

Chapter 1

Skills shortages and mismatches

Increased globalisation and rapid technological change, but also demographic, migration and labour market developments, have altered considerably the structure of skill requirements in most countries in recent decades – and these trends are expected to continue in the foreseeable future. In such a rapidly changing world, the need for the assessment of existing skill shortages and for forward-looking information on how the labour market and the demand for skills might change has become increasingly acute. Indeed, this chapter demonstrates that: i) the costs of “getting it wrong” are substantial, with significant economic costs, for individuals, employers, as well as society as a whole; and ii) the extent of mismatch and perceived shortages is high, and in some countries even increasing. Yet differences in the extent of mismatch and the prevalence of shortages across countries suggest that skills policies can make a difference.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

In response to past and current changes in the types of skills needed, countries from around the world are increasingly paying attention to skills shortages and mismatches (ILO, OECD and World Bank Group, 2014). Stakeholders and businesses recognise that better aligning education and workforce needs is a top policy priority (TÜSIAD, 2014). In fact, job creation in Europe and the United States up to the 2020s will be largely driven by growth in high-skilled occupations. In Europe, this will mainly occur in professional services, business services and computing. It has been projected that 3 million new professional jobs will be created and over 5 million new technician and associate professional jobs. These trends require an up-skilling of the workforce: 19.4 million new jobs will require high-level qualifications which compensate for a declining number of jobs requiring medium- and low-level qualifications (EU Skills Panorama, 2014a). In the United States, employment growth is projected to be fastest in the healthcare, healthcare support, construction and personal care fields. Nineteen of the 30 occupations projected to grow fastest require post-secondary education, with the fastest growth projected among those jobs requiring a master's degree (Richards and Terkanian, 2013).

This chapter reviews the evidence on current skills imbalances. It sets the scene and provides background for a discussion of the policy avenues to address changing skill needs and frames skills assessment and anticipation exercises as a tool for countries to respond to them.

Main findings

- Skills mismatch implies costs for workers, employers and the economy. For workers, it brings about lower wages and lower job satisfaction. For the economy, it entails lower economic output. Skills shortages increase hiring costs and lower productivity.
- More than 40% of workers in Europe and other OECD countries like Japan, Korea and Mexico feel their skill levels do not correspond to those required by the job. Three out of ten workers believe they have the skills to cope with more demanding work and more than one out of ten believe they need more training to cope well with duties. Employers in most countries report difficulty in filling jobs, suggesting that the skills they require are not available in the labour market.
- Mismatch by field of study is the most common form of mismatch, followed by qualification mismatch. Although some level of mismatch is always to be expected, countries differ in the incidence of mismatch, suggesting that policies can make a difference.
- Several policy avenues exist to respond to skill shortages and mismatches. Skills assessment and anticipation exercises can provide evidence-based and reliable information to develop such policies.

The sources of skills mismatch and shortages

The past decades have seen an important shift in the types of jobs that make up the economy. Jobs are created and others destroyed, changing the skill demand of the economy. The skills required in the jobs that remain also shift, as the remaining jobs also change. These shifts have been brought about by, among other factors: changes in the global division of labour and a growing dependence of domestic jobs on economic globalisation; economic cycles and shocks; changes in the way firms are organised; technological innovation; demographic change; and changes in consumption models.¹ Rapid improvements in computer technology over the last few decades have provided employers with cheaper machines that can replace humans in many middle-skilled activities such as bookkeeping, clerical work and repetitive production tasks. Technology

replaces certain tasks, changing the skill requirements to carry out a particular job. Improvements in technology enable employers to offshore jobs that do not require face-to-face interactions and shape a country's skills requirements. The pace of job technological job replacement seems to have slowed recently in the United States and there is debate as to how far this replacement will go (Autor, 2010, 2014; Bassanini and Manfredi, 2012; Cappelli, 1999). Countries and industries have shown a heterogeneous impact on wages and employment response to both the Great Recession and technological change (Eurofound, 2013a; Jaimovich and Siu, 2012). Economies' reaction to these changes depends, among other things, on their institutional and regulatory framework (Fernández-Macías, 2012).

The supply of skills is equally dynamic and has changed as a result of the expansion of compulsory and higher education (Meyer, Ramirez and Soysal, 1992; Schofer and Meyer, 2005), as well as changes in the quality of education (OECD, 2013b, 2013c), the increase in female labour force participation, migratory changes, demographic transitions, changes in the type of work carried out and the skills acquired as a result of experience, and changes in retirement regulation (Dixon, 2003; OECD 2013d, 2012a). Increases in skill supply can also be brought about by changes in the intensity (hours) or efficiency of work, potentially reducing shortages (Handel, 2012, 2003; Richardson, 2007).

The dynamism of both skill demand and supply raises the question of how economies match the two. In a perfectly competitive labour market, price and quantity adjust until the market clears: firms adapt production processes to the available stock of human capital and workers seek the amount and type of training currently required (or foreseen) in an economy (Hartog, 2000). This model relies on an assumption of perfect information. In reality, students, workers, employers and training institutions may not be well-informed about the skills required in the immediate-, medium- and long-term. In the presence of incomplete information, the time lag between the decision to enter education or a worker training programme and that of entering the labour market may lead individuals to under- or over-estimate employment prospects leading to mismatches and/or shortages. Workers may therefore have to accept posts for which they are mismatched, unless they go back in training to acquire the skill sets demanded by the economy; or employers invest in formal or informal training on-the-job. Similarly, when many of the attributes of the jobseeker are not easily observable to the employer, wages may not correspond to workers' productivity and may be unresponsive to changes in skills supply. As a result, lengthy periods of search might be required by both parties before job offers are made and accepted which means that overall mismatch can stretch considerably over time (Mortensen and Pissarides, 1999).

A lack of information is, therefore, an important driver of skill mismatch. Yet mismatch can still exist in the presence of perfect and complete information. Co-ordination failures can emerge when individual choices do not internalise other agents' preferences. Holzer (2013), for instance, suggests that students prefer education paths in fields where wages are expected to be high, not realising that other students will also have similar preferences and make the same investment, eventually overcrowding specific education fields. Further, for students and workers, financial constraints may limit the possibility of acquiring the skills in demand if individuals are unable to borrow (for lack of collateral), or lack sufficient savings to finance their up- or re-skilling (Bound et al., 2009; Haskins et al., 2009; Heckman and Lafontaine, 2007; Lovenheim, 2010). Equally, firms may not be in a position (or have the incentives) to adapt their productive processes to the available skill stock. Strict employment protection rules may make it costly for employer to hire workers with the skills required. It may make more

sense to or retain mismatched workers and offer on-the-job training to employees lacking these skills. Also, some sectoral labour shortages may occur because the jobs on offer are not attractive enough to a sufficient number of people (e.g. resulting from long and anti-social hours, relatively low wages, or demanding working conditions) (EU Skills Panorama, 2014b).

National/local or individual financial and budget constraints may limit the ability to reduce mismatches and shortages. Tight budget constraints may lead some countries/regions to reduce their education and training offer and/or limit their ability of updating them with education programmes more in line with the skills required by the labour market. This situation can limit the availability of training opportunities, thus limiting students and workers' possibility of acquiring skills that are in high demand.

For all the above-mentioned reasons the market for skills is unlikely to clear (rapidly) in and of itself, and government intervention will be required to address these market failures.² As a consequence of the economic crisis, unemployment in the OECD has increased while some vacancies remained unfilled. In Europe, for example, unemployment rose from 7% in 2008 to 10.8% in 2013. Yet, in 2013, there were around 2 million vacancies available in the European Union and four out of ten employers reported difficulties in finding employees with the right skills. This indicates an imbalance between the available labour and the jobs in the EU labour market and shortages of the right skilled people in the right places to fill these vacancies (EU Skills Panorama, 2014b).

The economic costs of mismatch and shortages

Skills mismatch can have adverse effects both at the aggregate and individual levels. Total economic output at the aggregate level is influenced by how well workers are assigned to jobs. Mismatch results in economic output that is lower than the potential given by the economy's skills stock (Sattinger, 1993). Skill mismatches and shortages can negatively affect economic growth through their effects on: increased labour costs, lower labour productivity growth, slower adoption of new technologies, lost production associated to vacancies remaining unfilled, and the implicit and explicit costs of higher unemployment rates (OECD, 2012b). In particular, skill and qualifications mismatch is associated with lower labour productivity within industries (Adalet McGowan and Andrews, 2015). The aggregate costs of field-of-study and qualifications mismatch can amount to more than 1% of GDP due to losses in productivity and the sunk cost of developing skills that are not used (Mavromaras, McGuinness and Fok, 2009; Montt, 2015).

Skill shortages (particularly high-skill labour shortages) also have negative implications for the economy and the labour market. They increase hiring costs and lower productivity as vacancies remain unfilled for a longer period of time. Shortages can also induce wage inflation and, by increasing workers' bargaining power, raise demands for an easier pace at work. In an efficient labour market wages are indeed expected to rise in response to shortages, but persistent shortages and the consequent inflation can be a sign of skill supply not adapting to changes in demand. In addition, shortages can induce skills mismatch as workers from other fields seek employment in sectors experiencing shortages (Bennet and McGuinness, 2009; Haskel and Martin, 1996, 1993; Montt, 2015; Shah and Burke, 2005).

At the individual level, over-qualification and over-skilling entail lower earnings, lower job satisfaction and a higher risk of unemployment relative to well-matched workers. For example, over-qualified workers working in their field are expected to suffer an 18% wage penalty compared to well-matched workers; for over-qualified workers who are working in a sector or job unrelated to their field of study (i.e. field-of-study mismatch), this penalty amounts to 26%. Workers who were mismatched by field-of-study are also five percentage points more likely to be unemployed than previously well-matched workers (Montt, 2015; OECD, 2014).

In recognition of the costs of shortages and mismatches, the ability to assess and anticipate skill needs has become a notable policy concern across OECD and partner countries.³ The 2008 International Labour Conference acknowledged that potential mismatch between skill demand and supply has high economic and social costs, contributing to structural unemployment (ILO, 2008). The World Economic Forum highlights the increased importance of matching skills and that skill mismatch has become more prominent during the last economic crisis (World Economic Forum, 2014). The G20 Training Strategy also recognises the importance of anticipating future skill needs (ILO, 2010).⁴ Employment plans in G20 countries propose to address this challenge by promoting the collection and use of information on the demand and supply of skills, the transportability of educational and occupational credentials, the upskilling or reskilling of new, unemployed and displaced workers and the promotion of geographic mobility (ILO, OECD and World Bank Group, 2014).

Evidence of mismatch and shortages in selected countries

In the European Union, more than 40% of workers feel that their skill level is not matched to the requirements of the job; that is, workers have trouble finding jobs suitable to their skill levels. Similar estimates are observed in Mexico, Japan and Korea, with somewhat lower levels in Australia and New Zealand. In parallel, around 40% of employers report difficulties in recruiting staff with the right skills to perform the tasks required by the job; that is, employers have trouble finding workers meeting their skill requirements. The incidence of skill shortages and mismatches varies by country according to labour market conditions and the skills matching policies in place (Montt, 2015; OECD, 2013b; Quintini, 2011a; Wolbers, 2003). The level of skills shortage and mismatch may also differ across countries at different stages of economic development. Shortages are likely to be greater in countries with low educational attainment and high economic growth as their educational infrastructures may lag in adjusting to rapid structural change. On the contrary, in many developed countries, over-qualification or over-skilling may represent a common phenomenon as increasingly larger shares of youth graduate from tertiary education. As described below, high/low levels of skill mismatch and/or shortage speak to different labour market dynamics and therefore require different policy responses. Box 1.1 provides details on how skills shortages and mismatches are defined and measured.

Mismatch: Workers' perspective

Skills mismatch

This section estimates the extent of skills mismatch across a selection of OECD and European countries. Figure 1.1 shows that 45% of workers report experiencing skill mismatch in 2010 across the EU-27. They are workers who feel they lack the skills to

perform their current job (i.e. under-skilled) or they feel they have the skills to perform more complex tasks (i.e. over-skilled). Self-reported mismatch was to highest in Romania, Greece, Hungary, Latvia, Slovenia and Albania, with more than 50% of workers feeling they are more (or less) skilled than what is required for the job. It was lowest in Lithuania, Belgium, Bulgaria, the Czech Republic, Finland, the Former Yugoslavian Republic of Macedonia (FYROM), Italy, Norway, Portugal and Turkey, at levels below 40%. In 2005, around 40% of worker-reported mismatch was observed for other OECD countries (Mexico, Israel and Japan) and 30% in Australia and New Zealand (Quintini, 2011a).

Box 1.1. Defining and measuring skill shortages and mismatch

Although there is no strict definition, skills mismatch and shortage describe situations in which workers' skills exceed or fall short of those required for the job under the current market conditions (Handel, 2003; Shah and Burke, 2005). More specifically, shortages occur when the skills sought by employers are not available in the pool of potential recruits. Mismatches, in turn, mean that workers are not well-matched with their current jobs. Mismatch implies that workers are either over-skilled, being able to deal with more complex tasks than those required by their jobs, or under-skilled and lacking the minimum skills required for their current jobs (OECD, 2014). Skill shortages can induce mismatch as employers, unable to find the skills needed, recruit mismatched workers.

Skill shortages can be measured in a variety of ways. For instance, vacancy surveys identify the skills that explain why posted vacancies remained unfilled after a certain period of time (see Box 3.1 for the use of such surveys in Australia and New Zealand). Shortages can also be assessed by indirect methods such as asking employers about the perceived difficulty for recruiting suitable workers or studying wage, employment and turnover trends in particular occupations in specific areas (Migration Advisory Committee, 2008).

Skills mismatches can be detected through surveys that ask workers whether they feel either over- or under-skilled for their current job (e.g. the European Working Conditions Survey). Other surveys, like the Survey for Adult Skills, measure three different types of mismatch: qualification mismatch, information-processing skill mismatch and field-of-study mismatch. In the case of qualifications mismatch, a worker has higher (or lower) qualifications than required to get the job. Alternatively, qualifications mismatch can be identified when a worker has a higher (lower) qualification level than the modal educational attainment for workers in the same job. Information-processing skill mismatch is observed when workers have better (or worse) numeracy or literacy skills than those possessed by workers who feel well-matched in the same job. Finally, in field-of-study mismatch workers received training in a specific field but work in an unrelated sector (OECD, 2014).

As developed further in Chapter 2, portraying an accurate picture of the level of skill shortages and mismatch across countries requires several simultaneous sources of information.

Source: Handel, M. (2003), "Skills Mismatch in the Labor Market", *Annual Review of Sociology*, pp. 135-165; Shah, C. and G. Burke (2005), "Skills Shortages: Concepts, Measurement and Policy Responses", *Australian Bulletin of Labour*, Vol. 31, No. 1, p. 44; Migration Advisory Committee (2008), *Identifying Skilled Occupations where Migration can Sensibly Help to Fill Labour Shortages*, London: The Migration Advisory Committee; OECD (2014), *OECD Employment Outlook 2014*, OECD Publishing, Paris, http://dx.doi.org/10.1787/empl_outlook-2014-en (accessed 8 February, 2016).

Not all types of skills mismatch are alike. For one, workers could be either over- or under-skilled. In general, workers were more likely to report being over- than under-skilled. On average across the European Union, 32% of workers report being over-skilled, having the skills to perform more complex tasks, while 13% report being under-skilled, requiring more training to perform their tasks (summing to a total of 45% of skill mismatch) (Figure 1.1). Comparing the rates of over- and under-skilling highlights how under-skilling is more of a problem in certain countries than in others. Under-skilling represents a more pressing challenge in Austria, Lithuania, Estonia, Germany and the Czech Republic where the percentage of under-skilled workers is comparatively close to that of over-skilled workers. By contrast, the bulk of the skills

mismatch challenge relates to over-skilling in Romania, Montenegro, Greece, and Croatia. In these countries, fewer than 10% of workers report being under-skilled while more than 40% report being over-skilled. In these countries a considerable share of workers are employed in jobs that do not take full advantage of their skill set and human capital.⁵

Trends in skills mismatch

Between 2005 and 2010, the average EU-27 skill mismatch did not change (Figure 1.1). This average, however, masks important country-level variation over this period. Self-reported skill mismatch increased by more than one percentage point in eight of the 30 countries with comparable information (the Czech Republic, Greece, Latvia, Romania, Slovenia, the Slovak Republic and Spain). Skill mismatch decreased by more than one percentage point in 14 of the 30 countries, with the largest reductions observed in France (16 percentage points), Turkey (14 pp), Austria (11 pp), Ireland (8 pp) and Croatia (8 pp). When comparing the results for the year 2010 with those for 2005, the incidence of self-reported skills mismatch remained rather stable for those countries initially experiencing higher levels of mismatch (e.g. around 50%); it decreased for most countries where the percentage of mismatched workers was already low in 2005. This evidence could suggest the existence of specific weaknesses and gaps in the way some countries are able to match their stock of skills to their labour market demand and that such weaknesses do not appear to have been sufficiently dealt with over time.

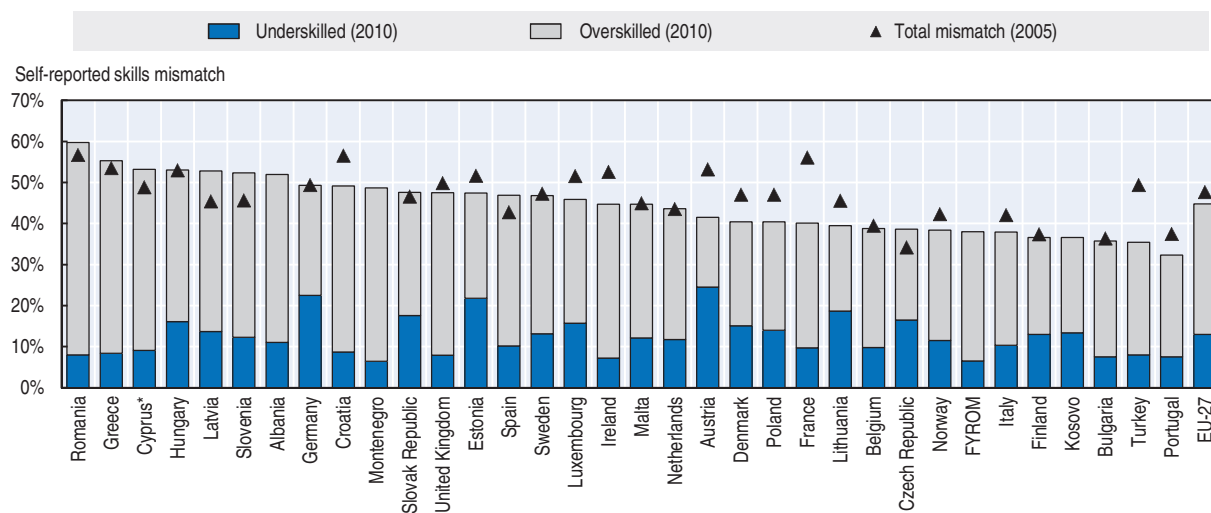
Qualifications mismatch

Another way of measuring mismatch is through qualifications.⁶ Workers can be over- (or under-) qualified for their job by having attained a higher (lower) educational level than that required by the job (or that commonly held by other workers in that occupation). Qualifications mismatch refers to the set of skills acquired in formal education. As a result, as workers gain work experience, their formal qualifications matter less – and so do the penalties related to qualifications mismatch. Qualifications mismatch is particularly relevant for youth as it sets out a career path that may lead to lower life-long earnings (OECD, 2014, 2015). Data from the European Labour Force Survey reveals that, in 2013 and across the EU-27, 23% of workers experienced qualifications mismatch with over-qualification being roughly twice as common as under-qualification. Qualifications mismatch was most common in Estonia, Greece, Ireland, Lithuania, Malta, Sweden and Switzerland. In these countries, more than 30% of workers experienced qualifications mismatch. Qualifications mismatch is least common in Croatia, the Czech Republic, Romania and the Slovak Republic (Figure 1.2).

Figure 1.2 also shows that, on average, qualifications mismatch in Europe does not seem to have changed substantially since 2006. It fell most notably in Iceland and Lithuania. It increased by more than 4 percentage points in Slovenia, Switzerland and the United Kingdom. Evidence from the academic literature, based on longer time series, suggests that qualifications mismatch has increased in recent decades in many countries. In Sweden, for example, workers in 1974 were over-educated by as little as half a year but average over-education increased steadily to almost two years in 2000 (Korpi and Tåhlin, 2009). Other European nations and the United States show similar long-term trends (Collins, 1979; Green, 2006; Vaisey, 2006).

Figure 1.1. Skill mismatch in Europe^{a,b}

As a percentage of all employment



Countries are sorted by total skill mismatch.

a) Workers are classified as under-skilled if they report that they need further training to cope well with their duties or that they have the skills to cope with more demanding duties.

b) Total skill mismatch in 2005 is the sum of self-reported under- and over-skilled workers in 2005.

* Footnote by Turkey: The information in this document with reference to « Cyprus » relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of United Nations, Turkey shall preserve its position concerning the “Cyprus issue”.

* Footnote by all the European Union Member States of the OECD and the European Union: The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

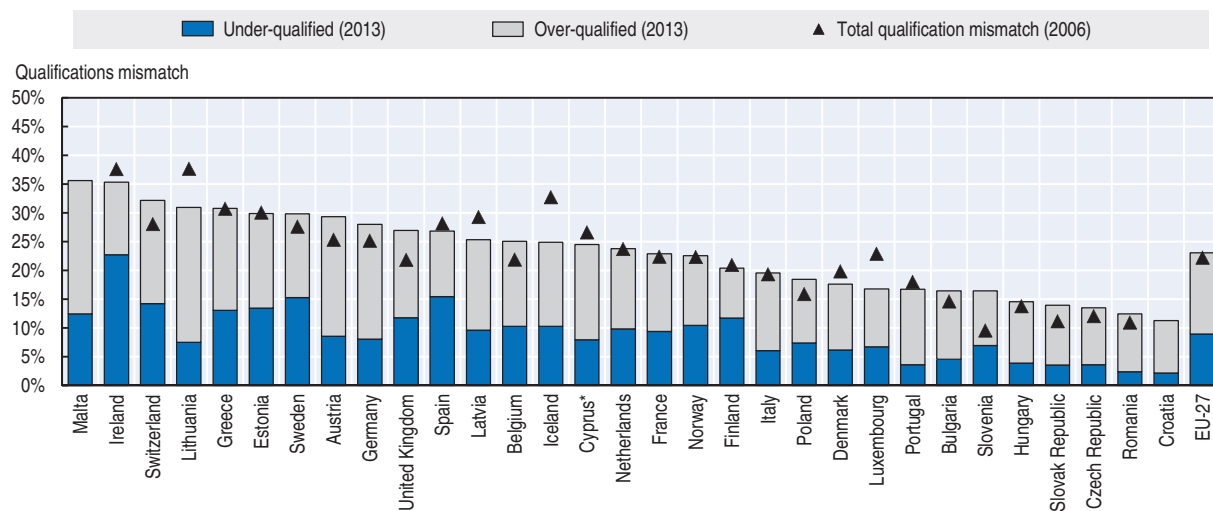
Source: OECD calculations based on the European Working Conditions Survey (2010, 2005).

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The estimates for qualifications mismatch in Figure 1.2 differ from those for skill mismatch in Figure 1.1. This is to be expected not only because one measure (overall skill mismatch) is based on self-reporting while the other is not. It is also expected because qualification mismatch is a form of mismatch that does not necessarily entail skill mismatch. Workers can be well-matched by qualifications but, because of skill heterogeneity within occupational groups, still feel mismatched. Alternatively, they can be mismatched by qualifications but have the adequate level of skills required for the job (Quintini, 2011b). Skill heterogeneity within an educational group is expected as graduates with a particular educational level differ in their skill levels (e.g. information processing, non-cognitive, job-specific or other types of skills).

Figure 1.2. **Qualification mismatch in Europe**^{a, b}

As a percentage of all employment



Countries are sorted the total qualification mismatch.

a) Workers are classified as under-qualified (over-qualified) if their educational attainment (four categories) is lower (higher) than the modal educational attainment of workers in their occupation within the country.

b) Total qualifications mismatch in 2006 is the sum of under- and over-qualification in 2006.

* See notes on Cyprus in Figure 1.1.

Source: OECD calculations based on the European Labour Force Survey (2013, 2006).

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Mismatch: Additional evidence from the Survey of Adult Skills

The 2012 Survey of Adult Skills, the OECD's *Skills Outlook* (2013b) and the *Employment Outlook* (2014) examine different forms of mismatch: by qualifications, by information-processing skills and by field of study. Indeed, some workers may be over-qualified (or under-qualified) for their jobs. Others may be working in a sector of the economy (or job) that is unrelated to their field of study. And other workers still may be mismatched in a particular type of skill like numeracy if their ability to deal with numbers, calculation and other numeracy tasks exceed (or is insufficient for) those required by the job. (Box 1.2 provides more details on measuring these forms of mismatch in the Survey of Adult Skills.)

On average, across the countries that took part in the 2012 Survey of Adult Skills, 60% of workers are mismatched; they are either over/under-qualified, over/under-skilled or graduated from a field of study that is different from the job sector in which they work (field-of-study mismatch). While the sources and the magnitude of mismatches vary by country, over half of workers in 16 of the 22 countries are mismatched along at least one of these dimensions. Mismatch is most common in England/Northern Ireland (UK), France, Ireland, Italy, Japan, Korea, the Russian Federation and Spain, where more than three in five workers experience some type of mismatch (Figure 1.3). Mismatch is lowest in Finland, the Netherlands and Sweden, where fewer than 45% of workers experience one of these three types of mismatch.

Box 1.2. Measuring qualification, skills and field of study mismatch in the Survey of Adult Skills

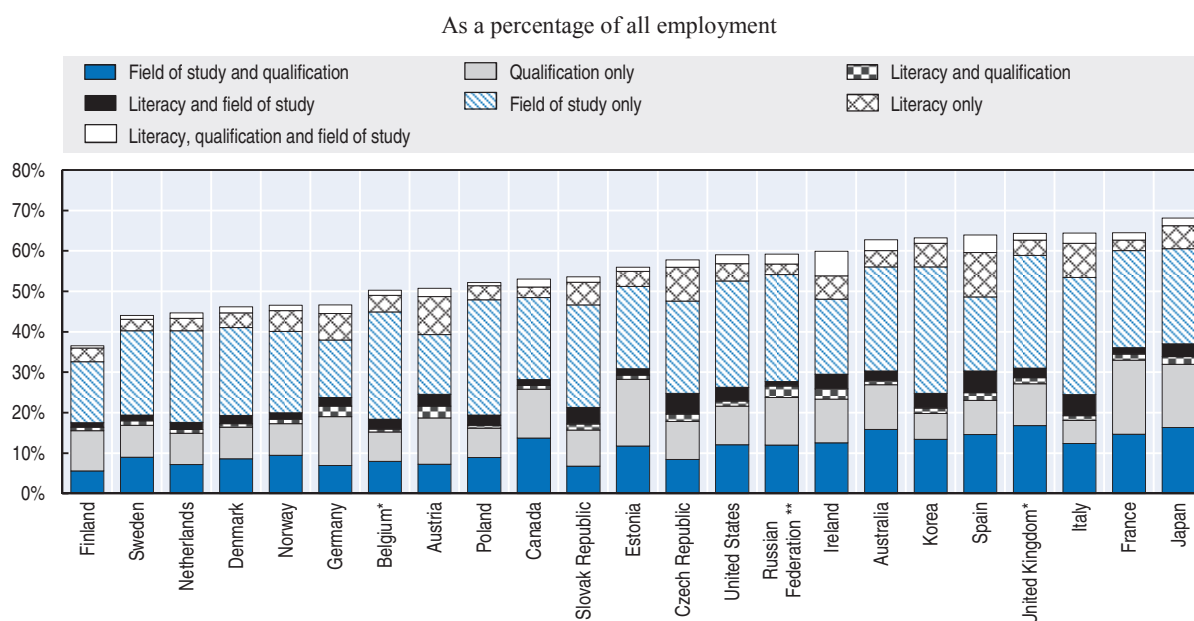
Qualification mismatch arises when workers have an educational attainment that is higher or lower than that required by their job. If their education level is higher than that required by their job, workers are classified as over-qualified; if the opposite is true, they are classified as under-qualified. In the OECD Survey of Adult Skills, workers are asked what would be the usual qualifications, if any, “that someone would need to GET (their) type of job if applying today”. The answer to this question is used as each worker’s qualification requirement and compared to their actual qualification to identify mismatch. While biased by individual perceptions and period or cohort effects, self-reported qualification requirements along these lines have the advantage of being job-specific rather than assuming that all jobs with the same occupational code require the same level of qualification.

Skills mismatch arises when workers have a level of skills that is higher or lower than that required by their job. If their skill level is higher than that required by their job, workers are classified as over-skilled; if the opposite is true, they are classified as under-skilled (Krahn and Lowe, 1998). For the purpose of this chapter, skill requirements at work, the key term in the measurement of skills mismatch, are derived following Pellizzari and Fichen (2013).

Field of study mismatch arises when workers are employed in a different field from what they have specialised in. The matching is based on a list of occupations (at 3-digit of the ISCO classification) that are considered as an appropriate match for each field of study. Workers who are not employed in an occupation that is considered a good match for their field are counted as mismatched. The list of fields and occupations used in this chapter can be found in Annex 5.A1 of OECD (2014). The list is largely based on that developed by Wolbers (2003) but has been adapted to the ISCO-08 classification.

Source: Krahn, H. and G. Lowe (1998), “Literacy Utilisation in Canadian Workplaces”, Catalogue No. 89-552-MIE, No. 4, Statistics Canada, Ottawa; OECD (2014), *OECD Employment Outlook 2014*, OECD Publishing, Paris, http://dx.doi.org/10.1787/empl_outlook-2014-en; Pellizzari, M. and A. Fichen (2013), “A New Measure of Skills Mismatch: Theory and Evidence from the Survey of Adult Skills (PIAAC)”, *OECD Social, Employment and Migration Working Papers*, No. 153, <http://dx.doi.org/10.1787/5k3tpt04lcnt-en>; Wolbers, M. (2003), “Job Mismatches and their Labour Market Effects Among School-leavers in Europe”, *European Sociological Review*, Vol. 19, pp. 249-266.

The most common form of mismatch is field-of-study mismatch alone (e.g. workers who are working outside their field but are not over- (or under-) qualified and have a level of skills adequate to the job) (dashed bar): on average across countries, 23% of workers are mismatched by field of study. When unaccompanied by over-qualification or over-skilling, field-of-study mismatch does not necessarily carry a wage penalty for workers, but does imply a loss in the investment made for field-specific training (Montt, 2015). Qualification mismatch, whether accompanied by field-of-study mismatch (dark blue) or not (light grey), accounts for around a third of overall mismatch. Over-qualified workers generally suffer an important wage penalty, implying important potential losses to productivity (OECD, 2014). Qualifications mismatch is notable in France and Japan, where more than 30% of workers are over-qualified within or outside their field of study; it is least common in Finland, Flanders (Belgium), the Netherlands and the Slovak Republic at less than 16%.

Figure 1.3. Total mismatch, by type of mismatch^{a,b}

a) Workers are classified as mismatched by qualification if they have higher or lower qualifications than required by their job; workers are classified as mismatched in terms of literacy skills if they have literacy proficiency exceeding or below that required in their job; workers are classified as mismatched by field of study if they are working in an occupation that is not related to their field of study (see Box 1.2).

b) Occupation is only available at the 2-digit level in the ISCO-08 classification for Australia. It is not possible to assess the extent of field of study mismatch using the same definition used for the other countries.

* The OECD Survey of Adult Skills only covered Flanders (BEL) and England/N. Ireland (GBR).

** Readers should note that the sample for the Russian Federation does not include the population of the Moscow municipal area. The data published, therefore, do not represent the entire resident population aged 16-65 in Russia but rather the population of Russia excluding the population residing in the Moscow municipal area. More detailed information regarding the data from the Russian Federation as well as that of other countries can be found in the Technical Report of the Survey of Adult Skills (OECD, 2013b).

Source: OECD calculations based on the Survey of Adult Skills (PIAAC) 2012.

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OECD findings further suggest that mismatch is common among all types of workers, although prime-age and older workers are less likely to be mismatched than young workers. Over-qualification related to field-of-study mismatch is, for example, almost twice more likely among young workers than among older ones. The likelihood of skills mismatch related to information-processing skills decreases as workers age. This is due, in part, to workers having had more time to find a job that matches their skills, but also to the fact that employers learn about workers' real skills which are not necessarily always aligned to their credentials or fields of study (OECD, 2014).⁷

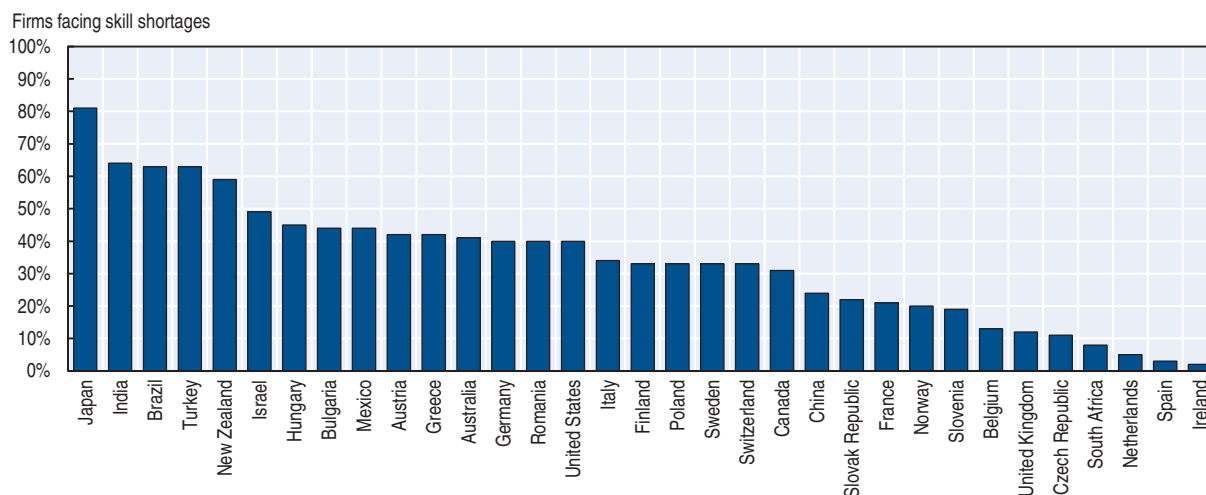
Skill shortages: Employers' perspective

While many workers are over-qualified, over-skilled or working in a different field from that which they trained for, in 2013 around 40% of employers in Europe reported difficulties in finding employees with the required skills (Eurofound, 2013b). This experience of shortage is most (least) common in the manufacturing (financial) sector,

and is also particularly common in Austria and the Baltic states (and least likely in Croatia, Greece or Spain). Another survey of more than 40 countries (both European and non-European) finds that 36% of employers find it difficult to fill specific vacancies. The biggest shortages are found in the skilled trades (e.g. welders, electricians and machinists), engineering and technicians.⁸ More than half of managers in Japan, India, Brazil, Turkey and New Zealand report difficulties filling jobs (Figure 1.4). Fewer than 10% of firms report these difficulties in Ireland, the Netherlands, South Africa and Spain. Perceived shortages generally fell between 2007 and 2008 with the onset of the financial crisis, although they have increased again since 2008 despite persistently high levels of unemployment (Manpower Group, 2014).

Figure 1.4. Skill shortage in selected countries^a

As a percentage of all firms with ten or more employees



Countries are sorted by the total skill shortage.

a) Firms are classified as facing a skill shortage if their manager reports having difficulties filling jobs.

Source: Manpower Talent Shortage Survey (2014).

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The challenge of skill shortage and/or mismatch

The facts that, on the one hand, a substantial part of workers are employed in jobs that do not correspond to their skill levels (Figure 1.1) and that, on the other, employers are not able to find workers with the skills they need (Figure 1.4), highlight the extent to which the labour market is unable to match the supply of, and the demand for, skills.⁹ Aggregated data at the national level can hide even larger shortages and mismatches at the local level (Shah and Burke, 2005).¹⁰ In many instances, labour markets can be localised at the sector, occupational and/or geographic level and an efficient allocation of skills to jobs will not work if both supply and demand are unresponsive to wages or to other employment conditions.^{11,12} Thus, specific skill requirements at the sector level or the lack of geographic mobility¹³ of jobseekers can reduce the scope for employers to find workers (and for jobseekers to find employment opportunities) and can exacerbate skill mismatches and shortages. In relation to geographic mobility, findings from the Netherlands show that mobile graduates are more likely to find jobs that are matched to their skills level (Hensen, De Vries and Cörvers, 2008). The fact that mobility reduces

mismatch indicates that labour market shortages and mismatches are in some cases region-specific and could be alleviated by promoting geographical mobility in the labour market.

Countries can be located in a quadrant depending on the level of worker-reported mismatch and employer-reported shortage (Table 1.1).¹⁴ Of the 24 countries with information on employer-reported shortages and worker-reported mismatch, Germany, Greece, Hungary, Japan, Romania and the United States can be classified as having a high level of mismatch (as perceived by workers) and a high level of shortage (as perceived by employers). For this group of countries, the policy challenges relate to the system by which workers are matched to jobs, the way skills are promoted by education and training institutions, how the development of these skills is aligned to those demanded by the labour market, the speed with which the provision of skills follows the changing demands of the labour market, or the transferability of a worker's skill set to different employers, occupations or economic sectors.

Table 1.1. **Skill mismatch and skill shortage in selected countries**

	Employer-reported skill shortage	
	High	Low
	Worker-reported skill mismatch	High Germany, Greece, Hungary, Japan, Romania, United States
	Low Austria, Bulgaria, Italy, Turkey	High Belgium, Canada, Czech Republic, Finland, France, Netherlands, Norway, Poland

Note: A country is considered to have high (low) employer-reported skill shortage if it ranks in the top (bottom) half among countries in Figure 1.4. A country is considered to have high (low) worker-reported skill mismatch if it ranks in the top (bottom) half among countries in Figure 1.1. For Canada, Japan and the United States, the rank used for worker-reported skill mismatch is that of Figure 1.3. Only countries with results from the Manpower Talent Shortage Survey and either the European Working Conditions Survey or the Survey of Adult Skills are included. For those countries with data on both the European Working Conditions Survey and the Survey of Adult Skills, results from the European Working Conditions Survey are used in the classification.

Source: OECD calculations based on the European Working Conditions Survey (2010), Manpower Talent Shortage Survey (2014) and the Survey of Adult Skills (PIAAC) (2012).

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Ireland, the Slovak Republic, Slovenia, Spain, Sweden and the United Kingdom, by contrast, can be classified as experiencing high levels of mismatch but low levels of shortage. For some of these countries it is also possible that educational expansion did not follow changes in labour market demand, and workers may have more than the skills required by employers. Another possibility is that employers in these countries recognise a broad set of skills as suitable for the job, but workers would like to have a better fit with their specific skills acquired through training. Finally, it may be that the economic crisis and low labour market demand has driven workers to accept jobs requiring different (and possibly lower) skills to the point that practically the few employers recruiting workers are able to fill their gaps.

In Austria, Bulgaria, Italy and Turkey, on the other hand, workers report low levels of skill mismatch, but employers report a high level of shortage. In this group of countries, it

may be that the skills provided by education and training institutions are at a lower level than those required by employers. Finally, both shortage and mismatch are comparatively low in Belgium, Canada, the Czech Republic, Finland, France, the Netherlands, Norway and Poland. However, even if these countries seem to face lower levels of both mismatch and shortage than other countries, this does not mean that skills mismatches and shortages do not exist.

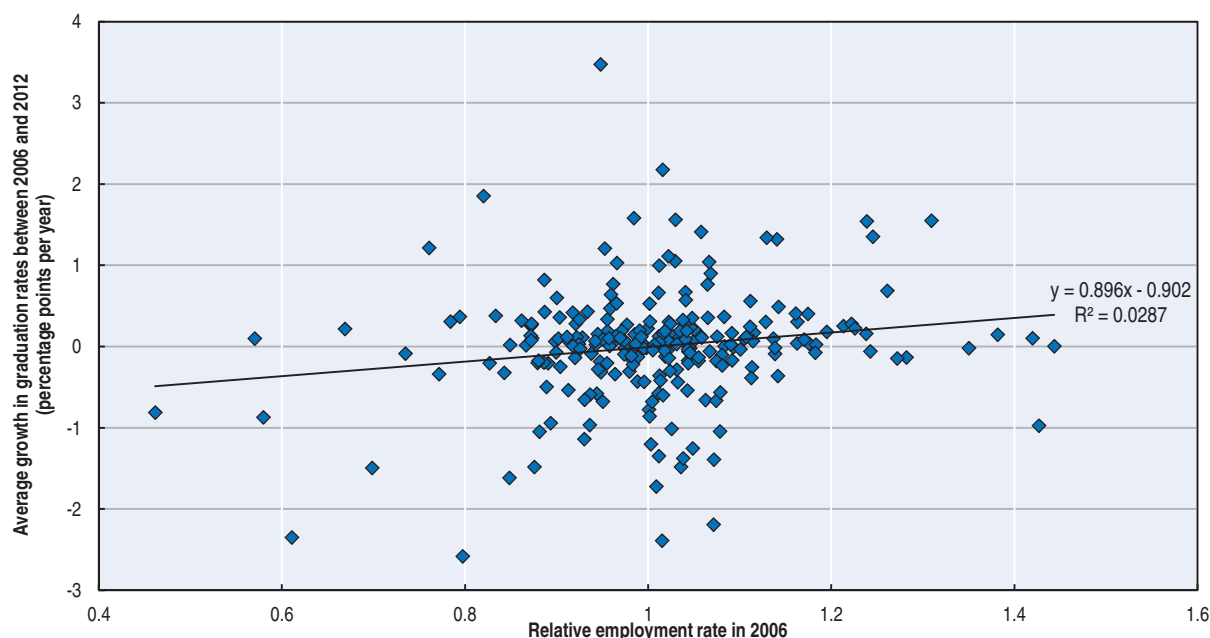
The responsiveness of skill supply to demand: An exploration by field of study

In a well-matched, efficient and effective labour market, skill demand and supply closely follow one another. The number of graduates from particular programmes should thus respond to employment prospects in the respective fields. Comparing graduation trends and employment prospects informs about the responsiveness of skill supply to skill demand. As mentioned earlier, mismatch results from imbalances labour demand and the skills produced in formal education and training; imbalances also occur as a result of changes in job characteristics and lags in workers' and employers' adaptation to these changes. The responsiveness of formal education to demand is only one indicator of a well-matched labour market.

In an efficient labour market, if the employment rate of a particular sector is lower than that of others, the number of graduates from the corresponding field of study should decrease. Similarly, if employment prospects for a sector are positive, the number of graduates from that respective field of study would be expected to increase to match the foreseen new vacancies. This would be the case if skills needs were adequately assessed and anticipated and stakeholders used this information to adapt and design policies to satisfy these needs (e.g. by better determining the provision of training offers or by providing information to prospective students).

Figure 1.5 shows, for each of eight fields of study¹⁵ and for 26 European countries, the relationship between graduation rates and the relative employment rate of graduates from that field. On the vertical axis is the average growth in the number of young graduates from a specific field of study between 2006 and 2012, as a share of the total number of young graduates; and on the horizontal axis is the relative employment rate for graduates from that field in 2006. Ideally, graduation and employment rates would align on the top-right and bottom-left quadrants, meaning that graduation rates increase for fields of study experiencing better employment prospects (top-right quadrant) or that graduation rates decrease for fields of study experiencing low relative employment (bottom-left quadrant). The figure shows some, albeit very weak, signs of responsiveness of fields of study to labour market demand: those fields that increase (decrease) in size tend to be those where the relative employment rate was high (low). However, the great majority of fields appear to be unresponsive to employment prospects, as a large share cluster horizontally around zero. For those that do experience changes in graduation rates, many cluster vertically around one – i.e. the number of graduates changes, but not in response to the rather stable employment prospects.

Figure 1.5. Change in the percentage of young graduates and relative employment rates across fields



Note: The average growth in the percentage of graduates from each field is calculated over employed youth (aged 15 to 29) considering graduates from specific fields (i.e. excluding youth who graduated from “General Programmes”) over the period 2006-12. The relative employment rate, considering the entire population, is calculated as the ratio of the employment rate for graduates from each field (irrespective of whether they work in the field or not) and the employment rate of the entire population. Relative employment rates above 1 mean that the employment rate among graduates from that field is higher than the national average; values below 1 mean that the employment rate for graduates from that field is lower than the national average. Each diamond represents one of eight fields in one of 26 countries.

Source: OECD calculations based on the European Labour Force Statistics 2006-2012.

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Assessing and anticipating future skill needs to reduce skill imbalances

Despite the apparent inevitability of skills shortages and mismatches, several avenues exist to reduce their incidence. There is variability across countries in the prevalence of shortages and mismatches, indicating that they are sensitive to policy making and/or economic conditions. Indeed, specific policies – like those that promote mobility – can reduce shortages and mismatches. Quintini (2011b) suggests further policy avenues: improving career guidance services and the co-ordination between the labour market and the education system; increasing the offer for adult learning and work-based training or the training to unemployed workers; and evaluating rigid wage-setting institutions and employment-protection legislation that prevent wages and firms’ employment from adjusting to mismatches.

Many of the solutions suggested by the existing literature to address skill shortages and mismatches involve the existence of information systems able to: i) assess the current and future supply of, and demand for, skills; and ii) to identify and/or anticipate skill shortages and mismatches (Shah and Burke, 2005).¹⁶ Skills assessment and anticipation exercises (e.g. skill needs assessments, forecast and foresight exercises) can play a fundamental role in providing adequate information to relevant stakeholders to better plan the offer of education and training programmes in formal education and lifelong learning

schemes and for individuals to decide on their future careers and work/education/training paths. These exercises do, in fact, exist in many countries. They highlight existing shortages or the skills needed in the medium- and long-term. They allow, at least in principle, to inform policies in accordance to the projected trends in the labour market by sector, region and/or occupation.

Conclusions

Increased globalisation and rapid technological change, but also demographic, migration and labour market developments, have drastically altered the structure of employment and the skill requirements of occupations in most countries in recent decades – and these trends are expected to continue in the foreseeable future. Such trends alter the demand for skills raising the questions of the extent to which economies face skill shortages and mismatches and how economies are able to match skill development to changing skill needs. Both the supply and the demand for skills are dynamic and they may well develop independently of each other as they respond to different drivers. It is no surprise, then, that skill mismatch and shortages are as common as they are – in fact, in the European Union, more than 40% of workers feel that their skill level is not matched to the requirements of the job and in many countries this figure is increasing – even though they bring about lower economic output for economies and lower pay and job satisfaction for workers.

Though seemingly inevitable, skill mismatches and shortages vary across countries, suggesting that they can be addressed through policy interventions. Skills assessment and anticipation exercises are policy tools countries can rely on to inform skill policies and reduce current or potential skill shortages and mismatches. Chapter 2 provides an overview of the different types of skills assessment and anticipation systems across some OECD countries and key partner economies.

Notes

1. See CEDEFOP (2008), Handel (2012, 2003), OECD (2013a) and Richardson (2007); and, for the well-documented processes of job polarisation, Autor (2010), Autor et al. (2003) and Goos et al. (2009).
2. Skills or labour shortages can be apparent or genuine. Apparent skills shortages occur when workers are unwilling to take up jobs given the current employment conditions; because skills are present but not put to use due to market factors, as wages and working conditions adjust, these skills shortages should disappear. Genuine skills shortages occur when vacancies remain unfilled despite attractive working conditions (OECD, 2012b).
3. Shortages and mismatch that require policy attention and can benefit from anticipation exercises are those that require long training periods, particular geographic mobility, or have restricted entry (restricted to license-owners or non-foreign workers). Shortages and mismatch in occupations that require low training periods may need less policy attention as they may be overcome by market forces (Shah and Burke, 2005).
4. In 2013, over half of the G20 member countries formally recognised the need to better align the supply of skills with the demand for skills in the context of changing skill needs (ILO, OECD and World Bank Group, 2014).

5. For some workers, mismatch is a voluntary outcome. It is conceivable that for many, however, it is a result of not being able to find a job that matches their skill set.
6. There are different ways to measure qualifications mismatch. Qualification mismatch based on self-reports usually ask workers about the qualification required to get their current job, and then compares that qualification with the qualification they actually hold. This is the measure of qualifications mismatch used in the Survey of Adult Skills (Figure 1.3). Another measure of qualifications mismatch is statistical: for each occupation, the modal educational attainment is compared to each worker's educational attainment. A worker with higher (lower) attainment than the mode for his/her occupation is considered over-(under)-qualified. This statistical approach is used to estimate qualifications mismatch from the European Labour Force Survey (Figure 1.2). Quintini (2011b) notes that statistical approaches to qualifications mismatch assume that all jobs with the same occupational title have the same educational requirements. They are also sensitive to cohort effects and to the level of aggregation to obtain a reliable distribution of education. In the estimates presented in this chapter, only occupations for which there are more than ten workers are considered. Estimates are country-specific so that educational requirements need not be identical across countries. These estimates are robust to an estimation that assumes variability in educational requirements by age groups (to account for cohort effects) but no variability across countries.
7. The finding that prime-age workers are less likely to be mismatched could also be due to age or cohort effects.
8. Although surveys to employers are a common way to detect shortages through reports of hard-to-fill or unfilled vacancies, employer reports of shortages often mask their unwillingness to offer competitive wages or working conditions or invest in worker training (Shah and Burke, 2005).
9. The contrasting experiences of skills shortage and mismatch experienced by employers and workers mirrors the discussion and treatment of skills mismatches in the academic literature and public opinion. While in the 1960s and 1970s academic attention focused on the increasing graduation rates and the failure of the economy to keep up to the populations' up-skilling, during the 1980s, 1990s and 2000s discussion shifted to the failure of graduates and the education system to keep up with economic transformations (Handel, 2003).
10. In fact, the more disaggregated the unit of analysis, the more likely it is to find shortages or mismatches, as they tend to offset each other in aggregated data (Shah and Burke, 2005).
11. Conditions of employment include, in addition to wages, burden of work, the quality of the working environment, prospects for mobility or career advancement, the commuting time and any other factor related to the job that jobseekers may consider when deciding to apply for a job or accept a job offer.
12. See, for example, Richardson (2007) for the use of skill needs information systems as a policy alternative in developing vocational education and training, and Spetz and Given (2003) and Shields (2004) in managing the supply and demand for nurses.
13. Results at the cross-national level will reflect those at the national, regional or local level if there was perfect information and geographic mobility across countries. The European Union, through the Employment Package is promoting free movement and a smoother flow of information through the European Network of Employment Services (EURES), the multilingual classification of European Skills, Competences,

- Qualifications and Occupations (ESCO) and the portability of social security protection and pension rights for workers.
14. As mentioned in note 8, the validity and cross-national comparability of employer shortage reports can be low. Some of these concerns can be extended to worker self-reports of skill mismatch. As a result, the categorisation proposed in Table 1.1 should be taken with caution.
 15. The eight fields of study analysed are: teaching, education and training: i) teacher training and education science; ii) humanities, languages and arts; iii) social sciences, business and law; iv) science, mathematics and computing; v) engineering, manufacturing and construction; vi) agriculture and veterinary; vii) health and welfare; and viii) services.
 16. Also see, for example, Richardson (2007) for the use of skill needs information systems in the vocational education and training systems; and Ruhs and Anderson (2010) and Chaloff and Lemaitre (2009) in the development of migration policy. Chapter 3 of this report also develops the uses of skills assessment and anticipation exercises in the context of employment, education and migration policy.

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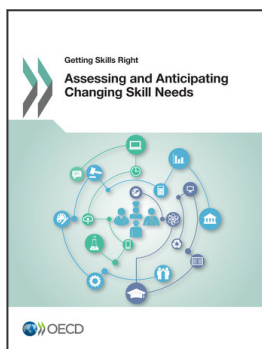
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