58	0.16	0.51
	Female	0.21	0.43	0.18	0.46
Ireland	Male	0.22	0.42	0.17	0.48
	Female	0.28	0.31	0.17	0.44
Italy	Male	0.28	0.35	0.27	0.32
	Female	0.33	0.25	0.24	0.3
Netherlands	Male	0.11	0.63	0.11	0.63
	Female	0.16	0.5	0.12	0.57
Poland	Male	0.24	0.41	0.21	0.43
	Female	0.23	0.38	0.16	0.48
Slovak Republic	Male	0.14	0.54	0.12	0.53
	Female	0.13	0.54	0.11	0.53
Spain	Male	0.27	0.35	0.26	0.35
	Female	0.34	0.24	0.28	0.31
Sweden	Male	0.13	0.6	0.13	0.58
	Female	0.17	0.51	0.13	0.57
United Kingdom	Male	0.2	0.48	0.12	0.52
	Female	0.25	0.36	0.15	0.49
EU 17	Male	0.17	0.52	0.16	0.5
	Female	0.21	0.42	0.16	0.48

Therefore by simply looking at these numbers it seems that numeracy really makes the gender difference between low and high skill achievers while no so strong differences seem to exist by gender for literacy performance. That said, gender becomes another important sub-group candidate.

Next, we look into differences in **educational qualifications**. Then, we divide individuals into three main groups according to their level of education. The first group is composed by individuals with lower secondary or less –which we call "**low**"; the second by individuals with upper secondary (ISCED 3A-B, C long) or post-secondary, non-tertiary education (ISCED 4A-B-C) – which we call "**medium**"; the third group is composed by individuals with tertiary education (ISCED 5A-B, 6) – which we call "**high**".

As for the age group classification, the red solid line represents the percentage of high achievers, while the blue solid one represents its low counterparts for each country. Dotted lines represent the EU17 weighted average percentages. As expected, a common feature among all the countries is the increasing proportion of high skill achievers as the level of education increase and the decrease in the number of low achievers. (See Figures 5a and 5b). Once again, Spain, Italy and France are well below EU 17 average in the proportion of high achievers when segregated by education level, while Finland, Sweden and the Netherland are those increasing the EU average of high skill achievers.

Figure 5a. Low and High Skill achievers in literacy by level of education

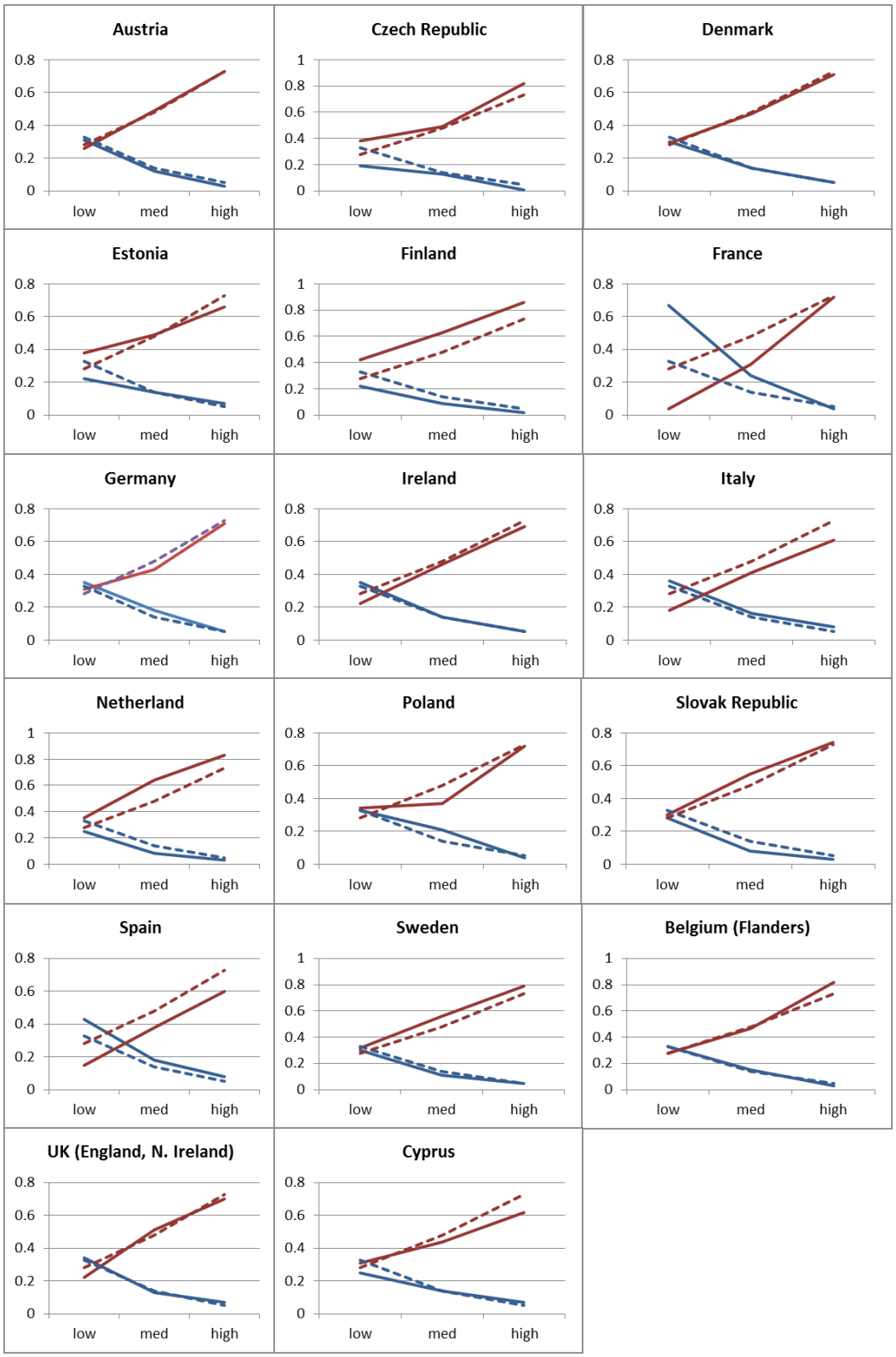
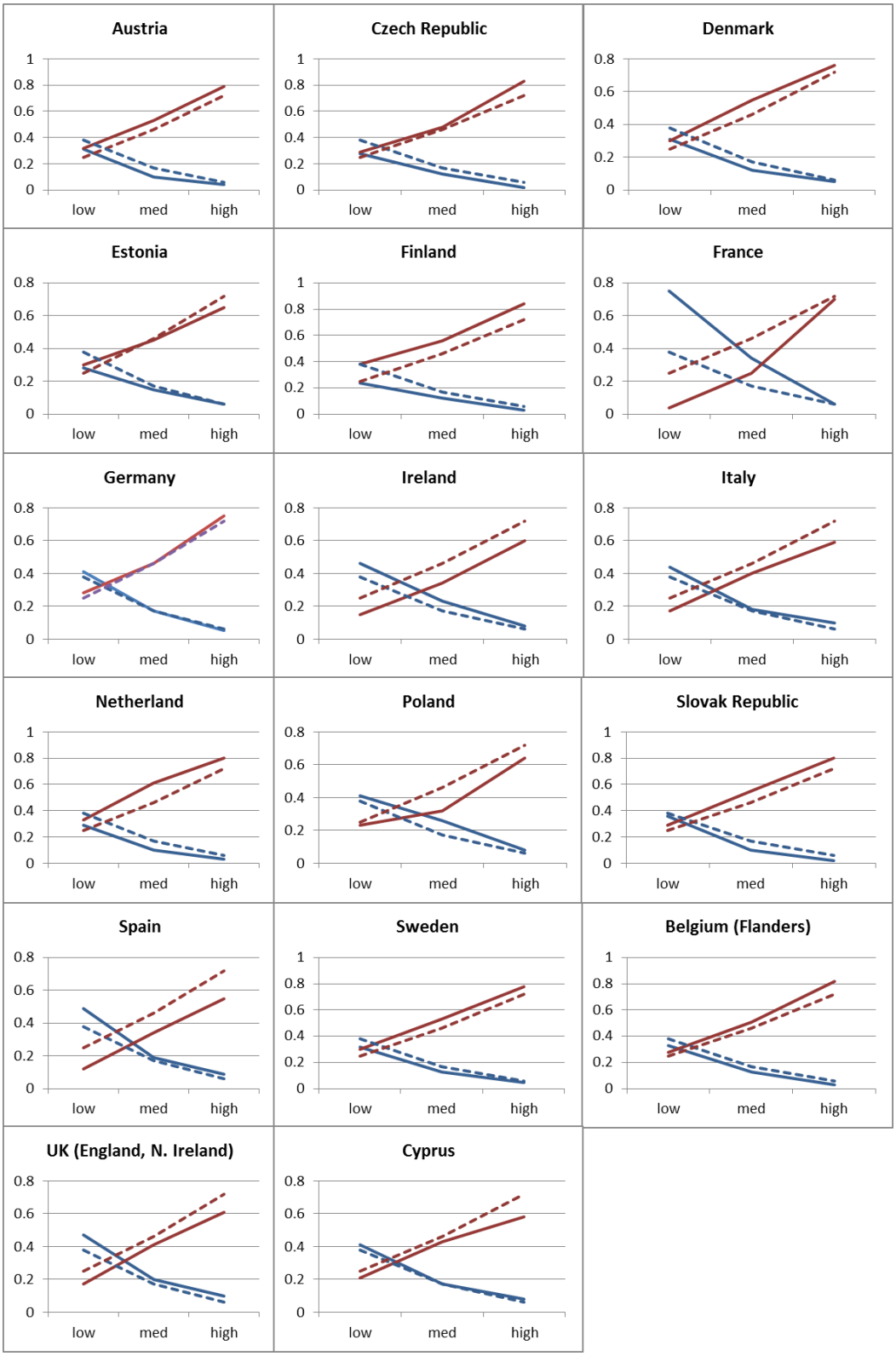


Figure 5b. Low and High Skill achievers in numeracy by level of education

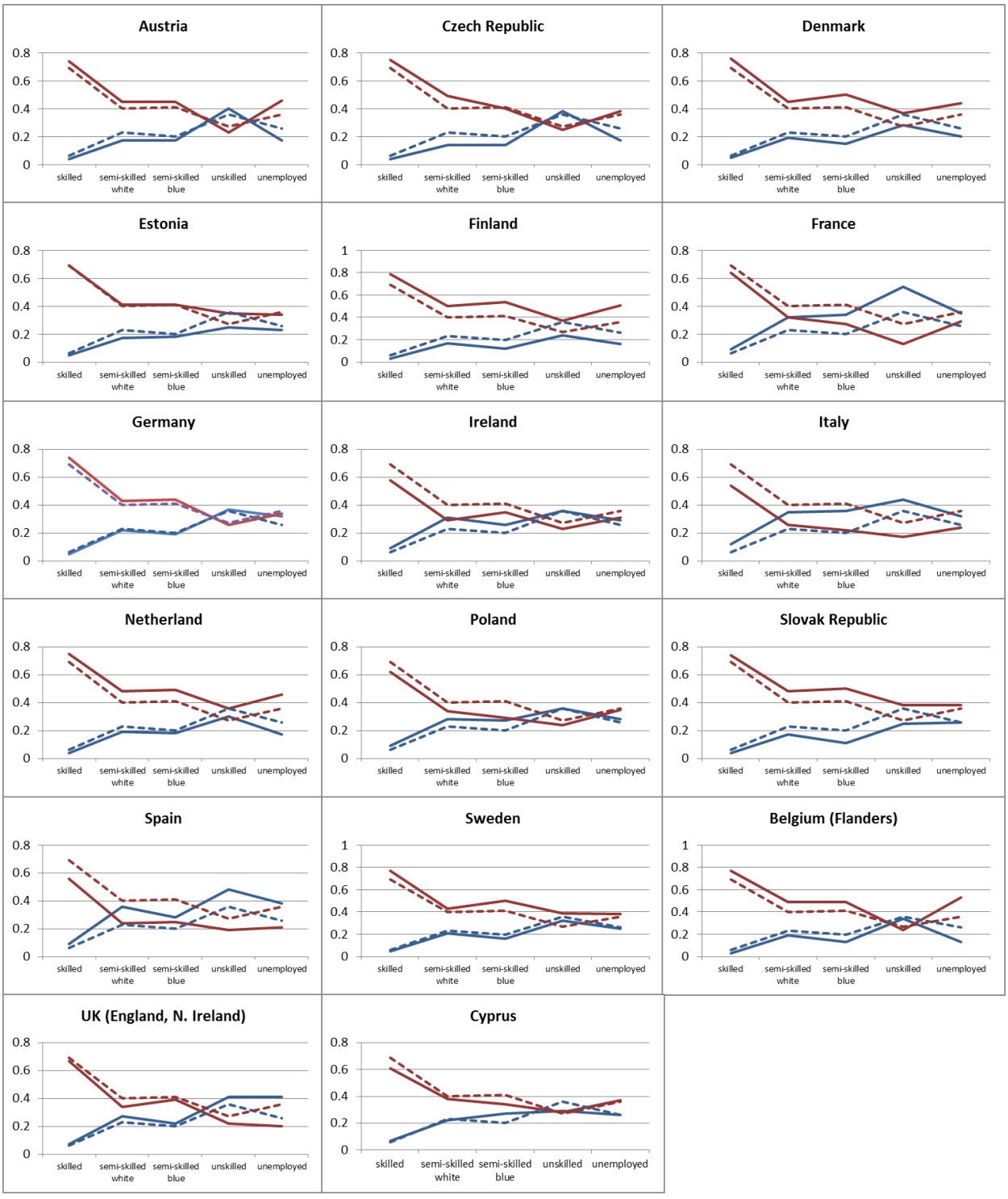


In addition, in **Figures 6a and 6b,** we divided individuals into four main groups according to their **occupations**, distinguishing between:

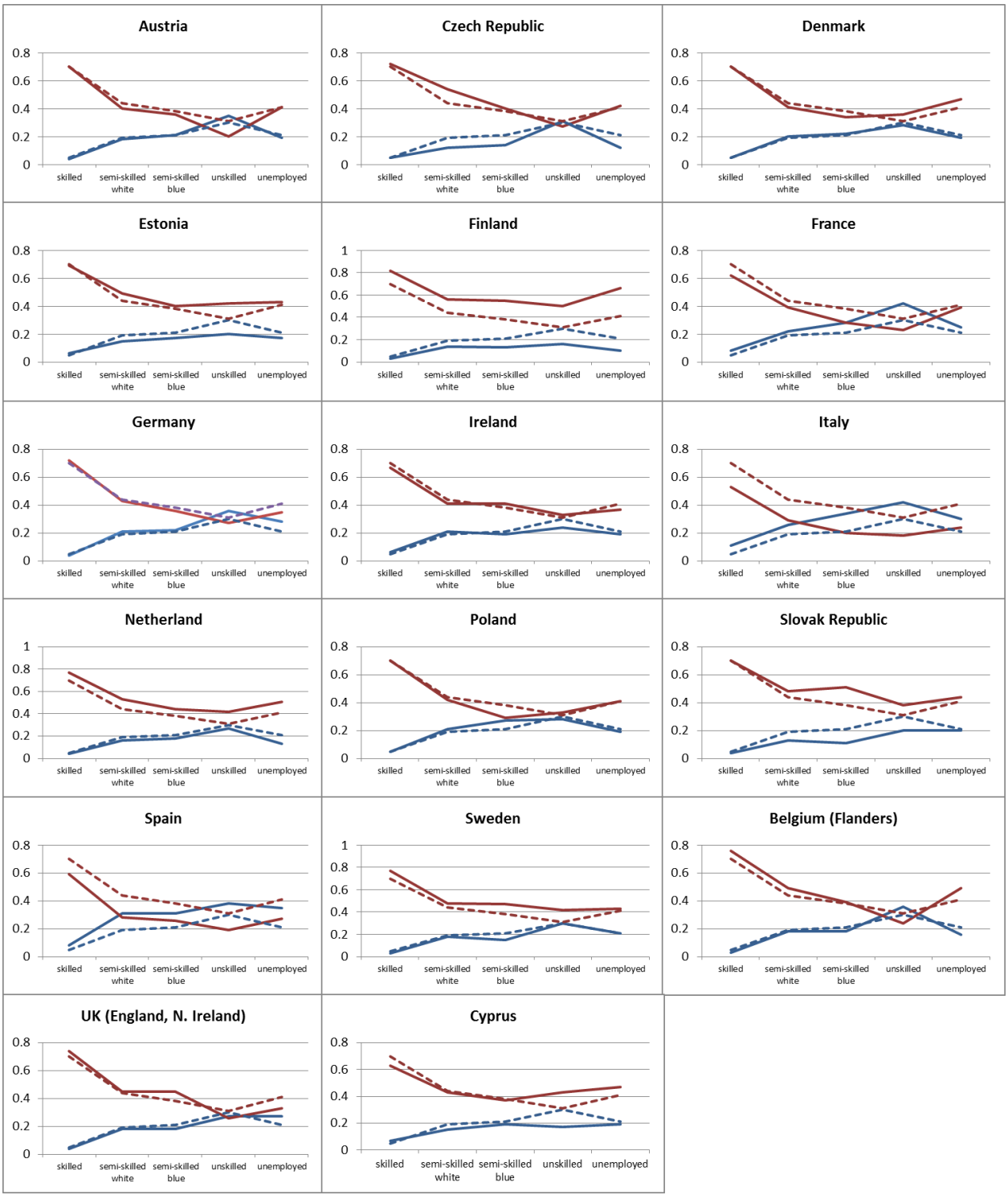
- **Skilled** occupations, including e.g. legislators, senior officials and managers; professionals; technicians and associate professionals (ISCO 1 digit 1, 2 and 3);
- **Semi-skilled white collar** occupations, including e.g. clerks; service workers and shop and market sales workers (ISCO 1 digit 4 and 5);
- **Semi-skilled blue collar** occupations, including e.g. skilled agricultural and fishery workers; craft and related trades workers; plant and machine operators and assemblers (ISCO 1 digit 6, 7 and 8);
- **Unskilled (or elementary)** occupations, including e.g. labourers (ISCO 1 digit 9).

As expected, there is a higher percentage of low skill achievers among the unskilled occupations and a higher proportion of high skill achievers among the skilled ones. Interestingly, on average, semi-skilled occupation (either blue or white collar) accumulate more or less the same share of both high and low skill achievers, suggesting a potential aggregation of these two sub-categories. Other than that, not many significant results are worth outlining.

Figures 6a and 6b. Low and High Skill achievers in numeracy by occupation



Figures 6a and 6b. Low and High Skill achievers in literacy by occupation



Lastly, before going into any type of multivariate analysis, in Table 3 we divided individuals by migrant status (Dummy equal to 1 if not born in country and 0 otherwise). Again, we observe,

as expected that there is a higher proportion of low skill achievers (both in numeracy and literacy) among the migrant population while they are less represented than native ones in the high skill achievers sub-group. The largest difference among the two categories is found in Sweden (close to 0.40 percent difference). Taking into account sample size, this is a sub-grouping which is worth maintaining to better understand the evolution of the adult skill indicator.

Table 3. Distribution in the categories by migrant status

		Numeracy		Literacy	
Country	**Migrant status**	**Low skill**	**High skill**	**Low skill**	**High skill**
Austria	Non-migrant	0.11	0.56	0.12	0.5
	Migrant	0.32	0.35	0.31	0.35
Belgium	Non-migrant	0.12	0.59	0.12	0.57
	Migrant	0.31	0.36	0.36	0.32
Cyprus	Non-migrant	0.19	0.43	0.13	0.48
	Migrant	0.21	0.43	0.23	0.42
Czech Republic	Non-migrant	0.12	0.53	0.11	0.54
	Migrant	0.19	0.37	0.17	0.46
Denmark	Non-migrant	0.11	0.59	0.12	0.53
	Migrant	0.36	0.35	0.39	0.3
Estonia	Non-migrant	0.13	0.52	0.11	0.56
	Migrant	0.21	0.37	0.22	0.36
Finland	Non-migrant	0.1	0.6	0.09	0.66
	Migrant	0.39	0.31	0.34	0.38
France	Non-migrant	0.24	0.41	0.18	0.45
	Migrant	0.52	0.17	0.42	0.24
Germany	Non-migrant	0.14	0.55	0.14	0.53
	Migrant	0.39	0.29	0.39	0.25
Ireland	Non-migrant	0.26	0.36	0.16	0.47
	Migrant	0.23	0.4	0.2	0.46
Italy	Non-migrant	0.3	0.31	0.24	0.33
	Migrant	0.4	0.23	0.43	0.15
Netherlands	Non-migrant	0.1	0.62	0.08	0.65
	Migrant	0.37	0.3	0.35	0.36
Poland	Non-migrant	0.23	0.39	0.19	0.45
	Migrant	0.61	0.21	0.17	0.41
Slovak Republic	Non-migrant	0.13	0.54	0.11	0.54
	Migrant	0.21	0.47	0.12	0.52
Spain	Non-migrant	0.28	0.31	0.25	0.35
	Migrant	0.46	0.18	0.41	0.22
Sweden	Non-migrant	0.09	0.62	0.07	0.64
	Migrant	0.43	0.28	0.42	0.3
United Kingdom	Non-migrant	0.2	0.44	0.13	0.53
	Migrant	0.37	0.3	0.29	0.41
EU 17	Non-migrant	0.17	0.5	0.14	0.52
	Migrant	0.36	0.31	0.31	0.34

2.3. Multinomial Analysis

To complement the descriptive statistics and being able to consider all the dimensions presented above jointly, plus a few other socio-economic characteristics, we run a series of non-linear probit regressions estimating the probabilities of being: 1) low skill achiever in numeracy; 2) low skill achiever in literacy; 3) high skill achiever in numeracy; and 4) high skill achiever in literacy. Since the purpose of the analysis is to further investigate on the potential sub-groups to be considered, we only run a pooled regression of all countries together. Odds ratios are reported indicating the relative probability of an event occurring for a particular group relative to a reference group. Thus, odds ratios greater than 1 represent greater chances for an event occurring for a particular group as compared to the reference group, while a value below 1 indicates lower chance. Complex survey design has been considered in the estimations. Results are reported in Table 4 (significant results are reported in bold).

Table 4. Probit Regressions (odds ratio provided).

		Numeracy		Literacy	
		High skill Achievers	**Low skill Achievers**	**High skill Achievers**	**Low skill Achievers**
Education level	Educmedium	**2.48**	**0.38**	**2.45**	**0.41**
	Educhigh	**6.59**	**0.16**	**6.16**	**0.17**
ALL	ALL	**1.49**	**0.66**	**1.52**	**0.67**
Basic characteristics	Age1624	1.22	**0.70**	**1.38**	**0.63**
	Age2534	**1.04**	1.00	**1.12**	0.96
	Age4554	**0.82**	**1.23**	**0.75**	**1.31**
	Age5564	**0.66**	**1.34**	**0.58**	**1.54**
	Female	**0.59**	**1.35**	**0.87**	0.94
	Married	**1.24**	**0.77**	**1.18**	**0.83**
	Children	**0.88**	1.06	**0.85**	**1.11**
	Parentseducated	**1.67**	**0.57**	**1.68**	**0.59**
	Migrant	**0.45**	**3.69**	**0.48**	**4.02**
SES	Skilled job	**2.58**	**0.41**	**1.65**	**0.45**
	Semi-skilled white	**1.61**	**0.68**	**1.13**	**0.70**
	Semi-skilled blue	**1.26**	**0.82**	**0.80**	0.93
	Out of labour force	**1.53**	**1.32**	**0.76**	**1.27**
	Unemployed	1.16	1.06	**0.83**	1.00

Omitted categories: Edulow, Age3544 and unskilled occupation

Results show that females are more likely than males to be low skill achiever in numeracy while not significant differences are found for the literacy competence. Women are significantly less likely to be high skill achievers both in numeracy and literacy. Having children, being a migrant or parents without

the given level of education decreases the probability of being high skill achiever in both competences and increases the probability of low skill achievers for numeracy only.

As for education, the pattern is a as expected: having a higher level of education implies higher probability of being high skill achiever and lower probability of being low skill one. For age, in general, younger age groups (35-44 years old base category) are more likely to be high skill achievers while the opposite applies to older groups. Finally for occupation we find again a similar pattern across all the countries, finding that the higher the skill of the occupation the higher the probability of being high skill achiever.

In summary, the analysis shows the appropriateness of using education, gender, occupation and migrant status as sub-groups of a potential adult skills indicator.

3. Conceptual framework for the definition of sub-indicators

The frequency for PIAAC survey is currently planned to be on a 5 year cycle but with not the same countries participating each time. That is, it may be 10 years before a country is surveyed again. Using PIAAC data is clearly not ideal for monitoring purposes. Thus, using quantitative sub-indicators as proxies of skill development is reasonable and relevant, but their choice should not be arbitrary but based on an appropriate conceptual framework. We present here the proposal of OECD et al. (2013) in developing indicators of skills (see Figure 1). Five comprehensive sub-indicator domains are identified which are related as follows. There are a range of ***contextual factors*** which affect both the supply of skills (***skill acquisition***) and the demand for skills (***skill requirements***). These factors will also have an impact on how well skills obtained through education and training are matched to skills required in the labour market (***matching***) which in turn will have an impact on economic performance, labour market outcomes and social outcomes, such as health (***outcomes***).

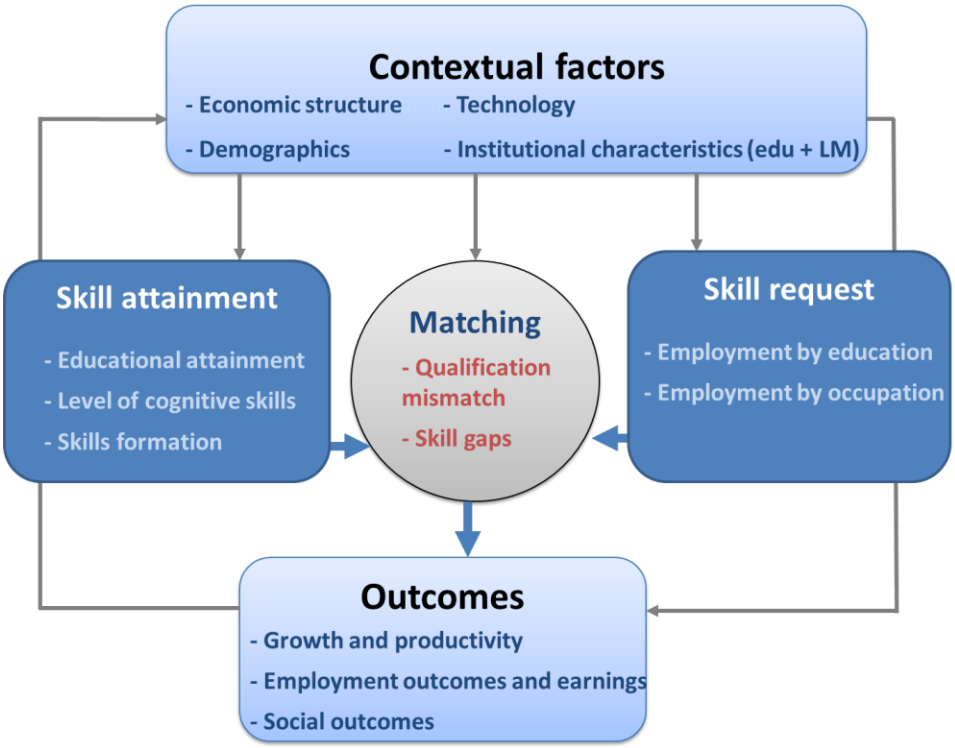


Figure 1. Conceptual Framework for sub-indicators on adult skills (OECD, et al., 2013)

The framework proposed makes clear that the set of desirable sub-indicators go beyond measuring solely the stock of human capital in each country and the ongoing investments in skill formation. A set of contextual factors is also important to capture the main drivers of skill supply and demand, as well as the key features affecting the efficiency of the matching process between them. Similarly, skill demand and matching skills related sub-indicators will determine how productive each country economy is, the efficiency of matching skills and the country's growth potential. Finally, a set of sub-indicators should also provide some information on the links between adult skills and economic, employment and social outcomes.

The sub-indicators proposed under this conceptual framework will quite likely offer a statistical snapshot of the current status of skills development in a given country putting the picture in comparative perspective. This statistical profile should provide a useful starting point for policy making.

The sub-indicators selected should at least satisfy the following key criteria:

- **Relevance.** The sub-indicators should provide useful comparative background information for assisting countries in identifying priorities for skills development and, desirably to monitor the impact of their strategies in this regard.

- **Feasibility and timeliness.** For the building up of the sub-indicators, data should be available for a reasonable number of EU countries if not all and, desirably collected on a regular basis so that the situation of each country is represented reasonably and followed accurately.

- **Comparability.** The indicators should be comparable across countries.

3.1. Proposed set of indicators

Based on the criteria highlighted and the conceptual framework proposed, a set of sub-indicators will be proposed in this document within each domain based on data availability. The resulting list is summarised in Table 5a to Table 5e under each of the five indicator domains. The choice of each sub-indicator is also justified in the Tables. Further details are provided in Annex A for some of the indicators proposed in terms of its relationship to the low skill and high skill achievers indicators. The five broad indicator domains are described in more detail below.

Contextual factors

A set of contextual indicators is required to capture the main drivers of skill supplies and demands as well as the key factors affecting the efficiency of the matching process between them. Many of these factors will also affect the outcomes of skill use. Accordingly, a range of indicators is proposed to cover areas such as: aggregate economic conditions, demographics, early childhood development, technology and work conditions, education and labour-market institutions or policy frameworks.

Skill acquisition

The domain of skill acquisition is divided into two broad areas. The first area covers the stock of human capital in the economy which has been acquired through past investments in skill formation and which is a key driver of economic growth and source of skills for meeting the requirements of employers. The second area covers ongoing investments in skill formation. This is captured by indicators on access to education and training, and opportunities for lifelong skills development. Other indicators to be included should capture skill development in growth-enhancing fields of science, technology, engineering and mathematics (STEM).

Skill requirements

Skill requirements (i.e. the demand for and utilisation of skills) will ultimately determine how productive each country's economy is and its growth potential. Two key indicators are proposed, including employment shares by education background and occupation.

Matching

Indicators are also required on the efficiency of matching skills that have been obtained through education and training with those required by employers and the self-employed. One other, more indirect, indicator of the matching process is proposed: changes in unemployment rates by educational attainment. All else equal, a change over time in the ratio of the unemployment rate by broad ISCED level relative to the overall unemployment rate provides an indicator of the change of relative demand for labour with different levels of education. Ideally, it would be useful to supplement this indicator with information based on employer surveys of skill gaps and shortages, although issues of comparability and limited availability prevent from its efficient implementation.

Outcomes

Finally, a number of indicators have been selected which may provide some information on the links between skills and economic, employment and social outcomes. In terms of economic performance, the selected indicators cover GDP growth and the level and growth of labour productivity. Employment outcomes are represented by indicators of employment rates, unemployment, youth not in employment or school, and earnings. Social outcomes are reflected in indicators of active citizenship.

Table 5a. Proposed list of indicators

Sub-indicator	Definition	Aim
CONTEXTUAL FACTORS (C)		
1.Economic structure		
C.1. **GDP per capita (PPS)**	Gross Domestic Product per capita (PPS)	Provides a measure of the overall economic size of each country and the potential resources available for skills development.
C.2.**Employment share by sector**	Shares of total employment in agriculture, mining and construction, industry and service sectors.	Provides an economy-wide measure of the general type and level of skill demands for each country. Maybe special attention should be paid to **employment in technology and knowledge-intensive sectors** at the national level, by type of occupation.
2. Demographic		
C. 3. **Relative size of youth population to the "soon" leaving working force**	Ratio of the youth population (aged 16-24) to the working-age population (56-64).	Provides a measure of the size of the potential group of new entrants to the labour market relative to the "soon" leaving working-age population and the scale of the challenge facing each country's education and training system to provide youth with appropriate skills.
3. Technology		
C.4. **Access to internet or computer or digital device**	Households having access to a computer or digital devices (to be decided if used)	Provides a proxy measure of the availability of IT technology and the potential demand for, and supply of, IT skills. May also indicate ease of carrying out job search and achieving better skill matches or the potential for developing and utilising entrepreneurial skills.
4.Institutional Characteristics		
C.5. **Public expenditure on education (as GDP or as GGE)**	Public expenditure on education as a percentage of GDP or GGE (a necessary time lag should be considered if this sub-indicator is used)	Provides a measure of public investment in human capital relative to the total resources available in the economy.
C.6. **Total public and private expenditure in life-long learning activities as % of GDP**	Proposed by "Technopolis" but source not found	
C.7. **Total public and private expenditure in primary and secondary educational level divided by the size of the cohort age 6 to 18 compared to GDP per capita**	Proposed by "Technolopolis".	This sub-indicators is used for *early school leavers* and *low achievers benchmarks*. Since adult skills refer to the working age population, this indicator does not seem to make much sense. Maybe considering the whole education system is more appropriate, but then which age cohort do you select? And how do you interpret the results?
C.8. **Ease of doing business**	World Bank's composite index of the ease of doing business.	More restrictive rules for setting up and running businesses may stifle job creation and better utilisation of human capital

Table 5b. Proposed list of indicators (continued)

Sub-indicator	Definition	Aim
SKILL SUPPLY (SS)		
1.Educational attainment		
SS.1. **Educational attainment of the adult population**	Distribution of population aged 25 years and above by highest (ISCED) level of education attained	Provides a measure of the stock of skills (as proxied by educational attainment) that are potentially available to employers and which are a key driver of economic growth.
SS.2. **Cognitive skills of students**	Mean literacy score in PISA	Provides a more direct measure of competence in key skills than educational attainment as well as a measure of the "quality" of education.
SS.3. **Share of low achievers (ET2020 benchmark)**	Share of low achievers in reading, maths and science	As above
SS.4. **Share of population with tertiary education attainment (ET2020 benchmark)**	The share of 30-34 year-olds with tertiary education attainment or equivalent.	Provides an indicator of the acquisition of high skills a precondition of the type of labour supply provided to the market.
2.Skill formation		
SS.5. **Share of population (16-65) with no completed education beyond basic one**	The share of 16-65 year-olds which did not go beyond basic education	Provides an indicator of potential low skill achievers.
SS.6. **Share of early leavers from education and training (ET2020 benchmark)**	The share of 18-24 year-olds with lower secondary education (ISCED 2) at most and who are no longer in formal or non-formal education and training	Again provides an indicator of potential adults classified as low skill achievers.
SS.7. **Share of adult population (16-65) participating in E&T in last 4 weeks**	Share of adult population (16-65) participating in E&T in last 4 weeks	Indicator of the acquisition and updating of skills through formal and non-formal training.
SS.8. **Share of vocational programmes in upper secondary education (*)**	Sum of students in ISCED 3 and 4 in the vocational track divided by the total number of students in ISCED 3 and 4.	Already used in JAF methodology. Indicates the possibility for students to obtain more vocationally-specific skills.
SS.9. **Share of tertiary enrolments/graduates in STEM subjects**	Share of graduates in the (ISCED) field of science and technology	Provides an indicator of the focus of the tertiary education system on a key area of skills demand which drives economic growth as well as on the potential supply of new labour market entrants with science and technology skills

(*) Used as sub-indicator in at least one ET 2020 benchmark

Table 5c. Proposed list of indicators (continued)

Sub-indicator	Definition	Aim
SKILL REQUEST (SR)		
1. Employment by education		

SR.1**. Share of STEM (Science, Technology, Engineering and Maths)**	Share of all enrolled tertiary students who are enrolled in the (ISCED) field of science and technology.	Provides an indicator of the focus of the tertiary education system on a key area of skills demand which drives economic growth as well as on the potential supply of new labour market entrants with science and technology skills.
SR.2**. Employment disadvantage (*)**	Difference in employment rate in percentage points between individuals with ISCED0-2 compared to individuals with ISCED 3-4	To measure disadvantage by educational attainment in labour market integration.
2. Employment by occupation		
SR2. **Employment shares by occupation**	Proportion of all employed persons by ISCO occupation (1or 2-digit). Time-series where available.	Provides a measure of the relative demand for different skill groups (as proxy by occupation) and, to the extent there are time-series data available, changes in that demand over time.
SR3. **CEDEFOP forecast on employment by sector, occupation and qualifications**	http://www.cedefop.europa.eu/EN/about-cedefop/projects/forecasting-skill-demand-and-supply/skills-forecasts.aspx	To have an idea of the skills needed in the coming years

(*) Used as sub-indicator in at least one ET 2020 benchmark

Table 5d. Proposed list of indicators (continued)

Sub-indicator	Definition	Aim
MATCHING (M)		
1. Qualification mismatch		
M.1. **Proportion of workers overqualified (*)**	Percentage of individuals aged 25-34 with tertiary education, i.e. ISCED 5-6, that work in ISCO 4-9, i.e. not as legislators, senior officials, managers and professionals (ISCO 1-2) and not as technicians and associated professionals (ISCO 3).	Already used in the ET 2020 JAF methodology, is aimed at capturing the mismatch between occupations and educational level of young people, and in particular vertical mismatch.
M.2. **Skill gaps**	Percent of firms identifying an inadequately educated workforce as a major constraint.	Provides an indicator of skill gaps or unmet demand for skills, although could also reflect firms not offering the going wage or not offering adequate training.
M.3. **Changes in unemployment rate by education**	Change over time in the ratio of the unemployment rate by broad ISCED level relative to the overall unemployment rate	Provides an indicator of the change of relative demand for labour with different levels of education.

(*) Used as sub-indicator in at least one ET 2020 benchmark

Table 5e. Proposed list of indicators (continued)

Sub-indicator	Definition	Aim
OUTCOMES (O)		
1. Growth and productivity		
O.1**. GDP growth**	Time series of annual growth in GDP	Provides an overall indicator of aggregate economic performance.
2. Employment and Unemployment		
O.2. **Employment rate by education and gender**	Employed persons aged 15 and over at each broad ISCED level as a proportion of the population aged 15 and over. Time-series where available.	Provides a measure of the impact of education on the probability of being in employment.
O.3. **Employment rate of recent graduates (ET 2020 benchmark)**	Share of recent graduates from upper secondary to tertiary education (age group 20-34) who are no longer in education and training but currently in employment	Provides a measure of the impact of education on the probability of being in employment, as well as, a measure of the school-to-work transitions of youth.
O.4. **Unemployment rate by gender**	Unemployment rate by gender for persons aged 15 and over. Time-series where available.	Provides a measure of the overall probability of being unemployed and the associated underutilisation of skills.
O.5. **Unemployment rate of adults by education**	Unemployment rate for persons aged 25 and over at each broad ISCED level. Time-series where available.	Provides a measure of the impact of education on the probability of being unemployed.
O.6. **Youth at risk (NEETS)**	Youth (15-24) not in employment or education and training (NEET) as a proportion of the youth population (15-24).	Provides a measure of the youth population most at risk of being marginalised from the labour market and underutilising their skills.
2. Social outcomes		
O.7**. Active citizenship (social)**	Share of adult population (16-64) participating in social activities	Provides information on non-market outcomes of education necessary for sustainable growth
O.8. **Active citizenship (political)**	Share of adult population (16-64) participating in political activities	Provides information on non-market outcomes of education necessary for sustainable growth.

4. Next steps to be considered for the integration in JAF methodology

The Joint Assessment Framework (JAF) is a methodology to structure the monitoring of Member States' education and training systems and to ensure its consistency and transparency. In EAC's education and training policy coordination, the JAF methodology is used as a first step in the assessment of education and training systems across Europe. The JAF is used in the preparation of the annual *Education and Training Monitor* series and the accompanying country reports[5].

Firstly, the JAF entails a quantitative analysis[6], which aims to point towards policy levers, assess the broader context and shed light on closely related domains of interest. This is done through standard breakdowns and additional sub-groups, but more importantly through a standard set of about five quantitative sub-indicators, developed and subsequently monitored in cooperation between EAC and the JRC's Centre for Research on Lifelong Learning (CRELL). Secondly, the JAF covers a more qualitative analysis[7], which aims at identifying key challenges, good outcomes and major reforms in specific education and training policy areas by using a checklist of qualitative elements to annually monitor updates. The qualitative part of the JAF is undertaken in cooperation between EAC, Eurydice and Cedefop[8].

This methodology builds on the Joint Assessment Framework (JAF) developed by DG Employment and EMCO to monitor and assess structural reforms under the Employment Guidelines through qualitative and quantitative methods. However, the JAF methodology has been adapted to analyze performance and progress in relation to the two headline indicators in education and training as well as in the four ET2020 indicators.

In order to go beyond the first snapshot provided by the six operational ET 2020 benchmarks, each indicator is broken down by a number of different sub-groups. For all indicators, two standard breakdowns apply namely, **sex** (male/female) and **country of birth** (foreign-born/native-born), except for early childhood education and care, for which the latter breakdown is not available. The benchmark is then further disaggregated according to additional sub-groups, which vary from one indicator to the other (e.g. employment status, ISCED level, age group, etc.). The purpose of the analysis of the benchmark by sub-group is to further investigate its behaviour: since very different situations can underlie the same overall

5 Latest version: http://ec.europa.eu/education/monitor.

6 By using quantitative indicators, we address all the indicators that capture events/facts by quantifying them. In other words, it concerns measures with numbers. Examples: the number of participants, the percentage of graduates, the mean score in mathematics, etc.

7 By using qualitative checklists, we address all the indicators that capture events/facts by describing them. In other words, it concerns measures with features/types of things by the use of words. Examples: the requested diploma to be a teacher, the kind of political reforms a country does in a specific field, whether or not young graduates receive guidance to get a job, etc. Unlike quantitative sub-indicators, qualitative sub-indicators have a nominal type of measurement (unranked categories/classifications) or an ordinal type of measurement (ranked categories/classifications).

8 Throughout 2014, EAC, Eurydice and Cedefop will develop *qualitative checklists*, compiled of elements taken from recent and upcoming Eurydice and Cedefop reports.

performance of the country, it is fundamental to understand what is driving it; in particular, it is relevant to see whether all sub-groups are performing similarly, or whether on the contrary there are discrepancies between them, in which case the overall indicator is hiding inequalities within the country: in this case special efforts might be required to improve the performance of these groups, thereby identifying the main country-specific challenges for reaching the targets.

Furthermore a standard set of about **five quantitative sub-indicators** is chosen to shed light on the overall country performance, in order to better explain the broad picture provided by the main indicator. The selected sub-indicators are not necessarily determinants of the main indicator, and most often do not constitute real policy levers that can be exploited to improve the country performance related to the benchmark, as it is generally very difficult to identify such factors, as well as to be able to measure them in a way which is comparable across countries.

The selection of the sub-indicators has to be carried out with the purpose of:

- hinting at policy levers that can be used;
- assessing the broader context (socio-demographic characteristics, labour market and economic conditions, etc.), in order to evaluate to what extent the country-specific situation affects the performance in terms of the benchmarks;
- shedding light on closely related domains of interest;
- eventually, explaining the behaviour of the benchmark in the medium and long term.

Data availability, sample size and comparability across countries and by sub-groups are also key factors in driving the selection of the sub-indicators. Relevance with the main indicator is also important. For example, for the Early school leavers (ESL) indicator, DG EMPL has added the NEET rate (15 to 24-year-olds not in employment, education or training) as a sub-indicator. However, we decided not to introduce this as a sub-indicator of ESL since the two indicators have two crucial differences. Firstly, the early school leaving indicator imposes a restriction on the education attainment of the captured population, whereas the NEET indicator does not. Secondly, the NEET indicator imposes a restriction on the employment status of the captured population, whereas the early school leaving indicator does not. This is why a proper conceptual framework is very important.

4.1. A proposal of sub-indicators

Our proposal of sub-indicators is presented in Table 6 below. This is not a definitive list and further amendments or analysis may be made if required for the final decision to be taken.

Table 6. Proposed list of indicators within JAF methodology

Sub-indicator	Definition	Aim
CONTEXTUAL FACTORS (C)		
1. **Access to internet or computer or digital device**	Households having access to a computer or digital devices (to be decided if used)	Provides a proxy measure of the availability of IT technology and the potential demand for, and supply of, IT skills. May also indicate ease of carrying out job search and achieving better skill matches or the potential for developing and utilising entrepreneurial skills.
SKILL SUPPLY (SS)		
2. **Cognitive skills of students**	Mean literacy score in PISA	Provides a more direct measure of competence in key skills than educational attainment as well as a measure of the "quality" of education.
3. **Share of low achievers (ET2020 benchmark) FOR LOW SKILL ACHIEVERS ONLY**	Share of low achievers in reading, maths and science	As above
4. **Share of population with tertiary education attainment (ET2020 benchmark) FOR HIGH SKILL ACHIEVERS ONLY**	The share of 30-34 year-olds with tertiary education attainment or equivalent.	Provides an indicator of the acquisition of high skills a precondition of the type of labour supply provided to the market.
SKILL REQUEST (SR)		
5. Employment disadvantage	Difference in employment rate in percentage points between individuals with ISCED0-2 compared to individuals with ISCED 3-4 FOR LOW SKILL ACHIEVERS and Difference in employment rate in percentage points between individuals with ISCED3-4 compared to individuals with ISCED 5-6 FOR HIGH SKILL ACHIEVERS and	To measure disadvantage by educational attainment in labour market integration.
MATCHING (M)		
6. **Proportion of workers overqualified**	Percentage of individuals aged 25-34 with tertiary education, i.e. ISCED 5-6, that work in ISCO 4-9, i.e. not as legislators, senior officials, managers and professionals (ISCO 1-2) and not as technicians and associated professionals (ISCO 3).	Already used in the ET 2020 JAF methodology, is aimed at capturing the mismatch between occupations and educational level of young people, and in particular vertical mismatch.
OUTCOMES (O)		
7. **Employment rate of recent graduates (ET 2020 benchmark)**	Share of recent graduates from upper secondary to tertiary education (age group 20-34) who are no longer in education and training but currently in employment	Provides a measure of the impact of education on the probability of being in employment, as well as, a measure of the school-to-work transitions of youth.
8. **Active citizenship (social) [OPTIONAL]**	Share of adult population (16-64) participating in social activities	Provides information on non-market outcomes of education necessary for sustainable growth

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ANNEX A. SCATTERPLOTS ON THE RELATIONSHIP BETTWEEN ADULT SKILLS INDICATORS AND SUB INDICATORS PROPOSED

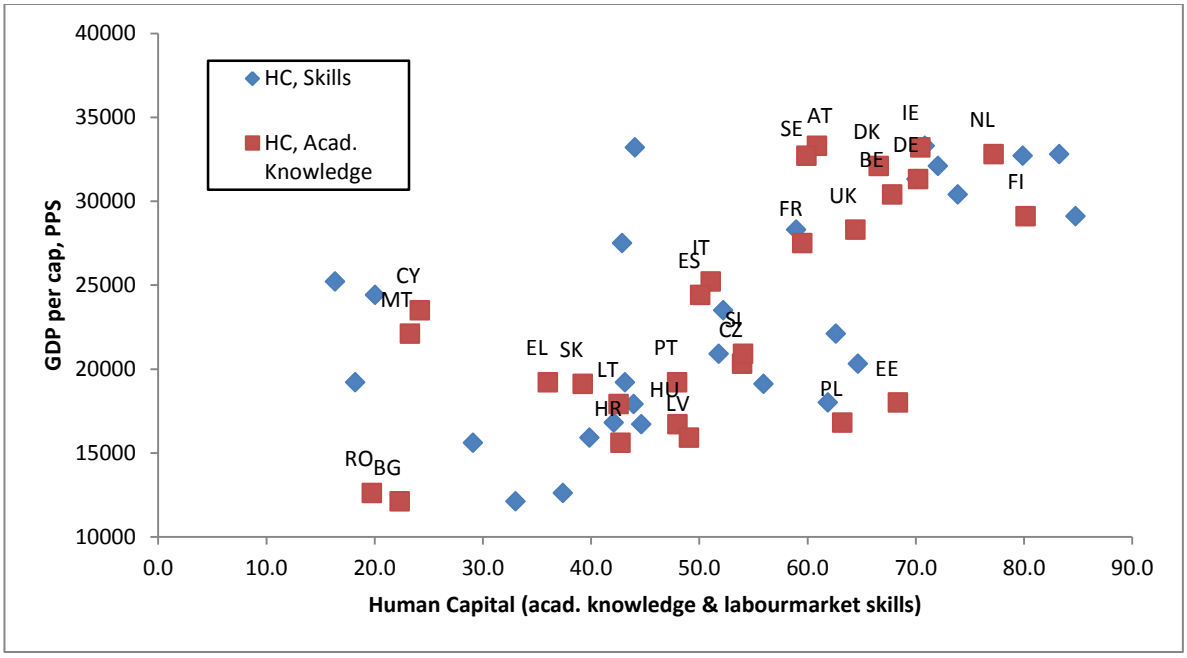

Figure A1. Human Capital and GDP per capita (PPS)

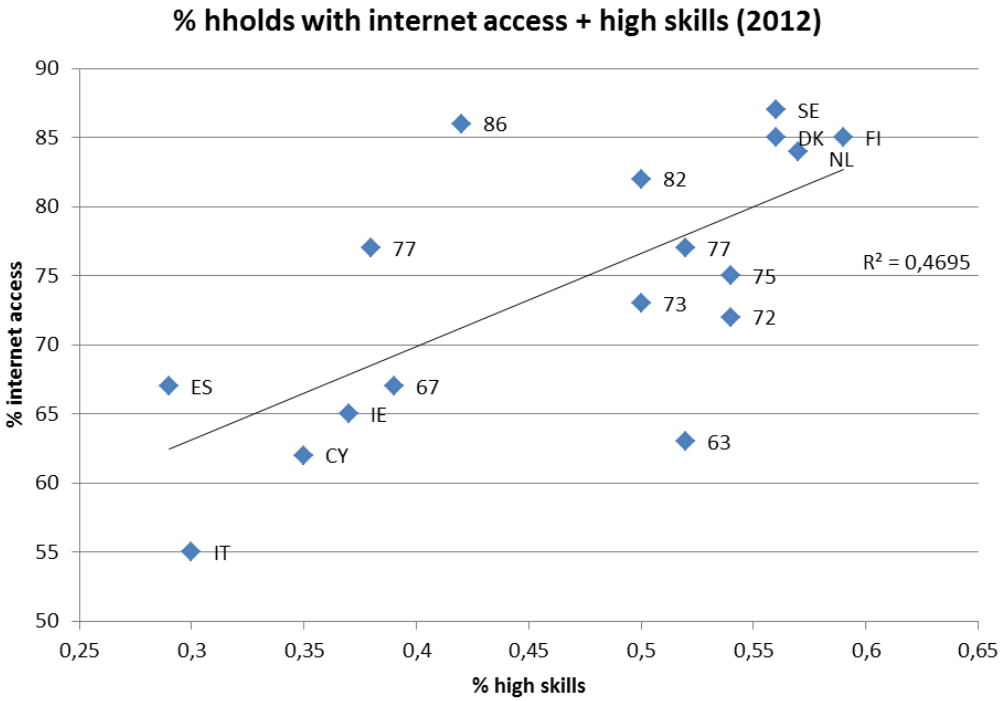

Figure A2. Access to internet and % of high skill achievers

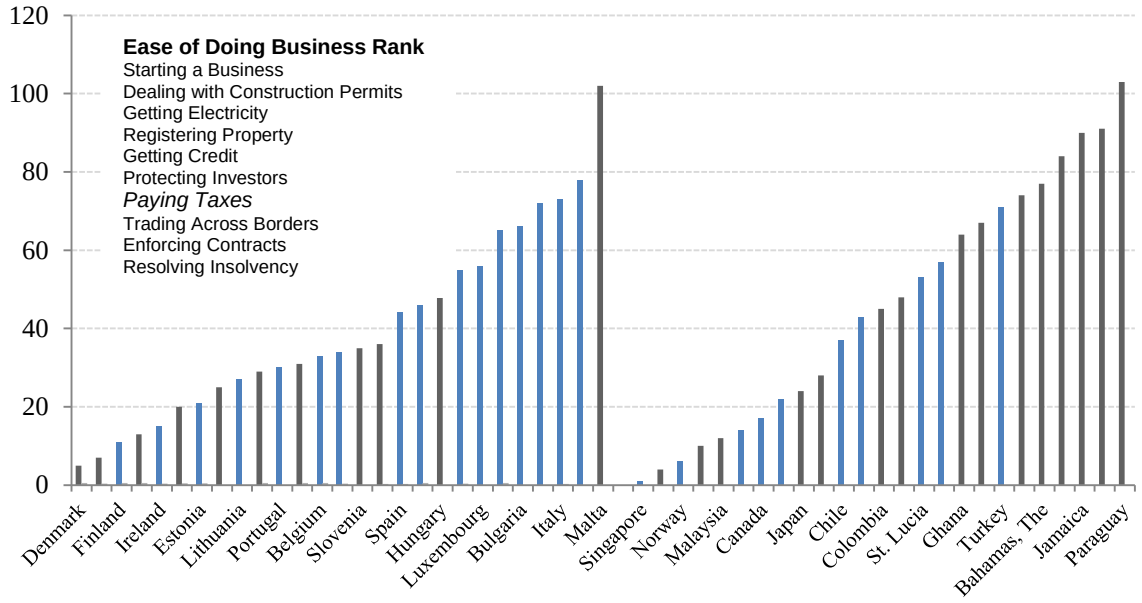

Figure A3. Ranking of countries for "easy doing business" indicator (World Bank source)

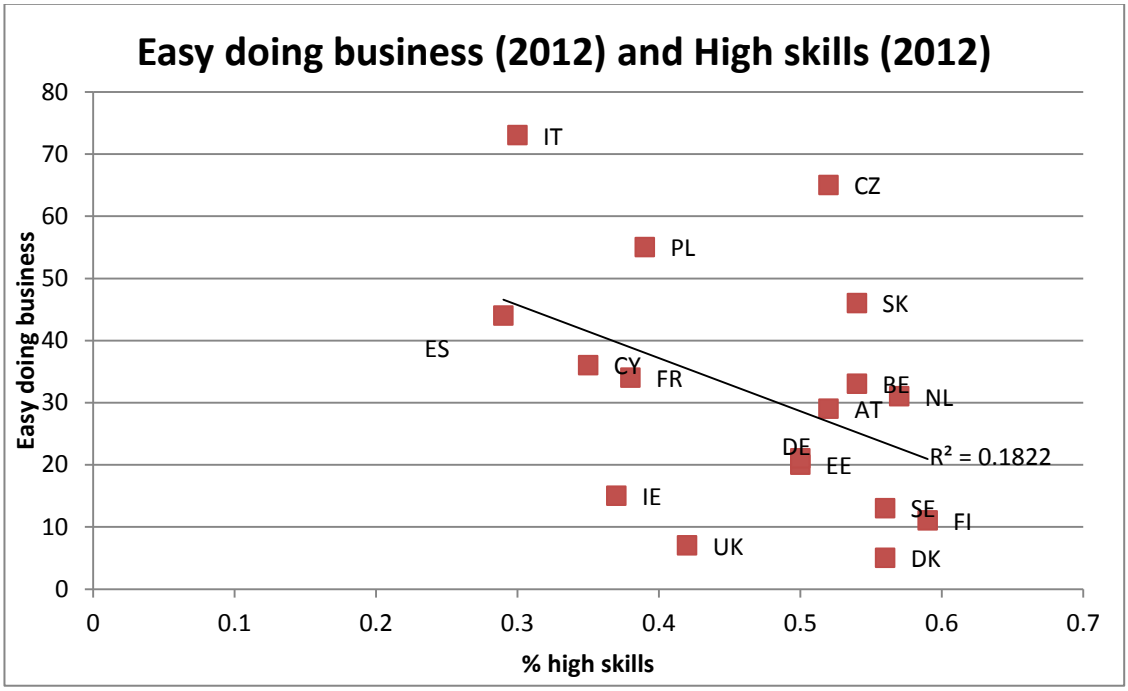

Figure A4. Scatterplot for "easy doing business" indicator and % of high skill achievers.

Table A1. Employment rate by highest level of education attainment

	ISCED 0-2	ISCED 3-4	ISCED 5-6
Belgium	38,1	65,2	81,7
Czech Republic	21,1	71,7	81,1
Denmark	55,5	76,7	86,0
Germany	52,7	76,4	87,6
Estonia	31,6	69,8	81,4
Ireland	33,8	59,6	78,9
Spain	44,1	56,6	74,8
France	44,4	66,7	80,9
Italy	43,5	64,2	76,6
Cyprus	43,7	66,0	78,8
Netherlands	59,7	78,4	87,1
Austria	49,3	77,0	86,8
Poland	23,4	61,7	82,1
Slovenia	34,6	65,8	84,2
Slovakia	15,0	65,8	74,8
Finland	41,0	72,2	84,2
Sweden	46,3	79,7	87,0
United Kingdom	53,2	71,5	83,1

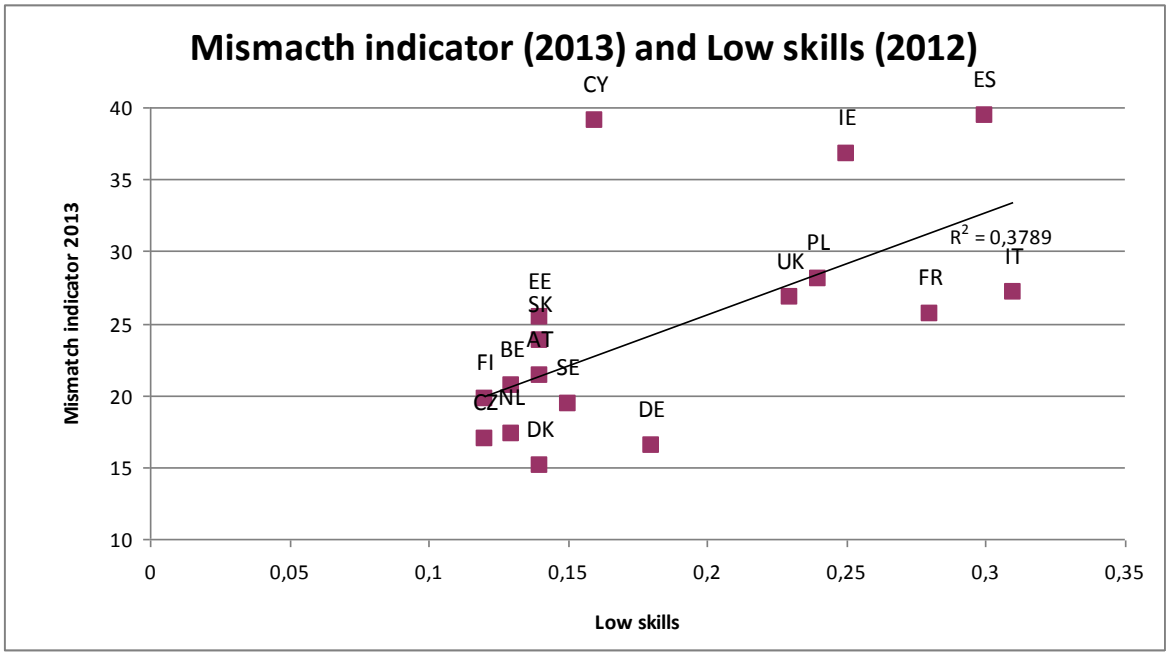

Figure A5. Scatterplot between mismatch indicator and % of low skill achievers by country

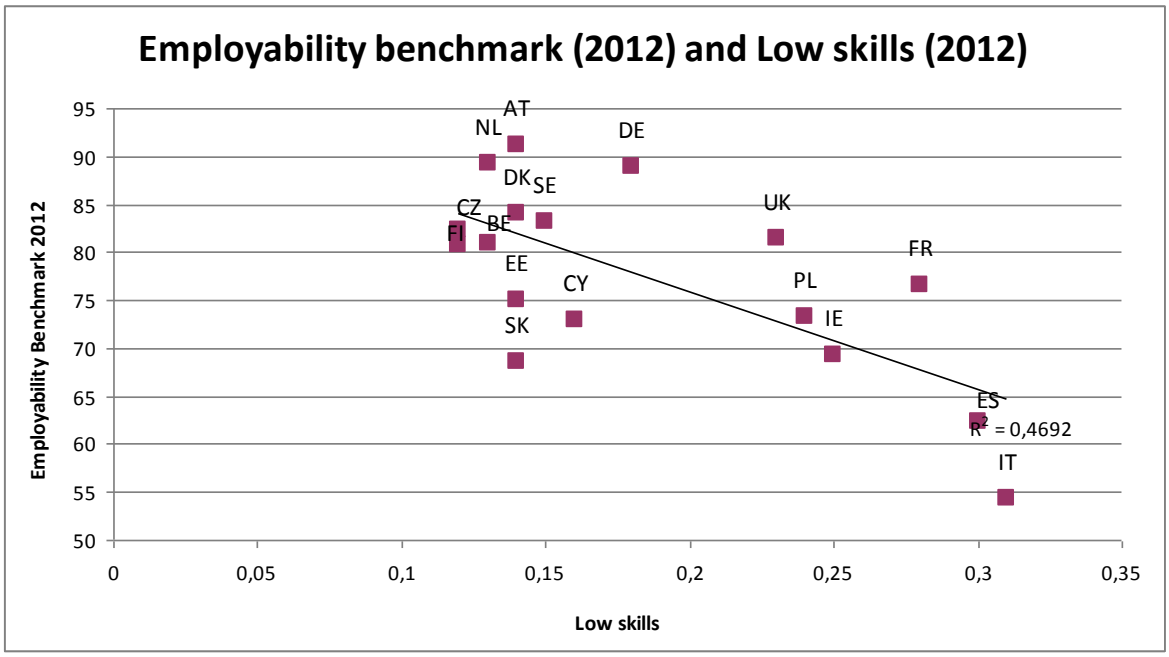

Figure A6. Employability benchmark and % of low skill achievers by country

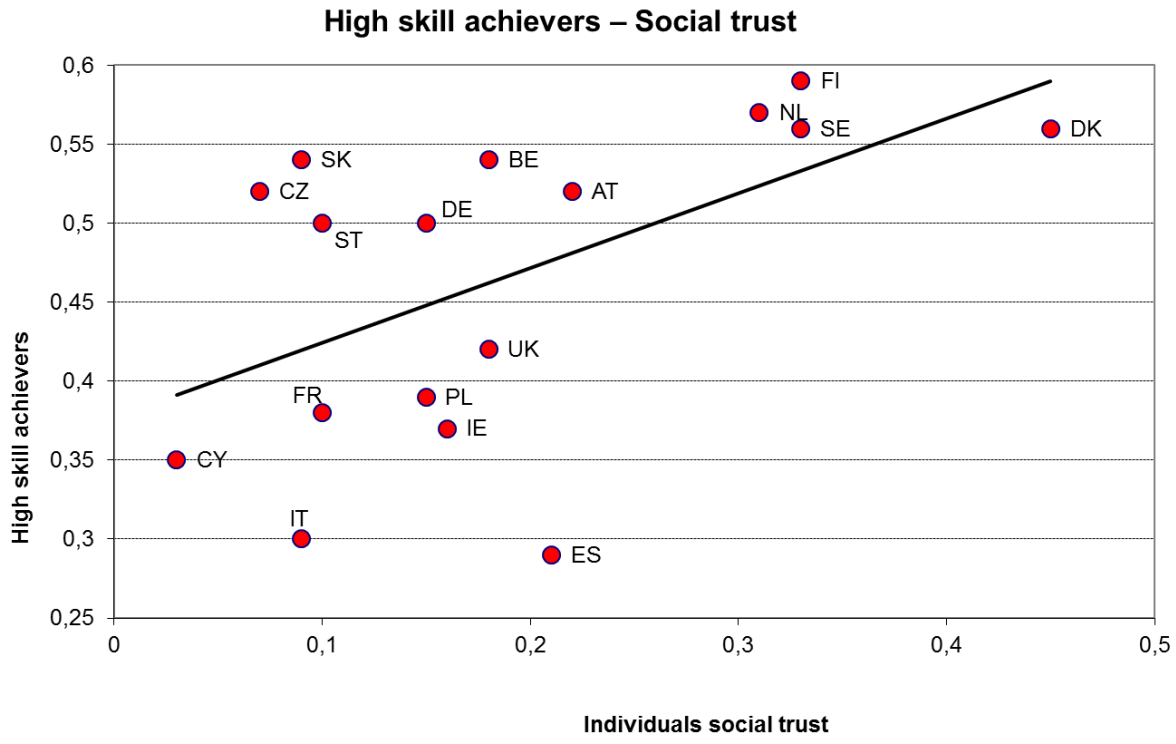

Figure A7. % of high skill achievers and individual social trust by country

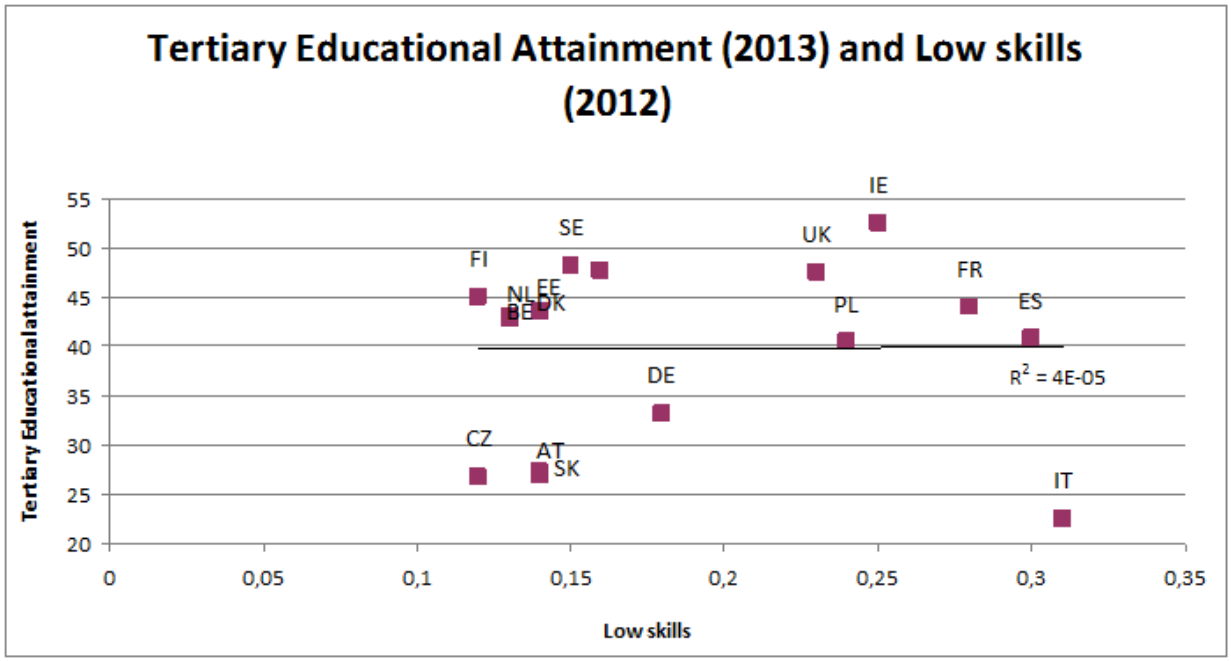

Figure A8. Tertiary educational attainment and % of low skill achievers by country

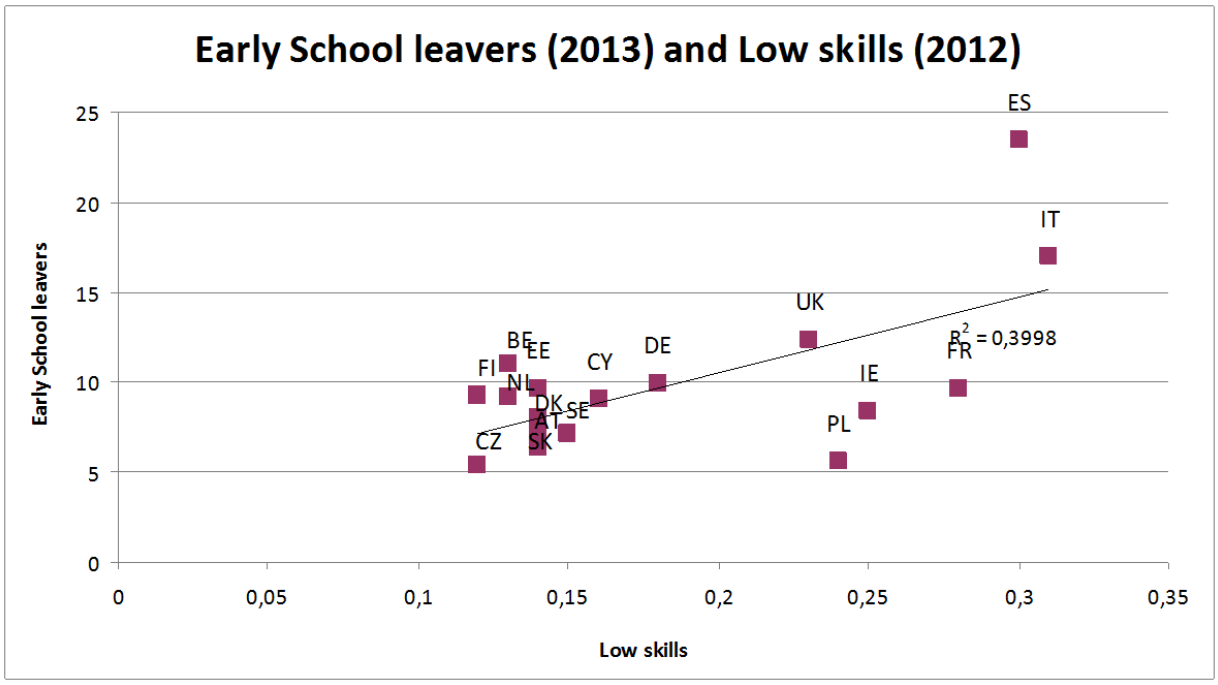

Figure A9. Early school leavers and % of low skill achievers by country

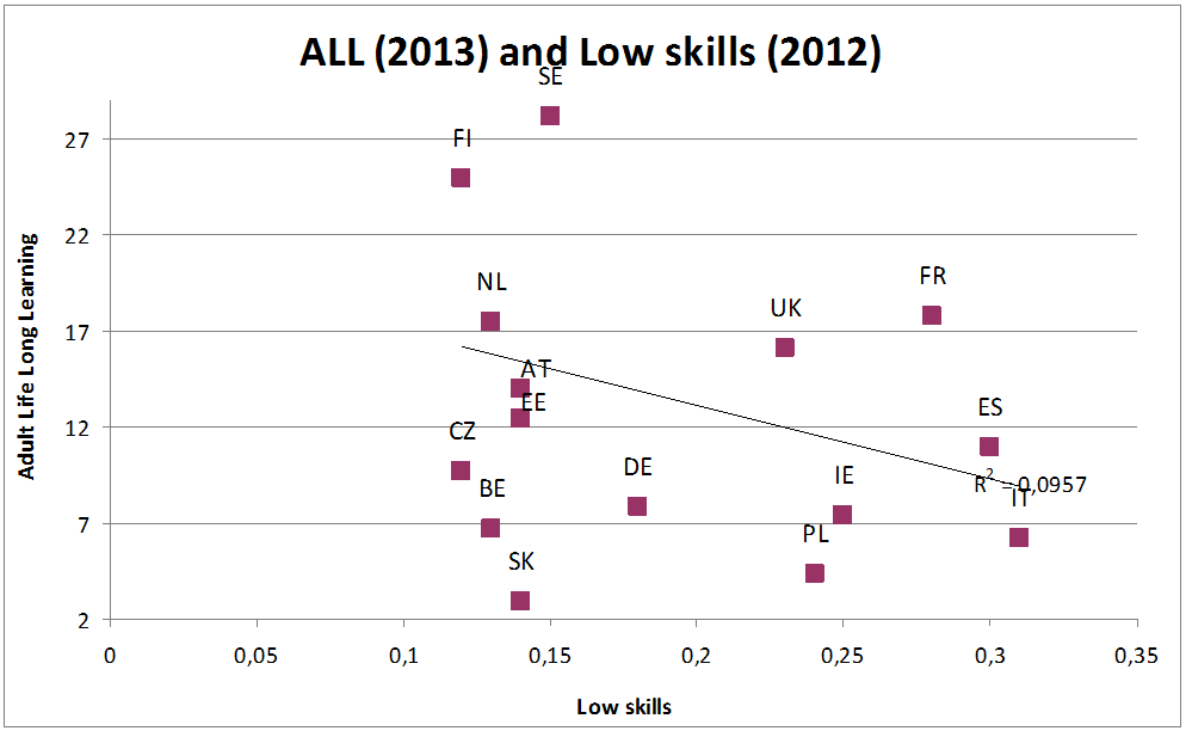

Figure A10. Adult lifelong learning and % of low skill achievers by country

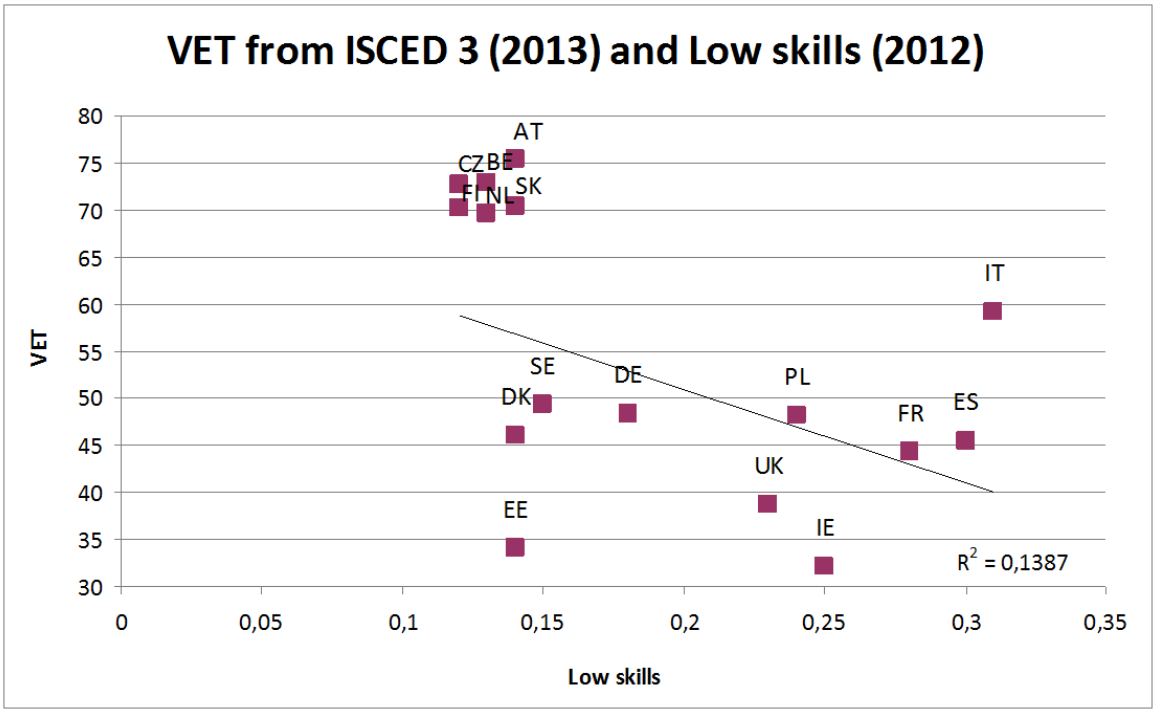

Figure A11. % of Vocational Education and Training and % of low skill achievers by country

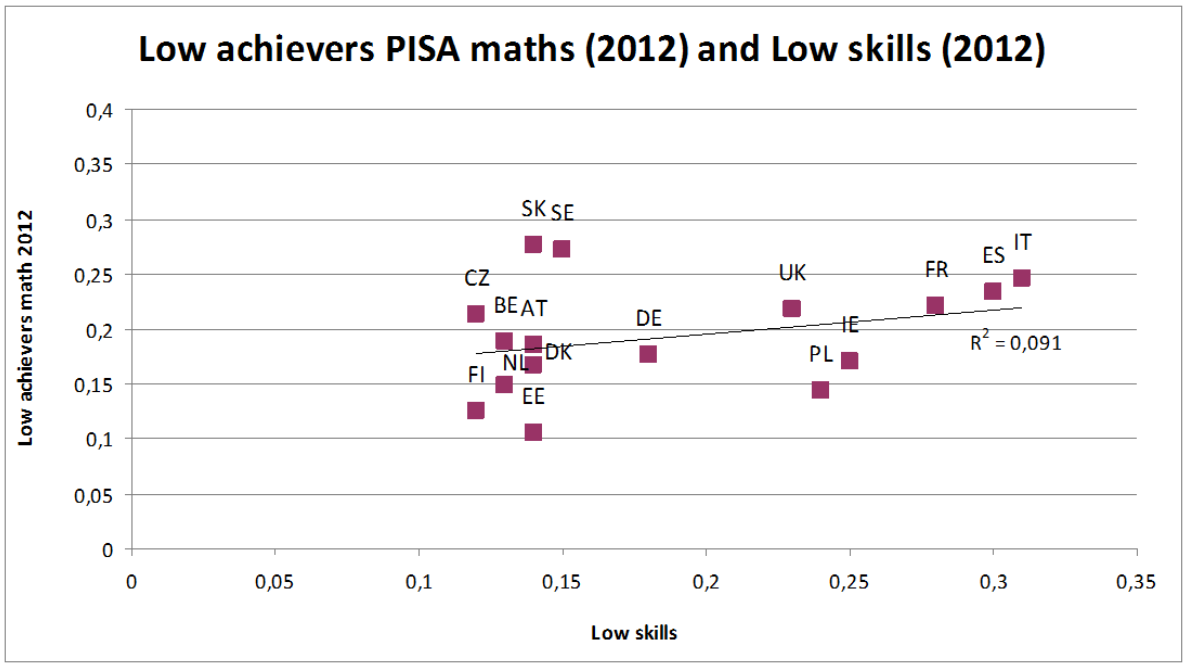

Figure A12. % of low achievers in PISA (Maths) and % of low skill achievers.

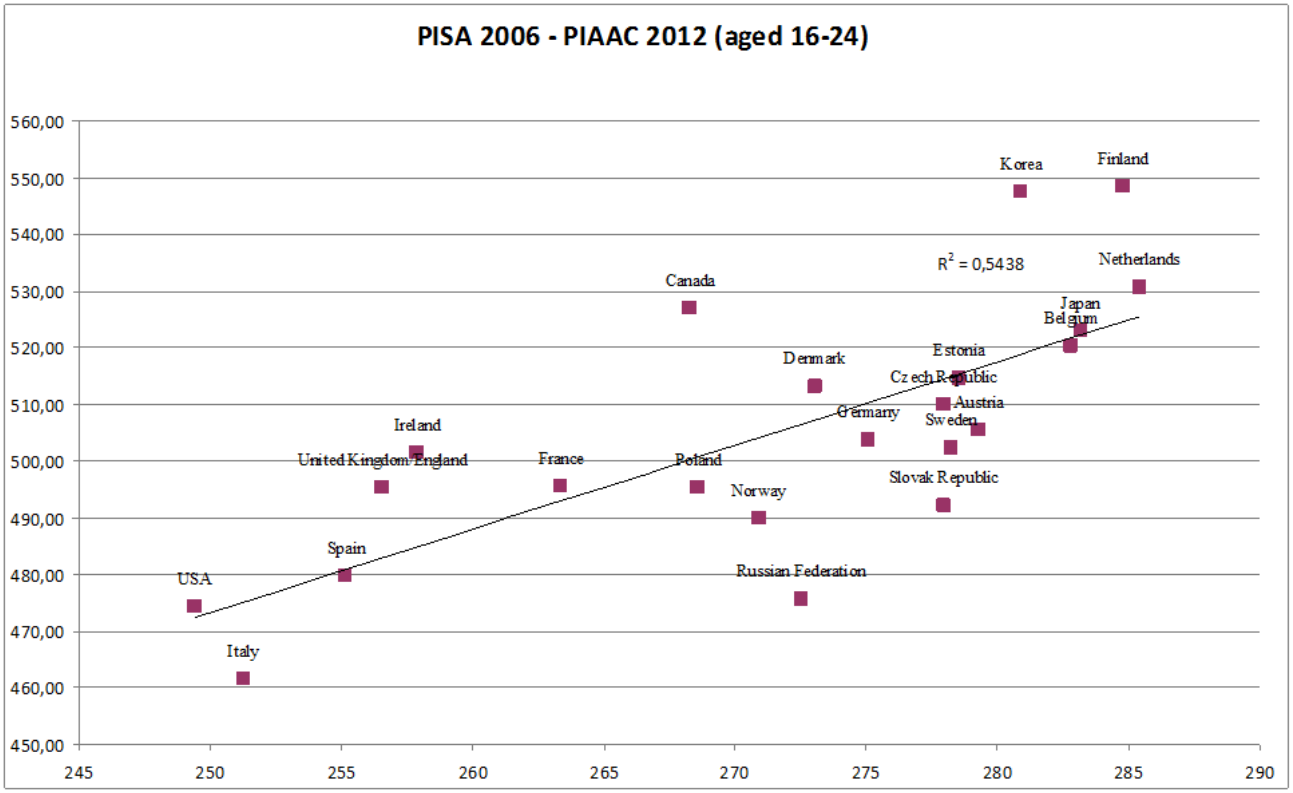

Figure A13. PISA students´performance and PIAAC achievement by country and age group 16-24 inPIAAC

European Commission
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Abstract

Thus, this paper aims to provide a framework for the collection of statistical indicators and sub-indicators on adult skills. This information can be used to monitor skill development among EU countries while comparing its progress with the agreed target and EU average performance. A preliminary list of indicators is proposed based on data availability. Some discussion on their appropriateness is also presented in line with the Joint Assessment Framework methodology (JAF). The conceptual framework and approach build upon the work of OECD et al. (2013) in developing indicators of skills in the context of developing countries.

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