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"Graduate Jobs" in OECD Countries: Development and Analysis of a Modern Skills-Based Indicator

Golo Henseke and Francis Green

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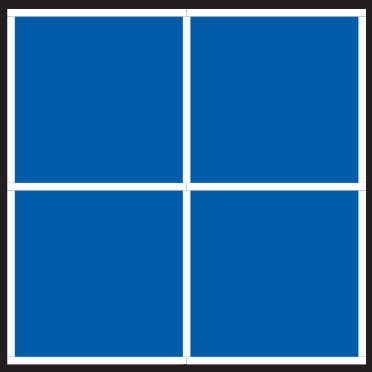

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Centre for Learning and Life Chances in Knowledge Economies and Societies (LLAKES)

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Abstract

A recurring issue for education policy-makers is the labour market effect of the long-term global mass expansion of higher education. One way in which this question is typically addressed is through the lens of the concept of the "graduate job".

In this paper we argue the need to go beyond the traditional assumption that graduate jobs are coterminous with professional and managerial occupations. We derive a new indicator of graduate jobs, termed ISCO(HE)2008, which is conceptually based on the skills used in jobs. We use task-based data drawn from the OECD's Survey of Adult Skills (SAS) of 2011/2012, applied to sixteen country-regions.

The validity of the indicator is based on consistency with concept, the fact that it generates a plausible distribution of graduate occupations, and its predictive power in relation to wages and job satisfaction. In these respects, it performs as well as or better than hitherto existing indicators. It avoids tautological descriptions of graduate jobs. The derivation procedure is replicable, open to public scrutiny, and sufficiently flexible to be applied in a range of settings.

The results using SAS show that, unlike with the traditional classifier, several jobs in major group 3 "Technicians and Associate Professionals" are classed as graduate jobs in many countries.

Altogether, 29% of jobs are classified as graduate jobs in the 16 OECD country-regions for which we have data. But there is considerable variation across industries. Graduate jobs are more prevalent in industries with high R&D intensity, in large establishments, and where the establishments are publicly owned. Across countries Germany and Japan each deploy low proportions of graduate jobs, while Norway and the Netherlands are at the opposite extreme. In the short period from 2011 to 2013, the proportion of graduate jobs has become more diverse across countries.

Keywords: *Graduate labour market, skill, OECD, wages, job satisfaction, higher education, R&D.*

1. Introduction

A recurring issue for education policy-makers is the labour market effect of the long-term global mass expansion of higher education. Across North America, Europe and Asia, school leavers' educational aspirations have risen to the point that they are now more likely than not to proceed to tertiary education, and the consequences have for the last two decades been seen in the growing stocks of tertiary-educated labour in the workforce. Between 2000 and 2011 the proportion of the population (35-64 years old) with tertiary education had grown from 22% to 32% on average across OECD countries (OECD, 2013a), and the European Union has declared a common goal to reach a proportion of at least 40% graduates in the age-group 30-34 year olds by 2020 (European Commission, 2014). By contrast, while the traditional destinations for graduates in professional and managerial occupations have expanded simultaneously, this has been to a much lower extent (Handel, 2012). If the large and ongoing rise of high-educated workers is to yield growth dividends and to meet new graduates' expectations for good jobs, the question arises: where are the jobs in which these graduates can adequately utilise their skills?

One way in which this question is typically addressed is through the lens of the concept of the "graduate job". Yet any investigation of graduate jobs begs the question as to how they are defined. Although the traditional notion of a "graduate job" in management or the professions lingers on in the language of elite HR recruiters from high-ranking universities and in the expectations of many students, we argue in this paper that there is need for a modern indicator which embraces a broader set of occupations and tasks, respecting the fact that, alongside the massification of higher education, there has been a prolonged period of skill-biased technological and organisational change and a globalisation of capital.

For a modern graduate job indicator to be useful for understanding graduate labour markets around the world, it is essential that it be rooted in the character of the job's skill requirements. In this paper, we develop and analyse a theoretically motivated, transparent and replicable classification of graduate jobs, using data from the Survey of Adult Skills (SAS) from the OECD's Programme for the International Assessment of Adult Competencies. The SAS is an international survey of key skills, skills use and socio-economic background of the adult populations aged 16-65 years. Using a method developed and validated using the British Skills and Employment Surveys (Green and Henseke, 2014), we combine self-reported information on the qualifications needed to do the job competently with rich data on skill use at work, to derive an indicator of graduate jobs. As our approach classifies ISCO 2008 minor groups, the classification can be easily applied within countries to other general purpose surveys where occupation is coded. It can also be used to deepen understanding of graduate labour demand from an international perspective.

This approach to understanding graduate labour demand complements the conventional economic approach that focuses on the economic return to higher education. While in most countries the graduate wage premium has been maintained through recent periods of HE expansion (OECD, 2014), there is some evidence of growing heterogeneity in the returns, linked in part to overeducation (Green and Zhu, 2010, Figueiredo et al., 2013). Below we use estimates of the wage premium to show the validity of the new classification in an international context, and how it compares with alternative traditional indicators.

Our classification -- which we term "ISCO(HE) 2008" -- displays a varied, country-specific picture of graduate jobs. The indicator shows that higher education is required for a considerable range of jobs, going beyond the traditional ones. We find that 29% of jobs across

16 OECD country-regions can be classified as graduate jobs. The prevalence of graduate jobs is positively associated, as expected, with industry R&D intensity, firm size and public ownership. It also varies considerably across countries, with relatively low proportions of graduate jobs in Germany, Japan and France, and relatively high proportions in Norway and the Netherlands.

The paper is structured as follows. In Section 2 we review the existing internationally comparative literature and develop the concept of graduate jobs. Section 3 introduces the Survey of Adult Skills, and describes the key indicators used in the classification. We derive the classifier in section 4 and examine its construct validity in section 5. Sections 6 presents our findings from analyses of the prevalence of graduate jobs. Section 7 concludes and discusses some limitations. The Appendix shows the occupations classified as graduate jobs across countries.

2. Background

2.1 The Concept of a Graduate Job

Following Green and Henseke (2014) we can think of a graduate job as being one where "at least a substantial portion of the skills used are normally acquired in the course of higher education, its accoutrements and its aftermath" (p.3). Graduate skills are generally thought to comprise subject-specific professional skills, cognitive skills such as problem solving and knowledge creation and management skills, as well as planning and people skills to mobilize others and oneself (Allen and Van der Velden, 2011, Barone and Ortiz, 2011). More generally, graduates are thought to command over a "combination of in-depth knowledge and flexible information-processing skills" (Barone and Ortiz, 2011). Following on from this concept, a graduate is deemed overqualified if working in a non-graduate job.

It is not easy to determine the timing, source and substance of skill acquisition. Graduate skills are the outcome of the entire history of skill formation since childhood (Heckman, 2007). Besides the skills acquired through formal education at universities and colleges, the broader higher education experience itself contributes to the development of graduate skills. Leaving home, travelling, potentially studying abroad and encountering other people with different viewpoints contribute to the individual skill set with potential productive value in the labour market. Higher education provides not only subject-specific skills but also helps to develop generic skills such as giving presentations, independent learning, delivering written documents on tight deadlines, solving complex problems and efficient learning strategies (Jackson, 2014).

Work placement including employment, internship or charitable work, either part-time during the course or full-time afterwards, is another potential source of skill formation. Students learn to apply taught skills productively at the workplace. Study-related work placement is often seen as key to secure employment (Crebert et al., 2004). Yet the prevalence of work placements varies considerably across countries: according to one recent study, for example, British, Spanish and Flemish graduates gathered much less work experience during higher education than graduates from the Netherlands or Germany (Allen and Van der Velden, 2011).

Family, friends and social networks can also contribute to skill development during higher education. Family background contributes to skill formation, potentially throughout life (Björklund and Jäntti, 2012, Björklund and Salvanes, 2011). However, its biggest effects on

individual development usually precede university studies and might thus be related to access to higher education (Heckman, 2007, Chowdry et al., 2013). This effect gives rise to suggestions that higher education is just a signal of higher abilities rather than a genuine source of skill development (Wolf, 2002), though the evidence for this is slim (Aakvik et al., 2010, Kautz et al., 2014). Nevertheless a concept of graduate jobs is more convincing if it can differentiate between skill use and credentialism.

Our proposed skills-focused concept of graduate jobs differs from alternative approaches which focus either on occupational prestige (Ganzeboom and Treiman, 1996, Macmillan and Vignoles, 2013), or more specifically on the professions (Milburn, 2009, Allen and Van der Velden, 2011) or, in line with human capital theory, on whether higher education is especially highly-valued within that occupation by the labour market (Cardoso, 2007, Gottschalk and Hansen, 2003, O'Leary and Sloane, 2014).[1] These alternatives overlap: thus skills usage, occupational prestige and pay are usually higher for "professional" occupations. Nevertheless, concentrating on the functional side of jobs, skills use, allows us to identify graduate jobs based on the tasks people carry out during their work and whether they require higher education to do so competently.

2.2. Existing Indicators

Existing studies utilise diverse principles for deriving indicators of graduate jobs. Most frequently used is the simple traditional classification based on being coded in one of the first two major ISCO groups – Managers or Professionals. To recognise the need to modernise this classification by going beyond the traditional approach, recourse is sometimes made to the idea that graduate jobs are defined by what graduates do. While this approach can be delivered in a subtle way that takes account of the age structure of occupations, and allows for exceptions or niches to be identified as graduate jobs (e.g. Elias and Purcell, 2004), at least in its simplest form this supply-driven approach is subject to the criticism that it is tautological and of limited use for analytical purposes. To replace such an approach with a conceptually more satisfactory demand-driven perspective, expert-based classificatory mechanisms may be available (e.g. Elias and Purcell, 2013, for the UK) which deploy knowledge about the tasks involved in occupations to make judgements about whether they require graduate-level skills. Some of this knowledge can be gleaned from detailed job titles. Yet, expert-based classification methods remain somewhat subjective, are hard to replicate and update, and could not be extended to an internationally comparable classification except perhaps at enormous cost.

A further method has been to identify occupations as graduate jobs when there is evidence that graduates are offered a premium within that occupation (e.g. Gottschalk and Hansen, 2003). Rooted in an assumption about the competitiveness of labour markets where scarce skills are rewarded when demanded, this method has the merit of avoiding use of self-reported job assessments. Yet it has the disadvantage that it relies on gaining unbiased estimates of within-occupation returns, which is rendered nearly impossible by the fact that occupational selection and human capital returns are closely interlinked. Moreover, the method cannot then be utilised as a tool for analysing wage returns without, again, risking tautology. The wage-returns approach would also be questionable when applied in an international comparative perspective, because there is a large international diversity in the effects of labour market institutions on wages. Among existing indicators, only the traditional indicator and the supply-driven methods

[1] See Green and Henseke (2014) for a critique of these alternative approaches.

lend themselves to an international approach. But since neither of these seem remotely adequate in the context of the modern world, with changing skills demands rendering the traditional measure out of date, and rapidly growing graduate stocks covering supply-driven indicators with a thick layer of tautology. A better method is warranted, and one that does not simply add on further major occupational groups indiscriminately without considering the concept of what a graduate job is.

Before proceeding to our improved approach, it is worth noting that one or other of the above principles for defining graduate jobs also underpins some of the indicators of overqualification found in the literature. The negative consequences of overqualification and skills underutilisation such as wage penalties, reduced job satisfaction and potential reductions in further training are well documented (Leuven and Oosterbeek, 2011, Quintini, 2011a). However, relatively little is known about graduate skills utilisation from a comparative cross-country perspective. The lack of consistent international data sources on skill utilisation has made it for some time impossible to validly compare the incidence of underutilisation across multiple countries. For instance, the European Working Conditions Survey (EWCS) has started collect information on skills utilisation from 2005 onwards. But this data has to our knowledge not yet been applied to study the labour market of university graduates across (European) countries (see Quintini, 2011b for an analysis of skills mismatch in the employed labour force in general).

A study by Croce and Ghignoni (2012) uses the European Labour Force Survey to investigate overqualification amongst graduates who hold a degree of higher education in Europe between 1998 and 2006. The study relies on the so-called "statistical" measure of overqualification, where required education is given by the modal or median or mean education level held by workers in each occupation. Graduate mismatch was worst in the Czech Republic, Germany and Austria with more than half of the graduate workforce in non-graduate jobs. Romania, Finland and Luxembourg were on the other end of the scale with a proportion of about 25% of mismatched graduates. The values for, for instance Italy, Spain and the United Kingdom were in between the extremes. In all, about 37% of graduates were overeducated in Europe at the turn of the millennium; the proportion slightly dropped to 35% in the middle of the 2000s. The authors conclude from a multivariate country level analysis that overeducation reacts mostly to short-term business cycle fluctuations.

Yet so-called "statistical" measures of over-education have received much criticism (Hartog, 2000). They are based, not on skill requirements, but on the qualifications of the people doing the job. Educational expansion and the distribution of educational achievements in the workforce vary considerably across countries (Green, 2013). Therefore, the statistical method is poorly suited for international comparisons of trends in overeducation.

The REFLEX (Research into Employment and Professional Flexibility) survey has so far been the richest source of internationally commensurate information on labour market outcomes of graduates. Collected in 2005, REFLEX sampled data on the labour market trajectories of tertiary education graduates from 1999/2000 in 16 European countries and Japan. It built on an earlier survey over 12 countries, conducted in 1999-2000 entitled CHEERS (Careers after Higher Education: a European Research Study). REFLEX provides detailed information on multiple dimensions of job mismatch, the higher education experience, labour market history, current employment and the parental background (Allen and Van der Velden, 2011). A small but hugely informative literature has evolved around this study and has provided so far the most comprehensive insights into the state of graduate labour markets in Europe and beyond. Further

international surveys based on REFLEX were later conducted in Eastern European countries ("HEGESCO") and in Latin America ("PROFLEX").

In all, 26% of the graduates were overqualified six months after they finished higher education according to the REFLEX data, but there was substantial variation between countries. In Spain, Italy and the United Kingdom more than 38% of recent graduates worked in jobs that did not require higher education, compared to less than 20% in France, Switzerland, Germany and Portugal. Five years after graduation the proportion of overqualified graduates had generally shrunk. The drop in overqualification was most pronounced in countries with initially high levels of mismatch. Germany, Switzerland and Japan were characterised by the highest persistency in average overqualification (Verhaest and Van der Velden, 2013). Variation in overeducation has been variously attributed to imbalances between the supply and demand for highly skilled labour, the quality and orientation of study programmes, skill heterogeneity within occupations, and the scarring effect of entering the labour market during a recession (Barone and Ortiz, 2011, Verhaest and Omey, 2009, Verhaest and Van der Velden, 2013).

Though the comparison is imperfect because populations did not entirely overlap, the figures for the proportions overqualified differed markedly from those reported by Croce and Ghignoni (2012). Not only was the incidence of overqualification lower in the REFLEX study despite applying to a younger population, but also the country ranking had swapped with graduates from Germany, Austria and the Czech Republic reporting the lowest proportion of overqualification. Such measurement diversity highlights the need for high quality data to track educational mismatch, especially across countries.

Overqualification is related to the concept of skills underutilisation. Overqualified workers are thought to utilise less of their skills than adequately matched graduates. However, the relation is far from perfect (Green and Zhu, 2010). The incidence of skills underutilisation varied between around 20% in Norway and Finland to almost 35% in Spain, the Czech Republic and the UK in the REFLEX data – roughly confirming the country ranking for the incidence of overeducation (Allen and Van der Velden, 2011). The country ranking also holds when horizontal mismatch, i.e. the gap between field of study and the required job-specific skills, to the exploration of mismatch, was added to the picture.

While REFLEX provides arguably the best analyses to date regarding the international deployment of recent graduates, it is not really suitable for defining a graduate jobs classifier of occupations. Not only is it now a decade old, its findings apply only to the jobs of recent graduates, not to jobs in general. It could define, on an individual level, whether workers perceive themselves to be in graduate jobs, using the self-reported single-item measure of whether a graduate-level qualification is required for the job. It is argued elsewhere that workers are generally well suited to assess the skill and qualification requirements of their job.[2] But responses to a single item will carry errors, affected by individual's self-esteem or facets of the job that are unrelated to skills usage. If unrecognised, these errors would be conveyed to the resulting indicators. An indicator of whether graduate skills are required in an occupation should aim to be purged of such errors.

In the next section we develop such an indicator. Similar to methods in health economics which rid self-reported health from reporting error, the procedure uses indicators of high skills use to

[2] There is no evidence of a substantial, systematic, bias in workers' self-assessments of their jobs, but there is a possibility of a small gender bias (Green and James, 2003).

uncover the variation in the qualification requirements that are attributable to differences in high skills demands. The classification captures the use of graduate skills independently of the sources of skills. It does not rely on assumptions about the link between higher education and wages within occupations. The method avoids the use of hard-to-replicate expert judgements and deploys an observer-neutral classification procedure, based on relatively simple statistical classification methods, while not relying on single survey item responses. The result is a transparent and replicable procedure, and an indicator that is flexible enough to allow for country differences in graduate jobs and which can be consistently amended over time as technologies and workplaces evolve.

3. Data and skills use indicators

a. The Survey of Adult Skills

We use data from the Survey of Adult Skills (SAS), which is an international survey that will eventually be carried out in 33 countries as part of the OECD's "Programme for the International Assessment of Adult Competencies" (OECD, 2013b). The fieldwork for the first round was conducted between 2011 and 2012 in 24 countries. The sample population is the respective national adult population aged 16 to 65 years. Overall, more than 120,000 people were assessed in three proficiency domains – literacy, numeracy and problem solving skills in "technology-rich environments" – and interviewed on topics covering use of skills at work and at home, the work experience, continuing training, and personal characteristics such as qualifications, family background or health. Around 5,000 interviews were carried out per country. A harmonized sampling procedure, a standardized questionnaire and shared classifications for industry, qualification and occupations ensured high comparability across countries.

The extent of data anonymisation in the public-use files differs from country to country, and affecting access to disaggregated occupation codes. At the time of the writing, only the German data has been made available as restricted use-file (Perry and Helmschrott, 2014). In all, we have information on detailed occupation codes for 15 countries: Belgium, Cyprus, the Czech Republic, Denmark, France, Germany, Italy, Japan, Korea, the Netherlands, Norway, Poland, Slovakia, Spain and the United Kingdom. This country selection covers various typed of education and training systems with varying trajectories in higher education. Data for Belgium and the UK are not nationally representative, but cover in case of the former Flanders and in the latter England and Northern Ireland. Because of data quality concerns, we excluded the Russian survey data from our analysis (OECD, 2013c).

SAS uses a complex sample design to achieve representativeness for the national target populations. To adjust for the sampling procedure, in the analyses that follow we make use of the provided probability weights to derive the correct standard errors for parameter estimates.

b. Skill Indicators

The SAS data have already been utilised to derive novel measures of skills mismatch among all employees (Allen et al., 2013, Pellizzari and Fichen, 2013). In contrast to these studies, we are specifically concerned here with the utilisation of graduate skills in the labour market

The indicator will classify minor group (3-digit) occupations, defined by the International Standard Classification of Occupations 2008 (ILO, 2012), according to whether they are graduate or non-graduate jobs. ISCO08 provides a consistent and internationally comparable framework to classify occupations, consisting of four hierarchical levels with increasingly detailed occupational groups. At the most detailed level it differentiates between 436 unit groups, which are structured into 130 minor groups and 43 sub-major groups. The top level is formed of 10 major groups: Armed Forces Occupations; Managers; Professionals; Technicians and Associate Professionals; Clerical Support Workers; Services and Sales Workers; Skilled Agricultural, Forestry and Fishery Workers; Craft and Related Trade Workers; Plant and Machine Operators and Assemblers; and Elementary Occupations.

ISCO08 groups these jobs according to the required skill level and skill specialisation as assessed by occupational experts. Jobs at the highest skill level usually demand high-level non-routine cognitive tasks such as problem-solving, decision-making and creativity drawing on an extensive knowledge base. According to ISCO documentation, most occupations in major group "1 Managers" and all occupations in "2 Professionals" utilise these high level skills. Since these skills are assumed to be normally acquired through higher education, these two groups are conceived as defining graduate jobs (European Commission, 2014). This classification forms a benchmark against which we will (below) compare our modern indicator of graduate job.

Before proceeding, it is important to note two limitations that potentially apply to any occupation-based classification of graduate jobs. Firstly, we need to assume that jobs within the basic unit (in this case, minor groups) are sufficiently homogenous in terms of skill levels to meaningful classify them as either graduate or non-graduate. Secondly, there is potential for measurement error in the occupational coding in any survey (Mathiowetz, 1992, Sullivan, 2009). Respondents might misreport their job titles or give ambiguous information, and there is the potential for ambiguity in the allocation of job titles to occupation. The problem could be exacerbated with international surveys as coding practices vary between countries. The distinction between managers and administrators (major groups 1 and 4) or professionals and associate professionals (major groups 2 and 3) can, for instance, be fuzzy (Handel, 2012). The PIAAC consortium has established safeguards at various stages of the survey design to ensure high quality and consistent occupational classification across countries. Members of the national survey teams received dedicated training to code occupations in the ISCO08 framework. Further, at least 50% of jobs had to be double coded. Potential coding conflicts were resolved by a member of the PIAAC consortium. The resulting distribution of occupations was checked against national labour force data. All participating countries passed the minimum quality criteria (OECD, 2013c).

The selected indicators are motivated by the concept of graduate jobs outlined in the section above. In all, we have constructed six variables which will form the ingredients of the classification:[3]

1. *Degree essential*: Employed respondents in SAS are asked to assess the qualification required to get their current job. Because there may be credentialism – where a qualification is asked for, but not necessary for doing the job, respondents are also asked whether the required qualification is also needed to perform the job satisfactorily. The information is

[3] Since the skills use data in SAS is internationally comparable we pool the data to derive these variables.

dichotomised according to the coding scheme in Table 7. Generally, higher education is required if a qualification at ISCED5A level or above is appropriate for the job. In cases where a master or doctoral degree is necessary to get but not essential to do the job, it is plausible to assume that a shorter higher education course will nevertheless be required to perform the job tasks satisfactory.[4,5]

Table 1: Coding of self-reported higher education requirements on the job

Higher education required to get the current job	Also needed to perform the current job	Higher education required to do the job
ISCED 6	Yes/ No	Yes(==1)
ISCED5A - Master	Yes/ No	Yes(==1)
ISCED5A - Bachelor	Yes	Yes(==1)
	No	No(==0)
<=ISCED5B	Yes/ No	No(==0)

2. *Degree essential (similar jobs)*: ISCO groups similar jobs in terms of required skill level and skill specialisation together. We exploit this construction principle to derive an indicator of the demand for higher education in jobs similar to the worker's current position. Observations within the same minor group (3-digit occupation) in the same country define the neighbourhood of similar jobs. The indicator is calculated as the average demand for higher education in the neighbourhood. Formally,

$$DN_i = \frac{1}{K(i)} \sum_{k=1}^{K} D_{k(i)},$$

where $k(i)$ described the set of observations within the same minor group and same country as job i, $D_{k(i)}$ captures the need for higher education to carry out job k in the neighbourhood of respondents i's job, and, finally, DN_i, represents the average demand for higher education in the neighbourhood of job i.

3. *3+ years of experience required*. Some graduate jobs potentially require prior work experience in addition to formal education. For certain high skill jobs, for instance managerial positions, it is essential to have command over some firm-specific or industry-specific knowledge to do the job competently. Participants in SAS report on how much related work experience is needed to get their current job. The variable is dichotomised and receives the value one if 3 or more years of experience are necessary to get the respondent's current job.

[4] There is an idiosyncrasy in the British data with respect to the relevant ISCED codes. Higher education is not further differentiated but instead subsumed into one category. We assume that a Bachelor degree will suffice to get most of the graduate jobs in Britain and treat the category accordingly within our coding scheme.

[5] In Denmark and Flanders, there were some graduate level jobs in sub-major group "95 Street and Related Sales and Service Workers". A closer inspection of the industry codes and the skill use on the job suggests that, despite the precautions by the PIAAC consortium, the occupations were most likely miscoded. We have excluded these cases from the analysis.

4. *High cognitive skills scale.* The growing use of cognitive and people skills at work is often seen as key driver of the increasing demand for graduates. It is this combination of generic skills that sets graduate jobs apart from more routine jobs. Higher education provides the holder with a comparative advantage to perform these tasks effectively (Autor and Handel, 2013, Green, 2012). The SAS background questionnaire covers a comprehensive list of skill use at work in areas such as literacy (reading and writing documents), numeracy (calculation of budgets, usage of simple algebra), the level of computer use, problem solving, organising (own work and others), and communicating (presenting, teaching). In addition, the published SAS data files include broader skill use scales derived from combinations of a selection of the single items. The scales are derived by the PIAAC consortium using Item Response Theory. The single items capture the frequency with which each task is performed, ranging in four steps from "Less than once a month" to "Every day".

   We deploy a subset of the single task items, a selection of the provided skill use scales, and some related variables to derive a 'high cognitive' skills use scale. Each component of the scales is defined as a binary variable which is one if respondents perform a specific task at least weekly (for single task items) or fall into the highest category of the included PIAAC skill use scale, and zero otherwise. The scale includes high-level numeracy, reading and writing as well as regular complex problem solving and high-level computer use. We calculate a simple average over these included components to derive values of the skill use scales.

5. *High people skills scale.* Using the same principles, the people skills scale summarises regular teaching, presenting, advising, influencing, negotiating, planning and supervisor status.

6. *High autonomy scale.* Finally, we include a measure of high job autonomy into the construction of the classification. Graduate jobs are thought to give the individuals a certain level of discretion over facets of the job. Autonomy is both a normative measure of graduates' job quality (Boccuzzo and Gianecchini, 2014, McGuinness and Sloane, 2011), but also a contributor to the skill requirements of the job. Planning one's own work, prioritizing tasks, and regulating the pace of work requires skills. In all, it is an additional dimension that distinguishes graduate jobs from non-graduate jobs, which impose stricter routines and offer less discretion. SAS data include items on self-planning and work flexibility. Work flexibility is assessed by four items on different facets of job autonomy with responses ranging from 1 "not at all" to 5 "to a very high extent". Like the skill use scale, job autonomy is measured by a summary score that covers information on how flexible workers can set their tasks, determine how the work is done, the speed of work and working hours as well as the need to plan their own work activities and time. The single indicators are again defined as binary variables with values one if respondents report very high levels of discretion for each flexibility item or state that self-planning skills are required at least on a weekly basis.[6] The final score is calculated as the average over the included items.

[6] With Cronbach's alpha for the resulting scale of 0.75, one could plausibly regard this scale as capturing a single latent construct of "high autonomy".

Table 2 summarises the descriptive statistics of these indicators for the pooled sample of 15 countries.

Table 2: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Degree essential	50249	0.226	0.418	0	1
Degree essential (similar jobs)	50249	0.226	0.287	0	1
3+ years of experience required	50249	0.208	0.406	0	1
High cognitive skills scale	50249	0.196	0.246	0	1
1. High level numeracy	50245	0.152	0.359	0	1
2. High level reading	50244	0.181	0.385	0	1
3. High level writing	50245	0.180	0.384	0	1
4. Complex Problem Solving	50169	0.342	0.474	0	1
5. High level computer use	50246	0.128	0.334	0	1
High people skills scale	50249	0.319	0.281	0	1
6. Regular Teaching	50217	0.286	0.452	0	1
7. Regular Presenting	50230	0.131	0.337	0	1
8. Regular Advising	50227	0.552	0.497	0	1
9. Regular Influencing	50171	0.471	0.499	0	1
10. Regular Negotiating	50206	0.352	0.477	0	1
11. Regular Planning	50226	0.305	0.460	0	1
12. Supervising	50223	0.138	0.345	0	1
High Autonomy scale	50249	0.353	0.259	0	1
13. High level discretion: tasks sequence	50235	0.208	0.406	0	1
14. High level discretion: how	50202	0.201	0.401	0	1
15. High level discretion: speed	50203	0.186	0.389	0	1
16. High level discretion: working hours	50240	0.092	0.289	0	1
17. Self-planning	50202	0.693	0.461	0	1
18. Self-organisation	50189	0.741	0.438	0	1

Overall, we have slightly more than 50,000 observations available to derive the classification. About 23% of respondents in the sample work in self-reported graduate jobs. A fifth of the respondents work in jobs that required long prior work experience. The cognitive skills scale is on average 0.20. Complex problem solving stands out slightly; a bit more than a third of the respondents have to think about problems that require 30 minutes or longer to come to a solution on a weekly basis. High level computer use is the least frequent item among the cognitive skill use indicators. Many people might use computers but mostly for relatively low-level tasks. The mean of the people skills scale is about 0.32 in the sample. The most common items were advising and influencing: about half of the sample uses these skills at least on a weekly basis at work. Potentially noteworthy, about 14% of job holders have supervisor responsibilities. The mean value of the autonomy scale is 0.35. Around a fifth of respondents reported high level discretion over task sequence how work is done. Working hours was an area over which workers were least likely to have significant autonomy. In contrast, more than two thirds of the workers in the sample planned their own work activities and again more than two thirds organised their own time.

This list of skill use measures is neither exhaustive nor will every graduate job necessarily demand high levels of each variable. We argue, however, that the defined variables capture different aspects of graduate jobs which, in combination, capture the non-routine cognitive and interactive-intensive characteristics that distinguish graduate from non-graduate positions. Within the set, all bivariate correlation coefficients are positive and significantly different form zero (see Table 3). Note especially that there is a relatively strong bivariate correlation between high cognitive and high people skill use, suggesting that these features tend to be bundled in the same jobs. The strong positive correlation between self-reported higher education requirements on the current job and jobs within the same minor group-country cell indicates that ISCO08 is overall successful in grouping jobs with similar educational requirements together.

Table 3: Pairwise Pearson Correlation Coefficients

	Degree essential	*Degree essential (similar jobs)*	*3+ years of required experience*	*High cognitive skills scale*	*High people skills scale*	*High autonomy scale*
Degree essential	1.000					
Degree essential (similar jobs)	0.656	1.000				
3+ years of required experience	0.231	0.231	1.000			
High cognitive skills scale	0.361	0.367	0.283	1.000		
High people skills scale	0.310	0.363	0.291	0.481	1.000	
Autonomy scale	0.188	0.219	0.225	0.296	0.333	1.000

4. Constructing ISCO(HE) 2008

a. Classifier

The classification procedure builds on our earlier work (Green and Henseke 2014). The main idea is to uncover the variation in the self-reported graduate job indicator that can be attributed to the variables capturing high skills use. The properties of the resulting classification are validated in section 0. All empirical estimation are carried out in Stata SE 13.1. We pool the available data into one international dataset.

The classifier is derived through a three-step procedure. Firstly, we estimate a latent "graduate skills requirement" score from the individual measures. Next we average the latent variable across minor group-country cells. And finally, we calculate for each country separately a threshold for the graduate skills requirement score, above which higher education is appropriate to do the job.

First, we run a probit regression of the self-reported graduate job indicator on the remaining five variables: degree essential in similar jobs, long prior experience required to get the job, cognitive and people skill use as well as job autonomy. We also include controls for age and

gender as control variables to take into account the possibility that these factors might affect the reporting of skills use in jobs. Table 4 reports the estimation results.

Table 4: Results from a probit estimation of self-reported degree requirements

	Degree essential
Degree essential (similar jobs)	3.135***
	(0.0486)
3+ years of required experience	0.217***
	(0.0304)
Cognitive skills scale	1.014***
	(0.0477)
People skills scale	0.157***
	(0.0430)
Autonomy scale	0.184***
	(0.0517)
Age	0.0120
	(0.00672)
Age^2/100	-0.0194*
	(0.00832)
Female	0.0409*
	(0.0203)
Const.	-2.349***
	(0.124)
N	50249

Survey probit using the probability and replication weights. Standard errors statistics in parentheses; * p<0.05, ** p<0.01, *** p<0.001

Generally, all skill use measures are highly significantly associated with the self-reported degree requirements. The coefficients are as expected positive. Reported degree requirements in similar jobs and the cognitive skill use scale receive the largest coefficients. The demographic variables are jointly significantly correlated with the outcome ($F(3,77)=5.76$, $p=0.0013$); however, the coefficients are relatively small.

The probit regression represents an underlying latent variable model that captures the graduate skill requirements of a job. The model does not contain country effects. Therefore, the mapping of high skill use to educational requirements is assumed to be the same across countries. The objective is to retain the variation in the latent variable that is explained by the reported high skill use variables. The remaining component is assumed to reflect other subjective influences on self-reported educational requirements, which will be discarded from the classification process.[7]

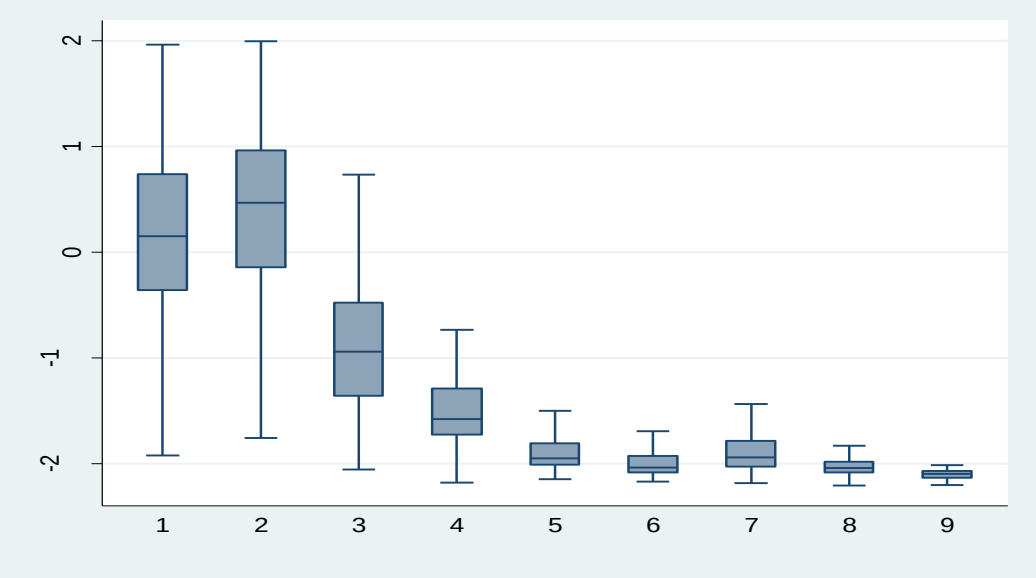
Before we predict the graduate skills requirements, we standardise the demographic composition of the workforce across countries. To do so we replace the individual demographic

[7] It is assumed, here, that self-reported educational requirements and the high skills use variables are not simultaneously affected by the same unobserved determinants, such as reporting behaviour or exerted work efforts.

information with the corresponding averages across all countries. Next, we predict the *graduate skills requirements* as a weighted average of the explanatory high-skills-use variables and the standardised control variables with the weights given by the estimated probit coefficients. As a first check, we found that almost 79% of the variation in the resulting *graduate skills requirements* score is explained by the ISCO08 minor groups, and that allowing for additional country differences increases the explained variance by only 1.5 percentage points. In other words, graduate skills requirements vary substantially between occupations and these patterns are similar across countries.

In the second step, we average the score across minor group-country cells. For cells with fewer than four observations, we impute the resulting index with the average value from the 2-digit occupation. This affects 19% of all minor group-country cells. There is the risk that we impute from overly coarse occupational groups that do not properly reflect the educational requirements for the subsumed minor-groups. However further analysis shows that 2-digit occupations explain the variations in graduate skills requirement index well. In fact, the differences in explained variance compared to the full set of minor groups is not even ten percentage points. In all, the procedure helps to reduce noise in the final classification. The distribution of the resulting *Graduate Skills Requirements Index* (GRSI), illustrated in Figure 1, varies clearly across major groups. It is generally highest, as expected, among Managers (1) and Professionals (2), with Technicians and Associate Professionals (3) somewhat lower. Nevertheless, there are stark variations within the broad groups.

Figure 1: Box Plot of the Graduate Skills Requirements Index by ISCO Major Groups 1-9 (excluding outliers and armed forces)



Note: The boxplot displays the distribution of the graduate skills requirement index. The upper and lower edges of a box represent the 75% and 35% Quartile, respectively. The median is given by the horizontal line within each box. The distance from the upper to the lower edge give the Interquartile Range (IWR); a measure of dispersion. Finally, median plus and minus 1.5 IQR determine the position of the whiskers. Outliers are not reported. Data covers all 15 countries.

In the final step, we run a k-medians cluster analysis for each country to partition jobs into a graduate and non-graduate group. The K-medians algorithm is more robust against outliers than the similar, well-established, k-means algorithm (Everitt et al., 2001). We impose a two-cluster solution. The algorithm assigns occupations to a cluster by minimizing the distance between the occupation-specific GRSI value and the cluster's centre. All occupations with a

GRSI score above the derived threshold are labelled "graduate jobs", whereas occupations below the threshold are referred to as "non-graduate" jobs.

As with most other indicators of graduate jobs – with the exception of the traditional ISCO-based indicator – the threshold between graduate and non-graduate job is allowed to vary across countries in response to the distribution of GRSI. The rationale is that the relative quality of the skill levels achieved by each education level is likely to vary somewhat between countries. Thus, employers in a country with an excellent sub-tertiary skills system are likely to be able to substitute workers with non-graduate qualifications satisfactorily to the same job that, in another country, might require graduate-level skills. Similarly, there will be variation across countries in the quality (i.e. skills output) of tertiary education. In effect, although the ISCED classification system aims at international comparability, for some purposes, including those of this paper, it is inappropriate to assume that it is a perfectly harmonised classification system.

b. Description of Classification Outcome

We term the resulting classification *ISCO(HE) 2008*. This section will provide details and discusses potential idiosyncrasies between countries. The distribution of GRSI by country, the cut-points and the proportion of graduate level minor groups are summarised in Table 5.

Table 5: Distribution of the Graduate Skills Requirement Index, the threshold between non-graduate and graduate occupations and the proportion of graduate level minor groups by country

Country	Number of minor groups	Proportion of graduate level minor groups (%)	Graduate Skills Requirement Index			
			Threshold	Min	Median	Max
Belgium (Flanders)	122	41.0	-1.202	-2.177	-1.670	1.587
Cyprus	121	45.5	-0.850	-2.127	-1.114	1.673
Czech Rep	121	32.2	-1.001	-2.179	-1.737	1.824
Denmark	124	38.7	-1.109	-2.111	-1.537	1.657
France	125	34.4	-0.841	-2.202	-1.722	1.572
Germany	124	28.2	-0.613	-2.181	-1.703	1.556
Italy	124	40.3	-0.774	-2.174	-1.381	1.737
Japan	124	39.5	-1.000	-2.140	-1.692	1.929
Korea	125	44.8	-1.185	-2.190	-1.438	1.996
Netherlands	120	33.3	-0.791	-2.205	-1.635	1.409
Norway	121	38.0	-0.671	-2.184	-1.665	1.639
Poland	125	44.0	-0.833	-2.161	-1.340	1.768
Slovak Re	123	34.1	-0.818	-2.199	-1.579	1.688
Spain	123	34.1	-0.610	-2.158	-1.437	1.962
United Kingdom (Engl. /N.Ire.)	121	41.3	-1.032	-2.160	-1.524	1.342

The proportion of graduate level minor groups varies between 28% in Germany and 46% in Cyprus (and nearly that in Korea and Poland). Compared to the country specific GRSI

distribution, the threshold between non-graduate and graduate occupations is relatively low in Belgium, Denmark and Korea, and highest in Germany, Norway and the Netherlands. In other words, higher education is required for a narrower, more skill intensive set of jobs in the latter countries, whereas in the former group higher education is also appropriate for less skill intensive jobs.

These variations in the threshold reflect the different distribution of GRSI across occupations and countries. The relative quality of post-secondary vocational education might contribute to country-specific variation in the threshold as it potentially determines when higher education becomes appropriate for a job with a given skill intensity. Further, the usual length of HE programmes might matter. For instance, prior to the Bologna Process to harmonise the HE standards across Europe, higher education programmes in Germany were between 4-5 years long. The introduction of 'short' Bachelor courses raised concern that these new graduates will not be fit to work in the traditional graduate positions due to a lack of generic cognitive and subject-specific skills (Briedis et al., 2011).

The full list of graduate and non-graduate occupations in each country is given in the appendix. While for most occupations the classification is decisive, at the margins there is ambiguity over whether higher education is appropriate to do the job competently or not. The ambiguity is hard, perhaps impossible, to avoid. The difference in GRSI between the highest scoring non-graduate and lowest scoring graduate jobs corresponds roughly to on average 2.2% of the total range in GRSI within countries; thus the step from non-graduate to graduate jobs is small and continuous. To give an impression of the grey area where higher education might be required but is not essential, we tested whether the occupation-specific GRSI is significantly above the country cut-point, and indicate which occupations fall in a grey area where the difference is not significant.

Does the overall spread of graduate occupations among major groups appear *prima facie* plausible? The classification broadly confirms ISCO's mapping of higher education to the first two major groups, but also suggests that the definition is too rigid at least for some countries where occupations outside of this narrow group require higher education (see Figure 1). Specifically, almost 90% of the minor groups in major group 1 and 93% in major group 2 are classified as graduate level jobs. However, in contrast to ISCO, roughly half of the minor groups in major group 3 are also graduate jobs. Further, there is a small but non-negligible proportion of graduate level occupations in major groups 4 "clerical support workers". Thus, in at least some countries higher education might be needed to do these jobs competently. We will come back to this result below.

The distribution of graduate and non-graduate occupations in ISCO(HE) varies across countries, as allowed for in the classification procedure. Taking, first, managers, the classification of jobs within this major group is largely stable across countries. For example, business services and administration managers are graduate jobs everywhere. But there is variation with respect to sub-major group 14 "Hospitality, Retail and Other Services Managers". Thus, "Hotel and restaurant managers" (141) are classed as graduate jobs in some countries, for example Korea, but not in others, for example the United Kingdom. Variations within major group 2 appear to stem on one hand from differences in training requirements for nurses and medical professionals in general and on the other from different qualification

demands to perform jobs as "Creative and performing artists".[8] The country differences are most pronounced in major group 3. None of the included minor groups requires a university degree in every country, but every occupation is appropriate for graduates in at least one country. Occupations such as "331 Financial and mathematical associate professionals", "333 Business services agents" or "351 Information and communications technology operations and user support technicians" are graduate jobs in most countries: this observation alone illustrates the significant error that can be made by treating managers and professional as the only graduate jobs. By contrast, "313 Process control technicians" and "342 Sports and fitness workers" are classified as graduate jobs in only a few cases. Overall, at least some of the "Technicians and Associate Professionals" occupations are graduate jobs in every country.

For most countries, graduate jobs are clustered almost exclusively in the first three major groups. However in Poland and Korea at least half of the occupations in major group 4 are classified as graduate jobs. This is surprising, seeing that the ISCO documentation suggest that secondary education should suffice to perform these jobs competently. But some positions in this major group might require advance literacy and numeracy skills and relatively high-level people skills. To investigate this question, we compared the skill use in graduate occupations within major group 4 in Korea and Poland to the skill use in the same minor group in the other countries. Table 6 gives the results.

Table 6: Comparison of skill use within graduate jobs in major group 4 across countries

ISCO08 Minor Group	Country	Degree essential	Long training	Cognitive skills use	People skills use	Autonomy
411 General office clerks	Korea	***	*	***	***	
411 General office clerks	Poland	***				
412 Secretaries (general)	Poland	**			(-)**	(-)**
413 Keyboard operators	Poland	*				
421 Tellers, money collectors and related clerks	Korea	**			(-)**	(-)*
431 Numerical clerks	Poland	***				
432 Material-recording and transport clerks	Korea	***		***	***	
441 Other clerical support workers	Korea	***	***	***	***	**

Note: p<0.1*, p<0.5**, p<0.01***, (-) indicates a negative coefficient

In general, people in graduate jobs in major group 4 were significantly more likely to report higher education requirements to do their job in Korea and Poland than across the remaining sample. In the case of Korea, this is usually mirrored in significantly higher skill use compared to people in the same occupation in the other countries. In other words, international variation in the content of occupations is driving the variation in the classification of graduate jobs. The exception is "421 Tellers, money collectors and related clerks" where required people skill and autonomy were below the average.

[8] There is the risk that the variation in graduate occupations among Health Professionals is partly the result of our imputation procedure. The low frequency minor groups "223 Traditional and complementary medicine professionals", "224 Paramedical practitioners" and "225 Veterinarians" receive the average GRSI value from the corresponding sub-major group, which is dominated by the large minor-groups "222 Nursing and midwifery professionals" and "226 Other health professionals". This constellation is specific to Health Professionals.

In Poland by contrast, skill use scales in major group 4 are indistinctive from values in the remaining countries or even below average. Job holders in major group 4 in Poland are more likely to report the need for higher education to do their work competently but this is not strictly reflected in more skill intensive job design. There are two potential explanations for this anomaly. First, there may be a remaining element of credentialism in Poland, despite the check on whether the required qualification is really needed to do the job competently. Second, there could be some coding errors.

With few rare exceptions, there are no graduate jobs in major groups 5-9. The few cases (minor groups 754 in Denmark, 511 in Italy, 511 in Korea) could stem from misallocated occupational titles or reflect noise in the data. Finally, in most countries where a classification is possible for occupations in the military, it is the Commissioned Armed Forces Officers' jobs that are graduate jobs, while others are either non-graduate or the classification is not significantly different from the threshold.

5. Validation

ISCO(HE) 2008 presents, as shown above, a *prima facie* plausible distribution of graduate jobs across major occupations, with few anomalies, and suggests that modern graduate jobs should be defined more broadly than is implied by the traditional definition. Across all country-regions, it results in 29% of jobs being classified as graduate jobs. But is this indicator valid? While its face validity is assured, in that it is based on the use of high skills, the particular operationalisation using the SAS data needs assessment.

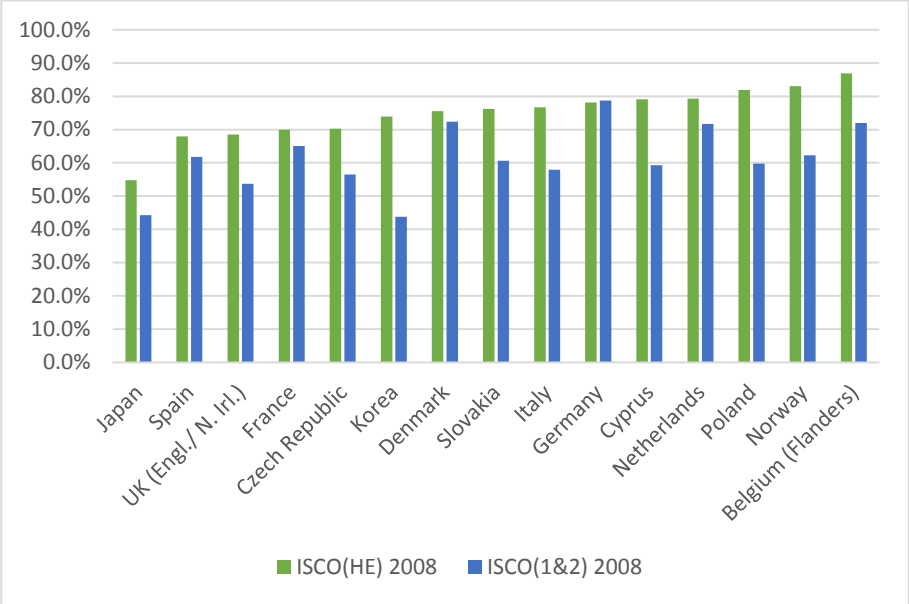
In this section, we examine the criterion validity of the indicator, by investigating the association of the indicator with expected outcomes. We analyse the deployment of graduates in graduate jobs in the employed labour force, and the connections between graduate job classification and three labour market outcomes: wages, job satisfaction, and training. We compare the performance of ISCO(HE) 2008 against traditional definitions, which we term ISCO(1&2) 2008 and ISCO(RM) 2008. The former classifies the first two major groups as graduate jobs, and other groups as non-graduate, in every country. The latter is based on what graduates do; a minor group is deemed a graduate job if the majority of workers hold a degree from higher education. This corresponds to the often applied method of realized matches in the overeducation literature that has been advocated by Verdugo and Verdugo (1989) and is still applied to measure overeducation (e.g. Boll and Leppin, 2014). Minor groups are classified country-by-country.

5.1 Deployment of Graduates and Non-Graduates

Do graduates get to work in graduate jobs? Even though matching of skilled workers to skilled jobs will be imperfect, one would expect a valid indicator of graduate jobs to reflect the matching process. Overall, we find that roughly 70% of graduates worked in a graduate job according to ISCO(HE) 2008, significantly above the 57% implied by the ISCO(1&2) 2008. The flipside is that according to ISCO(HE) 2008 relatively more non-graduates worked in graduate positions than in ISCO(1&2) 2008. The proportion is small though; only about 14% of non-graduates were active in graduate jobs based on ISCO(HE) 2008. The figure of matched graduates puts our classification results in between the findings by Croce and Ghignoni (2012) and the estimates based on REFLEX data (Verhaest and Van der Velden, 2013). The derived

proportion of matched graduates for Britain is virtually identical to earlier findings (Green and Henseke, 2014).

Figure 2: Proportion of graduates in graduate jobs across countries by classification



Base: Employed Labour Force who had finished their initial cycle of education

The proportion of matched graduates varies across countries (see Figure 2). In most countries between 70% and 80% of graduates worked in graduate jobs. Japan, Spain and the UK are at the bottom, whereas Poland, Norway and Belgium have the largest proportion of matched graduates according to ISCO(HE) 2008. The corresponding proportion of mismatch graduates are larger than the figures based on REFLEX data. The ranking of countries partly corresponds: Spain and the UK have among the highest proportion of graduates outside of graduate jobs, but the countries at the upper tail differ. Interestingly, the proportion of matched graduates varies rather more across countries when ISCO(1&2) 2008 is used, the values ranging from 44% in Japan and Korea to almost 80% in Germany. Thus, a country-specific matching of graduates to graduate jobs, using ISCO(HE) 2008, is closer than the matching indicated by a universal classification.

5.2 Labour Market Outcomes of Matched and Mismatched Graduates

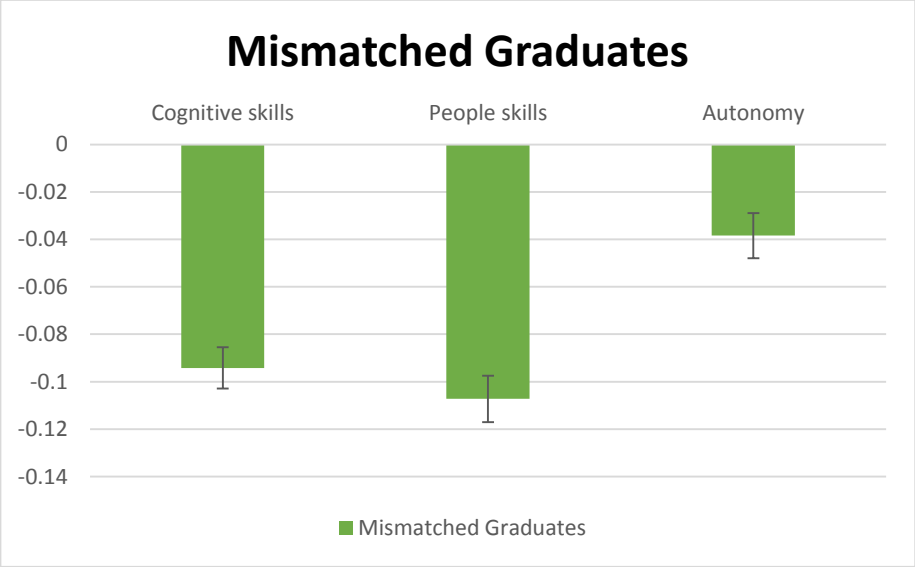
If ISCO(HE) generates a plausible picture of the deployment of graduates in graduate jobs, how well does it predict expected labour market outcomes? The better the classification, the more accurately it should predict these outcomes. Comparisons with the traditional classifier of graduate jobs (to be termed "ISCO(1&2)2008") based on ISCO major groups 1 and 2, and with a classification based on realized matches ("ISCO(RM)2008") can establish whether there is a gain in adopting ISCO(HE)2008 rather than these existing classifications.

First, it might be argued that occupations subsume multiple, not necessarily homogenous jobs, and that the job-holder determines the skills used, not the nature of the job. It is just conceivable that graduates in non-graduate occupations perform high-level jobs that are not properly captured by the occupational classification. To check this possibility, we compared skills use within skill-groups, according to whether they were in a graduate job or not. We ran linear regressions of cognitive skills, people skills and autonomy scales on a variable that

distinguishes between matched and mismatched graduates, including also controls for gender, age, sector and country dummies. The sample is restricted to working age adults, who finished their initial cycle of education and worked in an occupation within what we have called the "risk zone", where the potential for misclassification is strongest, that is, in major occupational groups where occupations are likely not to fall all in one category (1, 2, 3, and 4). Matched graduates are the reference category.

Figure 3 depicts the results on the variable of interest. The estimation results confirm that there is heterogeneity in skill use by educational level and job type: in particular, matched graduates use significantly more skills at work than mismatched graduates, while matched non-graduates use significantly less skill than their counterparts in graduate jobs.

Figure 3: Skill use on the job compared to matched graduates in the risk zone



Note: The reference category is matched graduates (graduates working in graduate jobs defined by ISCO(HE) 2008. The sample is restricted to people who finished their initial cycle of education and work in "risk zone" occupations. Controls included for gender, age, sector and country.

Next we analyse how well ISOC(HE)2008 predicts individual labour market outcomes. We expect graduates in graduate jobs to earn higher wages, to have fewer reasons to be dissatisfied with their job, and to receive more training than graduates in non-graduate jobs. These outcomes are captured as follows:

- *Log Hourly Wages:* The natural logarithm of the hourly earnings including bonuses for wages and salary earners, converted to PPP-$. Values in the 1% and 99% percentile have been removed to protect against potential distortions from outliers. Previous empirical evidence and theoretical arguments suggest that mismatched workers earn less than matched workers with the same level of education.
- *Low Job Satisfaction:* Question on job-satisfaction with values ranging in five steps from 1 "Extremely satisfied" to 5 "Extremely dissatisfied". Low job satisfaction is defined as a binary variable that distinguishes satisfied (categories 1 and 2) from non-satisfied workers (responses 3, 4 and 5). Mismatched workers are more likely to express dissatisfaction with their job (Allen and Van der Velden, 2001, Cabral Vieira, 2005).
- *Long Training:* Binary variable that receive the value one if workers participated for more than five days in non-formal job-related training in the 12 months before the interview. A value of zero is assigned if workers had either participated in non-formal job-related training

for five days and less or not at all in the last 12 months. The association between further training and mismatch status has seen much less scrutiny. But recent research suggests that further training is embedded into jobs and increases with skill use (Allen and de Grip, 2012, Mohr et al., 2015). As graduate jobs are more skill intensive, we expect matched graduates to engage more frequently in long training.

The top panel of Table 7 reports the results from linear regressions of the outcome variables on the set of covariates and the ISCO(HE)2008 classification of jobs for the total group of employed graduates. The bottom panel summarises the findings for graduates in the risk zone. We compare the results against the traditional classifier and the realised-matches classifier.

Table 7: Labour market outcomes of Matched over Mismatched Graduates, by Classification Method

	Log Hourly Wages			Job Dissatisfaction			Long Non-formal Training		
	ISCO (HE) 2008	ISCO (1&2) 2008	ISCO (RM) 2008	ISCO (HE) 2008	ISCO (1&2) 2008	ISCO (RM) 2008	ISCO (HE) 2008	ISCO (1&2) 2008	ISCO (RM) 2008
Total workforce									
Graduate Job	0.363	0.302	0.287	-0.109	-0.100	-0.081	0.078	0.054	0.052
	0.011	0.011	0.012	0.014	0.011	0.013	0.013	0.011	0.012
N	12146	12146	12146	15379	15379	15379	14521	14521	14521
R-sq	40.9%	39.0%	38.1%	5.9%	5.9%	5.5%	4.4%	4.1%	4.1%
Risk zone: ISCO Major Groups 1, 2, 3, 4									
Graduate Job	0.288	0.224	0.200	-0.096	-0.086	-0.063	0.066	0.037	0.036
	0.014	0.012	0.013	0.016	0.012	0.013	0.015	0.012	0.013
N	10917	10917	10917	13700	13700	13700	12901	12901	12901
R-sq	40.8%	39.9%	38.8%	5.5%	5.6%	5.1%	3.8%	3.6%	3.6%

Note: Results from linear regressions of the three outcomes (log hourly wage rate, job dissatisfaction and long job-related non-formal training) on the binary graduate job indicator, age, age squared, a gender dummy, set of dummies for public and not-for profit work organisations, a foreign-born dummy and a full set of country dummies. The sample is restricted to workers with completed higher education who finished their initial cycle of education.

The results confirm that working in a graduate jobs is associated with a significant pay premium, a smaller probability to express dissatisfaction with the job, and a higher probability to engage in long job-related non-formal training. The findings hold both in the total sample as well as in what we have called the "risk zone". ISCO(HE)2008 outperforms ISCO(RM)2008 and performs better or at least as well as ISCO(1&2)2008. The absolute values of the estimated coefficients and figures for R squared are generally larger than for the other two classifications.

Further validation regressions (not shown here) in the sample of graduates working in jobs in major groups 3 or 4 confirm the superior performance of our modern classifier to explain the stylised facts of over-qualification. Even in this contested group of occupations, graduates that work in graduate jobs according to ISCO(HE)2008 earned on average 22.7% more than mismatched graduates. If we had used the realised-matches classifier ISCO(RM) 2008 the estimated pay premium of matched graduates would have been 15%.

In all, the graduate jobs classifier ISCO(HE)2008 meets multiple validation criteria, and does so better than the realised-matches classifier ISCO(RM)2008 and better than or as well as traditional ISCO(1&2) 2008. Graduates in non-graduate jobs defined via ISCO(HE)2008 use lower skills at work, earn less, are more likely to be unsatisfied with their job and participate less in long training than matched graduates. The results hold in the total sample, the risk zone

and a sample restricted to major groups 3 and 4. Our approach is thus an improvement over existing practice. It is a data-driven, transparent and replicable indicator that is based on a theoretical concept of graduate jobs. It develops a more nuanced picture of graduate jobs for international comparison by taking country-specific features of the graduate labour market into account. By exploiting self-reported qualification requirements and the frequency of certain, well-defined tasks at work, we were able to test the proposed ISCO mapping of qualification levels to occupations across multiple countries. Our results suggest that the range of graduate jobs in ISCO is too narrowly focused on traditional professional positions. In most countries, graduate jobs encompass a broader field of occupations.

6. The Distribution of Graduate Jobs

The question posed in our introduction – the motivation for developing a modern graduate jobs indicator – concerned how labour markets have adjusted in the 21st century to the upskilling of labour forces around the world through the massification of higher education, alongside the ongoing rising demand for high-skilled labour. There are concerns in both western and Asian nations that the supply of graduate labour is outstripping the demand for graduate jobs (e.g. Cedefop, 2012). It is expected that the distribution of graduate jobs largely reflects this demand, and a better understanding of the demand for graduate jobs might help to inform policy makers about upcoming challenges. Especially, the state of the UK graduate labour market has come under increased scrutiny recently (Elias and Purcell, 2013, Green and Henseke, 2014, O'Leary and Sloane, 2014).

If graduate jobs go beyond the professions and management, what then is the pattern of distribution of graduate jobs, and how does their prevalence vary across countries? In this section we make use of ISCO(HE)2008 to present a preliminary analysis of the distribution of graduate jobs.

The widespread shift towards high-skill jobs is not new; it has been ongoing for at least several decades (Handel, 2012). The main attributed global drivers have been technological and organisational changes, alongside the evolving global division of labour. The emphasis has mainly been on technological change (Acemoglu and Autor, 2011, Machin and Van Reenen, 1998, Van Reenen, 2011); ICT, especially, is held to have raised the productivity of graduate workers over the last 30 years or so. This skill biased technological change has potentially spurred the demand for graduate labour and contributed to a constantly high and in some countries growing graduate wage premium, despite the continuously increasing supply.

Nevertheless, it is by no means certain that contemporary technological change is leading to an ongoing upgrading of jobs. An alternative contemporary and future scenario has been painted by certain commentators of a divergence of opportunities for graduate labour, with computerisation now leading to "digital Taylorism" and associated de-skilling of the bulk of graduate jobs, with only a minority of especially talented graduates from elite universities continuing to enjoy ever increasing favour in the labour market (Beaudry et al., 2013, Beaudry et al., 2014, Brown et al., 2011). Resolution of these contrasting predictions may only emerge as the future unfolds, but it remains useful to ask whether the distribution of graduate jobs in the current era is positively linked to technology, and work organisation.

While transferable technology is expected to be widely diffused, it is expected nevertheless that the pace of absorption varies according to the capacity of firms and their employees to absorb

new techniques and processes (Zahra and George, 2002). Management skills and systems of work organisation are among the important factors influencing such absorptive capacity. Regions that become stuck in "low-skills" equilibria can exhibit sustained low levels of skills demand, while other regions move ahead (Giguère and Froy, 2009). Some cross-national/cross-regional variation in the demand for high-level skills is thus to be expected. The extent to which such demand is manifested in graduate jobs depends further on the relative quality of high-end skilled labour emerging from countries' VET systems. For many tasks such labour may have a relatively high degree of substitutability for graduate labour.

Equally, the use of graduate labour can depend on the skills of the graduates, which are not only heterogeneous within nations but likely to vary across countries. It is for this reason that in the construction of SOC(HE)2008 we allowed the latent skills requirement threshold between graduate and non-graduate jobs to vary across nations: in countries where the quality of higher education is high *relative* to the quality of substitutable high-end vocationally-trained labour, there is likely to be a greater prevalence of graduate jobs. A further factor will be the relative costs of these different types of high-skilled labour, in turn reflecting labour market institutions and supply conditions in the long-term.

All these factors provide good reasons to expect notable variations in the disposition of graduate jobs, an expectation that is born out by application of the ISCO(HE)2008 indicator using the SAS data. As can be seen in Figure 6 and Table 8 (first column), the prevalence of graduate jobs varies considerably across countries. There is a group of countries -- consisting of Germany, France, Japan, the Czech Republic, Italy and Spain – with a distinctly lower proportion of graduate jobs than the remaining countries. It is lowest in Germany, France and Japan (22-25%) and almost double that in Flanders, the Netherlands and Norway (43-44%).

To some extent, this pattern of cross-country variation might reflect measurable structural factors that affect the demand for high-skilled labour, principally the different industrial compositions and the intensity of technological change as indicated by the intensity of R&D activities relative to gross value added. To capture these effects, we ran a linear regression of our graduate job indicator on these explanatory variables in the pooled data, including the provided sampling weights. The resulting gap between observed and predicted proportion of graduate jobs provides a measure of country-specific idiosyncrasies.

The regression (not shown) confirmed that the prevalence of graduate jobs is higher in industries with higher R&D intensities. In addition, however, service sector industries such as Information and Communication, Financial and insurance activities, real estate activities, professional, scientific and technical activities as well as Education had more graduate jobs than their R&D intensity would suggest. Another factor is that the prevalence of graduate jobs was larger in bigger workplace, everything else constant. Finally, the prevalence of graduate jobs is significantly greater in public and third sector workplaces than in private sector workplaces, even within the same broad industry.

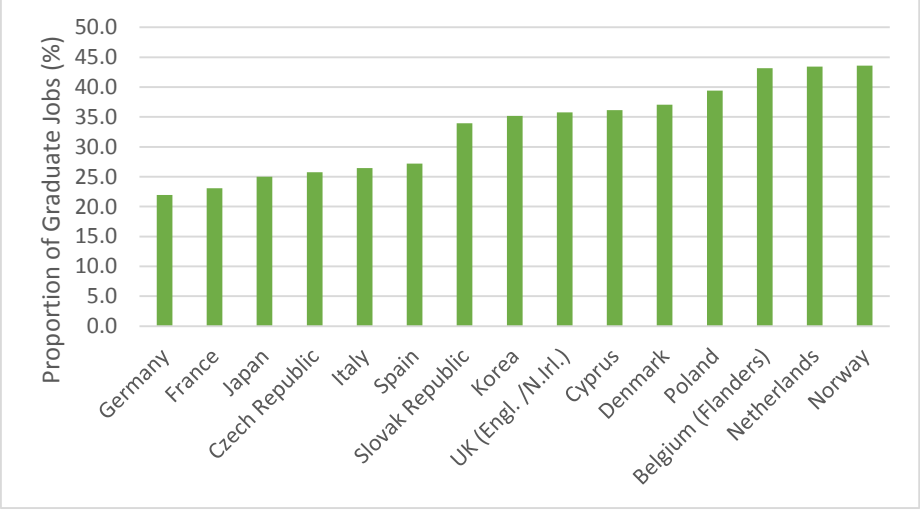
Using these findings, the second column of Table 8 shows the "surplus", that is, the extent to which in each country the prevalence of graduate jobs is above or below the level predicted by the industrial structure and other characteristics of each country. The surplus varies between -7.9% (DEU) and 11.9% (BEL). One can see for example that Germany has a large negative surplus, implying that its low prevalence of graduate jobs has nothing to do with its level of R&D or its industrial composition. So even conditional on the industry structure and the R&D intensity large country specific differences in the demand for graduate skills remain. In fact, the

value range between the smallest and largest surplus is, at 19.8 percentage points, only slightly below the range of observed proportions of graduate jobs across countries.

If it is not down to industry structure or to R&D intensity, to what extent can one account for the considerable cross-country differences in the use of graduate labour? As noted above, vocational and academic skills are, to a certain extent, substitutes (Card and Lemieux, 2001, Fitzenberger and Kohn, 2006). But, not only HE systems, also VET systems across the OECD vary hugely, with consequences for the relative quality of VET graduates compared to university graduates (Eichhorst et al., 2015). Similarly, labour market norms and institutions affect the way skills are formed through work experience. Depending on the overall institutional design of the labour market and the education systems as well as the general expectation of the population, VET systems are associated with outcomes ranging from "dead-end track and second-choice education" (Eichhorst et al., 2015) to a valuable alternative to higher education. Germany, in particular, is noted for its effective "dual" apprenticeship system, including high-level vocational skills for a sizable minority of the labour force; while Japan's internal labour markets are efficient vehicles for in-work acquisition of high-level skills (Koike and Inoki, 1990). Such factors should be part of the explanation for why both Germany and Japan show low proportions of graduate jobs. The absence of acceptable relative quality measures for vocational and academic routes to high skill acquisition inhibits further quantitative analysis of the cross-national distribution of graduate jobs. For the present, the question as to which of these factors are most important in understanding the cross-national variation in graduate jobs remains unanswered.

The third column in Table 8 uses available information from the European Labour Force Survey (ELFS) to give a snapshot of change in the prevalence of graduate jobs. Owing to the adoption only in 2011 of the ISCO 2008 classification, the analysis is only available from that date, and applies only to European countries. The period 2011-13 was one of slow recovery from recession, and might be expected to signal a slow resurgence of lower-skilled jobs; while the long term trend has been for growth in skilled jobs in most countries. In fact there seems to be have been a process of divergence over this short period. As can be seen, rather than Germany catching up with the prevalence of graduate jobs elsewhere, it was falling further behind. Meanwhile most of the high graduate job countries exhibited increases.

Figure 4: Proportion of graduate jobs in OECD countries, 2011



Base: Employed Labour Force who had finished their initial cycle of education

Table 8: Proportion of graduate jobs by country

Country	Observed (%)	Surplus (%)	Change 2011-13
Germany	22.2	-7.9	-2.09***
France	23.3	-5.9	0.20
Japan	25.1	-2.8	
Czech Republic	25.7	-1.8	1.84***
Italy	26.4	1.0	0.79***
Spain	27.4	0.2	0.86*
Slovak Republic	34.1	6.3	-1.77***
Korea	35.2	8.7	
UK (Engl./N.Irl)	35.6	1.7	0.28
Cyprus	36.2	7.1	-0.70
Denmark	37.1	4.3	1.33***
Poland	39.3	11.6	
Belgium	43.4	11.9	1.52***
Norway	43.5	10.7	1.59*
Netherlands	43.7	11.4	1.85***
Average (weighted)	28.7		

Notes:
"Observed" is the proportion of jobs that are graduate jobs (derived from SAS);
"Surplus" is the country-average residual from the regression of graduate job status on R&D intensity and industry dummies. Data sources: the OECD STAN database, EU-KLEMS (gross value added only), Eurostat or national statistical offices. Almost all variable values are from 2010 and expressed in nominal prices. Japanese data are for 2009. We use lagged variables as shifts in labour demand will take usually time to translate into changes in the stock of jobs. Monetary values converted into USD using average annual exchange rates. The data is merged into SAS by ISIC Rev. 4 industry codes. The level of aggregation is relatively high: most of the external data are available for broad 2-digit industries.
"Change 2011-13" is the percentage change in the proportion of jobs that are graduate jobs, derived from the European Labour Force Survey.

6.1 The variable role of R&D intensity in the demand for graduate skills

Further insight into the distribution of graduate jobs can be obtained by investigating variations in the strength of its association with R&D intensity. If, as suggested above, the disposition of graduate jobs may reflect the relative quality of higher education and of vocational sources of high-skilled labour, so might also its relationship with R&D. As with the intercept term, the association between graduate jobs and R&D intensity is likely to be affected by the relative quality of 'generalists' university graduates over other types of qualification, such as VET.

To investigate this, we ran regressions allowing the R&D coefficient to vary across countries, and the key results are shown in Table 9 below. The findings re-confirm that in every country graduate jobs are significantly more common in R&D intensive industries conditional on the other covariates. However, the estimated coefficients vary between 0.004 in Korea to 0.084 in Poland. In other words, industries with a one percentage point greater R&D intensity had between one-half to 8 percentage point larger probability to employ individuals in a graduate job. Notably, Germany and Japan, two countries with relatively good work-based systems for high skill acquisition, also show a low coefficients linking R&D intensity with graduate jobs. At the other end of the scale, the largest coefficient is for Poland (0.084), which suggests that

the VET programmes in that country may be rather poor relative to the quality of its university programmes.

Table 9: The association of R&D Intensity with the prevalence of graduate jobs within countries

Country	ISCO(HE) 2008	
Belgium (Flanders)	0.025	(0.004)
Cyprus	0.048	(0.014)
Czech Republic	0.063	(0.011)
Denmark	0.024	(0.002)
France	0.018	(0.002)
Germany	0.013	(0.003)
Italy	0.025	(0.007)
Japan	0.009	(0.001)
Korea	0.004	(0.002)
Netherlands	0.010	(0.002)
Norway	0.030	(0.004)
Poland	0.084	(0.020)
Slovak Republic	0.047	(0.017)
Spain	0.025	(0.006)
United Kingdom (Engl./ N. Ire.)	0.034	(0.005)

Note: Linear probability model of graduate job indicator on industry and country-specific R&D Intensities. Industry level variable are from 2010 (2009 for JPN). Parameters displayed are the country-specific coefficients of R&D intensity. A set of firm size dummies, dummies for public and not-for-profit sector, a dummy for a non-service-sector-workplace, age and age squared, foreign-born, and a gender dummy are included as controls. Standard errors statistics are shown in parentheses. All reported coefficient are significant at the 5% level or below.

7. Conclusion

In this study we have, based on previous work by the authors, derived a novel, data-driven and international indicator of graduate jobs, using a combination of self-reported required education and task data. The proposed procedure is transparent and replicable. It does not rely on expert judgement and is thus applicable to other countries and could track occupational upgrading if the required skills use data is available.

The resulting classifier ISCO(HE) 2008 is conceptually valid since it is grounded on the utilisation of high-level skills on the job. Further statistical tests show that the indicator explains the labour market outcomes of mismatched graduates – wage penalty, job dissatisfaction and lower participation in training – better than the traditional delineation of graduate jobs as being drawn from occupations in ISCO 2008 major groups 1 and 2, and better also than an indicator based on realised matches within occupations.

The analyses based on ISCO(HE) 2008 show that graduate skills are essential in more than a narrow set of traditional professional and management jobs. Overall, 29% of jobs in the countries examined are graduate jobs, including many in major group 3. Yet there are differences across countries: the proportion of graduate jobs in the labour market was lowest in Germany, France and Japan, and highest in Flanders, the Netherlands and Norway. Variation in industry structure, which might conceivably have explained the variation in the percentage of graduate jobs across countries, makes almost no difference. We have hypothesised that the demand does, however, reflect the relative quality of HE, as opposed to non-HE routes to high-skill acquisition. Meanwhile, within countries technology intensity, establishment size and

public ownership raise the proportion of graduate jobs, with the pattern largely consistent across countries.

Potential caveats need to be noted. First, it is challenging to classify occupations and qualifications across countries into an internationally comparable taxonomy. Considerable efforts were made in PIAAC to ensure internationally commensurate classification, but some ambiguity remains. Second, our classification approach relies on the decomposition of the self-report qualification requirements into a component that can be attributed to the variation into more objective skill use indicators and an unobserved component that is assumed to summarise measurement and reporting error. In doing this, we assume that work tasks are exogenous to the individual worker, but this might not necessarily hold, especially for graduates who normally enjoy some autonomy over how they conduct their work. Nonetheless, we think it is plausible to conjecture that reported job tasks vary around a mean that is given by the production technology. Third, a dichotomous classification system is likely to entail grey areas where the classification decision is close: the appendix lists those occupations in each country where the difference from the threshold is potentially within survey sampling error margins (there are not many of these). Moreover, the considerable simplification of a dichotomous graduate/non-graduate job classification is likely to be of value only in a meso- or macro-social context, and inevitably does not discriminate among heterogeneous graduate jobs.

With the above caveats in mind, potential uses of a graduate jobs indicator include application by HR professionals in careers guidance for HE students and graduates, and employability assessments of HE institutions (and sub-groups within them), in addition to its potential role in analysing high-skill labour markets. A key feature of the graduate job concept behind ISCO(HE) 2008 is that it does not derive from job-holders' own qualification level. Consequently, among graduates the classifier allows us to define an "overqualified" or overeducated graduate, as a graduate in a non-graduate job, without recourse to assumptions about how job skills are distributed within unit groups. The international pattern of variation in the extent and distribution of graduate overqualification has received relatively little attention hitherto in research on skills mismatch. In research parallel to this paper, therefore, we utilise ISCO(HE) 2008 to analyse the international pattern of overqualification.

Appendix: List of Graduate Jobs

This appendix lists occupation minor groups which are, at least in some countries, classified as graduate jobs. Shaded cells indicate that the skills requirements of the job are above or below the national threshold but the difference is not statistically significant at the 5% level.

Table 1: Graduate jobs in major groups 1-4 (=1 graduate job, =0 non-graduate job)

ISCO08 Minor Group	BE	CY	CZ	DE	DK	ES	FR	IT	JP	KO	NL	NO	PL	SK	UK
111 Legislators and senior officials	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1
112 Managing directors and chief executives	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
121 Business services and administration managers	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
122 Sales, marketing and development managers	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
131 Production managers in agriculture, forestry and fisheries	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1
132 Manufacturing, mining, construction, and distribution managers	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1
133 Information and communications technology service managers	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
134 Professional services managers	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
141 Hotel and restaurant managers	1	1	0	0	0	1	0	1	1	1	0	0	0	0	0
142 Retail and wholesale trade managers	1	1	0	0	1	0	1	1	1	1	0	0	1	1	0
143 Other services managers	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1
211 Physical and earth science professionals	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1
212 Mathematicians, actuaries and statisticians	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
213 Life science professionals	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
214 Engineering professionals (excluding electrotechnology)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
215 Electrotechnology engineers	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
216 Architects, planners, surveyors and designers	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
221 Medical doctors	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
222 Nursing and midwifery professionals	0	1	0	0	1	1	0	1	0	1	1	1	1	1	1
223 Traditional and complementary medicine professionals	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
224 Paramedical practitioners	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1
225 Veterinarians	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
226 Other health professionals	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
231 University and higher education teachers	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
232 Vocational education teachers	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1

ISCO08 Minor Group	BE	CY	CZ	DE	DK	ES	FR	IT	JP	KO	NL	NO	PL	SK	UK
233 Secondary education teachers	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
234 Primary school and early childhood teachers	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1
235 Other teaching professionals	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
241 Finance professionals	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
242 Administration professionals	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
243 Sales, marketing and public relations professionals	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
251 Software and applications developers and analysts	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
252 Database and network professionals	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
261 Legal professionals	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
262 Librarians, archivists and curators	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1
263 Social and religious professionals	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1
264 Authors, journalists and linguists	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1
265 Creative and performing artists	0	0	0	1	1	0	1	1	1	1	0	0	0	0	1
311 Physical and engineering science technicians	1	1	1	0	0	0	0	0	1	1	1	1	1	0	1
312 Mining, manufacturing and construction supervisors	1	0	0	0	0	0	0	1	1	1	0	1	0	1	1
313 Process control technicians	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1
314 Life science technicians and related associate professionals	1	1	0	0	1	0	1	0	1	1	1	1	1	0	1
315 Ship and aircraft controllers and technicians	0	0	0	0	0	0	1	0	1	1	0	0	1	0	1
321 Medical and pharmaceutical technicians	1	1	0	0	0	0	0	1	1	0	1	1	0	0	1
322 Nursing and midwifery associate professionals	0	1	0	0	0	0	1	1	0	0	0	1	1	0	1
323 Traditional and complementary medicine associate professionals	1	1	0	0	0	0	0	1	0	0	0	1	1	0	1
324 Veterinary technicians and assistants	1	1	0	0	0	0	0	1	0	0	0	1	1	0	1
325 Other health associate professionals	1	1	1	0	0	0	0	1	0	0	0	1	1	0	1
331 Financial and mathematical associate professionals	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1
332 Sales and purchasing agents and brokers	1	0	0	0	1	0	0	1	1	1	1	0	1	0	0
333 Business services agents	1	1	0	1	1	0	1	1	1	1	1	1	1	1	0
334 Administrative and specialised secretaries	1	1	0	0	1	1	0	0	1	1	0	0	1	1	1
335 Regulatory government associate professionals	1	1	0	0	1	1	0	0	1	1	1	0	1	1	1
341 Legal, social and religious associate professionals	1	1	0	0	1	1	0	1	1	1	0	1	1	1	0
342 Sports and fitness workers	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0
343 Artistic, cultural and culinary associate professionals	0	1	0	0	1	1	0	1	0	0	0	1	0	0	0
351 Information and communications technology operations and user support technicians	1	1	1	0	0	0	1	1	1	1	0	0	1	1	0

ISCO08 Minor Group	BE	CY	CZ	DE	DK	ES	FR	IT	JP	KO	NL	NO	PL	SK	UK
352 Telecommunications and broadcasting technicians	1	1	0	0	1	1	0	0	1	0	0	0	1	0	0
411 General office clerks	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0
412 Secretaries (general)	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0
413 Keyboard operators	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
421 Tellers, money collectors and related clerks	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
422 Client information workers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
431 Numerical clerks	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
432 Material-recording and transport clerks	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
441 Other clerical support workers	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0

Table 2 Graduate jobs outside major groups 1-4 and in the armed forces

ISCO08 Minor Group	BE	CY	CZ	DE	DK	ES	FR	IT	JP	KO	NL	NO	PL	SK	UK
511 Travel attendants, conductors and guides	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
531 Child care workers and teachers' aides	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
541 Protective services workers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
732 Printing trades workers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
742 Electronics and telecommunications installers and repairers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
754 Other craft and related workers	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
812 Metal processing and finishing plant operators	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
831 Locomotive engine drivers and related workers	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
961 Refuse workers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
011 Commissioned armed forces officers		1	1	1	1	0	1	0	1	1					1
021 Non-commissioned armed forces officers	1	0	0	0	0	0	0	0	0	0			0	0	0
031 Armed forces occupations, other ranks;		0	0	0	0	0	0	0	0		0		0	0	0

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