3 Jobs 4.0

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3.1 Introduction

Technology has always driven firms' requirements for skills and knowledge, as well as having changed the nature and content of occupations. This chapter presents cross-country evidence of firms' demand for labour to shed some light on firms' skills requirements, using firms' declared vacancies data from the UK, Italy and Germany. Given the current technological transformation, we want to ascertain what occupations firms are actually seeking to address their medium-term skills needs.

Several studies have shown that the adoption of new technologies (such as computers in the 1980s) was complementary to hiring employees for non-routine jobs, but was a substitute for workers who performed routine jobs, indicating that the demand for different types of jobs is heterogeneous (Autor et al., 2003). In fact, some evidence has documented the correlation between the adoption of computer-based technologies and the increased use of college-educated labour at the industry level. This is referred to as skill-biased technological change, suggesting that technological adoption has destroyed routine jobs (manual and cognitive), whilst increasing less-skilled jobs and high-skilled jobs (Acemoglu, 2002, Autor et al., 2003, Katz and Autor, 1999, Kemeny and Rigby, 2012). So technological change – and in part manufacturing offshoring – resulted in a so-called job polarisation (Autor and Dorn, 2013); that is, the simultaneous increase of employment in the highest- and lowest-skill occupations, as middle-skill occupations disappeared. Job polarisation of course is linked to a widening wage polarisation and the much-discussed plague of broadening income inequality in advanced economies (OECD, 2019).

The emergence of a wave of new technologies is often referred to as the Fourth Industrial Revolution (FIR) and a fast-growing debate is unpacking its implications for firms, consumers, workers and society more widely. In the chapter, we focus on the impact that in particular automation and digitalisation are expected to have on the labour market and the demand for skills. As suggested above, previous technological shocks were shown to cause significant job losses, especially in the short term, but over the longer term, as the economy adapted to the changes and started to grow again, jobs were eventually created.

So this time round, technological change is also expected to cause labour market adjustments and to trigger medium- and long-term growth and development (see Chapter 1), which in turn will create a new and growing demand for labour, notwithstanding the fact that this demand will be for new jobs or jobs with new and different types of skills and competences (McKinsey Global Institute, 2017).

The purpose of this chapter is to explore firms' demand for skills with vacancies data in the context of a disruptive technological change that has been unfolding for the last couple of years thanks to firms' adoption of FIR technologies. We want to gauge whether firms are anticipating and preparing for the skills requirements of the future by looking at their current demand for labour (i.e. vacancies).

The chapter will proceed as follows. Section 3.2 will briefly present the recent literature on the impact of technological change on the labour market. Section 3.3 will discuss the current debate on the future of work given the spread of FIR technologies. Section 3.4 will present the data and methodology. Section 3.5 will discuss the findings, and a short conclusion will recap the chapter.

3.2 Technological change and job polarisation

3.2.1 Background

Drawing on a large literature on both job polarisation and skill mismatch, we here note a few points to frame the empirical analysis that follows. Technological change and the efficiency-seeking internationalisation strategies of multi-national firms since the 1980s have led to major shifts in labour markets, resulting in job and wage polarisation with evidence primarily from the US (Autor and Dorn, 2013; Autor and Handel, 2013; Boehm, 2014). This has led to overarching concerns with growing intra-country income inequality. Between 1983 and 2007, the growth of low paid jobs was mostly in services and, in particular, personal care jobs (Dwyer, 2013). Other contributions find that job polarisation worsened following the 2008 financial crisis as the subsequent recession was followed by jobless recoveries in the short term (Goos et al., 2014).

Technological change is also argued to trigger imbalances in the labour market between demand and supply in the form of a skill mismatch: this concept captures the degree of heterogeneity in the labour market across a number of dimensions such as skills, industrial sector and location. Significant differences in the skills workers have and those required by firms tend to lengthen the time that it takes to match individuals with jobs. This frictional unemployment is of course a cost to the economy and can cause wide-ranging social difficulties. A skill mismatch can be a short-lived and transitory imbalance in the labour market. More fundamentally, if not addressed, it can lead to structural skill shortages, i.e. linked to megatrends such as digitalisation (Brunello et al., 2019).

In times of rapid technological change, firms face skill challenges not only when hiring but also with their existing labour force. We refer to *'on-the-job' skill mismatch* when workers are either over- or under-skilled for their jobs (vertical on-the-job mismatch) or have different skills/qualifications from those required for the jobs (horizontal on-the-job mismatch) (McGuinness, Pouliaka and Redmond, 2018). This mismatch leads to either redundancy or to the mismatched employees earning less than would otherwise be the case (Bárcena-Martín, Budría and Moro-Egido, 2012). This form of mismatch is dependent on rigidities in the labour market. For example, in a hire-and-fire context, an *'on-the-job'* skill mismatch might be limited, but firms pass on to individuals the cost and risk of training and retraining. Conversely, where firms face constraints in terms of firing employees, they might more proactively seek to address the skill mismatch of their labour force with on-the-job training and retraining, and implement a sort of life-long training to ensure that their labour force has the appropriate skills and competences.

Public policy interventions to manage or reduce such skill mismatches are crucial for the long-term growth of an economy and the shared prosperity of its people. This will be discussed at the end of the chapter.

3.3 The skills of the future

Projections, estimations and scenario painting have started to describe what changes in the workplace and labour market the rise of FIR technologies are likely to trigger. To appreciate the scale and pervasiveness of the technological change we are facing, predictions suggest that about two-thirds of children in primary school today are likely to be in occupations that do not yet exist (World Economic Forum, 2018). In the labour market, according to the McKinsey Global Institute (2017), automation and digitalisation will displace up to 30% of the workforce by 2030, especially in advanced economies (namely up to 800 million people) and up to 375 million will switch occupational category by learning new skills. Jobs will be lost primarily in 'physical work in predictable environments and data collection and processing', whilst there will be a demand for new skills and especially advanced cognitive capabilities such as logical reasoning and creativity (ibid). With automation and digitalisation also expected to hit high-skill jobs performing routine cognitive tasks, we are again looking at a skill-biased technological change that is likely to result in job polarisation with low-skill and high-skill jobs expected to increase (OECD, 2018). Indeed, technological change is thought to potentially involve jobless growth, making unemployment and under-employment a major business risk globally (De Propris/World Economic Forum, 2016). It has been estimated that 'as many as 45 percent of the activities individuals are paid to perform' are open to automation according to Chui et al. (2015). This conclusion is supported by other studies (Frey and Osborne, 2013; PwC, 2017), though not all envisage such profound effects (e.g. Arntz et al., 2016). It should be noted that automation will affect not just routine and codifiable activities, but also

those requiring tacit knowledge and experience (and hence activities where developed countries have a comparative advantage; Rifkin 2014). According to the OECD (2015), around ‘60% of occupations could have 30% or more of their constituent activities automated’. Such changes would dramatically transform the vast majority of occupations, possibly leading either to jobless growth and/or further job polarisation in the labour markets of developed economies (OECD, 2015).

Changes in the skill content of jobs will become clear relatively quickly, bringing about abrupt job losses in the most affected occupations and affecting some sectors more than others, while job creation will be delayed as individuals grapple with an emerging demand for new skills and seek to acquire them via education and training. This mistiming will create unemployment, which can be frictional or structural depending on the ability and commitment of the education sector, policy makers and businesses to train, retrain or uptrain individuals.

In this disrupted context, education and training are crucial. PwC (2018) explores different labour market scenarios and finds that people feel they are increasingly responsible for their skill development and that access to jobs will depend on people’s ability ‘to brand and sell their own skills’ (PwC, 2014: 19). In other words, in order to respond to changes in the workplace, people are expected to acquire and develop their own skills, adapt to flexible work patterns and environments, and autonomously identify job and career opportunities. Inevitably, this will translate in a *skill divide* that is probably determined from the very early education and training opportunities that individuals might have.

Looking at firms’ demand for labour can therefore provide a valuable insight into what occupations they are seeking in the short term and to gauge whether they are already anticipating skills needs that they are missing in their current workforce. We do this with firms’ job vacancy data for Italy, Germany and the UK.

3.4 Job vacancy data

3.4.1 German job vacancy data

Vacancy data for Germany was extracted from the Job Vacancy Survey carried out by the Institute for Employment Research (IAB) since 1989 (for more details, see www.iab.de/en/iab-aktuell.aspx). It is the only survey in Germany that measures the development of the unmet labour demand in a representative and statistically robust way. The survey data is subject to strict data protection and confidentiality regulations. This is guaranteed by the Institute for Employment Research as well as the Institute Economic Research & Consulting, which are currently conducting the survey on behalf of the IAB. The population of the main survey in the fourth quarter of every year consists of all firms in Germany with at least one employee subject to social security contributions.

A new stratified random sample is drawn every year from this population. It is stratified by region, seven firm-size classes as well as 23 industries based on the 2008 German classification of industries (NACE rev. 2). This creates a three-dimensional sampling matrix. The dataset covers the entire unfilled labour demand in Germany (structure of vacancies, future labour demand) and identifies the entire number of vacancies in the German labour market (last new hiring and the last case of a failed recruitment effort). Moreover, the survey offers information on lapsed vacancies and on employers' perceptions of recent labour market policy developments, and the special questionnaire examines employers' attitudes and firms' use of current labour market instruments. From this source, we have created a database with information about the number of vacancies in Germany grouped by occupations, regions, firm size and sector classification.

3.4.2 Italy: Excelsior dataset

Job vacancy data in Italy was collected via the Excelsior Information System; since 1997, this has been one of the main Italian sources of information on labour market forecasts. This survey is promoted and produced by Unioncamere (Italian Association of the Chambers of Commerce) with the participation of the Ministry of Labour and the EU (for more details, see <https://excelsior.unioncamere.net/eng>). It provides detailed and reliable data about the demand for labour by Italian firms both in the short term and in the long term, by region and sector. It also provides information about the specific characteristics of the occupational profiles required by firms, such as age, educational level, type of contract, work experience, difficulty in recruiting specific profiles and need for further training. Moreover, it is aimed at informing policy makers in relation to policies concerning the labour market and the education and training system, ultimately in order to favour the matching between labour supply and demand. The Excelsior survey is included in the official statistics produced on an annual basis within the Italian National Statistical System (SISTAN). The Excelsior Information System is based on data collected through an annual sampled survey conducted on more than 100,000 Italian enterprises (corresponding to about 8% of the total number of Italian companies) operating in the agriculture, manufacturing and service sectors. Firms must be registered with the Business Register and have at least one employee.¹

3.4.3 The UK: employer skills survey data

The UK Employer Skill Survey is a survey covering approximately 90,000 employers and contains data on vacancies, skills shortages, employee skill gaps and training (for more details, see www.skillssurvey.co.uk/index.htm). It distinguishes between different types of vacancies – e.g. hard-to-fill and skill-shortage vacancies. The data is disaggregated by regions (NUTS 1), vacancy types by occupation (relying on nine Standard Occupational Classification

Major Groups), by broad skill level and by sector disaggregation (13 sectors). Data is also available at the level of Local Enterprise Partnerships and Local Education Authorities. The available vacancy data include:

- number of total vacancies;
- number of hard-to-fill vacancies;
- number of a skills shortage vacancies (prompted or unprompted);
- number of vacancies as a percentage of all employment;
- number of under-utilised staff (i.e. those whose skill levels are above those required in the job they do).

3.5 Methodology

Data is classified using the Eurostat/Isco08 skills classification. We distinguish high-, medium- and low-skill occupations. High-skill occupations include managers, professionals, technicians and associate professionals. Medium-skill occupations include craft and related trades workers, clerical support workers, and skilled agricultural, forestry and fishery workers. Finally, low-skill occupations include elementary occupations, plant and machine operators and assemblers, and service and sales workers. Vacancy data was available only for the following periods: 2011–14 for Germany, 2011–15 for Italy and only the discrete years 2011, 2013 and 2015 for the UK. The unique database we have constructed with firms' job vacancies captures employers' needs and planning in terms of current and near-future skill requirements. In other words, they are telling us what skill they seek on the labour market demand side. Therefore, we can use the job vacancies database as a prediction of firms' skill composition demand at different levels by country.

3.6 Job vacancies trends

We analyse the distribution of vacancies at the national level and the regional level for Germany, Italy and the UK, also considering firms' size and sector. Below we present our findings by country.

3.6.1 Germany

The German data shows that the number of medium-skill vacancies is higher than those of low- and high-skill vacancies, and this is consistent over the period 2011–14. However, the growth rate of vacancies for high- and low-skill jobs is greater than for medium-skill jobs, so over the period firms are seeking to recruit more at the top and bottom ends of the labour market. This suggests a trend towards a possible job polarisation. The positive growth rates of vacancies suggest that in Germany, the labour market is lively and firms are seeking to hire; we cannot say whether they are replacing staff or expanding, but only that they are seeking occupations with specific skills. Consistently, the recovery

period in Germany has been characterised by two-thirds of the vacancies being in medium-skill occupations.

Tables 3.1 and 3.2 show the shares of vacancies by skill categories and by firms' size and by region at a more fine-grained level of analysis. In terms of vacancy shares by firm size, small firms (10–49 employees) are seeking medium- and low-skill workers, while medium-sized firms have over the period increasingly focused their recruitment on low- and high-skill jobs. Overall, by 2014, small and medium-sized firms showed the strongest demand for high-skill jobs. The most important results are that the vacancy growth rates are quite high for low- and high-skill occupations for micro-firms (0–9 employees) and medium-sized firms (50–249 employees). The demand for medium- and low-skill workers is negative for large firms (>250 employees) over the period.

3.6.2 Germany's manufacturing sector

What is happening in the German manufacturing sector? In general, growth rates are decreasing and more significantly so for low-skill jobs, even if they are less in demand (see Tables 3.3 and 3.4). Vacancies for medium-skill workers are stable over the period, but these occupations are the most sought-after. Finally, vacancies for high-skill workers suffered mostly in 2013, with a drop of 5,000 in 2012–13, but bounced back in 2013–14.

3.6.3 Germany's business service sector

In the business services sector, only demand for high-skill jobs increased consistently over the entire period and picked up in 2014, whereas the growth rates of vacancies for medium- and low-skill jobs fluctuated with alternating positive and negative growth rates. Overall, the job market seems to be more volatile for low- and medium-skill jobs than for high-skill jobs. This suggests that firms are constantly and increasingly seeking to fill high skill-positions. We cannot tell from the data whether this is related to upskilling or churning strategies (see Tables 3.5 and 3.6).

3.6.4 Italy

In Italy the number of vacancies for medium-skill jobs is significantly higher than in the others two categories, as we saw in the case of Germany. In general, the number of vacancies has fallen over the entire period for all three categories of skills in 2012–13, followed by a slight increase in 2014–15. Stagnation in the job market mirrored a long recession that Italy experienced following the 2008 financial crisis and the austerity policies forced on the country in the following decade. Stagnation meant that those in jobs hung on to their positions, so there was no need to replace them; in addition, firms were not looking to expand and therefore were not hiring. In Italy there is no sign of job polarisation and

Table 3.1 Germany: vacancy shares by firms' size and skills classification, 2011–14

	<i>2011</i>			<i>2012</i>			<i>2013</i>			<i>2014</i>		
	<i>High-skill</i>	<i>Medium-skill</i>	<i>Low-skill</i>	<i>High-skill</i>	<i>Medium-skill</i>	<i>Low-skill</i>	<i>High-skill</i>	<i>Medium-skill</i>	<i>Low-skill</i>	<i>High-skill</i>	<i>Medium-skill</i>	<i>Low-skill</i>
1–9 employee	14.4	26.9	16.0	20.2	25.9	27.8	30.5	26.8	16.1	19.6	28.1	27.4
10–49 employee	33.0	34.7	34.4	29.4	42.3	40.5	25.7	34.9	42.6	28.3	37.0	31.7
50–249 employee	25.3	24.8	33.0	19.3	20.6	15.3	21.5	26.4	24.1	27.0	25.1	29.3
>250 employee	27.3	13.6	16.6	31.2	11.2	16.3	22.3	11.8	17.2	25.1	9.8	11.6

Source: Authors' elaboration based on IAB Job Vacancy Survey Data.

Table 3.2 Germany: vacancy variation rates by firms' size and skills classification, 2011–14

	<i>2011–2012</i>			<i>2012–2013</i>			<i>2013–2014</i>			<i>2011–2014</i>		
	<i>High-skill</i>	<i>Medium-skill</i>	<i>Low-skill</i>	<i>High-skill</i>	<i>Medium-skill</i>	<i>Low-skill</i>	<i>High-skill</i>	<i>Medium-skill</i>	<i>Low-skill</i>	<i>High-skill</i>	<i>Medium-skill</i>	<i>Low-skill</i>
1–9 employee	59.0	-13.4	56.7	69.1	1.6	-19.1	-33.0	20.9	61.6	80.3	6.5	104.8
10–49 employee	1.0	9.5	6.1	-2.1	-18.9	47.1	15.2	22.1	-29.1	13.8	8.5	10.6
50–249 employee	-13.7	-25.5	-58.2	24.9	25.8	119.6	31.2	9.5	15.6	41.5	2.7	6.2
> 250 employee	29.2	-25.6	-11.4	-19.8	3.2	46.7	17.3	-4.5	-35.5	21.5	-26.7	-16.2
Total	13.4	-10.1	-9.9	11.9	-1.9	39.7	4.4	15.3	-4.8	32.5	1.7	19.8

Source: Authors' elaboration based on IAB Job Vacancy Survey Data.

Table 3.3 Germany: absolute values of vacancies by skills classification in the manufacturing sector, 2011–14

	2011	2012	2013	2014
High-skill	20,591	19,938	14,549	19,982
Medium-skill	46,653	49,136	45,794	45,884
Low-skill	7,124	8,261	7,252	5,871
Total	74,368	77,335	67,595	71,737

Source: Authors' elaboration based on IAB Job Vacancy Survey Data.

Table 3.4 Germany: vacancy variation rates by skills classification in the manufacturing sector, 2011–14

	2011–2012	2012–2013	2013–2014	2011–2014
High-skill	-3.2	-27.0	37.3	-3.0
Medium-skill	5.3	-6.8	0.2	-1.6
Low-skill	16.0	-12.2	-19.0	-17.6
Total	4.0	-12.6	6.1	-3.5

Source: Authors' elaboration based on IAB Job Vacancy Survey Data.

Table 3.5 Germany: absolute values of vacancies by skills classification in the business service sector, 2011–14

	2011	2012	2013	2014
High-skill	87,836	99,205	100,977	115,848
Medium-skill	316,952	259,945	257,079	299,894
Low-skill	92,076	73,204	92,102	86,440
Total	496,864	432,354	450,158	502,182

Source: Authors' elaboration based on IAB Job Vacancy Survey Data.

Table 3.6 Germany: vacancy variation rates by skills classification in the business service sector, 2011–14

	2011–2012	2012–2013	2013–2014	2011–2014
High-skill	12.9	1.8	14.7	31.9
Medium-skill	-18.0	-1.1	16.7	-5.4
Low-skill	-20.5	25.8	-6.1	-6.1
Total	-13.0	4.1	11.6	1.1

Source: Authors' elaboration based on IAB Job Vacancy Survey Data.

as the demand for labour improved from 2014, all skill profiles were sought, but medium-skill jobs still accounted for two-thirds of all vacancies.

In Italy micro-enterprises (1–9 employees) show the greatest demand for medium- and low-skill labour, whereas large firms seem to seek to hire high-skill labour. Medium-sized firms are less active in the labour market across all levels of skills (see Table 3.7). In general, all the enterprises suffered during the recession years, as negative variation rates between 2011 and 2013 show in Table 3.8; firms started hiring again in 2014 when the first positive signs of growth started to appear. All firms sustained the labour market until 2015; however, whilst large firms sought high- and mid-skill labour, micro-firms and small firms were seeking low- and medium-skill profiles. This can be particularly worrying as the adoption of new FIR technologies requires firms to upskill their labour force and some of this upskilling involves high-skill occupations. Italy's industrial structure is chartered by small firms and their ability to retain and retrain their human capital will be a precondition for their survival.

3.6.5 Italy's manufacturing sector

An overview of vacancies in the manufacturing sector reflects a weak demand for labour across all skill levels and a slight recovery in 2015 (see Table 3.9), and growth rates turning positive only in 2014–15, especially for low-skill and high-skill profiles (see Table 3.10). Again, the data suggests a lack of job polarisation in Italy, but growth trends suggest an increasing acceleration of vacancies for low-skill and high-skill profiles.

3.6.6 Italy's business service sector

In the business services sector, the data shows similar patterns, with vacancies picking up after 2014 across all levels of skills. Half of the vacancies are in medium-skill occupations, although low-skill and high-skill profiles are growing faster than medium-skill profiles.

3.6.7 The UK

In the UK, the number of vacancies seems to be greater for high- and low-skill jobs, which is different from what we found in Germany and Italy. In general, the number of vacancies grew steadily between 2011 and 2015, suggesting that firms were seeking to hire, although as we can see in Table 3.13, mostly in low-skill and medium-skill occupations. We find that in the UK, the most active firms were the micro-enterprises (0–24 employees – note that the UK firm size classification is different from that in Germany and Italy) in 2011, with the greatest vacancy shares, around 60% for medium- and low-skill jobs; however, by 2015, medium (100–249 employee) and large (>250 employees) firms large accounted for about 50% of high-skill vacancies, and small firms (25–99 employees) accounted for 40% of low-skill vacancies (see Table 3.13).

Table 3.7 Italy: vacancy shares by firms' size and skills classification, 2011–15

	<i>High-skill</i>	<i>Medium-skill</i>	<i>Low-skill</i>	<i>High-skill</i>	<i>Medium-skill</i>	<i>Low-skill</i>	<i>High-skill</i>	<i>Medium-skill</i>	<i>Low-skill</i>	<i>High-skill</i>	<i>Medium-skill</i>	<i>Low-skill</i>	<i>High-skill</i>	<i>Medium-skill</i>	<i>Low-skill</i>
1–9 employees	30.4	46.7	32.2	27.9	44.7	33.9	27.9	44.2	29.2	25.7	42.1	30.2	23.8	41.6	32.5
10–49 employees	21.8	21.5	26.4	17.5	19.2	23.6	20.4	22.0	24.8	18.9	23.5	24.2	18.0	22.5	24.2
50–249 employees	18.4	10.8	18.5	19.8	10.5	17.4	19.0	10.6	18.1	19.3	10.8	18.5	20.2	9.9	16.6
250 and more employees	29.4	21.0	22.9	34.8	25.5	25.1	32.6	23.2	27.9	36.1	23.5	27.1	38.0	25.9	26.7

Source: Authors' elaboration based on Excelsior Data.

Table 3.8 Italy: vacancy variation rates by firms' size and skills classification, 2011–15

	<i>High-skill</i>	<i>Medium-skill</i>	<i>Low-skill</i>	<i>High-skill</i>	<i>Medium-skill</i>	<i>Low-skill</i>	<i>High-skill</i>	<i>Medium-skill</i>	<i>Low-skill</i>	<i>High-skill</i>	<i>Medium-skill</i>	<i>Low-skill</i>	<i>High-skill</i>	<i>Medium-skill</i>	<i>Low-skill</i>
1–9 employees	-39.3	-26.3	-21.1	-1.2	-10.8	-30.1	-5.0	4.6	14.3	13.0	13.8	30.9	-35.6	-21.7	-17.6
10–49 employees	-46.6	-30.9	-33.0	14.7	3.4	-15.0	-4.3	17.2	8.3	16.3	10.2	21.4	-31.8	-7.7	-25.2
50–249 employees	-28.7	-24.9	-29.9	-5.4	-9.1	-15.6	4.9	12.2	13.1	27.7	5.5	9.0	-9.6	-19.2	-27.0
250 and more employees	-21.6	-6.4	-17.8	-7.5	-18.1	-9.9	14.1	11.6	7.4	28.4	26.5	19.5	6.3	8.2	-4.9
Total	-33.7	-22.9	-25.1	-1.4	-9.8	-19.0	3.2	9.8	10.7	22.0	15.0	21.5	-17.7	-12.1	-18.4

Source: Authors' elaboration based on Excelsior Data.

Table 3.9 Italy: absolute value of vacancies by skills classification in the manufacturing sector, 2011–15

	<i>2011</i>	<i>2012</i>	<i>2013</i>	<i>2014</i>	<i>2015</i>
High-skill	32,815	24,643	23,370	22,613	31,568
Medium-skill	70,454	53,312	46,568	50,227	58,348
Low-skill	66,475	45,073	35,581	42,155	72,642
Total	169,744	123,028	105,519	114,995	162,558

Source: Authors' elaboration based on Excelsior Data

Table 3.10 Italy: vacancy variation rates by skills classification in the manufacturing sector, 2011–15

	<i>2012/2011</i>	<i>2013/2012</i>	<i>2014/2013</i>	<i>2015/2014</i>	<i>2015/2011</i>
High-skill	-24.9	-5.2	-3.2	39.6	-3.8
Medium-skill	-24.3	-12.7	7.9	16.2	-17.2
Low-skill	-32.2	-21.1	18.5	72.3	9.3
Total	-27.5	-14.2	9.0	41.4	-4.2

Source: Authors' elaboration based on Excelsior Data.

Table 3.11 Italy: absolute value of vacancies by skills classification in the business service sector, 2011–15

	<i>2011</i>	<i>2012</i>	<i>2013</i>	<i>2014</i>	<i>2015</i>
High-skill	108,138	72,402	70,638	72,428	93,213
Medium-skill	258,331	194,054	167,559	182,045	215,309
Low-skill	169,300	111,645	91,216	102,358	132,223
Total	535,769	378,101	329,413	356,831	440,745

Source: Authors' elaboration based on Excelsior Data.

Table 3.12 Italy: vacancy variation rates by skills classification in the business service sector, 2011–15

	<i>2011–2012</i>	<i>2012–2013</i>	<i>2013–2014</i>	<i>2014–2015</i>	<i>2011–2015</i>
High-skill	-33.0	-2.4	2.5	28.7	-13.8
Medium-skill	-24.9	-13.7	8.6	18.3	-16.7
Low-skill	-34.1	-18.3	12.2	29.2	-21.9
Total	-29.4	-12.9	8.3	23.5	-17.7

Source: Authors' elaboration based on Excelsior Data.

Table 3.13 The UK: vacancy shares by firms' size and skills classification, 2011, 2013 and 2015

	2011			2013			2015		
	High-skill	Medium-skill	Low-skill	High-skill	Medium-skill	Low-skill	High-skill	Medium-skill	Low-skill
1–24 employees	44.3	61.5	60.0	38.5	52.4	46.6	17.5	29.1	22.5
25–99 employees	22.2	18.1	20.1	24.6	19.0	27.7	28.9	34.3	39.7
100–249 employees	13.5	9.8	9.8	15.6	10.9	14.5	26.8	17.7	27.8
250 and more employees	20.0	10.7	10.2	21.3	17.7	11.1	26.9	18.9	10.0

Source: Authors' elaboration based on Employer Skills Survey Data.

Table 3.14 The UK: vacancy variation rates by firm sizes' and skills classification, 2011, 2013 and 2015

	2013/2011			2015/2013			2015/2011		
	High-skill	Medium-skill	Low-skill	High-skill	Mid Skill	Low-skill	High-skill	Medium-skill	Low-skill
1–24 employees	-10.4	-13.4	1.7	-41.0	-17.0	-25.6	-47.1	-28.1	-24.3
25–99 employees	14.1	6.5	80.7	53.4	170.4	120.5	75.0	188.1	298.4
100–249 employees	18.7	13.2	93.8	124.3	143.5	195.0	166.3	175.7	471.8
250 and more employees	10.1	68.3	43.1	64.0	59.9	38.8	80.5	169.2	98.7
Total	3.1	1.5	30.8	30.3	49.7	54.1	34.3	52.0	101.6

Source: Authors' elaboration based on Employer Skills Survey Data.

The variation rates are always positive and high over the period: this suggests that the situation of the job market is quite different in the UK from the other two countries (Table 3.14). Overall, there is a high job mobility market, and the high number of vacancies suggests that workers are moving from one job to another one quite easily.

Growing vacancy rates might be explained in many ways: it might be that firms are replacing mobile talent, expanding the existing labour force or seeking complementary skills. The data cannot tell us anything about this; however, we

Table 3.15 The UK: absolute value of vacancies by skills classification in the manufacturing sector, 2011, 2013 and 2015

	2011	2013	2015
High-skill	12,203	11,916	13,260
Medium-skill	12,981	10,775	15,328
Low-skill	12,727	11,684	19,209
Total	37,848	34,375	47,797

Source: Authors' elaboration based on Employer Skills Survey Data.

Table 3.16 The UK: vacancy variation rates by skills classification in the manufacturing sector, 2011, 2013 and 2015

	2013/2011	2015/2013	2015/2011
High-skill	-2.4	11.3	8.7
Medium-skill	-16.6	42.3	18.7
Low-skill	-8.2	64.4	50.9
Total	-9.2	39.0	26.3

Source: Authors' elaboration based on Employer Skills Survey Data.

find large vacancy growth rates for small, medium and large-sized firms from 2011 to 2015 for medium and low skills, whereas large firms are mainly looking for high-skill workers. Meanwhile, micro-firms show signs of withdrawing from the labour market.

3.6.8 The UK's manufacturing sector

In the case of the manufacturing sector, there is no clear evidence of job polarisation in the jobs firms try to fill: in 2011, vacancies were evenly distributed across the different skill categories, while in 2015, the highest demand was for low-skill workers, followed by the medium-skill workers.

In particular, in the manufacturing sector vacancies contracted between 2011 and 2013 (post-crisis), but picked up again in 2013, signalling a dynamism in the sector which was mostly export-driven. Worryingly, however, the vacancies that grew the most were for low- and medium-skill workers.

3.6.9 The UK's business services sector

In the business services sector there appears to be some evidence of job polarisation in 2011 and 2013, while in 2015 vacancies for low-skill and medium-skill workers grew the fastest. In this sector, the data shows an increase of 200,000 vacancies between 2013 and 2015 (see Table 3.17).

Table 3.17 The UK: absolute value of vacancies by skills classification in the business service sector, 2011, 2013 and 2015

	2011	2013	2015
High-skill	143,099	140,818	182,390
Medium-skill	72,986	71,925	114,218
Low-skill	148,587	150,804	239,918
Total	364,672	363,547	536,526

Source: Authors' elaboration based on Employer Skills Survey Data.

Table 3.18 The UK: vacancy variation rates by skills classification in the business service sector, 2011, 2013 and 2015

	2013/2011	2015/2013	2015/2011
High-skill	-1.6	29.5	27.5
Medium-skill	-1.5	58.8	56.5
Low-skill	1.5	59.1	61.5
Total	-0.3	47.6	47.1

Source: Authors' elaboration based on Employer Skills Survey Data.

The service sector has very big variation rates in terms of vacancies for all three kinds of workers between 2015 and 2013 and between 2015 and 2011. However, between 2011 and 2013 (post-crisis), the situation appeared quite stationary.

3.7 Conclusions

The novel contribution of this chapter is to explore job vacancies in Germany, Italy and the UK. We used regional, sectoral and firm size data to reveal firms' demand for skills. Our analysis suggests that German and British firms were very active in looking for labour, notably in terms of high-skill labour in Germany and low-skill labour in the UK. Meanwhile, in Italy there was evidence of a stagnant job market where the demand for medium-skill workers was the largest. Finally, it is perhaps surprising that the sectoral analysis suggests that the service sector seems more receptive to Industry 4.0 skills than the manufacturing sector. Job vacancies data provides valuable information on firms' skill needs; however, unfortunately it does not enrich the analysis with details about the why and how of labour market changes. Nevertheless, we feel that a number of policy recommendations can be drawn from our research:

- 1 There is a need to raise awareness at the firm level of the types of skills needed to adopt new technologies. The extent to which firms still demand low-skill jobs raises some concerns with respect to their possible lack of readiness to fully exploit the benefits of all the FIR technologies. This

means that key stakeholders have a role to play in informing, alerting and advising firms on what skills they need, given the sectors they operate in and the activities they are undertaking. Such skills may be in the local labour market or may need to be acquired via the existing workforce.

- 2 The education system needs to start updating its programmes to include competences related to FIR technologies in order to avoid structural skill mismatches in the labour market.
- 3 The fast pace of technological change means that firms will experience rapid skill obsolescence. A solution would be for firms to prioritise constant on-the-job reskilling and upskilling of their internal labour force by accessing general or tailored courses offered by specialist providers, especially for smaller firms who might not have the in-house facilities and scale to invest in competence building.
- 4 Industry associations and public sector stakeholders can work with the knowledge-intensive business sector by supporting the latter to emerge and develop symbiotically with the industrial specialisation of the regional economy in order to offer tailored, customised and bespoke training programmes.
- 5 Skills formation is often considered a good example of market failure necessitating government intervention in order to compensate for the private sector's under-investment due to free-riding concerns. However, skills formation will increasingly become a multi-dimensional requirement for firms, government and society. The lack of skills will impact on people's employability and therefore on their job prospects and income. At the same time, governments will need up-to-date skills and competences across their range of departments in order to understand the policy and regulatory implications of technological change. Furthermore, firms can only become or remain competitive if their physical investments in digitally enabled technologies are dovetailed with investment in competence building. This means that skills formation cannot be left solely to schools and universities; firms need to be compelled to proactively invest and plan for the skills they need and will need. Policy needs in turn to incentivise firms to retain and retrain its labour force by introducing, for instance, 'skills vouchers' (similar to innovation vouchers) or programmes such as industrial doctorate programmes or apprenticeships.

Note

- 1 Public administration, public enterprises in the health sector, public primary and secondary schools, public universities and other no-profit organisations are excluded.

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