

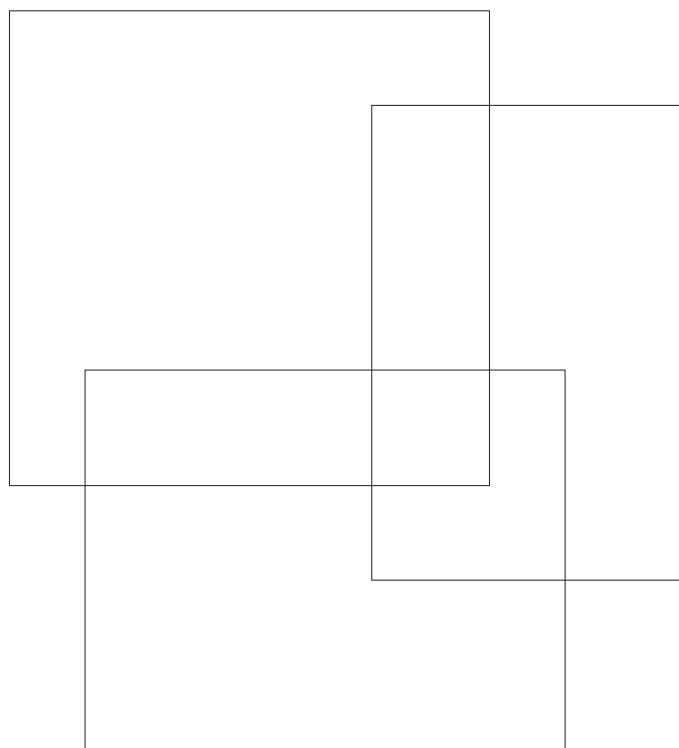


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How Useful is the Concept of Skills Mismatch?

Seamus McGuinness, Konstantinos Pouliakas, Paul Redmond

April 2017



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**Skills and Employability Branch
Employment Policy Department
International Labour Office, Geneva**

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Foreword

This paper was prepared as a background note for the International Conference on Jobs and Skills Mismatch to be held in Geneva on May 11-12, 2017.

The conference will discuss both new research on the different forms of mismatch and the measurement challenges that impact our understanding of this issue. For this reason, the conference will provide a global perspective on the topic by presenting insights from the Asia Pacific, Europe, Latin America and Africa regions. The conference will also discuss the policy implications of skills mismatch and suggest useful measures to counteract the different types of mismatch that occur.

The conference aims to deepen understanding of the labour market effects of various types of skill mismatch and how they can be best measured in different country contexts. It will include ILO research and also present the work of other partner international organizations.

The term skill mismatch is very broad and can relate to many forms of labour market friction, including vertical mismatch, skill gaps, skill shortages, field of study (horizontal) mismatch and skill obsolescence.

In this paper the authors provide a clear overview of each concept and discuss the measurement and inter-relatedness of different forms of mismatch. They present a comprehensive analysis of the current position of the literature on skills mismatch and highlight areas which are relatively underdeveloped and may warrant further research.

Using data from the European Skills and Jobs Survey, they examine in detail the incidence of various combinations of skills mismatch across the EU and review the European Commission's country specific recommendations and find that skills mismatch, when referring to underutilised human capital in the form of overeducation and skills underutilisation, receives little policy attention.

They argue that in cases where skills mismatch it is specifically addressed by policy recommendations, the policy advice is either vague or addresses the areas of mismatch for which there is the least available evidence.

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1. Introduction

Skill mismatch is a term that is frequently referred to in policy debates and documentation; nevertheless, the concept of skill mismatch itself is very broad and can incorporate a variety of measures. Specifically, skill mismatch can be used to describe vertical mismatch (usually measured in terms of overeducation, undereducation, overskilling and underskilling), skill gaps, skill shortages (usually measured in terms of unfilled and hard-to-fill vacancies), field of study (horizontal) mismatch and skill obsolescence. The term is generally restricted to mismatches impacting workers in employment, or firms currently employing or seeking to employ workers. While unemployment can be thought of as a form of mismatch, it is not generally considered in the context of this literature¹. The various concepts of skills mismatch mentioned above are very different in terms of how they manifest themselves, their measurement, their determinants and how their consequences are felt. Some relate to mismatches experienced by employees, while others relate to employers and firm level difficulties. Some skill mismatch concepts are measured subjectively while others are derived from existing data. Many of the mismatch indicators adopted in the literature have drawbacks and various approaches used to measure the same type of mismatch are often poorly correlated. All of this suggests that the use of the term skills mismatch within a policy context is highly problematic.

In this paper we explore the different forms of mismatch, usually included under the broad heading of skills mismatch, and consider the principal measurement approaches and stylised facts associated with each, before considering the relationship both within and between the various mismatch measures. We utilise the 2014 European Skills and Jobs Survey (ESJS) to provide empirical evidence on the incidence of various combinations of skills mismatch. We then examine the use of the concept of skills mismatch within a European policy framework in order to assess whether the policy argument actually reflects the evidence base.

Measures of mismatch can be most usefully sub-divided into those that are measured at the level of the individual's circumstances and those that are measured in terms of firm-level aggregates. Individual concepts of mismatch relate to the degree to which workers in firms possess skill or education levels that are above, below or poorly connected to those required within their current job (Cedefop, 2010; Quintini 2011, Cedefop, 2015a) and, in the case of vacancies, the degree to which the education and skills of job applicants meet the requirements of the hiring firm. These can be sub-divided into measures of surplus and deficit human capital. Surplus human capital is typically measured in terms of overeducation or overskilling.² With respect to the existing literature, the vast majority of

¹ Although it is likely that some applicants for posts which remain unfilled or hard-to-fill will be jobseekers.

² The policy literature tends to favour the word "overqualification" instead of "overeducation" (European Commission, 2015). The aversion to using the word "overeducation" comes from the opinion of some authors that there is no such thing as overeducation, on the grounds that it is always best to have more educated people than less. There is a similar aversion to the term "overskilling", as it is believed that having more skills on the whole is a good thing, since, even if the person does

studies relate to overeducation. However, surplus education may also be related to horizontal (or field of study) mismatch, whereby workers are employed in jobs that are not relevant to the skills and knowledge accumulated by them in formal education. Mismatches in human capital can also relate to the concept of skill obsolescence, whereby workers possess skills that are no longer required by the employer due to changes in physical strength, technical progress or market conditions. Human capital deficits, such as undereducation and underskilling, receive relatively little attention in the literature. The reason for this is not clear as they are generally assumed to have a direct negative impact on firm level productivity and, therefore, determine a large share of the training investments of both employees and firms.

Firm level aggregates of skill mismatch are typically restricted to the study of skill gaps and skill shortages. Skill gaps describe the situation whereby the employer believes that workers do not possess the adequate competencies to successfully discharge their current role. Skill shortages relate to a situation whereby employers are unable to fill key vacant posts due to a lack of suitably qualified candidates. From the perspective of policy, skill gaps may harm productivity due to lower output per worker, which also tends to inflate average labour costs. Firm-level profitability will also be adversely impacted by skill gaps as a consequence of additional training and recruitment investments, the capacity of enterprises to innovate and adapt to changing market conditions may also be negatively affected. At a macro-economic level, competitiveness may be eroded due to higher wage inflation and lower productivity levels. Skill shortages may also feed through to inferior firm level and macroeconomic performance through the creation of skill gaps, as firms are forced to allocate inadequately skilled (existing or new) workers into the unfilled positions.

The majority of research on skill mismatch focuses on surplus human capital, namely overeducation and overskilling. The evidence indicates that this imposes costs on overeducated workers in the form of lower wages and lower job satisfaction, relative to individuals with equivalent levels of education in matched employment. Overeducated workers are found to earn a premium relative to matched workers doing the same job, i.e. with lower levels of education, suggesting that individuals do manage to raise the productivity levels of jobs for which they are overqualified (for reviews see McGuinness, 2006, Quintini 2011 and Cedefop, 2015a). Firms may also incur additional hiring and training costs, arising from surplus human capital, as a consequence of higher rates of turnover among overeducated, overskilled or horizontally mismatched workers. High rates of overskilling in economies may reflect an overall inefficiency of the labour reallocation process, as skilled workers remain employed in firms that fail to fully exploit their potential, leading to a less productive job market equilibrium. Our analysis of the 2016 policy documentation of the European Union indicates that, despite the abundance of evidence from the academic literature on the costs associated with surplus human capital, this area of mismatch receives little policy attention at both a national and European level. Instead, policies relating to skills mismatch, where such policies exist, typically focus on areas of mismatch for which there is relatively little evidence, namely skill gaps and skill shortages.

not enjoy his job, he will be better equipped to change jobs, engage in mobility and be more resilient to structural, economic or social change.

The paper proceeds as follows. In Section 2 we assess the different measurement approaches for each type of skills mismatch. Section 3 analyses the current position of the literature and presents the stylised facts for each type of skills mismatch. Section 4 presents empirical evidence on the incidence of various combinations of skill mismatch affecting adult workers in Europe. Section 5 outlines potential policy levers and policy spillover effects for various types of mismatch before examining the concept of skills mismatch in a European policy framework. Section 6 concludes.

2. Measures of mismatch

Obtaining reliable and consistent estimates of the incidence of various forms of skill mismatch is necessary to inform policy debate in this area. However, this is difficult for a number of reasons. Studies of surplus human capital typically use two approaches, overeducation and overskilling. However, these concepts are weakly correlated (Green and McIntosh, 2007). Moreover, various approaches can be used to measure the same type of mismatch. Three different approaches are used in the literature to measure overeducation and results often vary substantially depending on the measure used (Barone and Ortiz, 2011; European Commission, 2015). Difficulties may also arise when using multiple datasets to make cross-country comparisons of skills mismatch, as there are inconsistencies in the wording of mismatch questions across datasets. Developing a clear understanding of these issues is an important prerequisite for policy design. To this end, we explain the measurement approaches involved in each type of skills mismatch, including any potential drawbacks or difficulties associated with each measure.

2.1 Overeducation and undereducation

There are three approaches to measuring overeducation and undereducation; the subjective method, the empirical method and the job evaluation method. The two most commonly used are the subjective and empirical methods. While each method is designed to measure the same type of mismatch, they often produce conflicting results. For example, Barone and Ortiz (2011) estimate the incidence of overeducation in Europe using both the subjective and empirical approaches. In Austria, the subjective approach yields an estimate of 9.6 percent versus 1.1 percent for the empirical approach. Similar inconsistencies are found by the European Commission (2015) when comparing the empirical and job evaluation methods across Europe. Details on the three approaches and the difficulties associated with each are discussed below.

Subjective: This is generally based on worker self-assessment of the level of qualifications required “to get” or “to do” the job, which is then compared to the highest level of education actually acquired by the worker in order to determine if they are matched (have a level of education equal to that required), overeducated (have a level of education

above that required) or undereducated (have a level of education below that required).³ Based on these responses, overeducation is generally measured in terms of a binary dummy variable, however, it is also occasionally determined with respect to years of overeducation. It is important to note that different combinations of the two subjective approaches may pick up different effects; being overeducated both “to do the job” and “to get the job” reflects surplus skills, whereas being overeducated “to do the job” while being matched “to get the job” may be more reflective of surplus entry requirements. According to Cedefop’s European Skills and Jobs survey (ESJS), 75.6 percent of EU tertiary graduates indicate the need for a tertiary degree simply for recruitment purposes, while 71.6 percent say they need a tertiary degree to do their job (Cedefop, 2015a). This apparent credentialism (i.e. employers requesting a higher degree than needed at the time of hiring relative to what is the genuine skill level of the job) is greater among younger EU workers (aged 24-29), with 73 percent stating that a higher education degree is necessary for recruitment and 67 percent indicating that a higher degree is necessary to do their job. It should also be noted that both types of overeducation can also occur at the sub-degree level where TVET qualifications are more relevant.

The principal advantage of the subjective approach is that it is relatively easy to apply in survey data. Its drawbacks include the potential of subjective bias and the fact that it cannot be retrospectively applied to existing data. Subjective bias arguments relate to, (a) higher levels of apathy among overeducated workers, leading to a lower response rates and an under-estimate of the incidence, and (b) a willingness of workers to exaggerate either their occupational status or the qualification required to be able to do one’s job, resulting in a reticence to admit overeducation, which also leads to a downward bias⁴. Finally, there is no uniform approach to the implementation of the overeducation question within datasets and these variations in application make it difficult to directly compare estimates or pool data for the purpose of cross-country analysis.

Realised matches (the empirical method): The realised matches method, also referred to in the literature as the empirical method, estimates the educational requirement of an occupation by assessing the mean or modal level of education within a given occupation, deeming workers with acquired education above (below) the average level as overeducated (undereducated)⁵. The key advantage of the realised matches approach is that it can be easily applied to any existing micro datasets containing information on both educational attainment and occupation. The ease of calculations implies that the approach can be applied to existing datasets, such as national labour force surveys, thereby facilitating cross-country comparisons. Drawbacks of the realised matches method are that it does not contain any information of the actual skill requirements of the job, it reflects average

³ In some cases, one direct question asks individuals to assess their education as a whole in relation to the qualification needed. For example, in the OECD’s Survey of Adult Skills (PIAAC), individuals are asked, relative to their own education, what level of education do they think would be necessary to satisfactorily do their job – a lower level would be sufficient; a higher level would be necessary; the same level.

⁴ Given that subjective methods typically yield the highest estimates of the incidence of overeducation, the downward bias discussed here does not appear to be pronounced.

⁵ In the early literature, the method was applied by defining workers as overeducated (undereducated) if they had years of schooling one standard deviation above (below) the occupational mean; however, this approach was heavily criticised due to the arbitrary nature of the cut-off points and the assumption that over and undereducation are symmetrically distributed within occupations. In recent years, the mode has typically been used in this type of analysis.

credentials of all workers within a given occupation and, therefore, is more closely related to education levels required “to get” as opposed “to do” a given job in contemporary terms. In addition, due to sample size constraints the mode education level is typically derived for broad occupational groups (e.g., health professionals) and not at a level that is close to an individual job title (e.g. nurse). This may conceal the variance in qualification needs across jobs that are classified within the same broad occupational group. Another potential flaw of the realised matches approach is that occupational averages will tend to be driven by the majority of older workers with longer tenure, thus the approach will tend to reflect historical entry requirements, rather than current ones.⁶ If changes in occupational practices have led to an increase in job skill requirements and increased entry requirements for new cohorts, the realised matches approach will identify more recent entrants as overeducated when this is not, in fact, the case.⁷

Job evaluation method: The job evaluation method is based on the assessments of professional job analysts who are tasked with measuring the educational requirements of occupations for the purpose of constructing occupational dictionaries (such as DOT or O*NET in the United States or SOC in the UK).⁸ The advantage of this approach is that it is perceived to be more accurate as it is based on field expertise. In terms of disadvantages, the job evaluation method is very expensive to carry out and, therefore, is not widely available at a national level. Furthermore, occupational requirements can change rapidly over time suggesting the approach can become outdated if the analysis is not updated on a fairly regular basis. Also, despite the fact that the classifications are based on the opinions of experts, the classification approach will also involve some level of subjectivity.

It is also possible to identify over and undereducation by using the International Standard Classification of Occupations (ISCO), which categorizes major occupational groups by level of education in accordance with the International Standard Classification of Education (ISCED)⁹. For example, ISCO categorizes legislators, senior officials and managers as requiring a tertiary (ISCED 5-6) level of education. As noted by Quintini (2011), this measure relies on the assumption that all jobs with the same titles require the same level of education and this is true in all countries using the same occupational classification.

⁶ Of course this will depend on the structure of the labour market and will be less of an issue in developing countries with young populations.

⁷ In response to the increased job requirements, older workers with longer tenure and lower qualifications will be trained accordingly, however new entrants will be required to have higher qualifications. Given that the average is based on both groups' education levels, the average will be lower than the required education for new entrants, and therefore this group will be incorrectly categorized as overeducated. Focusing on specific age cohorts could mitigate this problem, however, this could result in small sample sizes.

⁸ There is also a multilingual classification of occupations, skills and qualifications currently being developed at a European level (ESCO).

⁹ ISCO 08 assigns skill levels to major occupational groups. The skill level is measured based on one or more of the following three factors; 1. The nature of the work performed, 2. The minimum education required and 3. The amount of informal on-the-job training required. Most of the emphasis is placed on 1 and 2, with little emphasis placed on 3. However, given that information on individual human capital captured in datasets tends to be restricted to levels of educational attainment, information on 1 and 3 are generally ignored for assessing mismatch status.

2.2 Overskilling and underskilling

Overskilling describes the situation whereby the worker believes that they possess more skills than their current job requires, whereas, underskilling describes the situation whereby the worker believes that their current skills do not meet the demands of the job. While overskilling and underskilling can be measured through direct assessment by HR specialists, such direct measures are rarely captured in datasets. Both concepts are typically measured subjectively through separate questions, unlike education mismatch whereby a single question can be used to identify both over and undereducation. For instance, the overskilling question in the Reflex Project data, which has been extensively studied in the literature, is “to what extent are your skills utilized in this work”, with a response scale of 1 to 5 where 1 = not at all and 5 = to a very high extent.¹⁰ Values of 1 and 2 are typically taken as an indication of overskilling.¹¹ There is no way of identifying the underskilled using the overskilling question. In the Reflex data, there is a separate underskilling question on the same scale, “to what extent does this work require more knowledge and skills than you can actually offer”. In terms of disadvantages, overskilling and underskilling measures are prone to subjective bias in the same way as overeducation. Furthermore, it is not always clear that respondents are thinking only of work related skills when responding to the question.

Overskilling has been argued to be a more accurate measure of mismatch amongst existing workers than overeducation on the grounds that overeducation assumes that, (a) job entry requirements accurately reflect job skill content, and (b) worker qualifications adequately reflect their total work related human capital. The overeducation approach therefore ignores the fact that job entry requirements may be weakly related to job content, and more reflective of qualifications inflation and credentialism, while individual human capital will also consist of (non-formal and informal) skills acquired through labour market experience and training (Mavromaras et al, 2009). Overskilling may be a more comprehensive measure of mismatch as it requires the worker to compare all their skills and abilities, irrespective of whether they were learned in the classroom or work environment, with the actual skill requirements of their current job.

Arguments against the overskilling approach are generally related to problems with how the question is phrased. For instance, on the basis of the Reflex Project questions, it is feasible that the respondent is considering skills and abilities totally unrelated to the workplace, such as hobbies, when formulating their response, leading to biased estimates. Furthermore, the questions adopted to investigate overskilling vary substantially across

¹⁰ The Reflex project is a large-scale European survey of education graduates. The fifteen participating countries are Austria, Finland, France, Germany, Italy, the Netherlands, Norway, Spain, the UK, Czech Republic, Portugal, Switzerland, Japan, Estonia and Belgium-Flanders.

¹¹ There is a debate about whether the measurement of overskilling, namely whether a person's skills are higher than the level needed by his/her job, is the same as skill underutilisation, which can be conceptualised by comparing the deviation between an individual's frequency of skill use as part of his/her daily work tasks and the usual frequency of comparable workers in the same job. It is feasible that a worker who is not overskilled in terms of skill levels could nevertheless experience a low frequency of skill use within a job, although the two measures are likely to be highly correlated (Allen et al., 2013).

datasets which makes it difficult to compare estimates.¹² Finally, overskilling questions do not allow the researcher to identify the relative importance of underused skills deriving from labour market experience, training, innate ability or formal schooling. An exception to this is the Cedefop ESJ survey, which asks workers to assess the skills match of a subset of eleven specific skills (literacy, numeracy, ICT, technical skills, planning, problem solving, learning, foreign languages, customer service, teamwork and communication), in addition to being asked whether they are overskilled as a whole (Cedefop, 2015a). The ESJS reveals that there is a correlation (ranging between 0.19 and 0.26) between the total skills mismatch question and mismatches in individuals' technical or soft skills. This highlights that aggregate mismatches can be attributed to both skills acquired mainly during formal schooling (e.g. literacy, numeracy, technical skills) but also on-the-job skills (e.g. customer service, communication skills). In particular, the data reveal that high levels of reported overskilling among EU adult employees tend to be associated with high mismatches in literacy skills at their work but also high mismatches in transversal skills, such as inadequate opportunities to apply their problem-solving skills. By contrast, high levels of underskilling tend to be underpinned by high technical or digital skill deficits as well as an employee's lack of proficiency in terms of planning and organisation skills. While the set of eleven skills capture a substantial part of total overskilling, a sizeable amount nevertheless remains unexplained.

2.3 Horizontal mismatch

Horizontal mismatch measures the extent to which workers, typically graduates, are employed in an occupation that is unrelated to their principal field of study. This form of mismatch may be measured using a subjective question asking the respondent to assess the degree to which their current job is related to the study field of their highest qualification; however, it could also be measured independently by comparing a field of study variable with occupation codes.¹³ Relative to vertical mismatch, there are much fewer published studies of horizontal mismatch. The evidence that does exist is mixed; a number of studies report pay penalties, however, this impact is not detected universally. Where wage effects do occur, they are typically smaller than those found for vertical forms of mismatch and generally depend on whether horizontal mismatch is also accompanied by vertical mismatch.

¹² For example, in the OECD PIAAC survey, the question on overskilling is "do you feel that you have the skills to cope with more demanding duties than those you are required to perform in your current job?". For underskilling, individuals are asked "do you feel that you need further training in order to cope well with your present duties?". The Cedefop European Skills and Jobs Survey asks, "overall, how would you best describe your skills in relation to what is required to do your job?", with the responses being either, "my skills are higher than required by my job" (overskilling), or "some of my skills are lower than what is required by my job and need to be further developed" (underskilling).

¹³ See Verhaest et al. (2015), Robst (2007 & 2008) and Allen and de Weert (2007) for studies using the subjective approach to horizontal mismatch and Levels et al. (2014), Wolbers (2003), Beduwe and Giret (2011) and Domadenik et al. (2013) for the occupational code approach. As with overeducation, informal skills acquired through labour market experience and training are not picked up. It is possible that these informal skills could relate more to the occupation than the person's main field of study.

2.4 Skill Obsolescence

This refers to the process by which workers' skills become obsolete. Skills can become obsolete due to ageing which depreciates certain manual skills (physical obsolescence), through technological or economic change which renders certain skills unnecessary (economic obsolescence) or through the underutilisation of skills (skills atrophy) (Allen and De Grip, 2007; Van Loo et al., 2001). Skill obsolescence is generally measured through the subjective questioning of workers.¹⁴ Relative to other forms of mismatch, there are relatively few published studies of skill obsolescence. The research that is published in this area suggests that skill obsolescence is more frequent in high-tech industries (Neuman and Weiss, 1995) and can affect up to a third of workers during their careers (Allen and van der Velden, 2007). According to Cedefop (2015a), 21% of adult employees in the EU labour market think that it is very likely that several of their skills will become outdated in the next five years.

2.5 Skill gaps

Skill gaps measure the extent to which workers lack the skills necessary to perform their current job. Generally speaking, skill gaps are usually measured by collecting information from the employer on the perceived skill deficiencies of workers; when similar questions are directed at workers within firms this is usually akin to underskilling, although the form of the question is likely to differ.¹⁵ It has been argued in the literature that skill gaps and underskilling are the same thing and they are likely to be highly correlated; however, as with all forms of mismatch, it is unlikely that the correlation will be strong. McGuinness & Ortiz (2016) examine the correlation of employer-reported skill gaps and employee perceptions of underskilling within Irish enterprises and find that it is more common for employees to report skill gaps in firms than employers. Thus the general incidence of underskilling within firms was generally higher than that of skill gaps. The correlation between worker and employer perceptions was higher for technical skills and skills or competences related to IT, management or communication while being lower for literacy, numeracy and language skills. The extent to which employers and employees mutually recognised skill gaps and underskilling within firms ranged from 64% for communication skill deficiencies to 33% for skill deficiencies in literacy and numeracy. McGuinness & Ortiz (2016) discuss a number of possible reasons that would lead to

¹⁴ For example, a question asked in the Cedefop European Skills and Jobs Survey is “compared to when you started your job with your current employer, would you say your skills have now improved, worsened or stayed the same?” Skill obsolescence is likely to be captured by the share of workers stating that they have experienced some worsening in their skills over time.

¹⁵ For example, in the Reflex data underskilling is measured based on the question “to what extent does this work require more knowledge and skills than you can actually offer “where the scale runs for 1 (not at all) to 5 (to a very high extent) with values of 4 and 5 denoting underskilling. In the Irish National Employment Survey employees are asked if they required more training in a particular competency area. While a skill deficiency is clearly present when underskilling is detected, this is not necessarily the case with respect to the skill gap question. The respondent may be perfectly competent in their job and still perceive that they require further training. .

asymmetries in perceptions and conclude that the responses of workers may be more biased as they are more likely to consider future career requirements, rather than immediate job requirements, when responding to questions on skill shortfalls.

2.6 Skill shortages

Skill shortages generally refer to unfilled or hard to fill vacancies that have arisen as a consequence of a lack of qualified candidates for posts. Skill shortages are measured at the firm level and generally involve a series of questions that begin by establishing the existence of unfilled or hard-to-fill vacancies, followed by a series of questions establishing the employer's views for the reasons underlying any recruitment difficulties. As is the case with skill gaps, there is a degree of research that implicitly links skill shortages with firm level productivity corollaries, such as product development, labour costs etc.; however, there is relatively little research that demonstrates an actual causal link.

One of the challenges in estimating skill shortages is that part of the recruitment difficulties that employers attribute to skill shortages may in fact be due to their inability to offer the necessary salary or working conditions to attract the relevant skills (Cedefop, 2015b), as well as other factors such as location. However, genuine skill shortages only relate to situations where the demand for skills by employers cannot be met by the available supply at market clearing wage rates. As a result, estimates of the incidence of skill shortages based on employer responses may be overestimated, yet such rationalisation of the true magnitude and causes of skill shortages is often neglected in policymaking documents. The policy debate also frequently confuses current shortages with anticipated skill shortages or quantitative labour market imbalances (Sattinger, 2012) which are expected to arise due to the ageing of working age populations in many developed economies. Moreover, many policy documents are often driven by the acknowledgement that digitalisation and technological changes are undeniably shaping skill demands at a fast pace, yet the responsiveness of the supply side of the equation along with the issue of skills development and utilisation in firms is often overlooked.

2.7 Macroeconomic indicator of skills mismatch

Following the work of Estevao and Tsounta (2011) and Pouliakas (2012), the European Commission (2015) proposes a macroeconomic indicator of skills mismatch that is based on differences in employment rates across skill groups. They draw from and extend the theoretical and broader construct of the Beveridge curve, which relates the trends in vacancy and unemployment rates within countries or regions.¹⁶ Although

¹⁶ Part of the reason why the above-mentioned macroeconomic measures of skill mismatches have been proposed is because for many countries it is not possible to investigate movements of separate Beveridge curves at the (sub-)level of skills, industry or region, given the general unavailability of disaggregated vacancy information.

notoriously difficult to observe on the basis of spurious data and to de-link from cyclical fluctuations, shifts in the Beveridge curve could be indicative of rising mismatches in economies, namely greater difficulties to match unemployed workers to the available jobs.¹⁷ This could reflect a variety of reasons, one of which could be skill mismatches due to a greater concentration of older or lower-skilled workers in the pool of unemployed individuals. Macroeconomic indicators of mismatch typically reflect the relatively low employment chances of low-skilled workers, linked to falling economic demand in sectors that traditionally rely on manual labour (e.g. construction, manufacturing). The conclusion drawn is that structural declines in low-skilled sectors lead to skills mismatch.

Apart from being a very different concept to the other measures of mismatch discussed above, which focus on individuals in the labour market whose skills or qualifications do not match their job, there are some concerns regarding the interpretation of the macroeconomic measure. While some of the differences in employment rates across groups of various skill levels may be attributable to skill mismatch, unemployment is also a function of many other factors which may vary across skill groups, such as replacement rates, union density etc. Moreover, the different employment rates among skill groups may be attributable to systematic differences in the unobservable characteristics among members of different groups, as opposed to a skills mismatch. In addition, not all unemployment is structural and differences in frictional unemployment across groups could impact the estimates. Finally, the European Commission (2015) differentiates different skill groups based on educational attainment. However, while educational attainment may proxy skill levels, there is significant variance in skill levels within broad educational attainment categories (OECD, 2013).

3. Current position of the literature

The ILO and other international organisations and governments place a strong emphasis on evidence-based policymaking. For example, the European Commission notes that “a strong evidence base and solid analyses are key elements for informed policy discussions and policy developments in education and training”.¹⁸ Given that McGuinness (2006) has provided an extensive summary of the literature on overeducation up to 2006, we review the recent literature on each area of mismatch, focusing on published work from 2006-2016, to establish the existing evidence on skills mismatch and analyse whether the current policy debate and recommendations respond to and reflect this evidence. Our analysis of the literature on over/under education, over/under skilling and horizontal mismatch is based on peer-reviewed journal articles from various disciplines, including economics, education, psychology, industrial relations, human resources and youth studies as well as IZA discussion papers and research papers from the World Bank, OECD and

¹⁷ Nevertheless it is typically the case that there is sluggishness in the reaction of unemployment relative to vacancies, which gives rise to counter-clockwise loops observed in Beveridge curves that can sometimes be mistaken for structural shifts. Furthermore, shifts in the Beveridge curve are also linked to the recruiting intensity of firms, such as the underlying incentives of employers to search and hire available workers.

¹⁸ See the European Commission’s description of education and training policies based on evidence, http://ec.europa.eu/education/policy/strategic-framework/indicators-benchmarks_en.htm

Cedefop.¹⁹ There is a dearth of literature on skill gaps, skill shortages and skill obsolescence, and as such it was necessary to expand our selection criteria to include other types of working papers and, in some cases, earlier (pre-2006) work in these areas. The number of papers dealing with each area of mismatch is shown in Table 1 below.

Table 1: Number of papers by area of mismatch

| Type of mismatch | Number of papers |
|---------------------|------------------|
| Overeducation | 86 |
| Undereducation | 24 |
| Overskilling | 21 |
| Underskilling | 3 |
| Horizontal mismatch | 10 |
| Skill shortages | 11 |
| Skill gaps | 6 |
| Skill obsolescence | 5 |

3.1 Overeducation

Of the 86 papers on overeducation, four are review articles and the remaining 82 carry out some type of empirical analysis. The subjective method for measuring overeducation is used in 42 papers, the empirical approach in 32 papers and the job-evaluation method in 24 papers.²⁰

The incidence of overeducation is reported in 60 papers, covering 37 countries. Some authors calculate the incidence of overeducation for several countries in one published paper. As such, a single paper may consist of multiple ‘country studies’. Moreover, a study of a single country may report multiple estimates of overeducation based on different measurement approaches. There are a total of 241 estimates of the incidence of overeducation. Table 2 shows the average of the reported estimates of the incidence of overeducation for each country and each measurement approach.²¹ The number of estimates is also reported, allowing us to gauge which countries receive the greatest amount of attention in the literature and the frequency of use for each measurement approach. While most papers report statistics relating to specific countries, four papers report the overall incidence for a group of European countries, denoted as “Europe (aggregate)” in Table 2. In total, there are 100 estimates of overeducation using the subjective approach, 99 using the empirical approach and 42 using the job-evaluation approach. Estimates of overeducation tend to be consistently high for countries such as

¹⁹ Cedefop is the European Union’s Centre for the Development of Vocational Training. Apart from financing EU-wide research on skills and skill mismatch (e.g. Cedefop, 2010), the Centre is also a key contributor to new European data collection on skill mismatch, including the 2014 European skills and jobs survey (<http://www.cedefop.europa.eu/en/events-and-projects/projects/analysing-skill-mismatch>; <http://skillspanorama.cedefop.europa.eu/en/datasets>), and policy analysis to tackle skill mismatch e.g. Cedefop (2015c) <http://www.cedefop.europa.eu/en/publications-and-resources/publications/5546>

²⁰ Note that more than one measure may be used in the same paper.

²¹ A full list of papers used to calculate the average estimates of skills mismatch are available on request from the authors.

Ireland, Spain, Greece and Italy and lowest in Czech Republic, Norway, Switzerland and Finland. The most studied country is Belgium, which may be largely due to the availability of suitable data. The Flemish inter-university research group, SONAR, have data on transitions from school to work which has been used in several recent studies on overeducation.²² Belgium-Flanders is also covered in the Reflex data on European higher education graduates.

While the overall average incidence of overeducation across the three measures is similar, sizable differences are often reported within countries. Barone and Ortiz (2011) calculate the incidence of overeducation using both the subjective and empirical approach for eight European countries. The subjective approach yields a higher estimate in five of the eight countries and there is a substantial difference in some cases. For example, the subjective-based estimate of overeducation in Austria is 9.6 percent compared to an empirical estimate of 1.1 percent. The European Commission (2015) calculates job evaluation and empirical estimates of overeducation in EU countries and their findings indicate that, not only does the level of overeducation vary substantially across the two measures, the ranking of countries is also very different. For example, based on the job evaluation measure, Spain has the highest incidence of overeducation in the EU, however based on the empirical measure it has the third lowest incidence of overeducation. The report concludes that there is little correlation between the two measures, thereby highlighting the challenges associated with estimating and interpreting these indicators.

One of the most studied aspects of overeducation is its effect on wages, and the evidence consistently points to a wage penalty for overeducated individuals, relative to individuals with the same education in matched employment. Sixteen papers report estimates of the wage penalty.²³ Some papers report multiple estimates due to the fact that they investigate multiple countries or employ multiple methodologies. This results in 61 estimates of the overeducation wage penalty. Taking the average of these 61 estimates indicates that overeducated individuals earn 13.5 percent less than matched individuals with similar levels of education. The evidence also indicates that the overeducation wage penalty for females is typically greater than that for males (see Budria and Moro-Egido, 2009; Mavromaras et al., 2012; McGuinness, 2008; McGuinness and Bennett, 2007; Robst, 2008; Sánchez-Sánchez and McGuinness, 2015). While overeducated individuals suffer a wage penalty relative to individuals with similar education in matched employment, there is evidence of a wage premium relative to matched individuals in the same occupation, i.e. with lower education. Levels et al. (2014) find that having more education than is required for a job is associated with higher wages; specifically, each additional year of education in excess of that required yields a wage premium of 3 percent.

²² SONAR is an acronym for Studiegroep van Onderwijs naar Arbeidsmarkt, which loosely translates as Research Group on Education to Labour Market.

²³ These are McGuinness and Poulidakas (2016), Budria and Moro-Egido (2009), Chevalier and Lindley (2009), Cutillo and Di Pietro (2006), Diem (2015), Levels et al. (2014), Mavromaras et al. (2012), McGuinness (2008), McGuinness and Bennett (2007), McGuinness and Sloane (2011), Robst (2008), Sánchez-Sánchez and McGuinness (2015), Sloane (2014), Verhaest and Omey (2006), Verhaest and Omey (2012), Di Pietro and Urwin (2006). Some studies focus on specific sectors such as business graduates (Li et al., 2015) or nurses (Rubb, 2014) and find similar wage effects.

Table 2: Number of studies and average reported incidence of overeducation per country

| Country | Incidence of overeducation (%) | | |
|-----------------------|--------------------------------|-------------|----------------|
| | Subjective | Empirical | Job Evaluation |
| Australia | 14.3 n=1 | - | 37.3 n=3 |
| Austria | 20.7 n=5 | 37 n=3 | 23 n=1 |
| Belgium | 24.8 n=10 | 24 n=9 | 40.2 n=8 |
| Bulgaria | - | 33 n=1 | 24 n=1 |
| China | 20 n=1 | - | - |
| Croatia | - | 3 n=1 | 13 n=1 |
| Cyprus | - | 30 n=1 | 34 n=1 |
| Czech Republic | 6.3 n=3 | 25.9 n=4 | 13 n=1 |
| Denmark | 60.7 n=2 | 29 n=2 | 11 n=1 |
| Estonia | 2.2 n=1 | 36.5 n=2 | 28 n=1 |
| Europe (aggregate) | 33.5 n=2 | 25.5 n=2 | 51.6 n=1 |
| Finland | 18.2 n=5 | 14.4 n=5 | 18 n=1 |
| France | 24 n=6 | 27.1 n=3 | 21 n=1 |
| Germany | 20.5 n=7 | 22.1 n=8 | 17 n=1 |
| Greece | 41.1 n=2 | 29 n=3 | 25 n=1 |
| Hungary | - | 29.4 n=2 | 14 n=1 |
| Iceland | - | 30 n=1 | - |
| Ireland | 51.4 n=1 | 31 n=2 | 33 n=1 |
| Italy | 25.9 n=12 | 28.6 n=3 | 18 n=1 |
| Japan | 29.9 n=2 | - | - |
| Latvia | - | 36.5 n=2 | 20 n=1 |
| Lithuania | - | 30 n=2 | 16 n=1 |
| Luxembourg | 43.8 n=1 | 21.5 n=2 | 5 n=1 |
| Malta | - | - | 12 n=1 |
| Mexico | - | 25 n=1 | - |

| | | | |
|--------------|-----------------------------|----------------------------|----------------------------|
| Netherlands | 14.6 n=6 | 26.4 n=3 | 15 n=1 |
| Norway | 24.3 n=4 | 18.3 n=2 | 12 n=1 |
| Poland | - | 29 n=1 | 18.7 n=2 |
| Portugal | 18.5 n=5 | 24.2 n=3 | 12 n=1 |
| Romania | - | 27 n=2 | 17 n=1 |
| Slovakia | - | 49.5 n=2 | 18 n=1 |
| Slovenia | - | 35 n=1 | 12 n=1 |
| Spain | 31.5 n=9 | 23.4 n=7 | 36 n=1 |
| Sweden | - | 27.4 n=3 | 15 n=1 |
| Switzerland | 15 n=3 | 16.6 n=1 | - |
| Taiwan | 45.3 n=1 | 17.3 n=1 | - |
| UK | 27 n=11 | 25.9 n=5 | 22 n=2 |
| US | - | 25.6 n=9 | - |
| Total | 24.2 n=100 | 26.1 n=99 | 25.2 n=42 |

A large number of studies investigate the effect of overeducation on job satisfaction; however, the results of the literature are mixed. While some studies indicate that overeducation leads to lower job satisfaction (see e.g., Verhaest and Omey, 2006; Congregado et al., 2016; Peiro et al., 2010; Diem, 2015), others find that is only the case when overeducation is also accompanied by overskilling (see e.g., Sloane, 2014; Green and Zhu, 2010).²⁴ McGuinness and Sloane (2011) indicate that some overeducation may be voluntary as workers trade off earnings for other desirable job characteristics. Mavromaras et al. (2012) and McGuinness and Byrne (2015) find that overeducation is only associated with lower job satisfaction for females and Fleming and Kler (2014) find this effect is particularly strong for females without children at home.²⁵

Another strand of the literature focuses on the determinants of overeducation. The evidence indicates that overeducation is more prevalent among graduates of social sciences, services and humanities (Ortiz and Kucel, 2008), in workplaces that rely heavily on shift and part-time workers (Belfield, 2010) and areas where commuting to other labour markets is difficult (Ramos and Sanroma, 2011).²⁶

²⁴ In related work, Piper (2015) finds that overeducated people have lower life satisfaction.

²⁵ Verhaest and Verhofstadt (2016) suggest that providing more autonomy to overeducated workers may be an effective strategy to avoid job dissatisfaction.

²⁶ McGowan et al. (2015) find that skills mismatch is lower in countries with housing policies that do not impede residential mobility.

The literature on the persistence of overeducation is mixed. Verhaest et al. (2015) find that a high percentage of Belgian graduates experience persistent overeducation, however Frei and Sousa-Poza (2012) find that spells of overeducation in Switzerland are short, with half of overeducated persons in a given year being adequately matched one year later. Personal characteristics such as extraversion and conscientiousness reduce a person's probability of experiencing persistent overeducation (Blazquez and Budria, 2012).

Very little work has looked at the effect of overeducation on macroeconomic indicators. One exception is Ramos et al. (2012) who examine the effect of overeducation on GDP growth in six European countries and find that overeducation is associated with higher GDP growth. The authors attribute this finding to the high productivity of overeducated workers. This is consistent with work by Kampelmann and Rycx (2012) who find that additional years of overeducation are beneficial for firm productivity whereas additional years of undereducation are detrimental to productivity.

3.2 Undereducation

Compared to overeducation, the area of undereducation has received far less attention. Our literature survey consists of 24 papers in this area. Undereducation is not the sole focus of any of the papers in the sample, but is considered in conjunction with overeducation. It is also often the case that overeducation takes precedence and receives a larger share of the analysis and discussion within a paper.²⁷ The incidence of undereducation is reported in 16 papers with a total of 47 estimates covering 28 countries.²⁸ There are 25 subjective, 19 empirical and 3 job-evaluation estimates of undereducation. The average incidences of undereducation for the three measures are as follows; 11 percent (subjective), 26.9 percent (empirical) and 10.4 percent (job evaluation).

The empirical findings on undereducation are very mixed and as such it is difficult to ascertain stylized facts relating to this area. Verhaest and Omey (2006 & 2012) find evidence of an undereducation wage premium relative to workers with the same education in a matched job, however, Sánchez-Sánchez and McGuinness (2015) and Di Pietro and Urwin (2006) find no statistically significant wage effect for undereducated workers. In Salinas-Jiménez et al. (2016), undereducation is associated with higher subjective well-being which is attributed to individuals securing a better job than expected. However, in Peiro et al. (2010), undereducation is shown to have no relation to job satisfaction.²⁹ The literature is consistent in documenting a negative association between undereducation and

²⁷ In 11 of the 22 papers, the word overeducation features in the title and the word undereducation does not. However, each of the 22 papers deals with the issue of undereducation in some way, even if it is not the main focus of the paper.

²⁸ The 16 papers reporting the incidence of undereducation are Li and Miller (2015), Allen and de Weert (2007), Ghignoni and Verashchagina (2014), Hung (2008), Jauhiainen (2011), Kampelmann and Rycx (2012), Karakaya et al. (2007), Mahy et al. (2015), Mehta et al. (2011), Peiro and Grau (2010), Rubb (2014), Sánchez-Sánchez and McGuinness (2015), Verhaest and Omey (2006) and Yang and Mayston (2012), Cedefop (2015a), Di Pietro and Urwin (2006).

²⁹ Bracke et al. (2013) examine the relationship between educational mismatch and depression. While overeducated individuals are more likely to be depressed, undereducated individuals are similar to matched individuals.

firm productivity (Mahy et al., 2015; Kampelmann and Rycx, 2012) and showing that undereducation is more prevalent among females (Rubb, 2014; Jauhiainen, 2011).

3.3 Overskilling and underskilling

There are fewer papers on overskilling compared to overeducation. Our sample consists of 21 papers; 13 examine overskilling and overeducation together, and the remaining 8 focus exclusively on overskilling. The incidence of overskilling is reported in 13 papers, covering 28 countries. All estimates of the incidence of overskilling are calculated using the subjective method, and the average incidence is 20 percent. The literature on overskilling has largely focused on Australia, which accounts for 9 of the 21 papers.³⁰

As in the overeducation literature, the evidence indicates that there is a wage penalty associated with overskilling, with overskilled individuals earning less than individuals with equivalent levels of education who are in matched employment. 10 papers investigate this issue and the average overskilling wage penalty, based on 38 estimates, is 7.5 percent.³¹ The overskilling wage penalty is found to be smaller than the overeducation wage penalty (McGuinness and Sloane, 2011; Sánchez-Sánchez and McGuinness, 2015; Di Pietro and Urwin, 2006).³² In addition to the wage penalty, being overskilled also increases an individual's probability of future unemployment (Mavromaras et al., 2015) and is associated with lower job satisfaction (Mavromaras et al., 2012; Sloane, 2014; Green and Zhu, 2010; Congregado et al., 2016) and lower workplace harmony (Belfield, 2010). Overskilled workers are also more likely to want to quit their job (McGuinness and Wooden, 2009) and experience less skills development (Cedefop, 2015a).

Several studies investigate the determinants of overskilling and find that overskilling is more likely for those who have been overskilled in the past (Mavromaras et al., 2013) and for individuals with low levels of education (Mavromaras and McGuinness, 2012; Mavromaras et al., 2013).³³ McGuinness and Byrne (2015) focus on immigrant graduates in Europe and find that female migrants with a shorter duration of domicile have a higher likelihood of overskilling. The persistence of overskilling is also reported in Cedefop (2015a) using data from the European Skills and Jobs Survey; 80% of EU employees who were overskilled at the start of their current job, remained overskilled throughout their

³⁰ In the HILDA survey overskilling is assessed using the 7-point scale responses to the question: "I use many of my skills and abilities in my current job". A response of 1 corresponds with strongly disagree and 7 with strongly agree. HILDA stands for Household Income and Labour Dynamics in Australia.

³¹ The 10 papers are Di Pietro and Urwin (2006), Green and Zhu (2010), Mavromaras et al. (2012), Mavromaras et al. (2007), Mavromaras et al. (2009), Mavromaras et al. (2010), Mavromaras et al. (2013), McGuinness and Sloane (2011), Sánchez-Sánchez and McGuinness (2015) and Sloane (2014).

³² Jones and Sloane (2010) find that disabled workers are more likely to be overskilled and the wage penalty for this group is particularly large.

³³ The result in Mavromaras and McGuinness (2012) indicates that individuals with an advanced degree or diploma have a lower probability of being overskilled relative to individuals with no qualifications.

tenure. Only 17.6% of employees transitioned from being overskilled to matched, and 1.75% went from being overskilled to underskilled.

While overskilling and overeducation both measure surplus human capital, they are found to be weakly correlated (Green and McIntosh, 2007 and Flisi et al., 2014). Therefore, it is important to make it clear which type of measure is being used. This is not always the case in the literature and sometimes the terms overeducation and overskilling are used interchangeably (see e.g., Belfield, 2010).

The area of underskilling has received little attention in the literature. Sánchez-Sánchez and McGuinness (2015) and Cedefop (2015a) report estimates of underskilling in 13 European countries and the EU-28 respectively. The average incidence of underskilling is 25.5 percent.³⁴ Sánchez-Sánchez and McGuinness (2015) also show that underskilling has no statistically significant effect on wages and Pouliakas and Russo (2015) find that underskilled workers are more likely to be concentrated in high-skilled occupations.

3.4 Horizontal mismatch

As noted by Nordin et al. (2010), the literature on horizontal mismatch is relatively sparse in comparison to that of vertical mismatch. Our survey consists of 10 papers, of which 6 focus solely on horizontal mismatch and 4 on both horizontal and vertical mismatch. The incidence of horizontal mismatch is reported in 4 papers, covering 35 countries.³⁵ The average incidence of horizontal mismatch, based on 27 estimates, is 37.3 percent.

As with vertical mismatch, several studies investigate the wage effects of horizontal mismatch. Robst (2007 & 2008) and Nordin et al. (2010) find evidence of a wage penalty for horizontally mismatched individuals. However, Beduwe and Giret (2011) find no such effect and Montt (2015) indicates that the cost of horizontal mismatch on earnings is high only when combined with vertical mismatch. Horizontal mismatch has also been linked to lower job satisfaction (Beduwe and Giret, 2011).

Other studies have sought to establish the determinants of horizontal mismatch. Verhaest et al. (2015), Robst (2007) and Robert (2014) find a higher likelihood of horizontal mismatch among graduates of arts, humanities and social sciences. Levels et al. (2014) finds a lower incidence of horizontal mismatch among vocationally trained individuals. In related work, McGuinness et al. (2016) find that increasing the practical aspects of degree programs, irrespective of field of study, reduces the incidence of mismatch.

³⁴ In Cedefop (2015a), 22% of workers in the EU-28 are underskilled when they start their jobs, but this falls to 6% at the time of the survey.

³⁵ Montt (2015) reports estimates for 24 countries, Morgado et al. (2014) report an average incidence for 30 European countries, Robst (2007) and Nordin et al. (2010) focus on the US and Sweden respectively.

3.5 Skill shortages

The literature on skill shortages is typically based on employer surveys such as the European Business Survey (EBS), the Manpower Talent Shortage Survey and the European Company Survey (ECS). Caution is called for when using employer surveys to estimate the incidence of skill shortages due to difficulties in disentangling genuine skill shortages from other recruitment difficulties such as low wages or poor working conditions.³⁶ As noted by Cedefop (2015b), ECS data does not provide information on the reasons that employers find it difficult to attract talent. Drawing on the Eurobarometer Flash Survey 304, Cedefop (2015b) shows that while 47 percent of employers report difficulties in recruiting suitably skilled graduates, the total proportion of graduate employers facing genuine skill shortages is 34 percent. The European Commission (2015) calculates the incidence of recruitment difficulties across the EU using each of the three surveys and highlights inconsistencies in the estimates. For example results from the Manpower survey indicate that Greece has the second highest incidence of hard-to-fill jobs in the EU, however according to the EBS survey, employers in Greece are among the least likely to report that labour shortages are a major factor limiting production.³⁷

Several studies examine the effect of skill shortages on firm productivity. Bennett and McGuinness (2009), Tang and Wang (2005), Haskel and Martin (2006), Forth and Mason (2006) and Mason et al. (1994) find that skill shortages have a negative impact on firm productivity. Healy et al. (2015) investigate the strategies used by firms to respond to skill shortages using the Australian Business Longitudinal Database. They find that most firms respond to skill shortages by improved utilization of their core workforce through longer hours and better pay, while some firms use peripheral strategies such as temporary employment and outsourcing. Simple skill shortages, defined as skill shortages having one cause, are typically short-lived. This result is consistent with Bellman and Hubler (2014) who find that skill shortages in German firms are normally short-term phenomena.

Frogner (2002) states that it is now generally accepted that skill shortages are important due to their effect on economic issues such as productivity, GDP, employment and earnings, and uses data from the Employers Skill Survey to provide descriptive evidence relating to the productivity effect. Nickell and Nicolitsas (1997) estimate that a 10 percent increase in the number of firms reporting skill shortages lowers investment by 10 percent and R&D by 4 percent.

³⁶ Genuine skill shortages occur when demand for skills by employers cannot be met by available supply at market clearing wage rates (Cedefop, 2015b).

³⁷ Drawing meaningful comparisons between survey data is difficult due to different sample frames and surveying methods. For example, the EBS survey has a narrow focus as it relies only on a sample of manufacturing establishments and measures labour shortages that limit production.

3.6 Skill gaps

The majority of existing studies and estimates of skill gaps come from employer surveys carried out in respective countries.³⁸ Using the 2006 Irish National Employment Survey, McGuinness and Ortiz (2016) find that sectoral-level collective bargaining and a well developed human resource function are important factors in correctly identifying skill gaps in firms, with skill gaps found to be a key determinant of training expenditures and labour costs. Jackson and Chapman (2012) investigate the precise nature of non-technical skill gaps for graduates of Australian undergraduate business programs and find that graduates are deficient in vital elements of the managerial skill set. Using UK data, Tether et al. (2005) find that over one fifth of firms believe that skill gaps delay the introduction of new products and one third of firms believe that skill gaps are a barrier to the introduction of new work practices. As pointed out by McGuinness and Ortiz (2016), the literature on firm-level skill gaps remains relatively underdeveloped compared to other measures of mismatch.

3.7 Skill obsolescence

Finally, regarding skill obsolescence, the literature tends to focus on identifying the determinants of skill obsolescence. Murillo (2011) finds that workers in Spain with higher education levels are exposed to greater depreciation of human capital. Allen and de Grip (2012) and Janßen and Backes-Gellner (2009) relate skill obsolescence to job characteristics and find that workers are more likely to suffer from skill obsolescence when learning and technical knowledge are key components of the job. Similarly, Cedefop (2015b) find greater work complexity is associated with a greater degree of skill obsolescence. Van Loo et al. (2001) consider the determinants of different types of skill obsolescence and find that physically and mentally taxing working conditions increase skill obsolescence arising due to natural ageing, injury or illness.

3.8 Skills mismatch in low and middle income countries

Most of the existing data that allows for the measurement of skills mismatch, such as the Reflex and ESJS data, relates to high income countries and, as such, this is also the focus of most of the existing literature. However, more recently, some evidence has emerged for low and middle income countries. The World Bank's STEP (Skills Toward Employment and Productivity) dataset collects information on the following 12 low and middle income countries; Ghana, Kenya, Lao PDR, Sri Lanka, Vietnam, Armenia, Georgia, FYR Macedonia, Ukraine, Bolivia, Colombia and the Yunnan Province in China. In addition to collecting personal, education and occupational data, the STEP survey also

³⁸ In some studies skill gaps are treated as synonymous to underskilling and employee surveys are used (see e.g., Cedefop, 2015a & 2015b and Quintini, 2011). However, for the purposes of this study, we make the distinction that skill gaps are identified based on employer responses whereas employee responses relate to underskilling.

contains the following question which allows for the measurement of educational mismatch using the subjective approach; “*What minimum level of formal education do you think would be required before someone would be able to carry out this work?*” This question is close to those that are used to measure overeducation “to do” a particular job.

Handel et al. (2016), using the STEP data, find a high incidence of overeducation across the 12 countries in the sample, with overeducation being more prevalent than undereducation. The incidence of overeducation ranges from 22.3 percent in Macedonia to 70 percent in Vietnam, with an average incidence of 36 percent across all countries.³⁹ These rates are much higher than those found in more developed labour markets. Consequently, the incidence of undereducation is much lower, ranging from 3.8 percent in Ukraine to 40.4 percent in Kenya, with an average incidence of 12.4 percent. From a policy perspective, Handel et al. (2016) note that skills development alone is not enough to generate economic growth in these low and middle income countries, it is also necessary to foster creation of higher skilled jobs to ensure that the capabilities of the high skilled workers are fully utilised. In related work, Mehta et al. (2011) study four developing economies and find evidence of growing overeducation in unskilled jobs in the Phillipines and Mexico and little evidence of it in India and Thailand. However, the measure used by Mehta et al. (2011) differs from conventional measures of overeducation; their measure first involves identifying jobs where the wage returns to education are too small to justify their employees’ schooling, and then examining how many educated workers these jobs employ.

Handel et al. (2016) also investigate the determinants of educational mismatch across the 12 countries. Their main results can be summarized as follows;

- While more experienced workers may be expected to have a higher probability of undereducation, this is not supported by the STEP data.
- Working part-time is generally not associated with educational mismatch.
- Gender does not typically play a role in explaining educational mismatch, however, in some countries, women with young children are more likely to be overeducated than men.
- There is no role for health limitations in explaining educational mismatch.
- Informal employment is negatively associated with undereducation.
- In all countries, workers with lower years of tertiary education are more likely to be overeducated, as they are more likely to hold a non-tertiary job.
- Regarding field of study, the incidences of overeducation among graduates of humanities, social sciences, health and law tend to be relatively low, whereas the incidence is relatively high for business graduates.

The ILO’s School to Work Transition Survey (SWTS) data has also been used to study educational mismatch in low and middle income countries. Sparreboom and Staneva (2014) identify educational mismatch in 28 countries using the SWTS data using the International Standard Classification of Occupations (ISCO) method mentioned in Section 2.1, which categorizes major occupational groups by level of education in accordance with the International Standard Classification of Education (ISCED). In contrast to the study by

³⁹ This is the average for 11 countries, not including Colombia, whose descriptive statistics are not reported (see Figure ES.4 in Handel et al. (2016)).

Handel et al. (2016), Sparrebom and Staneva (2014) find a relatively high incidence of undereducation in low and middle income countries; on average in the 28 countries, 37 percent of youth are undereducated, 16 percent are overeducated and 47 percent are matched. In contrast to Handel et al. (2016), who highlight overeducation as a primary concern, Sparrebom and Staneva (2014) emphasise undereducation as the main policy concern, especially for low income countries where, on average, 51 percent of youth in non-vulnerable employment are undereducated.

Thus the evidence regarding the incidence of overeducation in low and middle income countries is somewhat unclear. Furthermore, we could find no research examining the impact of educational mismatch in developing economies on outcome variables such as job satisfaction or job mobility, and very little evidence on the impact of mismatch on earnings.⁴⁰ Based on our review of the literature, no published research has examined the issues of overskilling, underskilling, skill gaps or skill shortages. It is fair to say that research in the area of skill mismatch in developing countries is at a very early stage and is likely to remain restricted due to the limited availability of quality data linking aspects of skill mismatch to key outcome variables.

⁴⁰ Quinn and Rubb (2006) find evidence of an overeducation wage penalty in Mexico. Their data used is a survey of heads of households and therefore primarily relates to males.

4. Skill mismatch combinations: empirical evidence

It is clear that many of the concepts discussed above are likely to be and while some combinations of mismatch are mutually exclusive other combinations can potentially impact individuals simultaneously. Few data sources exist that allow for the simultaneous measurement of the multiple forms of both educational mismatch (overeducation and undereducation) and skill mismatch (overskilling, underskilling and skill obsolescence). The Cedefop European Skills and Jobs Survey (ESJS) is a unique exception, as it includes a variety of skill mismatch measures, some of which are captured at two points in time; employees are asked about their current skill levels (at the time of survey completion) as well as their skill levels when they were first hired for the job. The ESJS data thereby allows us to estimate the incidence of various combinations of skill mismatch affecting adult workers. Table 3 separates the respondents into three groups; overeducated, matched and undereducated individuals.⁴¹ We show the percentage of individuals within each group that exhibit other forms of mismatch. For example, 44 percent of overeducated individuals were overskilled when they were hired, 18 percent were underskilled when hired and 38 percent had skills matched to their job. In Figure 1 we report the overall incidence of various combinations of mismatch among the full sample of surveyed working individuals. For example, 10 percent of all workers surveyed in the ESJS are both overskilled and overeducated.

Several notable features emerge from the data. It appears that while education may act as a proxy for the total skills required to do one's job, the relationship between the two is not strong. For example, only 44 percent of overeducated individuals considered themselves overskilled at the time of being hired and just 27 percent of undereducated individuals considered themselves underskilled. It appears that for a significant number of workers, the skills acquired in formal education are not sufficient to meet the requirements of their job when they are first hired, as shown by the 18 percent of overeducated workers and the 22 percent of matched workers who were also underskilled. However, only 4 percent of overeducated workers were underskilled at the time of interview, with the drop from 18 to 4 per cent indicating that workers undergo on-the-job training and acquire necessary skills throughout their career. This pattern of on-the-job skill accumulation is also reflected in the relatively high number of undereducated individuals who are underskilled when hired (27 percent), compared to the low percentage who were underskilled at the time of interview (8 percent). Another notable statistic relates to the combination of overeducation and skill obsolescence; 21 percent of overeducated individuals report that their skills have worsened since they started their job. This provides support for the 'use it or lose it' hypothesis.

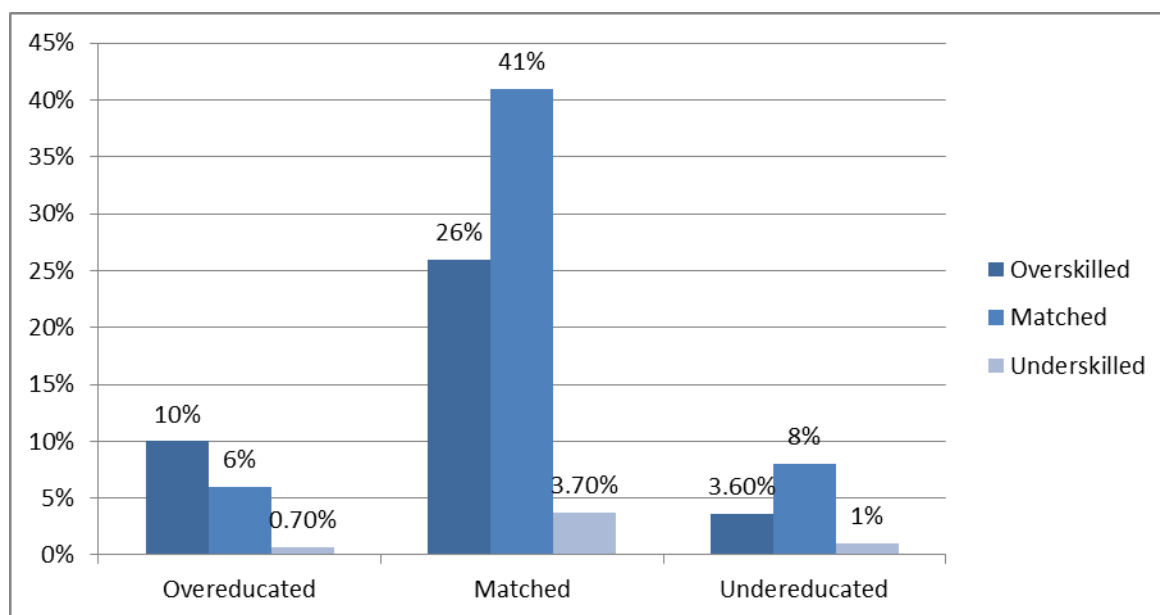
⁴¹ The educational mismatch variable relates to being over/undereducated "to do the job".

Table 3 Skill mismatch combinations among adult employees, 2014, EU28

| | <i>Overeducated</i> | <i>Matched</i> | <i>Undereducated</i> |
|-------------------------------|---------------------|----------------|----------------------|
| <i>When hired</i> | | | |
| Overskilled | 44% | 24% | 20% |
| Skill Matched | 38% | 54% | 53% |
| Underskilled | 18% | 22% | 27% |
| <i>Present time</i> | | | |
| Overskilled | 60% | 36% | 29% |
| Skill Matched | 36% | 58% | 63% |
| Underskilled | 4% | 5% | 8% |
| Skill obsolescence (physical) | 21% | 12% | 11% |

Notes: Overeducation and undereducation are derived by comparing an employee's highest qualification with the level needed to do the job. Overskilling is derived by asking workers to reflect if their overall skills level is higher than needed to do the job. Underskilling is obtained by asking respondents if some of their skills are lower than needed to do the job and require further development. Respondents were asked to reflect about their overskilling and underskilling status both at the start of their current job and at the time of the survey. (Physical) skill obsolescence is measured by the share of adult workers who claim that their skills have worsened since the start of their job with their current employer. Source: Cedefop European skills and jobs survey (ESJS); Cedefop (2015a)

Figure 1 Skill mismatch combinations in adult workforce, 2014, EU28



Notes: The percentages depict the share of adult employees in the whole EU28 sample affected by a given skill mismatch combination (e.g. overeducated & overskilled etc.). Overeducation and undereducation are derived by comparing an employee's highest qualification with the level needed to do the job. The skill mismatch variable captures whether an individual was over/underskilled at the time of being interviewed. Appropriate sample weights applied.

Source: Cedefop European skills and jobs survey (ESJS); Cedefop (2015a).

The data suggests that underutilisation of human capital is more prevalent than human capital deficits in Europe. Figure 1 shows that ten percent of all workers are both overeducated and overskilled and that 26 percent of workers, whilst matched (in terms of education) are overskilled. However, only one percent of all workers are both undereducated and underskilled in this sample of high income countries.

5. The policy position: potential levers, spillovers and current responses

5.1 Conceptual policy framework

As stated, while the subject of skill mismatch often appears within policy documents in a generic sense, the concept of skill mismatch is multi-dimensional and encapsulates a number of measures of both education and skill asymmetries, some of which are very loosely connected to each other. The policy debate requires greater clarity in the form of mismatch that is to be addressed, however, the interdependence between various forms of mismatch should also be understood as policy measures designed to address one form of mismatch may well have spillover effects to other related forms of mismatch. While the previous section indicated that individuals can simultaneously experience some forms of mismatch, it is important to consider the potential drivers of each form of mismatch and how they relate to each other at an aggregate labour market level. Policy initiatives to address mismatch both within and across countries should consider the inter-dependence and potential causal relationships between the various indicators.

The range of policy levers likely to be implemented in order to combat problems of skill mismatch will tend to vary according to the type of asymmetry being considered. With respect to forms of vertical mismatch associated with surplus human capital (overeducation and overskilling) the evidence, and subsequent policy debate, has focused on the value of initiatives such as (a) achieving a better alignment between educational / training supply and labour demand in terms of both levels and composition⁴², (b) removing information asymmetries to enable a smoother matching process between job seekers and employers and (c) enhancing the flexibility of firms to fully utilise the skills and abilities of their workforce. McGowan and Andrews (2015) present evidence which indicates that policies associated with lower mismatch include less stringent labour market regulations, lower barriers to entry among firms, less stringent bankruptcy legislation and lower transaction costs for housing.⁴³

The problems of deficits in human capital (skill gaps, uneducation, underskilling) and skill obsolescence are generally discussed in the context of finding ways to incentivise training. The issue of skill shortages tend to stimulate debate around balancing educational

⁴² Recently, the EU Skills Agenda has focused on strengthening the attractiveness of vocational education and work-based learning, such as apprenticeships. There is also a focus on enhancing the linkage of educational qualifications with labour market needs by shifting to a learning outcomes approach to ensure that employers know what the graduate can do in terms of skills and competences, as opposed to simply relying on education as a signal.

⁴³ Lower transaction costs improve residential mobility which can reduce skills mismatch.

and training provision with labour demand and improving labour mobility and skilled migration. Here we consider the extent to which various forms of mismatch are likely to simultaneously occur in the labour market and the degree to which policy initiatives to tackle specific forms of mismatch will have spill over effects on other dimensions of the phenomenon.

Overeducation and overskilling: To the extent that overeducation will result in under-used skills, there is good reason to believe that labour markets with high levels of overeducation will also exhibit high levels of overskilling. While the evidence does suggest a positive correlation, rates of overskilling within countries generally lie below those of overeducation. Many of the policy responses to vertical mismatch discussed in the literature are likely to simultaneously impact both overeducation and overskilling and policy spill over effects are likely to be strong.

Overeducation and undereducation: There is no reason to believe that high rates of overeducation in a labour market will necessarily lead to a high incidence of undereducation. Furthermore, the central policy responses necessary to address each respective problem will tend to be somewhat different. Policies focused at reducing undereducation will tend to be focused on improving incentives to train among both existing workers and employers and will tend not to impact rates of overeducation. However, policy initiatives targeted at overeducation, such as matching labour supply with demand, labour mobility and reducing information asymmetries, may also influence rates of undereducation. Very similar arguments can be made for the relationships between (a) overeducation and underskilling (b) overskilling and undereducation and (c) overskilling and underskilling.

Overeducation and skill obsolescence: Given that the potential drivers of both forms of mismatch are likely to be very different, there are no strong arguments to suggest that there will be a strong correlation between them at the labour market level. However, the evidence from the micro-data does provide some support for the “use it or lose it hypothesis” whereby workers with under-utilised skills are likely to report skill worsening over time, suggesting some correlation. While retraining initiatives designed to improve the situations for workers with obsolete skills will have little impact on rates of overeducation in the labour market, policies aimed at reducing overeducation may have positive spillover effects for skill obsolescence. Similar arguments apply to overskilling and skill obsolescence.

Undereducation and skill obsolescence: While on the grounds that both undereducation and skill obsolescence are more likely to affect older workers and have similar drivers, such as technological change, there is a basis to suggest that both forms of mismatch will be correlated at a labour market level to some extent. Given that the policy response to both types of mismatch centre around training, positive spill over effects will exist, but are likely to be limited to circumstances where workers suffer from both forms of mismatch simultaneously. Similar arguments can be made for the potential relationship between underskilling and skill obsolescence.

Undereducation and skill gaps: Undereducation and skill gaps represent two approaches to describing the problem of deficit human capital among the workforce. While both forms of mismatch will be correlated at a macro level, the correlation may be low as

undereducation does not necessarily imply a skill gap. Undereducated workers may still be matched with regards to job skill requirements. To the extent that the policy response to both forms of mismatch will tend to focus on improving incentives to invest in training, policy spill over effects between these two forms of mismatch are likely to be substantial in circumstances where both forms of mismatch occur simultaneously.

Overskilling and skill gaps: There are no arguments to suggest that both forms of mismatch will be correlated at a labour market level.⁴⁴ Nevertheless, both forms of mismatch can potentially be driven by poor connections between employer demand and the composition of education and training provisions, suggesting that some relationship could exist.⁴⁵ Policies aimed at tackling overskilling that focus on improving the match between education provision and employer needs will also tend to reduce the incidence of skill gaps among new labour market entrants, so some spill over effects are likely. The same arguments apply for the relationship between overeducation and skill gaps.

Underskilling and skill gaps: This combination of skill mismatch is likely to be strongly correlated in the labour market as they both measure the prevalence of skill deficits in the workplace. Given that the policy response to both types of mismatch centre around improving training, positive spill over effects are likely to be strong.

Skill shortages and skill gaps: There is a strong basis for believing that both of these dimensions of skill mismatch are strongly correlated, particularly given the evidence suggesting that firms will tend to respond to skill shortages by reallocating less skilled workers to vacant posts, thereby creating skill gaps (Bennet & McGuinness, 2009). Policies aimed at reducing skill gaps may range from improving the match between the outputs of a country's education and training institutions and employer needs, to encouraging skilled migration. To the extent to which skill gaps emerge as a consequence of skill shortages, policies aimed at addressing the latter will also impact on the former. Furthermore, improved firm-level training designed to address skill gaps may also reduce the incidence of skill shortages as it becomes more feasible to fill new positions internally. Similar arguments apply to the relationship between skill shortages and both undereducation and underskilling.

Skill shortages and overskilling: There are no obvious arguments linking the incidence of skill shortages and overskilling at an aggregate level. Nevertheless, both forms of mismatch can potentially be driven by poor connections between employer demand and the composition of education and training provisions, suggesting that some relationship could exist. Policy spill over effects between both forms of mismatch are likely to be strong in the context where policy is focused at an improved match between labour demand and the outputs of education and training institutions. It is also possible that stringent employment protection legislation could lead to both skill shortages and overskilling; less flexibility may lead to overskilled employees being trapped in certain firms, while restrictions on a firm's ability to hire externally could lead to the firm

⁴⁴ With regard to career progression, it is possible that a person could be overskilled in their current post, but this does not mean that they are not subject to a skill gap in relation to progressing in the organisation.

⁴⁵ Poor managerial quality could also be a driver of overskilling and skill gaps; ineffective managers may not exploit the employee's potential and may be more likely to report skill gaps among workers rather than admit managerial deficiencies.

reporting skill shortages. The same set of arguments apply for the link between skill shortages and overeducation.

Skill shortages and skill obsolescence: As both forms of mismatch are potentially driven by common factors such as skill biased technological change, there may exist some correlation at an aggregate labour market level. However, the responses to each form of mismatch are likely to be distinct and will be targeted at unrelated segments of the labour market. Policy spill over effects between both of these forms of mismatch are likely to be limited. However, it is possible that more effective employee training could simultaneously reduce skill obsolescence and skill shortages by lowering a firm's reliance on external hiring.

5.2 Current policy responses to skill mismatch

There appears to be a misalignment between the focus of the academic literature on skill mismatch and the direction of skills and labour market policy. Despite the existence of a large body of research demonstrating the costs associated with surplus human capital as evidenced by the data on overeducation and overskilling, policies focused on addressing the problem are rarely evident either at a national or European level. The reason for such policy inertia is unclear; however, we suspect that political problems associated with implementing policies that question long-held assumptions around the benefits of the continued educational expansion may be a factor along with the challenges of addressing enhanced skills utilisation in enterprises. Moreover, it may also be the case that policy makers do not view overeducation or overskilling as being overly problematic, viewing it simply as a short-run phenomenon despite some convincing evidence for the contrary.

Generally speaking, policy initiatives related to skills mismatch tend to concentrate on developing initiatives aimed at enhancing the responsiveness of the education and training system to emerging labour market needs. Approaches adopted in the pursuit of this policy include anticipating future skill needs and supply through the use of occupational forecasting models, the use of sectoral or occupational skills councils and the commissioning of bespoke qualitative and quantitative research projects.⁴⁶ The view that skills mismatch is also a function of asymmetric information between jobseekers, workers and firms has also led some countries to improve career guidance and counselling services in order to tackle mismatch. So, somewhat ironically, policy initiatives seem to be focused on combating the different forms of skill mismatch with the most under-developed evidence base, i.e., skill shortages and skill gaps. The heavy policy focus on eradicating and preventing skill shortages and gaps appears to be based on an assumption that such mismatches impose substantial costs on firms rather than on an evidence base demonstrating causal relationships. On balance however, it is reasonable to suggest that policy needs to focus more attention on the problem of surplus human capital, i.e., overeducation and low skills utilisation, given that a substantial body of research has established that these forms of mismatch impose substantial costs on workers and firms.

⁴⁶ Skill mismatch indicators are also widely used for informing labour migration policies.

5.3 The position of skill mismatch in the European policy agenda

To illustrate the conclusions drawn above, we review the latest country specific recommendations and policy documents from the EU and assess the extent to which skills mismatch appears as a policy priority. We focus on the 2016 country specific recommendations (CSR) issued by the Council of the European Union and the 2016 National Reform Programme (NRP) publications. It is clear that any country specific policy recommendations relating to skills mismatch, in cases where such recommendations exist, primarily relate to skill shortages. Specific reference was made to skill shortages in the CSRs for Lithuania, Germany, Belgium, Estonia and the UK and the NRPs for Ireland, Greece, Malta, Bulgaria, Cyprus and Hungary. Emphasis is placed on the reform and implementation of education and training strategies as a way of reducing skill shortages in Lithuania, Greece, Malta, Ireland, Belgium and the UK. In Bulgaria, Cyprus and Hungary, the policy focus relates specifically to a shortage of qualified ICT specialists, whereas in the UK specific mention is made of skill shortages in construction. For Germany, the area of policy concern relates to impending age-related skill shortages as the population continues to get older. In Estonia, it is noted that exports of manufactured goods have shifted towards lower-value goods in recent years, and skill shortages may pose a barrier to greater investment in high-tech sectors.

Section 3.5 of this paper highlighted an important consideration regarding the interpretation of skill shortage statistics based on employer survey responses; namely, a large part of what employers report as skill shortages may instead relate to recruitment difficulties due to poor wages or working conditions. The New Skills Agenda for Europe (European Commission, 2016) raises concerns relating to skill shortages and mismatch by highlighting that “40% of European employers have difficulty finding people with the skills they need to grow and innovate”. However as pointed out by Cedefop (2015b), it is likely that only a subset of this 40% are faced with genuine skill shortages. Using data from two Eurobarometer surveys (196 and 304), Cedefop (2015b) finds that, of the firms reporting difficulties relating to a lack of skilled labour, about a quarter face problems that cannot be directly related to poor wages and working conditions or inferior recruitment strategies. Therefore, the statistics on skill shortages being used to inform and guide policy in Europe are likely to overestimate the prevalence of genuine skill shortages.

The term ‘skills mismatch’ is specifically mentioned in the CSRs of Belgium, Bulgaria, Ireland, Spain, Finland and the UK. Whilst we have seen that skills mismatch is a complex area and can relate to a number of different types of mismatch, the policy documents typically make no distinction as to the type of mismatch in question. An example of this is contained in the second recommendation of the CSR for Finland, which simply suggests that measures should be taken to reduce regional and skills mismatch. The recommendations for the UK are also quite vague, stating that skills mismatches should be addressed and skill progression provided for by strengthening the quality of apprenticeships. The policy advice contained in the CSR for Spain is more specific and appears to relate to overeducation and skills obsolescence. Attention is drawn to the fact that a high percentage of Spanish graduates are employed in jobs that do not require a university degree and concerns are expressed regarding the depreciation of skills among

the long-term unemployed. There is no mention of overeducation, overskilling, skill gaps, skill obsolescence or horizontal mismatch in any of the CSRs.

The fact that Spain is singled out for policy recommendations concerning overeducation is interesting as it highlights the difficulties and inconsistencies in forming evidence-based policies on skills mismatch. In the European Commission (2015), the incidence of overeducation in Spain based on an objective method is the highest in the EU (at approximately 36 percent).⁴⁷ However, when the European Commission (2015) applies the empirical method, the incidence of overeducation in Spain is the third lowest in the EU. Whilst the European Commission recognize that empirical challenges exist in the measurement of overeducation and calls for caution when interpreting the indicators, the recommendations of the European Commission for Spain appear to be at odds with the low incidence of overeducation reported by the empirical method and suggests that the CSR for Spain is based on the higher incidence reported by the objective method. However, as noted by the European Commission (2015), “there are several reasons why a considerable share of the high-skilled that show up as ‘overqualified’ in the objective indicator should not necessarily be a concern for policy makers”. As such, it is not clear that the objective measure alone provides the best statistics to inform and guide policy in the area of over education.

6. Conclusion

The term skills mismatch is very broad, and can refer to a variety of concepts including vertical mismatch, horizontal mismatch, skill gaps, skill shortages and skill obsolescence. Being cognizant of the distinction between types of skills mismatch, their inter-relatedness, and the various measurement issues associated with each type of mismatch is necessary to inform policy debate in this area. Current policy recommendations on skills mismatch tend to be vague, as the term skill mismatch is often used without any mention as to the specific type of mismatch in question nor how the policy priority is expected to address it.

In the few cases where policy recommendations on skills mismatch exist, our analysis has highlighted inconsistencies between the focus of the academic literature and available data and the direction of policy. Whilst an abundance of evidence exists on the costs associated with surplus human capital, as measured by overeducation and overskilling, much less is known on the effects of skill gaps, skill obsolescence and skill shortages. However, the policy debate seems to focus on precisely the areas for which the least evidence exists, namely skill shortages. It is not clear why this is the case, especially given the strong emphasis placed by international organisations and governments on evidence-based policies. In the rare instance where specific attention is drawn to overeducation, as in Spain, further inconsistencies emerge. There is no clear discussion or justification as to which measure of overeducation is being used by the European Commission and national

⁴⁷ In this case, a rather crude measure of overeducation is used, namely one that assumes that all tertiary education graduates employed in medium- or low-skilled occupations (ISCO 4-9) are overeducated. This method essentially assumes that the skill requirement of all occupations other than managers, professionals and associate professionals requires a non-tertiary education degree.

governments to inform policy recommendations. This is important given that the ranking of countries based on the incidence of overeducation can change dramatically depending on the type of measure used.

A more transparent and consistent approach that takes account of the existing evidence should form the basis of future policy debate in this area. By bringing together the various concepts of skills mismatch into this one document and analysing their inter-relatedness, measurement approaches and stylized facts, our paper may help to guide future policy debate along these lines. It is clear from the evidence presented here, including the 2014 European Skills and Jobs Survey, that underutilisation of human capital is more prevalent than human capital deficits in Europe. The situation whereby 1 in 4 employees are operating below their productive capacity should be a major concern for policy, particularly given the weight of evidence on earnings suggesting that such forms of mismatch lower worker productivity. There are strong grounds to believe that substantial benefits would accrue to individuals, firms and macroeconomy should policy interventions in this area prove successful. It is important that policy continues to focus on tackling the issue of skill shortages and skill gaps,; however, a greater balance needs to be struck between policies aimed at improving welfare by eliminating gaps in the productive capacity of human capital and those that achieve the same goal by removing constraints that restrict the productive capacity of human capital.

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