STEM SKILLS, TECHNICAL EDUCATION AND CAREER PROGRESSION IN THE UK

A REPORT TO THE GATSBY FOUNDATION

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COMMENTARY

Moving from job to job over the course of a career is an important way in which individuals increase their earnings and find more rewarding, higher-quality employment. Skill development has a key role in shaping such progression, both through those skills developed prior to entering the labour market, and those resulting from both formal job training and work experience. It is tempting to conceptualise an individual's career progression as regular steps-up in occupational level, following the development of sufficient higher skills. However, career paths can be considerably more complex than this, with barriers to acquiring the right skills to progress, and to mobility even for those who have the required skills.

Some skills are specific and valuable only in certain workplaces. Such skills can reduce mobility, as they can tie workers to certain employers, occupations or industries where those skills are valued and likely to command an earnings premium. In other situations, specific skills can facilitate upward occupational mobility – that is, a move from one occupation to a more rewarding occupation – within a similar field of work, such as within a firm or an industry (Sicherman, 1990; Sicherman and Galor, 1990). In this case, the skills and knowledge needed for the first occupation are also required for second occupation, which also requires some additional capabilities that are developed through working in the first job. For example, a lab technician may develop the ability to manage a lab or take a lead on projects through their time working as a technician. This links together particular types of occupations, leading to opportunities to progress within these occupations, but more limited access for people outside a particular career path.

General skills, on the other hand, are valuable across a large range of employers, occupations or industries. In principle, these should facilitate wider mobility across occupations or industries. Firms may be reluctant to invest in these skills as they fear that such investments will not pay off because workers are able to take those skills to a wide range of other employers. This leaves it up to individuals to make these investments themselves at school, college or university, and continuing further training programmes once entering the labour market. Such individual investments can be affected by market failure, which will ultimately restrict the amount of progression and mobility that can take place, making this an area requiring government intervention.

Skills are not the only factor, however – in some cases, having the right skills is not enough. Firms create limited entry points for recruitment from outside of their company, and career ladders and promotion opportunities for those within. They may adopt strategies about who to recruit and when. This means that some individuals have advantages over others, even if they have the same qualifications. For example, a firm may seek new recruits from cohorts of recent school or university leavers, rather than those already working elsewhere in the labour market. In recent years, the entry point to this internal labour market has shifted, with firms no longer directly employing staff in lower-level occupations, but instead moving to outsourcing and third-party contracting. Mobility and competition are likely to increase between these lower-level positions. But employees' internal progression to more secure positions is becoming harder.

Table 1. List of selected technical occupations

	2010	2017	*Change 2010-17*
Science professionals	0.5%	0.5%	*0.0%*
Engineering professionals	1.6%	1.5%	*-0.1%*
ICT professionals	1.6%	1.8%	*0.3%*
Science and engineering technicians	0.8%	1.0%	*0.2%*
Draughtspersons and building inspectors	0.2%	0.2%	*0.0%*
IT service delivery occupations	0.6%	0.6%	*0.0%*
Metal forming, welding and related trades	0.4%	0.3%	*-0.1%*
Metal machining etc. trades	1.1%	1.0%	*-0.1%*
Vehicle trades	0.8%	0.7%	*-0.2%*
Electrical trades	1.5%	1.4%	*-0.1%*
Process operatives	1.0%	0.8%	*-0.3%*
Plant and machine operatives	0.6%	0.6%	*-0.1%*
Assemblers and routine operatives	0.9%	0.9%	*0.0%*

Source: UK Quarterly Labour Force Survey, own calculations. Note: Employment share calculated using a headcount of main occupation from survey respondents in April-June survey of each year. There may be rounding errors.

This summary highlights evidence about the complex nature of career paths and patterns of occupational mobility in technical occupations, using data from the UK Household Longitudinal Survey (UKHLS), sometimes known as Understanding Society. This is an annual panel survey, which began in 2009 with 40,000 households. The final report gives more of the technical details on the analysis conducted. The technical occupations examined in this report are given in Table 1 defined using three-digit SOC2000 codes. The table shows their share in employment in the UK, as calculated using the UK Quarterly Labour Force Survey, and how it has changed between 2010 and 2017, the years covered in the mobility analysis that follows.

These occupations account for around 11-12% of all employment in the UK. The share of technicians and professionals has stayed broadly the same, while technical skilled trades and process operatives have seen a drop in their employment share. For process operatives and some skilled trades, this is part of an on-going structural shift that started in the late 1970s (Goos and Manning, 2007), where occupations which mainly performed routine tasks – that is, tasks which are predictable and repeated – have been in decline, either because they have been automated and replaced by ICT capital, or because they have been offshored to countries with lower labour costs.

Table 2. Original occupations and destinations

	Destination one year later				
Origin	Non-technical occupations	**Technical occupations**	Unemployment	Inactivity	Study
Non-technical occupations	91.2%	1.0%	2.0%	4.9%	0.9%
Technical occupations	8.2%	86.9%	1.9%	2.8%	0.3%
Unemployment	27.4%	2.9%	42.4%	23.7%	3.6%
Inactivity	5.0%	0.2%	2.8%	91.6%	0.3%
Study	19.6%	1.2%	7.3%	3.3%	68.5%

Source: UKHLS, own calculations

Table 2 describes the aggregate trends in one-year transitions in the data between 2009 and 2016 across the five main categories of activity – employment in non-technical occupations (as coded using the Standard Occupational Classification), employment in technical occupations, unemployment, inactivity (not including study), and study. It shows that, in any year, people in employment are highly likely to remain within their occupational group from year to year. There there are roughly eight times as many jobs in non-technical occupations as there are in technical occupations, so we would expect the proportion leaving technical occupations for non-technical work to be larger than in the other direction. There is nothing here to suggest movement between the two groups is more difficult in one particular direction. The biggest difference between technical and non-technical occupations is flows into and out of employment, which are more common in non-technical occupations. This suggests lower turnover in technical occupations, and that recruitment into technical occupations is more likely to come from those already working rather from those previously outside the workforce.

OCCUPATIONAL MOBILITY IN TECHNICAL OCCUPATIONS

Occupational mobility is measured as the proportion of individuals in an occupation who are in a different occupation one year later (rather than in the same occupation, or no longer in employment). Occupational mobility in technical occupations ranges **from 9% to 17%**, depending on the starting occupation. Some occupational transitions are more common than others:

- For the higher-skill technical occupations, there is some mobility between different levels (e.g. between associate professional and professional). However, there is more mobility into and out of non-technical roles in management, and for technicians and associate professions into and out of other lower-skill non-technical roles, suggesting people are more likely to leave particular occupational pathways than progress within them (see below).
- Skilled tradespeople and process operatives show some mobility between each other, but there is little evidence of many individuals moving to higher-level occupations beyond that. One exception seems to be skilled tradespeople moving into engineer roles, which seems to be mostly associated with electricians and machinists. There may be specific skills that need to be

developed in order to make those particular transitions, which certain jobs are able to facilitate.

- Process operatives are least likely to remain in technical occupations year from year. This is perhaps as expected – these occupations have been most at risk of automation, which displaces people from these jobs. Leavers from these jobs tend to have a higher chance of ending up outside of the labour market, or in another lower-skill non-technical occupation.
- Individuals move into skilled trade technical occupations and process operative occupations from unemployment, but those in process operative jobs also move back into unemployment in similarly large numbers, suggesting there is an issue of churn (rather than progression) between these jobs and spells of unemployment.

OCCUPATIONAL MAPS

Occupational maps, produced for the Institute for Apprenticeships and Technical Education by industry experts, are an alternative way of looking at progression and mobility patterns. The maps group occupations with related knowledge, skills and behaviours into pathways, making it easier to see the opportunities for career progression within that particular route. Within each pathway, occupations at the same level are grouped into clusters, to show how skills learnt can be applied to other related occupations. Each map has three levels – technical occupations, higher technical occupations and professional occupations. Progression, therefore, corresponds to movement from one level to the next level to another.

Table 3. Mobility in occupational maps

	No progress	Progress in pathway	Leave pathway
Maintenance, Installation & Repair Pathway	89%	2%	9%
Engineering, Manufacturing, Process and Control Pathway	89%	2%	9%
Engineering, Design and Development Pathway	86%	5%	9%
Science Pathway	84%	4%	12%
Digital Production, Design and Development Pathway	83%	6%	11%
Digital Support and Services Pathways	83%	6%	11%

Source: UKHLS, own calculations. Notes. Figures report year-to-year labour market transitions

There are six occupational maps, listed in Table 3, which are relevant to the technical occupations analysed previously. It should be noted that the match between these occupations and the job titles listed in the occupational maps is not perfect. Occupational map job titles are more disaggregated than the occupational groups. The occupational groups can cover job titles that appear on multiple levels of a pathway, meaning less progression within a pathway is measured than is taking place. Moreover, some occupational groups cover job titles which appear across multiple pathways, or even outside the six selected occupational maps, meaning the proportion of people may be leaving a pathway may be higher than we measure.

Although the broadness of the occupational groupings means it is difficult to fully evaluate how progression and mobility occurs in reality in the UK labour market as compared with how it is conceptualised by industry experts, the data in Table 3 suggest that progression between closely related technical occupations happens relatively infrequently. For example, thinking about the two Digital pathways (analysed together because the job titles in each fall into the same occupational groups), each year around 6% of individuals move from the ICT technician role to the ICT professional role. At the same time, it should be noted that around half as many people move from professional to technician. At the same time, a much larger proportion of individuals move to occupations that do not fall inside the relevant pathway (or even in a closely related occupation in the same occupational group which is technically outside the pathway, but not distinguishable in the data at this level of aggregation). In general, the figures above suggest at least twice as many people leave an occupational pathway than progress within that pathway in any given year. To illustrate the overall effect of this very roughly, if a group of workers all had a 9% chance of leaving a pathway each year, we would predict that over ten years, around 60% of those who were in the pathway in the first year would have left it over that time period. As mobility goes both ways, some of the mobility out of the path represents churn of workers who frequently move between different jobs and employment statuses searching for a better match, meaning that the proportion of the workers who were there in the first year that leave will likely be less than 60%. However, there are a number of reasons to think this is not a significant part of this outward mobility: tenure effects don't seem to be very large, and many of the destination occupations are high status non-technical occupations (in management or other professional work). Moreover, because mobility goes in both directions, some of those who leave the pathway may return, but the more this happens, the less sense it makes to refer to use the language of pathway, which implies a simple single direction of travel.

This raises the question over what these pathways are for. Two options are that they may be *descriptive*, or they may *prescriptive*. If they are descriptive, then it is clear from the above analysis that they are dramatically over-simplified, and that progression patterns in the UK do not correspond to these mappings. On the other hand, if they are prescriptive – that is, if they represent the ideal way for individual careers to develop, building up skill, knowledge and competence at one level before moving up to the next, then they raise some important questions for skills policymakers and industry stakeholders. Firstly, they should ask if the pathways depicted are indeed the ideal, or whether some of the occupational mobility outside of the pathway is beneficial to the workforce development but is not currently being recognised. For example, perhaps some of the leakage represents necessary screening of individuals who are not well-matched to a particular group of occupations. Moreover, perhaps some occupation transitions outside of the pathway enables different skills to be developed which benefit both worker and firms later on in that person's career. This suggests more work should be done to understand what skills are needed, and how can they most efficiently be developed.

Secondly, if these pathways are still believed to be the ideal, policymakers and industry stakeholders need to ask why so much leakage is taking place as compared with progression within the pathway. It might mean that there are some market failures which prevent certain skills being developed at one level and limits movement to the next level. A commonly given example of this is fears about poaching between firms (Stevens, 1996), which occurs in cases when training is

transferable between a small number of firms – so neither fully general or specific, in the way Becker (1994) described – and as a result, labour markets for these skills are not entirely competitive. There may also be coordination failures too. If there was a single employer which hired all workers at each level in the pathway, they would easily be able to coordinate the skill development and progression of individual workers within the firm. It is more realistic to imagine that some firms specialise in work which requires workers at one level, while other firms employ workers at another level. Therefore, it might be more difficult to facilitate progression from one level to another when it involves firm-to-firm moves than when it is simply progression up a firm's progression ladder. In any case, if these maps are to be used as prescriptive tools, it is important that the system is made to work, so as to ensure the desired progression between specific jobs can take place, and it cannot be taken for granted that this will happen if the system is simply left to its own devices.

EXPLAINING PROGRESSION BETWEEN TECHNICAL OCCUPATIONS

There are some key characteristics of individuals and their work which predict who is more or less likely to progress in their careers within technical occupations. Skill differences are obviously expected to be important. The analysis uses the different measures of skills, education and training, and these are organised into three categories of variables. Firstly, there is an individual's highest qualification level grouped as: postgraduate degree; undergraduate degree; other higher education qualifications, post-16 qualifications; GCSEs; below GCSEs, and no qualifications. Secondly, there is the impact of having vocational qualifications (which may or may not be an individual's highest qualification). Finally, there is firm training, and in particular whether an individual has participated in any training in previous 12 months; whether this training was linked to finding a better job or promotion; and whether this training has led to the acquisition of new vocational qualifications.

Alongside skill differences, the analysis also looked for differences in mobility by gender, age (as mobility tends to reduce as people get older), tenure with the current employer, sector, firm size, and contract. Tenure is expected to have a negative impact on mobility as individuals develop firm-specific skills which make moves costlier and progression less likely outside of the firm. However, individuals may still be able to progress within their organisation if routes exist. Variables on firm size and contract type are included to capture the idea that intra-firm promotion ladders and internal labour markets are more likely to be found in large firms, particularly for permanent contract workers (or core workers) rather than non-permanent peripheral contract workers (including agency workers, fixed-term and seasonal workers and other flexible work contractors). The last factor is a measure of the change in the number of jobs in the origin occupations. The occupational structure of the labour market has changed markedly over the past few decades, with a growth of high-skill jobs, including professional and technician occupations, and a decrease in skilled trades and at the operative level (Autor, Levy and Murnane, 2003; Goos and Manning, 2007). These structural changes alter mobility patterns, because they create displacement or employment opportunities depending on whether the occupation is growing or shrinking compared with others.

The analysis shows that:

- When an individual remains in a technical occupation, differences in qualifications or skills do not seem to make much difference to retention. However, two factors outside a worker's control do make a difference: changes in the occupational structure and type of contract. A growing occupation leads to less mobility (as more people remain), while a shrinking occupation creates more mobility (as some people are displaced). In addition, people on non-permanent contracts are more likely to leave a particular occupation. Across all occupations, non-permanent contracts are associated with a 10-15pp (percentage points) fall in the probability of remaining in the occupation. People leaving seem to be moving outside technical occupations, or perhaps even outside employment, rather than to other employment within technical occupations.
- Entry into professional level occupations is closely linked to having high-level qualifications. For technicians, having a degree qualification or higher is associated with around a 3-4pp increase in the chance of moving to a professional level occupation.
- Aside from this, there is only sporadic evidence that skill differences affect progression chances, usually connected to a particular type of occupation-to-occupation move. Examples are associated with completing some form of training, leading to a higher chance of moving on from operative roles or skilled trade roles to higher skill roles. There is little evidence of any general patterns linking all forms of progression to, for example, newly acquired vocational qualifications, or even completing training programmes which are linked to promotion.
- Although the analysis has only a limited scope here given the data, there is some evidence that firms directly shape progression opportunities. One example is that when there was progression from operatives to professional occupations, it was almost always found within the manufacturing sector. A second example was that skilled tradespeople progressed to professions more frequently in larger firms, and when they had completed some training related to promotion, suggesting some form of career progression ladder. This makes sense when you consider that many skilled tradespeople operate as sole-traders or in smaller occupational-specific companies, and these naturally cannot create opportunities to progress to professional occupations. This suggests market or coordination failures which larger firms are better suited to overcome, and which otherwise affect progression opportunities.

CONCLUSIONS

This report has examined occupational and job mobility into the technical occupations that demand STEM skills. Looking at the years between 2009 and 2016, the purpose has been to evaluate what career progression looks like for people in these occupations and what makes progression more likely. In doing so, it also gives some insights into the STEM skills pipeline.

KEY FINDINGS

- There is significant mobility into and out of technical occupations. Between 15% and 25% of individuals in a technical occupation will be in a different occupation, or out of employment, the following year, depending on occupation.
- Some occupations are more closely linked than others in terms of occupational moves. However, occupational maps give a hugely oversimplified picture of progression between different occupations, as there is generally more mobility towards non-technical occupations or out of employment than between technical occupations. Within each occupational maps, mobility outside of a pathway tends to happen a roughly twice the rate as progression (to a higher-level occupation).
- There are therefore important questions to address about the role of occupational maps. As a descriptive tool, they do not give a realistic view of progression and mobility patterns for workers in these jobs. As a prescriptive tool, and assuming the pathways they describe are considered optimal and the degree of skill leakage is inefficient, industry should be considering how better to retain skilled workers and offer more progression opportunities. The system should be made to work so as to ensure the desired progression between specific jobs, and it cannot be taken for granted that the system will do this if simply left to its own devices.
- For those who do progress within technical occupations, having high-level degree qualifications is associated with a better chance of moving into technical professions, particularly for younger workers. There are also specific paths into professions, for example in manufacturing for operatives, and in large firms offering specific training for skilled trades. However, education and training differences can only explain so much of the observed mobility. There are people entering technical occupations from non-technical occupations without particularly high qualifications, and qualifications and training have only a small impact on the chance of moving into technician roles from skilled trades and operative jobs. Being on a non-permanent contract predicts a 10-15pp fall in the chance of remaining in a particular technical occupation, which means that some of the leakage in the occupational maps is related to employment conditions.

1 INTRODUCTION

Moving from job to job over the course of a career is an important way in which individuals increase their earnings and find more rewarding, higher quality employment. Skill development forms an important part of such progression and may be a pre-requisite for being able to take on more demanding roles. This report examines mobility patterns and career progression for a group of technical occupations in the UK which make use of particular STEM skills. It looks at opportunities for adults working in these occupations to progress, the ways in which different types of education, training and skills help facilitate this progression, and the barriers individuals may face even after making suitable investments in their human capital and skills.

The skills an individual possesses are a key determinant of labour market outcomes (Becker, 1994). It is tempting to conceptualise an individual's career progression as regular steps up in occupational level, following the development of sufficient higher skills. However, career paths can be considerably more complex than this, with barriers to acquiring the right skills to progress and barriers to mobility even for those who have the required skills. This report aims to improve the understanding of career paths and occupational mobility in the highlighted technical occupations.

A key distinction, in discussing the right skill development for individuals to achieve career progression, is between general skills and specific skills. Specific skills are those which are valuable in a select number workplaces. Such skills can reduce mobility as they can tie workers to certain employers, occupations or industries where those skills are more valued and likely command an earnings premium. Employees may be willing to develop such specific skills if it allows them to improve their labour market outcomes within that firm, occupation or industry. For example, a skilled tradesperson may remain in that occupation for a large part of their career, but they can boost their earnings and opportunities through upgrading and honing their occupational-specific skills, providing their pay reflects the quality or efficiency of their work. In other situations, specific skills can facilitate upward occupational mobility – that is, a move from one occupation to a more rewarding occupation – within a similar field of work, such as within a firm or an industry (Sicherman, 1990; Sicherman and Galor, 1990). In this case, the skills and knowledge needed for the first occupation are also required for second occupation, and this also requires some additional capabilities which are developed through working in the first job. This can lead to a period of time where an individual might appear overqualified for their job, but need both a higher formal qualification and work experience in order to enter a higher skill job. For example, a lab technician with a university degree may develop the ability to manage a lab or take a lead on projects through their time working as a technician. This type of progression path links together particular types of occupations, leading to opportunities to progress for those who are able to enter them.

Firms help with developing specific skills by providing their own training (or investing in off-the-job training) with a view towards either promoting their current employees to higher positions or more skill-intensive, better-paying work in the future. Informal learning, via on-the-job experience and which does not necessarily lead to a recognisable qualification, is also important – skills are honed and perfected through work, and the experience of working in an occupation or learning about an industry may be vitally important for an individual seeking to move to higher-level positions.

On the other hand, some skills are general, and are valuable across a large range of employers, occupations or industries. In principle, these should facilitate wider mobility across occupations or industries. Firms may be reluctant to invest in these skills as they fear that those investments will not pay off because workers are able to take those skills to a wide range of other employers. This leaves it up to individuals to make these investments in skills themselves. Many of these investments are developed during formal education at school, college or university, prior to entering the labour market. However, even after leaving full-time education, individuals can continue to invest in their own skills through further training programmes and apprenticeships. Under some circumstances, this may not provide skills to the efficient level described by Becker, and as particular sources of market failure (such as insufficient information or market competition) restrict the amount of progression and mobility that can take place. Ensuring that people are able to acquire the right skills which both benefit their careers and meet the needs of the labour market to avoid problems of skills mismatch: this is a concern and ongoing challenge for governments (see, for example, House of Commons Committee of Public Accounts, 2018). It is reflected in the degree of governmental involvement in vocational education programmes and apprenticeships both for young people entering the labour market for the first time and for adults who may need to retrain during the course of their working life.

However, there are many factors affecting occupational mobility, and while having particular general and specific skills is usually a necessary requirement, this may not be enough to enable progression. For example, promotion ladders in firms, which may exist to facilitate the development of specific skills necessary for people to progress to higher-level jobs, can also create an internal labour market within a firm (Doeringer and Piore, 1971). This limits the points of access to certain jobs, reduces the competition for those jobs from individuals outside the organisation, and may mean that those who have acquired skills elsewhere may find it difficult to compete for jobs they would be qualified to do. That said, in recent years, firms have become less likely to directly employ for lower-level or periphery positions and instead use third-party contractors or other firms of non-permanent contracts to find labour to fill these jobs – a phenomenon which Weil (2014) calls the fissured workplace. This changes the career paths an individual might take. We are likely to see more mobility between lower-level jobs as competition for those jobs increases, but a reduction in promotion opportunities and mobility from lower-level jobs outside of the internal labour market into higher-levels jobs which are still part of an internal labour market.

There are other factors shaping opportunities to progress between different occupations. A key driver of change in mobility patterns is that the demand for different skills in the labour market changes over time. This may be because technological progress makes certain skills more valuable to an organisation and renders others obsolete due to automation (see, for example, Autor, Levy and Murnane, 2003), or because firms can outsource certain task and responsibilities to lower labour cost countries, or because of changes in the preferences and demands of consumers. Whatever the reason, the end result can leave some workers with skills that enabled them to progress to better employment in the past, but which today are not sought after. At the same time, the growth of higher-skill occupations may create more opportunities for individuals to progress if more jobs are opening up.

In this report, mobility patterns for individuals within a group of specific technical occupations are analysed using data from the UK Household Longitudinal Survey (UKHLS), sometimes known as Understanding Society. This is an annual panel survey, which began in 2009 with 40,000 households. The UKHLS follows on from the British Household Panel Survey (BHPS), which was smaller (approximately 12-15,000 households) but ran from 1991 to 2008 with a proportion of those households carried forward in the UKHLS. The analysis in this report focuses on the years between 2009 and 2016, looking at year-to-year transitions between select technical occupations, other non-technical occupations, and outside of employment.

This report is structured as follows. Section 2 describes the dataset and defines the technical occupations which are most relevant for thinking about STEM skills. It also explains how occupational mobility is defined and what variables in the dataset are available to measure job-to-job transitions. It also describes how skills are measured for individuals in the dataset, from education, vocational qualifications and firm training. Section 3 gives the results in three parts. Firstly, it provides mobility tables showing what proportion of individuals move into, out of, or remain in the select technical occupations, and which occupations the moves are between. Secondly, it focuses on specific occupation pathways which have been developed to join related occupations together by the Institute for Apprenticeships and Technical Education, and looks to see what progression there is between occupations in those pathways. Finally, it uses regression analysis to evaluate which factors help predict which individuals are more or less likely to progress between different technical occupations. Section 4 summarises the results, with some conclusions about the nature of occupational mobility for technical occupations in the UK and the role of skills policy.

2 DATA AND METHOD

2.1 DEFINING THE TECHNICAL OCCUPATIONS

The analysis in this report focuses on specific technical occupations which require particular STEM skills.[1] These occupations range from professional occupations through technicians and associate professionals to skilled trades and process operatives. Table 2.1 gives the occupational groups, defined at the three-digit SOC2000 codes, and their total share of all employment in the UK, as calculated using the UK Quarterly Labour Force Survey.

Table 2.1. Employment in technical occupations

	2001	2010	2017	Change 2001-17	Change 2010-17
Science professionals	0.4%	0.5%	0.5%	*0.1%*	*0.0%*
Engineering professionals	1.5%	1.6%	1.5%	*0.1%*	*-0.1%*
ICT professionals	1.5%	1.6%	1.8%	*0.4%*	*0.3%*
Science and engineering technicians	1.0%	0.8%	1.0%	*0.0%*	*0.2%*
Draughtspersons and building inspectors	0.3%	0.2%	0.2%	*0.0%*	*0.0%*
IT service delivery occupations	0.7%	0.6%	0.6%	*-0.1%*	*0.0%*
Metal forming, welding and related trades	0.6%	0.4%	0.3%	*-0.4%*	*-0.1%*
Metal machining etc. trades	1.5%	1.1%	1.0%	*-0.5%*	*-0.1%*
Vehicle trades	1.0%	0.8%	0.7%	*-0.3%*	*-0.2%*
Electrical trades	1.7%	1.5%	1.4%	*-0.3%*	*-0.1%*
Process operatives	1.5%	1.0%	0.8%	*-0.7%*	*-0.3%*
Plant and machine operatives	0.9%	0.6%	0.6%	*-0.4%*	*-0.1%*
Assemblers and routine operatives	1.6%	0.9%	0.9%	*-0.7%*	*0.0%*

Source: UK Quarterly Labour Force Survey, own calculations. Note: Employment share calculated using a headcount of main occupation from survey respondents in April-June survey of each year. There may be rounding errors.

1 There are some occupations which could considered technical occupations and use STEM skills, such as those in finance and healthcare, which are not part of the analysis. The term 'technical occupations' used throughout this report indicates the select occupations in Table 2.1.

These occupations account for around 10.8% of all employment in the UK. Since 2001, there has been a small increase in the total employment share of the professional occupations, particularly for ICT professionals after the financial crisis. The share of technicians has stayed broadly the same, while technical skilled trades and process operatives have seen a drop in their employment share. The decline in these skilled (or semi-skilled) manual technical jobs occurred mostly up to 2010 – during the years that followed, the rate of decline has slowed. For process operatives and some skilled trades, this is part of an on-going structural shift that started in the late 1970s (Goos and Manning, 2007), where occupations that mainly performed routine tasks – that is, tasks which are predictable and repeated – have been in decline, either because they have been automated and replaced by ICT capital, or because they have been offshored to countries with lower labour costs.

2.2 OCCUPATIONAL AND JOB MOBILITY

To analyse mobility patterns in technical occupations in the UK, I use the UK Household Longitudinal Survey (UKHLS), sometimes known as Understanding Society. This is an annual panel survey, which began in 2009 with 40,000 households. The UKHLS follows on from the British Household Panel Survey (BHPS), which was smaller (approximately 12-15,000 households) but ran from 1991 to 2008 with a proportion of those households carried forward in the UKHLS. I use the first eight waves of data from 2009 to 2016.

Combining the eight waves of data gives labour market histories for around 85,000 individuals from the sample households over this time period. Across this time period, there are no data from each individual in every year. Some households are added to the survey, and under 16s enter the dataset once they reach their 16th birthday. Moreover, there are households which don't respond or drop out of the survey for various reasons. Hence, the transitions that we look at for each one-year period are those who report data at both the start and end of that period (i.e. in two consecutive surveys). Table 2.2 summarises the level of non-response in each year – in each year there is labour market data from between 42,000 and 51,000 individuals, and of these individuals, between 75% and 85% report data in the following year so their transitions (or lack of transition) can be recorded. In total, 275,000 year-to-year labour market transitions are recorded over the eight-year period.

Table 2.2. Labour market activity available in UKHLS dataset

	2009	2010	2011	2012	2013	2014	2015
Activity recorded	50,994	54,564	49,689	47,066	44,826	45,183	42,164
Missing	33,931	30,361	35,236	37,859	40,099	39,742	42,761
Missing in following year	12,634	10,389	7,616	6,142	8,022	7,666	6,826
Total	84,925	84,925	84,925	84,925	84,925	84,925	84,925

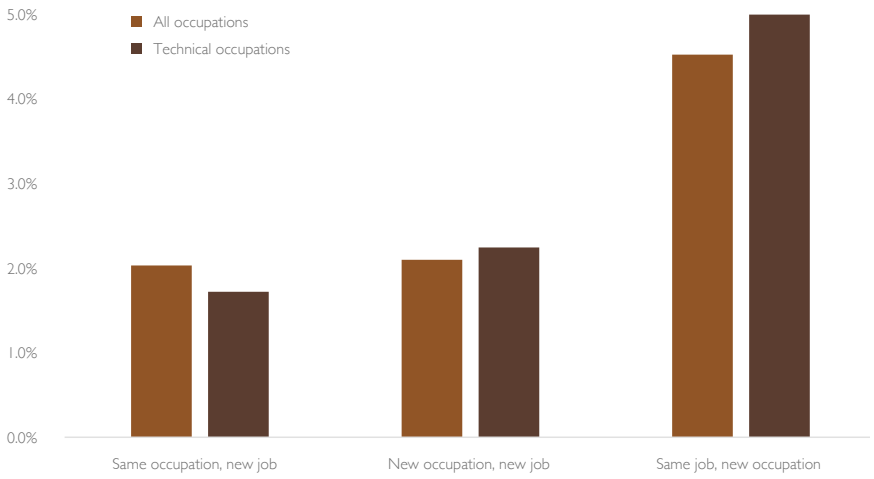
In this report, mobility is captured in two ways. Firstly, all survey respondents in employment are assigned an occupational group (based on three-digit SOC codes) which is derived from the description of their current job. Using this, I call **occupational mobility** a situation when an individual's recorded occupation changes over a specified time period. For occupational mobility, I also include change in economic activity status as separate categories so we are also including movement from employment into unemployed or inactivity and vice versa. An unemployed individual is someone who is not currently in employment, but who is available for work and searching for jobs. An inactive person is someone who is not in employment, and is not available for work and/or not actively searching for jobs. This includes people who are retired, people who have caring responsibilities, people with mental or physical ill health which prevents them from working, and students. I record individuals who are studying as a separate category.

Secondly, I call **job mobility** a situation when an individual self-reports a change in employer or a change in job at their existing employer.[2] It is possible that this measure could record more or less mobility than the occupational measure. For example, a person could move employer whilst remaining in the same occupational category. Moreover, because the job mobility measure is based on an individual self-report, the response is subject to individual interpretation of what it means to have a new job. They may have a different job title or new responsibilities within the same employer but the extent of the changes are quite small such that it is still captured by the same SOC code. On the other hand, a person might take on different responsibilities in their organisation to the extent that they would be recorded as changing occupation in the data, but when asked they consider that they are in the same job (for example, if they equate a job with an employer, or with a title that hasn't changed despite a change in work responsibilities). Figure 2.1 shows that both are indeed possible – looking at year-to-year mobility. Around 91% of workers in employment remain in the same occupation and report being in the same job at the same employer each year, meaning that about 9% of workers have moved occupation and/or job. Just over 2% of workers each year report having a new job (either at the same employer or having moved employer), and have changed their occupation. Another 2% of workers are in the same occupation, but report having changed job and/or employer. Finally, a perhaps surprising 5% of workers report being in the same job at the same employer, but having a change in their recorded occupation.[3]

2 Survey respondents are asked if they are with the same employer as they were in the previous survey; and if they are with the same employer, they are also asked whether they are in the same job. What it means to be in the same job is not defined for the respondent. It is possible a person says they have a new job with the same employer as before, but that the occupational category for this is the same as it was previously. Similarly it is possible that someone has changed to a different occupation, but that the individual considers this to be the same job – perhaps if they equate job with employer, for example. The self-reported nature of this question will lead to different measures of mobility depending on how the respondent interprets the question, so the report focuses on both occupational and job mobility to give as full a picture of transitions as possible.

3 There is of course the possibility is that there is error in the occupational data – for example, if occupational codes are incorrectly recorded as having changed or having not changed, this impacts on the measure of occupational mobility.

Figure 2.1. Occupational and job mobility in the UKHLS dataset



Source: UKHLS, own calculations.

2.3 RESEARCH PLAN

The main analysis of this report looks to answer two questions.

Firstly, I describe patterns of occupational and job mobility into, out of and between technical occupations. The purpose of this is to see how people enter into these occupations and progress through them. I then compare the progression paths to the occupational maps produced by the Institute for Apprenticeships and Technical Education[4] to assess whether actual career progression maps closely with how it is being conceptualised by industry bodies and policymakers.

Secondly, I analyse who makes occupational and job transitions, and what characteristics make such progression or transitions more or less likely. Initially, I focus on the roles of skills, education, qualifications and experience (as a proxy for informal learning on the job) in this process. In section 2.4 below, I describe what data are available on these different aspects of human capital.

2.4 MEASURING SKILLS AND QUALIFICATIONS

The UKHLS data contain rich information on an individual's education, qualifications, training and skills. In the analysis in section 3.3, I include as much of this information as possible. This section explains how this information is derived from the underlying survey data.

Firstly, I record an individual's highest qualification level. This is available in the first survey the respondent completed, but in subsequent years it is only recorded if it had changed. As most people's highest qualification does not change, their highest qualification was often missing in the data for years after the first year they were surveyed. If it was missing, I coded the final data set so that a person's highest qualification in that year was the same as the previous year. Then highest qualification was grouped into seven categories: postgraduate degree,

4 https://www.instituteforapprenticeships.org/about/occupational-maps/

undergraduate degree, other higher education qualifications, post-16 non-tertiary qualifications (including A-Levels and Highers), GCSEs (and their equivalents), lower school qualifications below GCSEs, and no qualifications.

Secondly, the UKHLS has information on the different vocational qualifications an individual has. There are many options for this, covering NVQs, BTECs, City & Guilds and other qualification types. As there were only a small number of observations for most qualification types, I simplified the analysis by recording whether some had a vocational qualification of any type and level. This approach means missing out some of the specific ways in which particular vocational qualifications affect an individual's career, but it seemed likely that without this grouping it would be hard to detect any effect of vocational qualifications with any degree of accuracy given the small numbers. This can therefore be interpreted as distinguishing differences in occupational mobility that relates to following a more vocational educational path or not. I also record whether a vocational qualification has been recently gained (in the previous twelve months) to see whether there is any difference in people who have recently completed a course, perhaps because it might be linked to a particular career move.

Finally, the UKHLS has information of whether an individual has received any firm training in the previous twelve months – some of which may be linked to acquiring a new vocational qualification, as mentioned above, but much of which is not accredited. As well as looking at people who have received training, I also distinguish between types of training that don't necessarily lead to a new qualification. In particular, the data recorded whether an episode of training is linked to a new job or promotion, which is obviously relevant for mobility prospects.

3 MOBILITY PATTERNS AND PROGRESSION

3.1 OVERALL PATTERNS OF MOBILITY

Table 3.1 describes the aggregate trends in one-year transitions in the data between 2009 and 2016 across the five main categories of activity – employment in non-technical occupations (as coded using the Standard Occupational Classification), employment in technical occupations, unemployment, inactivity (not including study) and study. It shows that in any year, people in employment are highly likely to remain within either non-technical occupations (91%) or technical occupations (87%) from year to year. For non-technical occupations, around 8% of individuals leave employment, while for those in technical occupations, the chance of leaving employment is lower (at around 5%). It is more likely that the individual will move to a non-technical occupation technical occupation than vice versa. However, it should be remembered that there are roughly eight times as many non-technical occupations as there are technical occupations, so we would expect the proportion leaving technical occupations for non-technical work to be larger than in the other direction. Indeed, if mobility between technical and non-technical occupations faced no particular barriers in one direction rather than the other, we'd expect moves from technical occupations to non-technical occupations to be around eight times larger than in the other direction, which is what we observe in the table.

Table 3.1. Original occupations and destinations

	Destination one year later				
Origin	Non-technical occupations	**Technical occupations**	Unemployment	Inactivity	Study
Non-technical occupations	91.2%	1.0%	2.0%	4.9%	0.9%
Technical occupations	8.2%	86.9%	1.9%	2.8%	0.3%
Unemployment	27.4%	2.9%	42.4%	23.7%	3.6%
Inactivity	5.0%	0.2%	2.8%	91.6%	0.3%
Study	19.6%	1.2%	7.3%	3.3%	68.5%

Source: UKHLS, own calculations

At this level of aggregation, while most people remain in their existing group, there is nothing here to suggest that movement between the two groups is more difficult in one particular direction. The biggest difference is flows out of employment, which are more common in non-technical occupations. This suggests lower turnover in technical occupations (which makes sense, as many of the non-technical jobs are in high turnover sectors such as retail, hospitality and personal care). Similarly, the proportion moving from unemployment, inactivity and study into technical occupations is relatively low compared with non-technical occupations – that is, it is more than eight times smaller, as discussed above. This suggests that recruitment into technical occupations is more likely to come from those already working rather from those previously outside the workforce.

Table 3.2 shows where people doing technical occupations in one particular year came from in the previous year. Table 3.3 looks at mobility in a slightly different way, as it shows where people doing technical occupations in one year move to in the following year. From year to year, most people remain in the same technical occupation as they were in the previous year (between 75% and 86%, depending on the occupation).

Table 3.2 highlights how much entry into each occupation has occurred from other occupations – for some occupations, this figure is lower, such as science professionals and vehicle or electrical trades, where around 9% of people in that occupation were doing a different occupation in the previous year. For other jobs, such as science and engineering technicians or plant and machine operatives, nearly one in five people doing those jobs in any year were in a different occupation the previous year. Very few people move from full-time study into these occupations as compared with job-to-job moves – draughtspersons and science professionals are the main examples of when this does happen. This suggests that only a few jobs have entry points coming out of full-time education, although those qualifications may be important later on.

Table 3.3 shows a measure of occupational mobility, which is the proportion of individuals in a job who are in a different occupation one year later (rather than in the same occupation, or no longer in employment). The patterns in the figures here generally mirror those for job-to-job entry in Table 3.2, as would be expected.[5] They demonstrate that occupational mobility in technical occupations ranges from 9% to 17%. This level of occupational mobility is higher than in some recent estimates (Bachmann et al, 2019), who find occupational mobility in the UK across all jobs to be around 3%, which is still higher than their estimates for most European countries. However, some of this is due to differences in both data and methodology. The analysis in this report uses SOC 3-digit codes to define occupations, as opposed to ISCO 2-digit codes – more disaggregation in occupational groupings will naturally increase the measure of mobility. Moreover, the lower estimates in Bachmann are for those reporting a job change and an occupation change – as was shown in Figure 2.1, over 5% of individuals in technical occupations in the data used here report an occupational change without a job change.

Other studies have found higher estimates for occupational mobility, which suggest that mobility in these particular occupations is neither exceptionally high or unusually low. Longhi and Byrnin (2010) estimate occupational mobility to be around 10% using 3-digit ISCO codes, twice as high as in Germany. Kambourov and Manovskii (2008) find US occupational mobility is higher than that, at around 15% at the two-digit level and 18% at the three-digit level. Finally, Lalé estimates occupational mobility in France (at the three-digit level) to be around 7% – considerably higher than the Bachmann figures (which was below 2%, so lower than their estimate for the UK), emphasising again how the methodology and data makes comparisons difficult.

In Table 3.2, I highlight the most frequent common moves into technical occupations, while in Table 3.3, I highlight the most common destinations for those leaving these technical occupations. The key trends are:

5 These two figures will only differ where flows into non-employment and from non-employment are not the same (e.g. more moves from unemployment to the job than from the job back to unemployment) or where the size of the occupation is changing (so more flows into the job than to other occupations when a job is expanding, and vice versa for an occupation in decline). Rhein and Trübswetter (2012) show that changes in occupational structure in the UK are generally supported by moves into and out of the labour market, rather than moves between occupations, as compared with somewhere like Germany. Holmes (2018) shows that as occupations have shrunk since the 1970s, this used to facilitate more job-to-job mobility, but that has become increasingly less common in the past few decades.

- For the higher-skill technical occupations, there is some mobility between different levels (e.g. between associate professional and professional). However, there is more mobility into and out of non-technical roles in management, and for technicians and associate professions, into and out of other lower-skill non-technical roles. This suggest progression paths are more complex than might be envisioned by industry bodies.
- Skilled tradespeople and process operatives show some mobility between each other, but there is little evidence of many individuals moving to higher-level occupations beyond that. One exception seems to be skilled tradespeople moving into engineer roles, which seems to be mostly associated with electricians and machinists. There may be specific skills that need to be developed in order to make those particular transitions, which certain jobs are able to facilitate.
- Process operatives are least likely to remain in technical occupations year from year. This is perhaps as expected – these occupations have been most at risk of automation, which displaces people from these jobs. Moreover, even without those structural changes, these jobs generally require less specific skill investment. As such, workers are likely to be less tied to them, leading to more sidewards or downwards moves (such as into other process operative occupations, into other lower-skilled non-technical occupations or out of the labour market, which is what is shown) as well as, in some cases, a pathway into higher-skilled positions. For example, there is some mobility between plant and machine operatives and metal forming or metal machining skilled trades. Leavers from these jobs tend to have a higher chance of ending up outside of the labour market, or in another lower-skill non-technical occupation.
- Individuals move into skilled trade technical occupations and process operative occupations from unemployment, but those in process operative jobs also move back into unemployment in similarly large numbers, suggesting there is an issue of churn (rather than progression) between these jobs and spells of unemployment.

Table 3.2. Technical occupations and occupation one year earlier

			Different technical occupation				Different non-technical occupation					Not working		
	Same occ.	In-work entry	Prof	Assoc. Prof	Skilled trade	Operative	Manager	Prof	Assoc. Prof	Skilled trade	Others	Unemp.	Inactivity	Study
Science professionals	85.8%	7.9%	0.2%	1.4%	0.0%	0.2%	0.2%	2.0%	1.6%	0.2%	1.3%	1.1%	3.2%	2.0%
Engineering professionals	82.0%	14.5%	0.8%	1.2%	2.7%	1.2%	3.3%	0.7%	1.8%	0.4%	1.7%	1.5%	1.0%	0.9%
ICT professionals	85.0%	10.2%	0.4%	2.0%	0.5%	0.3%	2.5%	0.6%	1.7%	0.1%	1.3%	1.9%	1.3%	1.6%
Science and engineering technicians	77.2%	18.7%	1.7%	1.1%	2.4%	2.1%	2.0%	0.8%	2.1%	0.8%	4.5%	1.9%	1.4%	0.8%
Draughtspersons and building inspectors	78.3%	15.7%	2.4%	0.7%	0.7%	0.3%	2.4%	0.7%	2.8%	1.0%	3.5%	0.7%	1.7%	3.5%
IT service delivery occupations	78.0%	15.9%	2.5%	0.8%	1.2%	0.5%	2.9%	0.7%	1.8%	0.0%	4.6%	2.9%	1.9%	1.3%
Metal forming etc. trades	80.8%	11.0%	0.7%	0.2%	2.6%	1.4%	1.2%	0.0%	0.2%	1.2%	2.8%	5.6%	1.6%	0.9%
Metal machining etc. trades	81.3%	15.0%	1.5%	0.4%	3.0%	2.6%	1.1%	0.0%	0.7%	1.9%	2.5%	1.8%	0.6%	1.3%
Vehicle trades	85.8%	8.7%	0.4%	0.5%	2.0%	0.8%	1.0%	0.1%	0.1%	0.5%	2.6%	2.4%	1.7%	1.4%
Electrical trades	86.3%	9.8%	1.4%	1.2%	1.0%	0.7%	0.9%	0.3%	0.4%	0.4%	2.4%	1.9%	0.9%	1.1%
Process operatives	79.5%	14.4%	0.6%	0.4%	1.0%	2.6%	0.8%	0.2%	0.1%	1.1%	6.3%	3.4%	1.2%	1.5%
Plant and machine operatives	75.8%	18.2%	0.7%	0.7%	4.2%	3.2%	1.2%	0.0%	0.7%	1.7%	4.8%	3.2%	1.4%	1.3%
Assemblers and routine operatives	76.6%	15.6%	0.4%	0.7%	2.1%	2.5%	1.1%	0.3%	0.7%	0.9%	5.6%	3.9%	2.3%	1.6%

Source: UKHLS, own calculations.

Cells highlighted in blue are the most common moves where an individual stays in a technical occupation. Cells highlighted in brown are the most common moves where an individual goes from a non-technical into a technical occupations. Cells highlighted in pink are the most common moves where an individual goes from being out of employment into a technical occupation.

Table 3.3. Technical occupations and occupation one year later

			Different technical occupation				Different non-technical occupation					Not working		
	Same occ.	Occ. mobility	Prof	Assoc. Prof	Skilled trade	Operative	Manager	Prof	Assoc. Prof	Skilled trade	Others	Unemp.	Inactivity	Study
Science professionals	84.2%	9.1%	1.2%	0.9%	0.0%	0.2%	1.2%	2.3%	1.8%	0.2%	0.5%	1.6%	4.0%	1.1%
Engineering professionals	81.8%	14.3%	0.6%	1.3%	3.1%	0.9%	3.5%	0.5%	1.6%	0.4%	1.2%	1.1%	2.8%	0.0%
ICT professionals	86.1%	9.8%	0.4%	1.2%	0.3%	0.2%	3.4%	0.8%	1.6%	0.0%	0.6%	2.0%	1.8%	0.4%
Science and engineering technicians	79.0%	16.4%	1.9%	0.6%	2.0%	1.6%	2.2%	1.6%	2.2%	0.5%	2.6%	1.2%	3.3%	0.2%
Draughtspersons and building inspectors	78.6%	13.7%	2.5%	1.1%	0.4%	0.4%	2.1%	1.1%	2.8%	0.7%	2.1%	2.5%	4.6%	0.7%
IT service delivery occupations	78.7%	17.2%	4.4%	1.3%	1.0%	0.3%	2.9%	0.9%	2.2%	0.0%	3.0%	2.4%	1.4%	0.3%
Metal forming etc. trades	83.9%	12.2%	0.5%	0.2%	2.4%	2.0%	1.5%	0.0%	0.2%	1.0%	3.7%	1.7%	2.0%	0.2%
Metal machining etc. trades	80.9%	15.1%	1.2%	1.0%	2.5%	3.0%	1.7%	0.1%	0.7%	1.2%	2.5%	1.4%	2.4%	0.1%
Vehicle trades	85.3%	10.8%	0.2%	0.4%	2.0%	1.3%	2.0%	0.0%	0.2%	0.8%	2.8%	1.0%	2.4%	0.5%
Electrical trades	84.6%	11.5%	1.6%	1.2%	1.3%	1.0%	2.1%	0.2%	0.7%	0.7%	1.6%	1.4%	2.3%	0.1%
Process operatives	78.3%	15.3%	0.8%	0.8%	1.4%	2.9%	1.4%	0.1%	0.4%	0.8%	6.0%	3.0%	3.1%	0.4%
Plant and machine operatives	77.8%	15.8%	0.9%	0.8%	2.9%	2.8%	1.5%	0.0%	0.8%	1.1%	4.1%	2.3%	3.6%	0.5%
Assemblers and routine operatives	77.9%	14.0%	0.6%	0.9%	1.3%	2.6%	1.2%	0.1%	0.6%	0.9%	4.3%	3.2%	4.7%	0.1%

Source: UKHLS, own calculations.

Cells highlighted in blue are the most common moves where an individual stays in a technical occupation. Cells highlighted in brown are the most common moves where an individual goes from a technical to non-technical occupations. Cells highlighted in pink are the most common moves where an individual goes from a technical occupations to being out of employment.

Table 3.4 shows the alternative measure of job mobility, which relied on self-reports of changes in employers, staying with the same employer, and change in job within the same employer. This approach demonstrates less mobility than when looking at occupations directly, meaning that there are individuals who say they are in the same job in the survey, even while their occupational classification has changed. Moreover, the table shows that in all of the occupations, transitions to a new employer are far more frequent than new jobs within the same employer. Table 3.5 shows that for many of the occupations, the majority of changes in employer are associated with no change in occupation.

This likely speaks to the amount of occupational-specific skills built up in these occupations – individuals may take those skills and expertise to new employers in order to advance in their careers, rather than move to a new job which may require having to learn new skills. Career progression may be seen in terms of developing higher status within an occupation (which itself leads to higher pay and more prestige) as much as transitions into higher status occupations.

Table 3.4. Occupational and job mobility

	Changed employer	Same employer, new job	Same job
Science professionals	4.9%	4.3%	90.8%
Engineering professionals	7.8%	4.1%	88.1%
ICT professionals	8.1%	4.5%	87.3%
Science and engineering technicians	5.9%	4.9%	89.2%
Draughtspersons and building inspectors	6.3%	0.9%	92.8%
IT service delivery occupations	6.8%	6.3%	86.9%
Metal forming, welding and related trades	7.7%	3.7%	88.6%
Metal machining, fitting and instrument making trades	6.1%	3.4%	90.5%
Vehicle trades	8.1%	0.8%	91.1%
Electrical trades	7.7%	2.9%	89.4%
Process operatives	5.3%	3.9%	90.8%
Plant and machine operatives	5.5%	1.7%	92.8%
Assemblers and routine operatives	4.9%	3.1%	91.9%

Source: UKHLS, own calculations

Table 3.5. Occupational mobility and employer changes

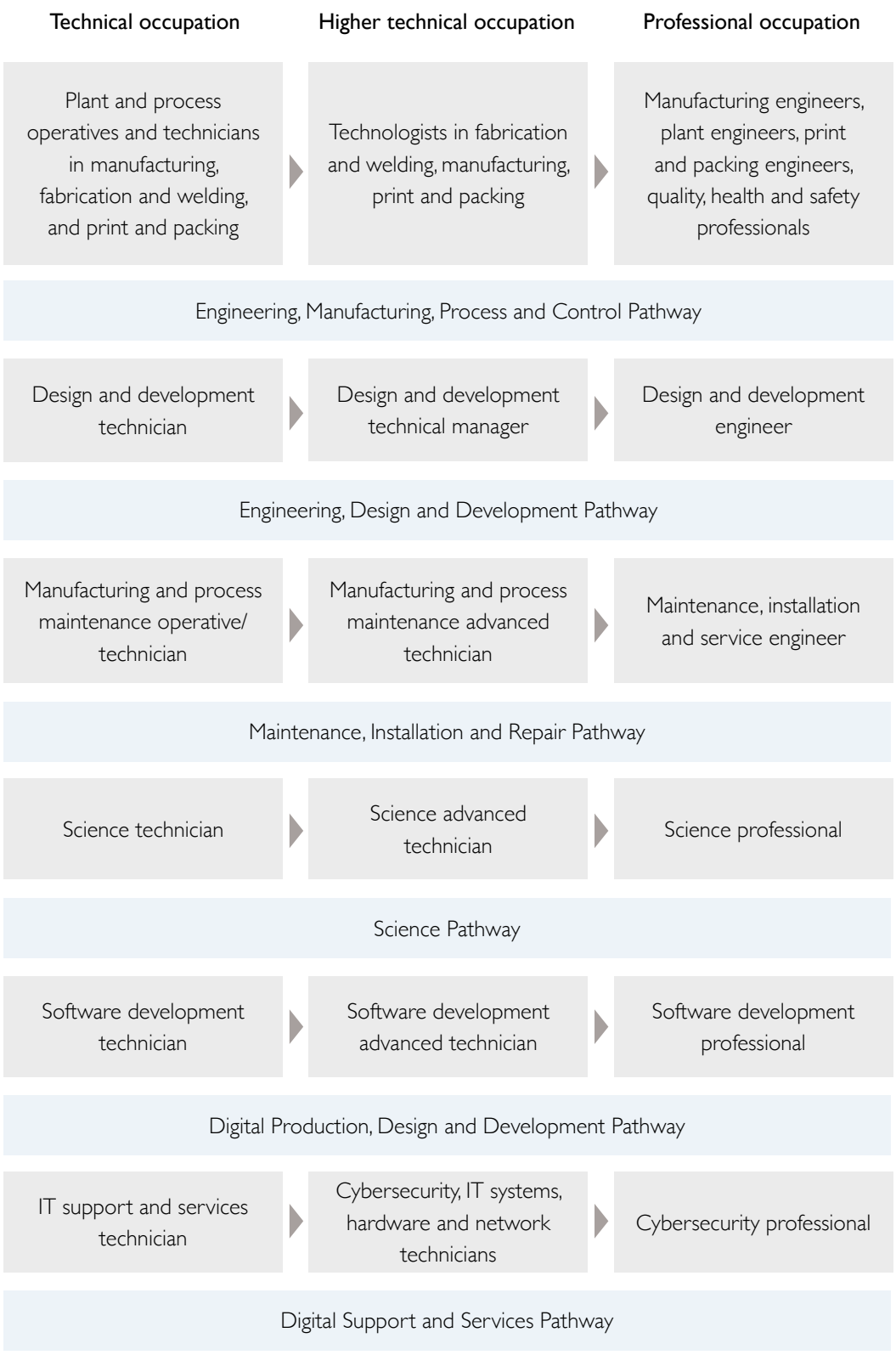
	Same occupation	New technical occupation	New non-technical occupation
Science professionals	56.5%	17.4%	26.1%
Engineering professionals	70.9%	10.7%	18.4%
ICT professionals	80.5%	4.0%	15.4%
Science and engineering technicians	30.2%	17.5%	52.4%
Draughtspersons and building inspectors	57.1%	7.1%	35.7%
IT service delivery occupations	39.0%	28.8%	32.2%
Metal forming, welding and related trades	76.2%	9.5%	14.3%
Metal machining, fitting and instrument making trades	56.0%	25.3%	18.7%
Vehicle trades	55.3%	12.8%	31.9%
Electrical trades	64.5%	15.5%	20.0%
Process operatives	29.0%	22.6%	48.4%
Plant and machine operatives	35.7%	16.7%	47.6%
Assemblers and routine operatives	46.7%	10.0%	43.3%

3.2 OCCUPATIONAL MAPS

The previous section looked at job-to-job transitions across all the technical occupations that are the focus of this report. As an alternative way of looking at progression and mobility patterns, I used the occupational maps produced by the Institute for Apprenticeships and Technical Education to show where technical education can lead. Each map is owned by a route panel, made up of industry experts who use the maps to support decision-making about apprenticeships, T-levels and route reviews, and to help identify additional occupations that need to be developed. The maps group occupations with related knowledge, skills and behaviours into pathways, making it easier to see the opportunities for career progression within that particular route. Within each pathway, occupations at the same level are grouped into clusters, to show how skills learnt can be applied to other related occupations.

Each map has three levels – technical occupations, higher technical occupations, and professional occupations. Figure 3.1 shows the six pathways which are most relevant to technical occupations. The main heading for the occupations is given in the figure. The occupational maps give an extensive list of occupational titles within each of these headings, which are omitted here.

Figure 3.1. Occupational maps



Source: Institute for Apprenticeship and Technical Education

Progression, therefore, corresponds to movement from one level to the next level and to another. The occupation titles under each heading are not coded using the same SOC codes which have been used in this report and are used in the UKHLS dataset. In order to make use of these maps, each occupational title was entered into the SOC lookup tool and then matched to a SOC 4-digit code (which given the data, was used to find a SOC 3-digit code). Table 3.6 shows this conversion. It also includes some occupations outside those which have been focused on so far in this report.

Given that the occupations in Figure 3.1 are more narrowly defined than the occupational groups in the dataset, there are two main issues to deal with. The first is that some occupations at different levels in the map fall into the same 3-digit SOC code. Where this happens, the occupation is only assigned to one level – if they are professional occupations (with a SOC code 2xx) then they are placed in the highest level, if an associate professional or technician occupation (with a SOC code 3xx) then they are put in the middle level, and anything else is put in the lower level. The occupations selected for each level are highlighted in Table 3.6 in bold. The result is that some moves between levels will not be recorded.

The second issue is that some occupational groups appear across multiple pathways (and indeed, there would be some occupations within those groups which are also outside of the six pathways). There is nothing that we can do about this given the limits of the data[6] – as a result of this, the analysis is likely to under-report situations where individuals leave a particular pathway and do not progress within it.

Because some jobs may be outside each of these pathways but coded as having the same occupational code as a job within the pathway, the proportion of people remaining in each pathway reported in the next section is a maximum, and likely overstates the true figure, while the proportion of people leaving the pathway is almost certainly understated. These caveats will not be repeated in the following section, but they should be bore in mind throughout.

The following section only looks at people who remain in employment (as the figure for those leaving employment each year from these jobs was reported in the previous section).

6 I considered adding industry into the analysis to be more precise about the specific occupations an individual held – however, the point about occupations with standards is that they do not need to be constrained to a particular industry, as they demonstrate a level of skill to be applied in potentially different firms across different industries – for example, an IT technician may be employed in any sector where firms rely on IT (which could be finance, manufacturing, transportation, and many others).

Table 3.6. Occupational map coding

	Technical occupation	Higher technical occupation	Professional occupation
Maintenance, Installation and Repair Pathway	Science and engineering technicians (311) **Metal machining, vehicle and electrical trades (522, 523 and 524)**	**ICT professionals (213)** **Science and engineering technicians (311)**	**Engineering professionals (212)**
Engineering, Manufacturing, Process and Control Pathway	**Metal forming, welding and machining trades (521 and 522)** **Textile and garment trades (541)** **Other skilled trades (544)** **Process operatives, plant and machine operatives, assemblers and routine operatives (811, 812 and 813)**	Engineering professionals (212) **Quality and regulatory professionals (246)** **Science and engineering technicians (311)** Metal forming, welding and related trades (521)	**Engineering professionals (212)** Science and engineering technicians (311) **Public services and other associate professionals (356)** **Production managers and directors (112)**
Engineering, Design and Development Pathway	Draughtspersons and building inspectors (312)	**Draughtspersons and building inspectors (312)** **Design occupations (342)**	**Engineering professionals (212)** **ICT professionals (213)**
Science Pathway	Science and engineering technicians (311)	**Science professionals (211)** **Research and development managers (215)** **Science and engineering technicians (311)**	**Science professionals (211)**
Digital Production, Design and Development Pathway	**Science and engineering technicians (311)** **IT service delivery occupations (313)**	**ICT professionals (213)** **Design occupations (342)**	**ICT professionals (213)**
Digital Support and Services Pathway	**IT service delivery occupations (313)**	ICT professionals (213)	**ICT professionals (213)**

Notes: Occupations in each pathway and at each level were inputted into the SOC lookup tool, with matching occupation coded at 3-digit level. All matched occupation groups are listed in the table – occupations highlighted in bold are the ones selected for each level for the transition analysis.

3.2.1 Maintenance, Installation and Repair Pathway

The entry-level technical occupations in this pathway fall into three groups. As metal machining (SOC group 522) appears in two pathways, we focus first on vehicle and electrical trades (SOC groups 523 and 524). 89% of such individuals remain in this pathway but do not progress to a higher level, while only 2% of these individuals progress to a higher level each year. This implies that at least 9% of individuals in these occupations leave for a job outside the pathway.

3.2.2 Engineering, Manufacturing, Process and Control Pathway

The entry-level technical occupations in this pathway fall into metal forming, welding and machining trades (SOC groups 521 and 522), textile and garment trades (SOC group 541), other skilled trades (SOC group 544), and process, plant and machine operatives, assemblers and routine operatives (811, 812 and 813). Similar to the previous pathway, 89% of individuals in these occupations remain in this pathway but do not progress to a higher-level occupation, while 2% progress to the higher-level occupational groups. At least 9% of individuals leave this pathway each year.

3.2.3 Engineering, Design and Development Pathway

The draughtsperson and building inspectors occupational group (SOC 312) covers occupations at both the technical and higher technical level in this pathway. For people in this group, 86% of individuals remain in the pathway but don't progress to professional occupations, while 3% do. A further 2% of individuals move into design occupations (SOC 342) which is potentially a move within the pathway but may not be progression between levels. This implies 9% of individuals leaving the pathway each year.

3.2.4 Science Pathway

The science pathway is one of several pathways which feature science and engineering technicians (SOC group 311). 84% of individuals in this occupational group remain in the same occupation each year (which may mean some are moving the jobs outside of their initial pathway). A maximum of 4% of individuals may be remaining within the same pathway and progressing (or at least not moving to a lower level) although some of these moves may be across pathways. This means at least 12% move from these occupations outside of these pathways.

3.2.5 Digital Production, Design and Development Pathway and Digital Support and Services Pathways

The occupations in the final two pathways cannot be distinguished in the data. The key lower-level occupations fall into the ICT service delivery occupations (SOC group 313), which generally progress to ICT professional occupations (SOC group 212) in both pathways. Around 83% of individuals remain in the lower-level occupational group. Including the science and engineering technician category which also appears in these pathways, around 6% of people move into another occupational group which is found within the same pathway, while 11% move to other occupations.

3.2.6 Summary of occupational map analysis

Although the broadness of the occupational classification used in the UKHLS data means it is difficult to fully evaluate how progression and mobility occurs in reality in the UK labour market as compared with how it is conceptualised by industry experts, the data above suggest that progression between closely-related technical occupations happens relatively infrequently. It is worth noting that the rates of progression recorded in the previous sections are the gross figures rather than net

figures – in any year, as well as individuals moving between jobs from a lower level to a higher level, there is also a proportion of people moving in the opposite direction. For example, in the two final ICT pathways, each year around 6% of individuals move from the ICT technician role to the ICT professional role. However, around half as many people move from professional to technician in the same time period. Meanwhile, a much larger proportion of individuals move to occupations that do not fall inside the relevant pathway (or even in a closely-related occupation in the same occupational group that is technically outside the pathway but not distinguishable in the data at this level of aggregation). In general, the figures above suggest at least twice as many people leave an occupational pathway than progress within that pathway in any given year. To illustrate the overall effect of this very roughly, if a group of workers all had a 9% chance of leaving a pathway each year, we would predict that over ten years, around 60% of those who were in the pathway in the first year would have left it over that time period. As mobility goes both ways, some of the mobility out of the path represents churn of workers who frequently move between different jobs and employment statuses searching for a better match, meaning that the proportion of the workers who were there in the first year that leave will likely be less than 60%. However, there are a number of reasons to think this is not a significant part of this outward mobility: tenure effects don't seem to be very large, and many of the destination occupations are high status non-technical occupations (in management or other professional work). Moreover, because mobility goes in both directions, some of those who leave the pathway may return, but the more this happens, the less sense it makes to refer to use the language of pathway, which implies a simple single direction of travel.

This raises the question of what these pathways are for. Two options are that they may be *descriptive*, or they may *prescriptive*. If they are descriptive, then it is clear from the above analysis that they are dramatically overly simplified, and that progression patterns in the UK do not correspond to the simple schematics shown in Figure 3.1. On the other hand, if they are prescriptive – that is, if they represent the ideal way for individual careers to develop, building up skill, knowledge and competence at one level before moving up to the next, then they raise some important questions for skills policymakers and industry stakeholders. Firstly, they should ask if the pathways depicted are indeed the ideal, or whether some of the occupational mobility outside of the pathway is beneficial to the workforce development but is not currently being recognised. For example, perhaps some of the leakage represents necessary screening of individuals who are not well-matched to a particular group of occupations. Moreover, perhaps some occupation transitions outside the pathway enable different skills to be developed which benefit both worker and firms later on in that person's career. This suggests more work should be done to understand what skills are needed, and how can they most efficiently be developed.

Secondly, if these pathways are still believed to be the ideal, policymakers and industry stakeholders need to ask why so much leakage is taking place as compared with progression within the pathway. It might mean that there are some market failures which prevent certain skills being developed at one level and limit movement to the next level. A commonly given example of this is fears about poaching between firms (Stevens, 1996), which occurs in cases when training is transferable between a small number of firms – so neither fully general or specific, in the way Becker (1994) described – and as a result, labour markets for these skills are not entirely competitive. There may also be coordination failures too. If

there was a single employer which hired all workers at each level in the pathway, they would easily be able to coordinate the skill development and progression of individual workers within the firm. It is more realistic to imagine that some firms specialise in work which requires workers at one level, while other firms employ workers at another level more heavily. Therefore, it might be more difficult to facilitate progression from one level to another when it involves firm-to-firm moves than when it is simply progression up a firm's progression ladder. In any case, if these maps are to be used as prescriptive tools, it is important that the system is made to work to ensure the desired progression between specific jobs can take place, and it can not be taken for granted that it will if simply left to its own devices.

3.3 PREDICTING PROGRESSION

In this section, I use regression analysis to explain which factors help predict which individuals are more likely to progress into technical occupations. The outcome of interest in all these analyses is a binary variable which indicates whether an individual is or isn't in a particular occupation group at the end of the time period (the destination occupation), conditional on a certain starting point (the origin destination). The destination occupations are professional technical occupations (selected occupations in SOC major group 2), technician occupations (selected occupations in SOC major group 3), technical skilled trades (selected occupations in SOC major group 5), and technical process operatives (selected occupations in SOC group 8).

An important technical point with this analysis is that it is estimating factors which affect the probability of making a particular transition. The simplest approach estimates a linear model, where the effect of each explanatory variable represents the size of the change in the probability of making a particular transition for each one unit change in that variable (so, for example, the change associated with being one year older, or for binary variables like educational attainment, the change associated with going from not having qualification to having that qualification). However, linear probability models – while easier to interpret – can lead to unrealistic predictions, especially for low or high probability events (for example, they can lead to a prediction of a probability below zero or in excess of one). Therefore, I also estimate a logistical regression alongside each linear probability estimate. Logistical regressions force estimates of probability to be between zero and one, so they better deal with highly likely or unlikely outcomes. The downside is their ease of interpretation, which are generally not intuitive.[7] In the figures below, I report the estimated effect and statistical significance from the linear probability model, and use the logistical regression model as a sense check on these estimates. The regression outputs from both models in all cases are reported in the appendix.

The analysis uses the different measures of skills, education and training described in section 2. To summarise, these are grouped into three categories. Firstly, I compare highest qualification level grouped as: postgraduate degree; undergraduate degree; other higher education qualifications, post-16 qualifications; GCSEs; below GCSEs; and no qualifications. Secondly, I look at the impact of specifically having vocational qualifications, which could be an individual's highest qualification but does not have to be. The UKHLS records 15 types of vocational certificate, but due to small numbers for each type of qualification these are reduced down to simply

7 Specifically, the estimated effect of each explanatory variable represents the change in the logarithm of the odds ratio of making a particular transition.

whether the individual has vocational qualifications or not. Finally, we look at firm training, and in particular whether they have participated in any training in previous 12 months; whether this training was linked to finding a better job or promotion; and whether this training has led to the acquisition of new vocational qualifications.

In addition to those key skill and education variables, the analysis controls for gender, age (as mobility tends to reduce as people get older), tenure with their current employer, sector, firm size and contract. Tenure is expected to have a negative impact on mobility as individuals develop firm-specific skills which make moves costlier and progression less likely outside the firm. However, individuals may still be able to progress within their organisation if such routes exist. Variables on firm size and contract type are included to capture the idea that intra-firm promotion ladders and internal labour markets are more likely to be found in large firms, particularly for permanent contract workers (or core workers) rather than non-permanent peripheral contract workers (including agency workers, fixed-term and seasonal workers, and other flexible work contractors).

Table 3.7. Change in employment share of major occupational groups, 2009-2016

	2010	2011	2012	2013	2014	2015	2016	2009-16
Managers	-0.2%	-0.1%	0.2%	0.0%	-0.1%	0.1%	0.2%	0.0%
Professionals	-0.4%	0.3%	0.4%	0.0%	-0.1%	0.4%	0.2%	0.8%
Technicians and associate professionals	-0.2%	0.3%	-0.1%	0.3%	0.5%	0.1%	0.3%	1.3%
Administrative occupations	0.1%	-0.4%	-0.1%	-0.3%	-0.5%	0.2%	0.1%	-0.9%
Skilled trades	0.4%	-0.1%	-0.2%	-0.3%	-0.2%	-0.4%	-0.4%	-1.3%
Personal service occupations	0.4%	0.2%	0.3%	0.1%	0.0%	0.1%	0.0%	1.1%
Retail service occupations	0.0%	-0.2%	-0.1%	0.1%	0.1%	-0.2%	-0.1%	-0.4%
Process operatives	0.0%	0.1%	-0.3%	0.1%	0.2%	-0.1%	0.0%	-0.1%
Elementary occupations	-0.1%	-0.1%	0.0%	-0.1%	0.1%	-0.3%	-0.2%	-0.6%

Source: UKHLS, own calculations

Finally, I include a measure to capture the change in the number of jobs in the origin occupations. The occupational structure of the labour market has changed markedly over the past few decades, with a growth of high-skill jobs, including professional and technician occupations, and a decrease in skilled trades and at the operative level (Autor, Levy and Murnane, 2003; Goos and Manning, 2007), largely due to the impact of new technology which has allowed many of the more routine manual tasks to be automated, whilst improving the productivity of highly-skilled professionals.

Moreover, the first two years of the data cover a period of time where the economy was starting to recover from the global finance crisis in 2007-8, which caused further disruption to careers. Prior research (see Holmes, 2018, Holmes and Tholen, 2013) has shown that occupations which are getting smaller in share of total employment increase mobility as people leave those jobs, and can increase the likelihood of moving both upwards and downwards (or indeed, out of employment).

Table 3.7 shows that for all occupations, this pattern largely continued during the period analysed in this report – there was growth in high-skilled managerial, professional and technician-level occupations, as well as some lower-paid service occupations. At the same time some lower-skill and the middle-skill occupations have continued to shrink.

Table 3.8 shows the employment share of the technical occupations that are focused on in this report, at each level. It highlights how the situations for these specific occupations are not quite the same as for all occupations at their respective levels, but that overall (except for the period immediately after the recession) high-skilled occupations have been growing while skilled trades have a relatively smaller number of jobs. The share of technical jobs at the operative level has fluctuated, but there isn't a trend towards a decrease.

Table 3.8. Occupational share of employment for technical occupations

	Professional	Technician	Skilled trades	Operatives
2009	3.1%	1.4%	3.4%	2.5%
2010	2.8%	1.5%	3.6%	2.6%
2011	2.8%	1.7%	3.7%	2.7%
2012	2.9%	1.7%	3.5%	2.6%
2013	3.0%	1.7%	3.3%	2.7%
2014	3.1%	1.7%	3.1%	2.7%
2015	3.2%	1.8%	3.1%	2.6%
2016	3.2%	1.8%	3.0%	2.5%

Source: UKHLS, own calculations

The explanatory variables are generally categorical rather than continuous. Therefore, each analysis has a reference group – male, has GCSEs, no recent training or vocational qualifications, working in a large firm with a permanent contract, in manufacturing – which gives a baseline probability for making a particular occupation transition. The effects shown in Figures 3.2 to 3.6 represent the change in this probability associated with each characteristic, relative to that baseline. The effects sizes reported are taken from the linear probability model, rather than the logit model, as these estimates are easier to interpret and assumed constant for everyone. Statistical significance is reported next to each effect, at the 1%, 5% and 10% levels. Statistical significance is only reported if both the linear probability model and the logit model find the effect of a variable.

To begin, Figure 3.2 displays the effects of the key explanatory variables on predicting whether an individual remains within their current technical occupational group. In general, there isn't any difference by highest qualification, with the exception of technicians who hold degrees – they are less likely to remain than those with lower qualifications. Those with vocational qualifications are more likely to leave professional and technician roles, and less likely to leave skilled trades. Those who have recently completed some training are marginally more likely to leave their occupation shortly afterwards. Structural changes in the size of the occupation matter for technicians and operatives, as they are more likely to remain

if the occupation is growing (and more likely to leave if it is shrinking).[8] Finally, the one effect that seems large and consistent across all occupations is that non-permanent occupations are associated with a 10-15pp (percentage points) fall in the probability of remaining in the occupation.

Figure 3.3 shows factors affecting progression into technical professional occupations from the lower level technical occupations. In general, from looking at the baseline probability estimate, progression is more likely from technical and operative occupations than from skilled trades – those in skilled trades have a much higher degree of immobility, as individuals in these jobs are far more likely to continue in those jobs that the other occupations analysed. The high baseline probability for operatives into professional occupations might seem puzzling as that would involve a pretty significant degree of occupational mobility in one year. This is because the industry someone is in has an impact on the probability of making a particular transition – the effects of industry are estimated in the analysis but are not reported in the figure due to a lack of space. The baseline probability is estimated for manufacturing, and the industry effects show that mobility between operatives and professionals in other sectors is around 5-6 percentage points lower, so this appears to be a specific progression path between operatives and professionals in manufacturing only – this would probably be into engineering jobs, based on what was seen in Table 3.2.

The main observation is that those with high-level qualifications, particularly postgraduate qualifications, are far more likely to progress into professions than those without. Post-graduate qualification holders are around 3pp more likely to move to a professional technical occupation those without, and a similarly-sized effect is found for technicians with undergraduate degree qualifications and vocational training. This suggests, perhaps unsurprisingly, that high-level qualifications are a genuine barrier to entry into those jobs. In addition to this, for those in skilled trades, progression is more likely after a period of training linked to promotion (2.5pp), and in larger firms (0.9pp). This makes sense when you consider many skilled tradespeople operate as sole-traders or in smaller occupational-specific companies, which naturally cannot create opportunities to progress to professional occupations found in other firms. Those working in larger firms which have both skilled trades and professional employees might be better able to provide relevant training to facilitate upward mobility. In Table 3.3 we saw this sort of move happened more frequently for electricians and machinists; potentially it is when those occupations are found in larger firms, they are able to create progression paths into engineering roles.

Figure 3.4 compares factors that affect the probability of progression into the technical professional occupations from two other groups of occupations – non-technical professionals and non-technical associate professionals – in comparison to technicians. This shows whether being a technician is an advantage for progression into technical professions, or whether other highly-skilled individuals, such as associate professionals in non-technical occupations – might have similar opportunities. The figure reveals that even without undergraduate and post-graduate qualifications, an individual in a technician role is much more likely to progress into technical professions than those in other high-skill non-technical roles. However, it should also be noted that although moving into technical professions is

8 Occupations can grow or shrink without encouraging more or less mobility, if instead of displacing existing workers it leads to an increase or decrease in new entrants into that occupation.

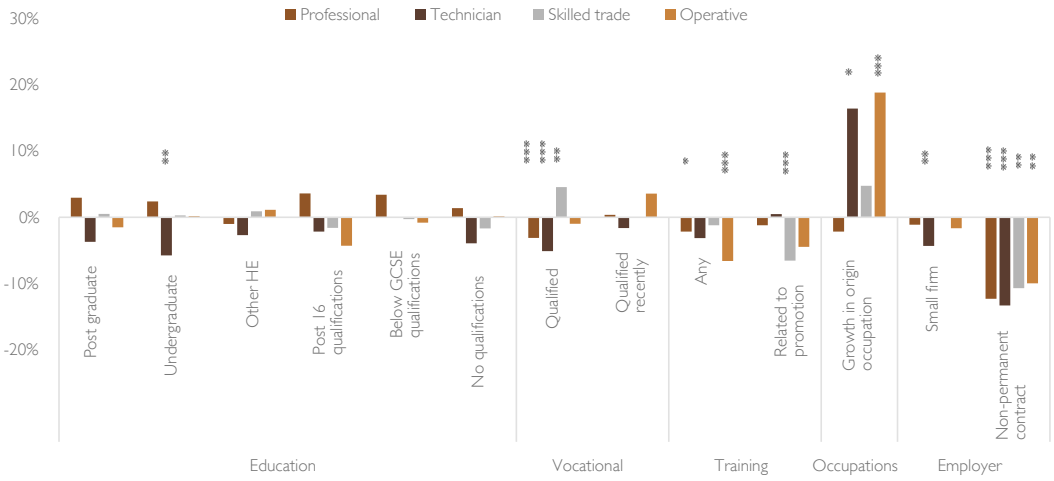
much less likely for an individual from non-technical high-skilled occupations than it is from technician occupations, the fact that the former group is far larger to begin with means that, as was shown in Table 3.2, the actual numbers of new entrants entering technical professions is divided relatively evenly between technicians and other non-technical high-skill occupations. It is not that mobility into technical professions from non-technical occupations is rare, it is just that such individuals have other opportunities too. For those in technician jobs, progressing into technical professions is a more obvious route. That said, and as was shown in Table 3.2, technicians move into non-technical occupations in similar numbers to those progressing to other high-skill technical occupations, so as has been noted before, it is not the only route.

Figure 3.4 shows that while having higher qualifications is relevant for technicians, it doesn't predict a higher chance of moving into technical professions for those outside of technical occupations. The simplest explanation for this could be that technicians with degrees likely studied something closely related to a technical profession, while degree holders in other occupations may have studied a wider range of things.

To build on the observation that technicians move into professional occupations and other non-high-skill technical occupations, Figure 3.5 compares the factors predicting moves from technician jobs into managerial occupations and into technical professional occupations. The first striking thing is that the baseline probability is very different, which is because the age of an individual matters much more for technician to professional moves than it does for technician to managerial moves. The baseline is calculated – in this case, somewhat improbably – for 16-year-olds, and all age effects are estimated relative to that. Although there isn't space to show the age effects in the diagram, the model estimates that a 30-year-old technician is a further 6 percentage points less likely to make a move into technical professional occupations as compared with the baseline, bringing this more in line with the likelihood of transitions between technicians and managerial occupations. Age isn't an important factor for technician to managerial moves, which are similarly likely for younger and older technicians, holding everything else constant. It seems that technician jobs offer a stepping stone into technical professional occupations early in an individual's career, but opportunities to do this disappear for older technicians who become more likely to remain at a technician level. Aside from that, there are not many factors predicting why individuals follow one progression path or the other – higher qualifications for both are the key factor explaining mobility, with those having degrees being 2-3 pp more likely to move into either a technical profession or a managerial position than those without.

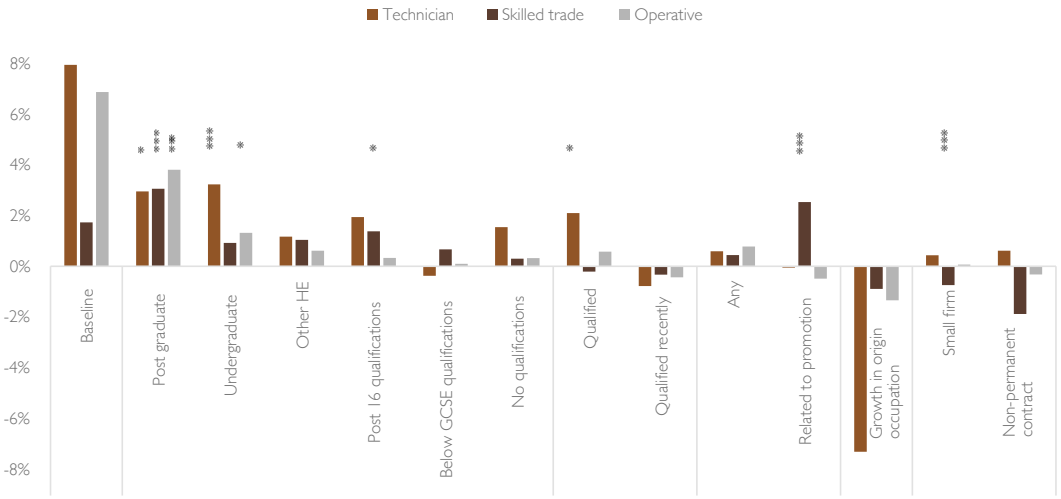
Finally, Figure 3.6 looks at progression at the lower level (i.e. into technician roles from skilled trades and operatives, and into skilled trades from operative level). Here we find just a few factors that relate to differences in progression opportunities, which are relatively infrequent anyway (as shown in Table 3.2). For those in skilled trades, the chance to progress is higher for those who have recently completed a vocational qualification. For operatives, mobility is higher for those who have recently completed some firm training, and for non-permanent workers.

Figure 3.2. Predictors of remaining in same technical occupation group



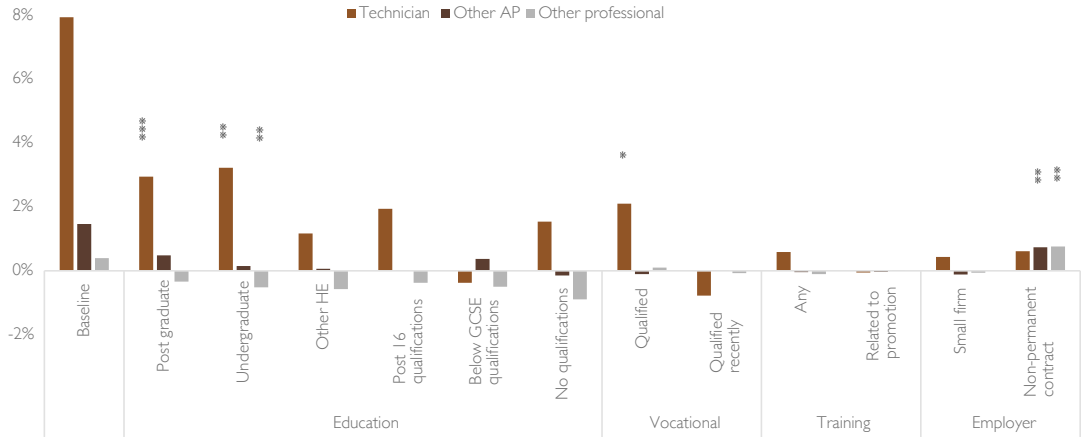
Notes: Baselines not reported for scale – Professionals = 84.0%; Technicians = 73.7%; Skilled trades = 91.3%; Operatives = 64.0%. Statistical significance for an effect is reported if found at 10% level (or lower) in both linear probability and logit model estimates – level of significance taken from linear probability model estimates. Key for statistical significance: *** = 1%, ** = 5%, * = 10%.

Figure 3.3. Predictors of progressing to technical professional occupation group



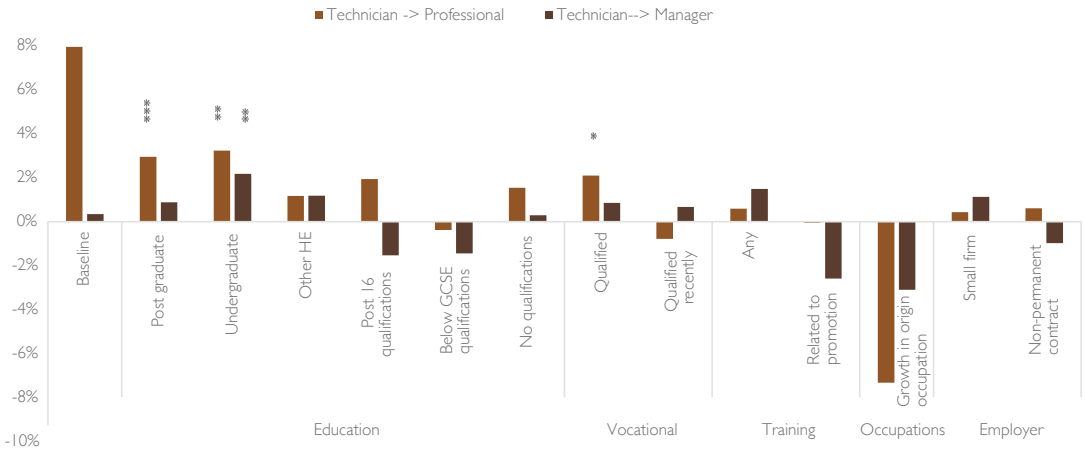
Notes: Statistical significance form effect reported if found at 10% level (or lower) in both linear probability and logit model estimates – level of significance taken from linear probability model estimates. Key for statistical significance: *** = 1%, ** = 5%, * = 10%.

Figure 3.4. Predictors of progressing to technical professional occupation group



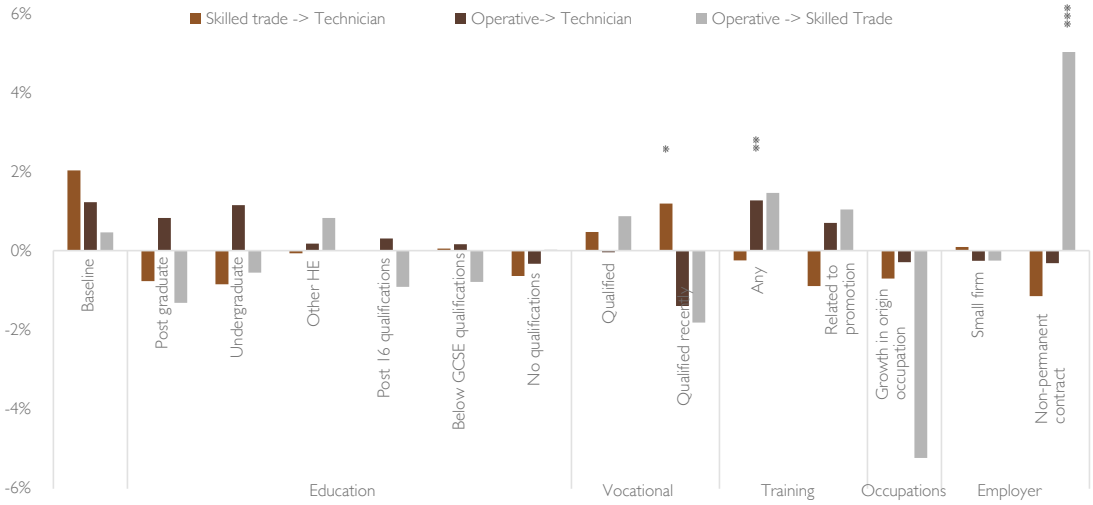
Notes. Other AP = Other associate professional occupations (SOC major group 3) not including the selected technician occupations. Statistical significance form effect reported if found at 10% level (or lower) in both linear probability and logit model estimates – level of significance taken from linear probability model estimates. Key for statistical significance: *** = 1%, ** = 5%, * = 10%.

Figure 3.5. Predictors of progressing from technician occupation group



Notes. Statistical significance form effect reported if found at 10% level (or lower) in both linear probability and logit model estimates – level of significance taken from linear probability model estimates. Key for statistical significance: *** = 1%, ** = 5%, * = 10%.

Figure 3.6. Predictors of progressing to technician and skilled trade occupations from lower-level occupations



Notes. Statistical significance form effect reported if found at 10% level (or lower) in both linear probability and logit model estimates – level of significance taken from linear probability model estimates. Key for statistical significance: *** = 1%, ** = 5%, * = 10%.

4 CONCLUSION

This report has examined occupational and job mobility into the technical occupations that demand STEM skills. Looking at the years between 2009 and 2016, the purpose has been to evaluate what career progression looks like for people in these occupations and what makes progression more likely. In doing so, it also gives some insights into the STEM skills pipeline.

In each year, around 87% of individuals in technical occupations – as they have been defined in this report – remain within that group, with around 8% of workers moving to non-technical occupations. Looking at the different types of occupation within the technical occupations group – professionals, technicians, skilled trades and operatives – between 75% and 86% remain in the same occupation (defined at the three-digit SOC level) as they were in the previous year, depending on the occupation. Mobility from professions is lowest, which makes sense given these jobs are often regarded as the top of the occupational structure. Mobility is similarly low for skilled trades, suggesting people do not progress in these jobs into higher-level occupations, but perhaps can progress within the occupations itself (for example, if a skilled tradesperson were to be able to more regularly find better-paying work contracts). One exception seems to be skilled tradespeople moving into engineer roles, which seems to be mostly associated with electricians and machinists.

For the higher-skill technical occupations, there is some mobility between different levels (e.g. between technician and professional). However, there is more mobility into and out of non-technical roles in management, and for technicians, into and out of other lower-skill non-technical roles. Operatives are more mobile, but rarely into higher-level technical occupations. They are the least likely to remain in technical occupations from year to year, as might be expected from both differences in specific occupational skills and changing patterns of demand for workers in these more automatable jobs. Leavers from these jobs tend to have a higher chance of ending up outside of the labour market, or in another lower-skill non-technical occupation.

In terms of entry into these occupations, individuals move into skilled trade technical occupations and process operative occupations from unemployment, but those in process operative jobs also move back into unemployment in similarly large numbers, so there could be some job cycling or churn going on. Very few people move from full-time study into technical occupations as compared with job-to-job moves – draughtspersons and science professionals are the main examples of when this does happen, and science professionals to a lesser extent.

It would be expected, however, that particular occupational moves are more likely than others. Jobs in certain occupations and industries, or that use particular skills, have more in common than others. This report looked at mobility within occupational maps that have been developed for sectors, jobs and skills. Given the limits of the data, occupational groups that match up with these particular pathways are too broad, so are likely to capture more retention (within a pathway) than there actually is (for example, if an individual moves to a different job on a different pathway, but both jobs are grouped together in the SOC, this would not be noticed). However, whilst noting that caveat, the analysis has concluded that mobility outside of a pathway tends to happen a roughly twice the rate as

progression (to a higher-level occupation) inside a pathway, even when looking at just those who stay in the employment – if transitions to unemployment or inactivity has also been included, this disparity would be even larger. The question this raises is whether this level of specific skill leakage is a policy and/or industry concern. For example, it might mean that there are market or coordination failures preventing progression happening in the way envisioned by the pathway's depiction. Policies which encouraged a better retention of skills, rather than new investment, may be a more efficient way to meet skills shortages. On the other hand, there would never be an expectation of no skill leakage – the matching process between individuals and jobs is not perfect, and working in a particular occupation for a while is an important part of skill development which likely reveals information about whether an individual is well-suited to a particular type of work. The question is whether that is happening too frequently. Moreover, there may be some benefits to a less linear progression path than the ones set out in the occupational maps – for example, in terms of a wider range of useful skills being developed which benefit worker and firms latter on – which are not being recognised formally at present with the linear progression implied by occupational maps.

For those that do progress between technical occupations (either within or across pathways), this report has drawn out some of the key factors which make those moves seem more or less likely. For retention (where an individual remains in one technical occupation), differences in qualifications or skills do not seem to make much difference. Two factors outside of a worker's control do however – changes in the occupational structure and type of contract. As occupations change in their relative size, mobility is also affected – a growing occupation leads to less mobility (as more people remain) while a shrinking occupation creates more mobility (as some people are displaced). It suggests that such changes do not just result from changes in entry into those occupation – for example, a shrinking occupation could simply see a reduction in the inflow of new workers, rather than an increase in the outflow of existing workers, which is not what we see happening. In addition, those on some form of non-permanent contract are more likely to leave a particular occupation. What is striking, from the other analysis, is that these characteristics are not associated with a change in the chance of progressing from those occupations – for example, if the number of technicians goes down and more people leave, there is not an increase in transitions from technicians to professionals. Similarly, those on non-permanent contracts are not generally more likely to progress to higher-level technical occupations (the one exception is operatives moving to skilled trades). Instead, this suggests they may be moving outside of technical occupations, or perhaps even outside of employment.

Entry into professional level occupations is more likely for those in technical occupations with high-level qualifications, suggesting there are career paths where individuals take jobs which they are apparently overqualified for, and then move from them into professions. These higher qualifications, particularly post-graduate qualifications, increase mobility modestly, by around 2-3pp, so while that is associated with a greater chance of progression, it doesn't guarantee it. It is still the case that many technicians leave technical occupations and more elsewhere, and that as people get older, they are less likely to go from a technician to professional role, even if they have those higher qualifications. It is also the case that individuals move from non-technical occupations into technical professions. I find that an individual in a non-technical occupation is much less likely to do

so than a technician, and that higher qualifications are not a predictor of such a move, perhaps because the subject of those higher qualifications is less relevant for technical professional work than that possessed by a technician. However, given the relative number of technicians compared with other non-technical occupations, there is still a comparable number moving into technical occupations each year despite a lower individual chance of this happening.

Aside from the role which high qualification have for progressing into technical professions from other technical occupations, I find little other evidence that formal qualification or training differences are associated with different progression chances, usually connected to a particular type of occupation-to-occupation move. There is not really any evidence of any general patterns which link all forms of progression to, for example, newly-acquired vocational qualifications, or even completing training programmes that are linked to promotion. However, one example is for progression from operatives to professional occupations, which while infrequent, was almost always found within manufacturing, with other sectors finding few or no instances of this. A second example was that skilled tradespeople progressed to professions more frequently in larger firms, suggesting some form of career progression ladder. This makes sense when you consider that many skilled tradespeople operate as sole-traders or as smaller occupational specific companies, which naturally cannot create opportunities to progress to professional occupations. This suggests market or coordination failures which larger firms are better suited to overcome, and which otherwise affect progression opportunities. Putting these examples aside, this means there remains a lot of differences in progression that isn't well-explained by education and training differences alone, which means that when progression opportunities do arise for technical occupations, firms might be looking for factors beyond qualifications and courses.

So, to summarise the key findings:

- There is significant mobility into and out of technical occupations. Between 15% and 25% of individuals in a technical occupation will be in a different occupation or out of employment the following year, depending on which occupation is being looked at.
- Some occupations are more closely linked than others in terms of occupational moves. However, occupational maps give a hugely oversimplified picture of progression between different occupations, as there is generally more mobility towards non-technical occupations or out of employment than between technical occupations. Within each occupational map, mobility outside of a pathway tends to happen at roughly twice the rate of progression (to a higher-level occupation).
- There are therefore important questions to address about the role of occupational maps. As a descriptive tool, they do not give a realistic view of progression and mobility patterns for workers in these jobs. As a prescriptive tool, and assuming the pathways they describe are considered optimal and the degree of skill leakage is inefficient, industry should be considering how to better retain skilled workers and offer more progression opportunities.

- For those that do progress within technical occupations, having high-level degree qualifications is associated with a better chance of moving into technical professions, particularly for younger workers. There are also specific paths into professions, for example in manufacturing for operatives, and in large firms offering specific training for skilled trades. However, education and training differences can only explain so much of the observed mobility – there are people entering technical occupations from non-technical occupations without particularly high qualifications, and qualifications and training have only a small impact on the chance of moving into technician roles from skilled trades and operative jobs. Being on a non-permanent contract predicts a 10-15 pp fall in the chance of remaining in a particular technical occupation, which means some of the leakage in the occupational maps is related to employment conditions.

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APPENDIX REGRESSION RESULTS

Table A1. Predictors of mobility into technical professional occupations regression results

	Origin technical occupation	Professional		Technician		Skilled Trade		Operative	
		OLS	Logit	OLS	Logit	OLS	Logit	OLS	Logit
Demographics	Age	0.005	0.029	-0.008***	-0.222*	0.000	0.086	-0.003***	-0.56***
		(0.004)	*(0.061)*	*(0.003)*	*(0.126)*	*(0.001)*	*(0.165)*	*(0.001)*	*(0.204)*
	Age^2	0.000	0.000	0.000	0.002	0.000	-0.001	0.000	0.006***
		(0.000)	*(0.001)*	*(0.000)*	*(0.002)*	*(0.000)*	*(0.002)*	*(0.000)*	*(0.002)*
	Female	-0.031**	-0.436**	0.000	0.013	-0.010	-2.083	-0.003	-1.191
		(0.014)	*(0.210)*	*(0.009)*	*(0.425)*	*(0.015)*	*(3.838)*	*(0.004)*	*(0.940)*
Education	Postgraduate degree	0.0294*	0.440	0.0295*	1.621**	0.031***	1.805*	0.038***	3.078***
		(0.017)	*(0.269)*	*(0.015)*	*(0.791)*	*(0.011)*	*(0.926)*	*(0.010)*	*(1.099)*
	Undergraduate degree	0.024	0.362	0.032***	1.729**	0.009	1.136	0.0132*	1.925*
		(0.017)	*(0.258)*	*(0.012)*	*(0.685)*	*(0.008)*	*(0.896)*	*(0.008)*	*(1.162)*
	Other HE	-0.010	-0.044	0.012	0.835	0.010	1.134	0.006	1.413
		(0.022)	*(0.304)*	*(0.014)*	*(0.778)*	*(0.008)*	*(0.872)*	*(0.007)*	*(1.091)*
	Post-16 school	0.036	0.559	0.019	1.162	0.0138*	1.424*	0.003	0.469
		(0.022)	*(0.362)*	*(0.015)*	*(0.757)*	*(0.008)*	*(0.859)*	*(0.007)*	*(1.357)*
	GCSE	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
	Less than GCSE	0.034	0.562	-0.004		0.007	1.106	0.001	
		(0.034)	*(0.632)*	*(0.022)*		*(0.007)*	*(0.985)*	*(0.005)*	
	No qualifications	0.014	0.211	0.015	0.746	0.003	0.082	0.003	0.549
		(0.029)	*(0.515)*	*(0.019)*	*(1.240)*	*(0.007)*	*(1.192)*	*(0.005)*	*(1.084)*
	Has vocational qualifications	-0.03***	-0.546***	0.0210**	0.911**	-0.002	0.079	0.006	1.999*
		(0.012)	*(0.203)*	*(0.010)*	*(0.457)*	*(0.006)*	*(0.727)*	*(0.004)*	*(1.173)*
	Recently gained vocational qualifications	0.004	0.037	-0.008	-0.353	-0.003	-0.163	-0.004	-0.332
		(0.019)	*(0.269)*	*(0.014)*	*(0.619)*	*(0.007)*	*(0.588)*	*(0.007)*	*(0.963)*
Training	Trained in last 12 months	-0.0216*	-0.359*	0.006	0.228	0.004	0.666	0.008	1.145
		(0.013)	*(0.205)*	*(0.010)*	*(0.454)*	*(0.005)*	*(0.675)*	*(0.005)*	*(0.823)*
	Training related to promotion	-0.012	-0.108	-0.001	0.026	0.025***	1.048*	-0.005	-0.226
		(0.018)	*(0.257)*	*(0.014)*	*(0.583)*	*(0.007)*	*(0.612)*	*(0.008)*	*(1.168)*
Job	Non-permanent contract	-0.123***	-1.264***	0.006	0.383	-0.019		-0.003	
		(0.030)	*(0.336)*	*(0.022)*	*(0.818)*	*(0.015)*		*(0.011)*	
	Tenure	0.0015**	0.0328**	0.001	0.027	-0.0005*	-0.114**	0.000	0.029
		(0.001)	*(0.015)*	*(0.001)*	*(0.031)*	*(0.000)*	*(0.053)*	*(0.000)*	*(0.047)*
	Small firm	-0.011	-0.188	0.004	0.090	-0.00743*	-1.274**	0.001	0.302
		(0.012)	*(0.186)*	*(0.011)*	*(0.477)*	*(0.004)*	*(0.624)*	*(0.004)*	*(0.770)*
	Change in origin employment share	-0.022	-0.415	-0.0732*	-3.121	-0.009	-1.821	-0.013	-2.439
		(0.036)	*(0.583)*	*(0.043)*	*(1.917)*	*(0.012)*	*(1.507)*	*(0.022)*	*(4.172)*
	Constant	0.805***	1.805	0.182***	0.323	0.033	-3.521	0.110***	6.554
		(0.090)	*(1.302)*	*(0.066)*	*(2.567)*	*(0.031)*	*(5.084)*	*(0.027)*	*(4.494)*
	Observations	2485	2483	1406	1227	2248	1670	2076	1442
	R-squared	0.037		0.041		0.033		0.043	

Note. Each transition was modelled using OLS and logit models with identical sets of explanatory variables. The number of observations is usually lower for the Logit as some of the explanator variables predicted the outcome perfectly, which the calculation of a log odds ratio cannot handle – these observations were then dropped from the model from the statistical software.
Key for statistical significance: *** = 1%, ** = 5%, * = 10%.

Table A2. Predictors of mobility into technician occupations regression results

	Origin technical occupation	Technician		Skilled Trade		Operative	
		OLS	Logit	OLS	Logit	OLS	Logit
Demographics	Age	0.023***	0.179***	-0.001	-0.038	0.000	0.256
		(0.006)	*(0.058)*	*(0.001)*	*(0.137)*	*(0.001)*	*(0.298)*
	Age^2	0.000	-0.00164**	0.000	0.000	0.000	-0.003
		(0.000)	*(0.001)*	*(0.000)*	*(0.002)*	*(0.000)*	*(0.004)*
	Female	-0.026	-0.264	-0.010		0.004	0.740
		(0.018)	*(0.194)*	*(0.014)*		*(0.004)*	*(0.719)*
Education	Postgraduate degree	-0.037	-0.393	-0.008		0.008	1.030
		(0.031)	*(0.346)*	*(0.010)*		*(0.009)*	*(1.220)*
	Undergraduate degree	-0.0574**	-0.613**	-0.009		0.012	1.267
		(0.025)	*(0.273)*	*(0.008)*		*(0.008)*	*(1.042)*
	Other HE	-0.027	-0.315	-0.001	-0.143	0.002	0.398
		(0.028)	*(0.315)*	*(0.007)*	*(0.768)*	*(0.007)*	*(1.181)*
	Post-16 school	-0.022	-0.282	0.001	0.025	0.003	0.596
		(0.030)	*(0.317)*	*(0.007)*	*(0.827)*	*(0.007)*	*(1.187)*
	GCSE	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
	Less than GCSE	0.000	0.086	0.001	0.047	0.002	0.265
		(0.044)	*(0.592)*	*(0.006)*	*(0.719)*	*(0.005)*	*(0.952)*
	No qualifications	-0.039	-0.397	-0.006	-1.237	-0.003	-1.045
		(0.039)	*(0.450)*	*(0.006)*	*(1.098)*	*(0.004)*	*(1.205)*
	Has vocational qualifications	-0.0511**	-0.558**	0.005	1.123	0.000	-0.329
		(0.020)	*(0.223)*	*(0.005)*	*(1.109)*	*(0.004)*	*(0.699)*
	Recently gained vocational qualifications	-0.016	-0.121	0.0119*	1.376*	-0.0140**	-1.569
		(0.028)	*(0.276)*	*(0.006)*	*(0.832)*	*(0.007)*	*(1.127)*
Training	Trained in last 12 months	-0.032	-0.333	-0.002	-0.617	0.0127**	1.509**
		(0.021)	*(0.225)*	*(0.005)*	*(0.803)*	*(0.005)*	*(0.728)*
	Training related to promotion	0.005	0.054	-0.009	-1.159	0.007	0.741
		(0.029)	*(0.281)*	*(0.007)*	*(1.104)*	*(0.008)*	*(0.933)*
Job	Non-permanent contract	-0.133***	-0.847**	-0.012		-0.003	
		(0.045)	*(0.367)*	*(0.014)*		*(0.011)*	
	Tenure	-0.001	-0.007	0.000	-0.028	0.000	0.053
		(0.001)	*(0.014)*	*(0.000)*	*(0.040)*	*(0.000)*	*(0.043)*
	Small firm	-0.0432**	-0.455**	0.001	0.009	-0.003	-0.832
		(0.022)	*(0.225)*	*(0.004)*	*(0.553)*	*(0.004)*	*(1.104)*
	Change in origin employment share	0.164*	1.692*	-0.007	-0.926	-0.003	-1.075
		(0.088)	*(0.916)*	*(0.011)*	*(1.432)*	*(0.021)*	*(3.928)*
	Constant	0.453***	-1.085	0.039	-3.734	0.004	-10.150
		(0.135)	*(1.305)*	*(0.029)*	*(2.816)*	*(0.026)*	*(6.354)*
	Observations	1406	1406	2248	1453	2076	1651
	R-squared	0.063		0.013		0.012	

Note. Each transition was modelled using OLS and logit models with identical sets of explanatory variables. The number of observations is usually lower for the Logit as some of the explanator variables predicted the outcome perfectly, which the calculation of a log odds ratio cannot handle – these observations were then dropped from the model from the statistical software.
Key for statistical significance: *** = 1%, ** = 5%, * = 10%.

Table A3. Predictors of mobility into lower technical occupations regression results

	Origin technical occupation	Skilled Trade		Operative		Operative	
	Destination technical occupation	Skilled Trade		Skilled Trade		Operative	
		OLS	Logit	OLS	Logit	OLS	Logit
Demographics	Age	-0.004	-0.082	0.001	0.043	0.013	0.084
		(0.003)	*(0.047)*	*(0.002)*	*(0.136)*	*(0.004)*	*(0.052)*
	Age^2	0.000	0.001	0.000	0.000	0.000	-0.001
		(0.000)	*(0.001)*	*(0.000)*	*(0.002)*	*(0.000)*	*(0.001)*
	Female	-0.111	-1.044**	-0.002	-0.224	0.031	0.508**
		(0.042)	*(0.421)*	*(0.006)*	*(0.546)*	*(0.014)*	*(0.212)*
Education	Postgraduate degree	0.005	0.067	-0.013		-0.015	-0.202
		(0.030)	*(0.426)*	*(0.015)*		*(0.035)*	*(0.428)*
	Undergraduate degree	0.003	0.068	-0.006	-0.402	0.002	-0.076
		(0.023)	*(0.327)*	*(0.012)*	*(1.111)*	*(0.029)*	*(0.364)*
	Other HE	0.009	0.139	0.008	0.415	0.011	0.123
		(0.021)	*(0.318)*	*(0.011)*	*(0.617)*	*(0.026)*	*(0.327)*
	Post-16 school	-0.016	-0.230	-0.009	-0.833	-0.0428*	-0.441
		(0.021)	*(0.288)*	*(0.011)*	*(1.068)*	*(0.026)*	*(0.297)*
	GCSE	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
	Less than GCSE	-0.003	-0.057	-0.008	-0.755	-0.008	-0.090
		(0.018)	*(0.277)*	*(0.008)*	*(0.792)*	*(0.020)*	*(0.267)*
	No qualifications	-0.017	-0.304	0.000	0.082	0.002	0.099
		(0.018)	*(0.262)*	*(0.007)*	*(0.510)*	*(0.017)*	*(0.231)*
	Has vocational qualifications	0.0454***	0.601***	0.009	0.968*	-0.010	-0.189
		(0.016)	*(0.213)*	*(0.006)*	*(0.578)*	*(0.014)*	*(0.194)*
	Recently gained vocational qualifications	0.000	-0.008	-0.0182*	-1.077	0.036	0.291
		(0.018)	*(0.239)*	*(0.010)*	*(0.817)*	*(0.025)*	*(0.275)*
Training	Trained in last 12 months	-0.012	-0.185	0.0146*	0.754	-0.0660***	-0.721***
		(0.015)	*(0.219)*	*(0.008)*	*(0.499)*	*(0.019)*	*(0.220)*
	Training related to promotion	-0.0655***	-0.665***	0.010	0.690	-0.045	-0.350
		(0.020)	*(0.244)*	*(0.012)*	*(0.738)*	*(0.030)*	*(0.304)*
Job	Non-permanent contract	-0.107**	-0.973**	0.050***	1.68**	-0.0996**	-1.032**
		(0.042)	*(0.443)*	*(0.017)*	*(0.685)*	*(0.041)*	*(0.405)*
	Tenure	0.001	0.018	0.000	-0.018	0.000	0.006
		(0.001)	*(0.013)*	*(0.000)*	*(0.027)*	*(0.001)*	*(0.012)*
	Small firm	0.000	0.011	-0.003	-0.189	-0.017	-0.245
		(0.012)	*(0.177)*	*(0.006)*	*(0.495)*	*(0.014)*	*(0.189)*
	Change in origin employment share	0.048	0.695	-0.053	-3.975*	0.188**	2.590**
		(0.032)	*(0.482)*	*(0.033)*	*(2.367)*	*(0.079)*	*(1.028)*
	Constant	1.073***	4.630***	-0.006	-5.539*	0.435***	-1.337
		(0.087)	*(1.165)*	*(0.041)*	*(3.244)*	*(0.100)*	*(1.164)*
	Observations	2248	2206	2076	1875	2076	2065
	R-squared	0.033		0.017		0.068	

Note. Each transition was modelled using OLS and logit models with identical sets of explanatory variables. The number of observations is usually lower for the Logit as some of the explanator variables predicted the outcome perfectly, which the calculation of a log odds ratio cannot handle – these observations were then dropped from the model from the statistical software.
Key for statistical significance: *** = 1%, ** = 5%, * = 10%.

Table A4. Predictors of mobility for other transitions regression results

	Origin occupation	Other professionals		Other associate professionals		Technician	
	Destination occupation	Technical professional		Technical professional		Manager	
		OLS	Logit	OLS	Logit	OLS	Logit
Demographics	Age	0.000	-0.009	0.000	-0.005	-0.001	0.188
		(0.000)	*-(0.123)*	*(0.000)*	*-(0.183)*	*-(0.003)*	*-(0.210)*
	Age^2	0.000	0.000	0.000	0.000	0.000	-0.003
		(0.000)	*-(0.002)*	*(0.000)*	*-(0.002)*	*(0.000)*	*-(0.003)*
	Female	-0.001	-0.371	0.000	-0.286	0.017	0.984**
		-(0.001)	*-(0.363)*	*-(0.001)*	*-(0.600)*	*-(0.009)*	*-(0.467)*
Education	Postgraduate degree	0.00485**	1.108*	-0.003	-0.620	0.009	0.375
		-(0.002)	*-(0.599)*	*-(0.003)*	*-(0.960)*	*-(0.014)*	*-(0.784)*
	Undergraduate degree	0.002	0.511	-0.00516**	-1.793*	0.0218**	1.067*
		-(0.002)	*-(0.610)*	*-(0.003)*	*-(1.013)*	*-(0.011)*	*-(0.611)*
	Other HE	0.001	-0.760	-0.00570*		0.012	0.632
		-(0.002)	*-(1.127)*	*-(0.003)*		*-(0.012)*	*-(0.703)*
	Post-16 school	0.000	0.121	-0.004	-0.651	-0.015	-1.275
		-(0.002)	*-(0.723)*	*-(0.003)*	*-(1.322)*	*-(0.013)*	*-(1.143)*
	GCSE	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
	Less than GCSE	0.004	1.042	-0.005		-0.014	
		-(0.003)	*-(0.895)*	*-(0.006)*		*-(0.019)*	
	No qualifications	-0.001		-0.00894*		0.003	-0.352
		-(0.003)		*-(0.005)*		*-(0.017)*	*-(1.168)*
	Has vocational qualifications	-0.001	-0.134	0.001	0.950	0.009	0.493
		-(0.001)	*-(0.369)*	*-(0.001)*	*-(0.604)*	*-(0.009)*	*-(0.533)*
	Recently gained vocational qualifications	0.000	0.133	-0.001		0.007	0.150
		-(0.002)	*-(0.695)*	*-(0.002)*		*-(0.012)*	*-(0.602)*
Training	Trained in last 12 months	0.000	-0.205	-0.001	-0.685	0.015	0.796
		-(0.001)	*-(0.467)*	*-(0.001)*	*-(0.791)*	*-(0.009)*	*-(0.497)*
	Training related to promotion	0.000	-0.035	0.000	0.180	-0.0258**	-1.220
		-(0.002)	*-(0.643)*	*-(0.002)*	*-(1.273)*	*-(0.013)*	*-(0.801)*
Job	Non-permanent contract	0.00735***	1.327**	0.00762***	2.825***	-0.010	-0.386
		-(0.003)	*-(0.525)*	*-(0.002)*	*-(0.688)*	*-(0.020)*	*-(1.103)*
	Tenure	0.000	-0.056	0.000	0.029	0.001	0.051
		(0.000)	*-(0.039)*	*(0.000)*	*-(0.041)*	*-(0.001)*	*-(0.032)*
	Small firm	-0.001	-0.410	-0.001	-0.322	0.011	0.856
		-(0.001)	*-(0.405)*	*-(0.001)*	*-(0.667)*	*-(0.009)*	*-(0.556)*
	Change in origin employment share					-0.031	-1.324
						-(0.038)	*-(2.130)*
	Constant	0.0183*	-3.450	0.004	-6.682	-0.006	-7.738
		-(0.010)	*-(2.694)*	*-(0.010)*	*-(4.269)*	*-(0.059)*	*-(4.770)*
	Observations	11183.0	6227	8536	6091	1406	1217
	R-squared	0.009		0.020		0.032	

Note. Each transition was modelled using OLS and logit models with identical sets of explanatory variables. The number of observations is usually lower for the Logit as some of the explanator variables predicted the outcome perfectly, which the calculation of a log odds ratio cannot handle – these observations were then dropped from the model from the statistical software.
Key for statistical significance: *** = 1%, ** = 5%, * = 10%.

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