

PIN – 08

Evidence Review

## Skills and Productivity

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## About PIN

The Productivity Insights Network was established in January 2018 and is funded by the Economic and Social Research Council. As a multi-disciplinary network of social science researchers engaged with public, private, and third sector partners, our aim is to change the tone of the productivity debate in theory and practice. It is led by the University of Sheffield, with co-investigators at Cambridge Econometrics, Cardiff University, Durham University, Glasgow Caledonian University, SQW, University of Cambridge, University of Essex, University of Glasgow, University of Leeds and the University of Strathclyde. The support of the funder is acknowledged. The views expressed in this report are those of the authors and do not necessarily represent those of the funders.

## Table of Contents

1. Introduction .....	4
2. Productivity in the United Kingdom .....	5
2.1 Overall production performance .....	5
2.2 Regional patterns .....	5
2.3 Sectoral patterns .....	5
3. Early childhood education .....	6
3.1 Conceptual and empirical findings .....	6
3.2 Overall performance and regional patterns in the UK .....	6
3.3 Gaps in the literature .....	7
4. Primary and secondary schooling .....	7
4.1 Conceptual and empirical findings .....	7
4.2 Overall performance and regional patterns .....	7
4.3 Gaps in the literature .....	8
5. Higher education .....	8
5.1 Conceptual and empirical findings .....	8
5.2 Overall performance and regional patterns .....	9
5.3 Gaps in the literature .....	10
6. Adult skills .....	10
6.1 Conceptual and empirical findings .....	10
6.2 Overall performance and regional patterns .....	10
6.3 Gaps in the literature .....	11
7. Conclusions .....	12
Bibliography .....	13

## 1. Introduction

The United Kingdom has had a low productivity performance, as compared to other OECD countries, since the 1970s. However, the productivity gap with other countries, and in particular with the United States, Germany, and France, closed significantly in the late 1990s and 2000s, and GDP per hour worked grew at an average rate of 2.1% per year until 2007, when the financial crisis hit, and productivity growth decreased significantly (van Reenen, 2013). Since then the UK's productivity growth has been negative (-1.1% per year over 2007-2009) or very low (0.4% per year over 2009-2013), and the productivity gap with other OECD countries has increased again, although employment rates have remained relatively strong, leading to the so-called “productivity puzzle”.

While the increase in productivity in the pre-crisis period was driven by a rapid growth in TFP, ICT-capital deepening (van Reenen, 2013), and significant increases in skill levels, the reasons for the productivity slowdown are somewhat different. Rincón Aznar et al. (2015) decompose productivity growth in the pre- and post-crisis periods, and find that most of the productivity decline over the 2008-13 post-crisis period is due to a steep decline in TFP, plus a small decline in the contribution of capital accumulation and job-related training. In both the pre- and post-crisis period, improvements in the skills of the labour force contributed positively to productivity growth, indicating that the decline could have been significantly worse without them (Rincón Aznar et al., 2015). Moreover, the positive contribution of labour composition to productivity growth is greater for the UK than for all comparable countries in both the pre- and post-crisis period, with the exception of the Netherlands over 2002-07.

This paper evaluates the literature on productivity performance across regions in the UK, with a focus on the contributions made by skills acquisition and utilisation, as well as skilled migration. While the existing literature has shown that the contribution of skills composition has been positive in both the pre- and post-crisis period, there may be regional deficiencies in skills acquisition, which could in turn explain the lower TFP growth and the weaker contribution of training to productivity growth. The analysis in this paper also covers skills mismatch, and regional variations in the demand for skills.

In discussing the links between skills and productivity, this paper starts from the premise that an investment in skills is likely to have a positive effect on productivity levels and growth rates, as shown by a very extensive macro and micro literature on the returns to education (Hanushek and Kimko, 2000; Card, 2001; Krueger and Lindahl, 2001; Sianesi and Van Reenen, 2003). Much of the literature focuses on formal schooling, particularly on quantity-based measures of schooling, although there has been some progress recently in developing quality-adjusted measures of educational attainment (Hanushek and Woessman, 2011; Islam et al., 2014; Barro and Lee, 2015). An important point to note is the distinction between cognitive skills, such as numerical, verbal, and problem-solving skills, and non-cognitive or “soft” skills, which include personality traits, self-efficacy, and resilience (Payne, 2017), as well as psycho-emotional skills such as compassion, tolerance, and solidarity. The relevance of non-cognitive skills, and the complementarities between different types of skills are relatively under-researched areas, particularly in a regional context.

The remainder of the paper is organised as follows. Section 2 reviews the literature and evidence on early life (pre-school) interventions. Section 3 discusses the patterns in primary and secondary schooling. Section 4 covers higher education, while Section 5 discusses adult skills and on-the-job training. Each section also highlights the gaps in the literature and evidence base, with a focus on those that are spatial or regional in nature. Finally, Section 6 concludes.

## 2. Productivity in the United Kingdom

### 2.1 Overall production performance

As discussed in Section 1, labour productivity in the UK has been lower than the average for comparable countries since the 1970s, although it experienced rapid growth over the period 1995-2007 (Rincón Aznar et al., 2015). Following the financial crisis, UK productivity growth fell dramatically, and has been slow to recover. It has remained close to zero over the past decade, and recovery has been significantly slower than in other OECD countries, although this sluggishness at the aggregate level may conceal important differences across regions.

### 2.2 Regional patterns

The analysis of productivity differences across regions has been constrained by a lack of suitable data, but new experimental statistics recently published by the ONS allow us to compare productivity levels across UK regions, and English sub-regions (ONS, 2017). The new statistics are based on chained volume real estimates of labour productivity (GVA per hour worked), over the period 2004-2016, which allows for comparisons over time. Based on these statistics, labour productivity in 2016 was significantly above the UK average in London (33% above UK average), and in the South East (6% above average), close to the UK average in Scotland, but below average in all other regions and nations, and particularly low in the North East (11% below average), West Midlands (13% below average), East Midlands (14% below average), Yorkshire and the Humber (15% below average), Northern Ireland (17% below average), and Wales (17% below average). These statistics also mask significant variation at the sub-regional level. In terms of the UK's city regions, only London, Aberdeen, Edinburgh, and the West of England conurbation (which includes Bristol and Bath), had above average productivity levels in 2016. Only a small number of English sub-regions experienced real productivity growth over the period 2011-2016, with the majority of English regions experiencing a decline (ONS, 2018).

### 2.3 Sectoral patterns

A further interesting question is the extent to which the decline in productivity levels is associated with specific sectors, which might to some extent explain the regional variation, due to differences in sectoral composition across regions. Forth and Rincón Aznar (2018) find that UK productivity growth rates in the low-wage sectors that employ a large proportion of the population (such as agriculture, food processing, retail, hospitality, and arts, entertainment, and recreation), have been relatively high compared to other countries, but that productivity levels (as opposed to growth rates) in these sectors are still significantly below those of Germany and France. The authors argue that these differences may be due to lower levels of job-related training, a higher share of workers on temporary contracts, a lower share of workers using ICTs, and a lower share of workers subject to management practices such as performance-related pay or continuous improvement in the UK, relative to other countries.

The following sections cover the literature and empirical evidence on skills in the UK, starting with early-life (pre-school) skills and policy programmes, moving on to primary and secondary school, then considering higher education, and finally adult skills. In each case we briefly cover the conceptual and international literature, before discussing the evidence of regional disparities in the UK, and the remaining gaps in the literature. Overall, the UK has a relatively good performance in skill levels and educational attainment, as compared to other EU and OECD countries. The two significant exceptions are adult participation in lifelong learning, and young adult literacy and numeracy skills (Ballas et al., 2012).

### 3. Early childhood education

#### 3.1 Conceptual and empirical findings

The academic literature across a number of disciplines including Education, Sociology, Psychology, and Economics, has highlighted the importance of skills acquired during early childhood. In particular, the cognitive and non-cognitive skill formation in early childhood lays the foundation for further skills development later in life, and due to these complementarities, it becomes increasingly difficult to remedy an early disadvantage at older ages (Knudsen et al., 2006; Elango et al., 2015). This is true of both foundational cognitive skills, and the softer, social, “non-cognitive” skills, which have been shown to be particularly important in the acquisition of future skills, and in later educational and labour-market outcomes (Cunha and Heckman, 2007). In a review and analysis of the outcomes of several early childhood education programmes in the US, designed to prepare children from disadvantaged backgrounds for school, Elango et al. (2015) find that although the short-term effects on educational outcomes tend to fade (the “IQ fade-out effect”) fairly rapidly once children start school, there are still significant positive long-term effects on graduation rates, employment, health, and lower criminal activity which persist into adulthood. The authors attribute these long-term effects to the acquisition of non-cognitive social skills.

#### 3.2 Overall performance and regional patterns in the UK

International comparisons of early childhood educational are complex because of differences in education systems and types of childcare facilities and funding available. Nevertheless, existing studies show that the UK is close to the EU-15 average in terms of take-up of early years education, although the proportion of children who attend an early education setting for 30+ hours a week is significantly below the international average (West, 2016). This could be due to the significantly higher cost of nursery and pre-school education in the UK, relative to other countries, but also potentially due to differences in family structure (for instance, in the availability of extended family members able to help with childcare needs).

Comparisons across the UK regions show that there are significant differences in early education opportunities across locations (SMC, 2017). The South East has the best educational outcomes, as measured by the percentage of five-year-olds eligible for free school meals who achieve a good level of development at the end of the Early Years Foundation Stage. This is likely to be due to greater availability of good-quality childcare in the region. London also has good early-childhood development outcomes, despite lower levels of nursery take-up, expensive childcare, and higher levels of poverty and deprivation (the “London paradox”).

Even in the more deprived regions, there is significant variability, with better and worse outcomes at the local level. In particular, and unlike in later life stages, good outcomes are also observed in rural, isolated, and coastal communities, and in areas of significant deprivation. There is relatively little research in this area, but these outcomes are likely to be due to the lower cost of childcare in rural and isolated areas, and childcare provision by friends and family, as well as variations in the availability of local public spaces and facilities (for instance, public parks). In the case of London, the better than expected outcomes may also be due to extensive learning opportunities available outside the home, such as parent and baby classes, playgroups, cultural activities, libraries, etc. In many deprived areas, as well as in London, there is significant under-use of free preschool places, particularly among disadvantaged families. The reasons include a lack of childcare availability, lack of understanding of the advantages of preschool attendance, variability in the quality of childcare, and a lack of continuing professional development and training for early years teachers (SMC, 2017).

### 3.3 Gaps in the literature

There is relatively little research on the spatial patterns of early childhood education in the UK, and in particular, on the reasons for these spatial disparities, for instance, in the uptake of free pre-school places. In addition, there is little research on the reasons for the “London paradox”, on why disadvantaged children in London have better education outcomes by the end of the Early Years Foundation Stage, despite lower nursery and preschool attendance rates, and higher levels of deprivation. The quality of early years settings also varies considerably across space, but there is little research into the determinants of this variation, and in particular, into variation in the quantity and quality of the training of early years education teachers.

## 4. Primary and secondary schooling

### 4.1 Conceptual and empirical findings

A large literature across several disciplines has investigated the determinants of school performance and educational outcomes. The focus has mainly been on parental background, availability and quality of teachers, school policies and organisational forms, and school resources (see World Bank, 2017, for a policy-focused review). At the regional level, much of the literature has analysed the relevance of neighbourhood effects, and whether neighbourhood characteristics affect student educational outcomes. However, the literature has found only small effects, with family background having a much larger effect on the educational attainment of individual pupils (Gibbons, 2002).

More recently, the literature has analysed the role of teacher quality in determining schooling outcomes, and has found that good teachers can close achievement gaps, particularly for students from disadvantaged backgrounds (Hanushek, 2011). This is highly relevant from a regional perspective, because teacher mobility has been shown to have a significant regional dimension, with teachers often choosing to work in locations that are close to their original home district, and good teachers (those with greater classroom and pedagogical experience, better qualifications, qualifications in the subject taught) tend to be more mobile (Barbieri et al., 2011). In addition, schools in deprived communities find it difficult to recruit and retain qualified teachers, as well as provide good-quality training, exacerbating the regional differences in educational outcomes (Rice, 2013; SMC, 2017). Demographic factors such as the ageing stock of teachers in certain locations add to the problem (OECD, 2012).

Another emerging area of policy interest is the extent to which the quality of careers advice in schools differs across locations, and whether improving careers advice, for instance, by increasing the number of hands-on experiences of the workplace, could help to raise educational outcomes and employment prospects. There is evidence that the quality and availability of work experience placements varies considerably across regions (CCE, 2018).

### 4.2 Overall performance and regional patterns

In an international context, the UK’s performance in numeracy and literacy skills is below the OECD average up until the ages of 30 (literacy) and 35 (for numeracy), although the figures are slightly better if older age groups are included, particularly the 60-65 age group which is relatively high-performing in cognitive tests. The relative size of the low-skill group is three times larger in England than in the top performing countries, such as Japan and Finland (Kuczera et al., 2016). Within the UK there are significant regional variations, for instance, in 2015/16 over 60% of pupils in London achieved five good GCSEs (with grades A\*-C, including English and Maths), compared to 55% in the West and East Midlands (SMF, 2017). These disparities have been relatively persistent since the 1980s, although the performance of pupils in London has improved steadily over time (Strand, 2015).



The variation in results between the top and lowest performing quintiles is significantly higher in the UK than in other OECD countries, and much of it can be attributed to the disadvantages related to parental socio-economic background (OECD, 2013). A lower proportion of pupils who receive Free School Meals (FSM) achieve five good GCSEs (33% in 2015/16) relative to those not receiving FSM (61%). There are also significant variations in performance at the sub-regional level, with deprived urban areas and coastal towns being particularly negatively affected.

#### *4.3 Gaps in the literature*

Standardised skills tests (PISA, TIMSS, PIRLS) are not generally representative at the regional level. A promising area of research is the use of spatial microsimulations to estimate local skill levels, using the results of existing surveys and combining them with census (or school census) data (Kavrouidakis et al., 2013).

There is a relatively large literature on the determinants of teacher mobility, with studies finding that teachers tend to return to their home districts after teacher training programmes, that they are deterred by high house prices, and by locations with low levels of school funding. In addition, schools in areas with high levels of deprivation tend to have difficulties in retaining experienced teachers (Barbieri et al, 2011; Vagi and Pivovarov, 2017). However, there is a scope for more policy oriented research on the incentives that might encourage teachers to remain in the locations with the greatest need, with a focus on both financial and intrinsic incentives.

There is also relatively little research on the constraints to providing high-quality careers advice and work experience to secondary-school pupils, and on the regional disparities of work experience outcomes. For instance, the Children's Commissioner's Office found that career aspirations by children in the North of England were heavily informed by those of people known to them personally. This was true even in cases where schools were providing extensive careers advice. The most effective careers advice involved visiting local employers, and well-structured periods of work experience, but there is little research on why these are less widely available in certain locations, particularly in the North of England. The complex role of aspirations in determining education and labour market outcomes is also an interesting area for further research, particularly in an empirical context (Hart, 2016; Hart et al., 2014).

## **5. Higher education**

### *5.1 Conceptual and empirical findings*

The literature on access to higher education has found significant regional disparities in the rates at which young people enrol in further and higher education institutions. This is partly due to lower school attainment in low-participation locations, and partly due to variations in the availability of courses, and the travel time and associated cost required to attend institutions located further away from home (SMC, 2017). Previous research has found that poor achievement in secondary school is a key determinant of participation in higher education, although regional variations remain once this is accounted for (Chowdry et al., 2013).

Distance to the nearest university does not affect the decision to attend university, but it does affect institution choice, with prospective students more likely to attend local institutions (Gibbons and Vignoles, 2012). The quality of the university attended is therefore affected by the local availability of high-quality institutions, which varies across the UK regions. Other relevant factors include family background and support, perceived costs and benefits, and cultural factors (Callender and Jackson, 2008; Declercq and Verboven, 2015). In addition, the availability of



information, advice, and guidance varies considerably across schools and locations, further constraining the choices of pupils from disadvantaged backgrounds (Reed et al., 2007).

A further determinant of the regional imbalance in skills occurs after graduation, with a larger proportion of graduates moving to large, dense, cities with good labour market prospects (Faggian and McCann, 2008; Venhorst et al., 2011; Ahlin et al., 2014). In addition, the most mobile graduates are those with the highest grades, and from the best institutions, leading to an accumulation of skills in larger cities like London (Swinney and Williams, 2016; Abreu, 2018). Studies based on employer surveys often find that there is a mismatch of skilled workers and jobs, with over-supply of highly-skilled workers in some locations, and under-supply in others. This mismatch is not always resolved through further migration, because other factors (such as the cost of living, urban amenities, and faster wage trajectories) act to retain graduates in highly sought-after locations. There is also evidence to show that the mismatch is often resolved by the most highly-skilled graduates (those with top grades, and from the best institutions) through migration, but by graduates with lower grades through a change in occupation, thus exacerbating the local mismatch problem (Abreu et al., 2014).

## 5.2 Overall performance and regional patterns

The UK has comparatively good levels of higher education attainment, with 52% of 25-34 year olds holding a university degree (and 37.6% of 55-64 year olds), the fourth largest level in the OECD, after Korea, Canada, Japan, and Lithuania (OECD, 2017). Overall, the participation rate has been rising steadily since the 1990s, and the gap between the participation rate of the most and least disadvantaged students has also narrowed (Wiseman et al., 2017). However, these statistics mask important variations across the UK regions. For instance, the young participation rate, showing the higher education entry rate in any one year for people aged 18-19, ranged from 43% in London to 29% in the North East in 2012/13 (HEFCE, 2013). The North West, the South West, and the East and West Midlands, also have relatively low rates of higher education participation. Contrary to expectations, there was no significant fall in the higher education enrolment rate following the rise in tuition fees in 2012, although there is some evidence of an increase in the proportion of students attending their local university (Wakeling and Jefferies, 2013).

Regions also differ in the extent to which they experience a net gain of graduates. At the point of entry into higher education, most large cities (with the exception of London) experience a net influx of UK-domiciled students, with Leeds, Nottingham, Edinburgh, and Cardiff, attracting a high number of students, although smaller cities and some non-urban areas also experience gains. London experiences a significant net *outflow* of UK students, equivalent to a loss of 50,000 students in 2014/15. However, overall it attracts a larger number of students from abroad (100,000 in 2014/15), a detail that is often lost in the UK productivity debate (Swinney and Williams, 2016). After graduation, a large proportion of new graduates move to London (24.4%), while other large cities experience (small) outflows. London also has very high graduate retention rates, with nearly 77% of London-based students remaining in the city after graduation. The retention rates for Manchester, Belfast, Birmingham, Glasgow, Aberdeen, and Edinburgh are also very high (above 40%). In addition, London attracts a larger proportion of top graduates (those with first or upper-second degrees from Russell Group universities), relative to other regions. However, there is no evidence that these patterns are accelerating, or have changed significantly over time. An important, but relatively under-researched topic, is the extent of the contribution of foreign-domiciled students to productivity growth in London and the South East (McCann, 2016).

### 5.3 Gaps in the literature

Much of the literature focuses on cognitive skills (reading comprehension, numerical skills, etc.), but there is significant evidence of the importance of non-cognitive skills (personality, interpersonal skills, attitudes to risk, adaptability) for both educational and job-related outcomes (Almlund et al., 2011). There is a large amount of research on migration and sorting arising from cognitive skills, but very little research on sorting on non-cognitive skills (Abreu and Venhorst, 2018). Moreover, the literature has shown that non-cognitive skills can be taught in early childhood education settings and in schools, suggesting an important policy dimension.

There is by now a relatively extensive literature on graduate migration, but much of it focuses on short-term migration patterns, mainly due to data limitations. There is scope for analysing long-term patterns of graduate migration, career paths, and transitions in/out of employment in the UK by combining existing survey data (such as HESA data) with administrative data provided by HMRC and the DWP. A similar methodology is used by the existing Longitudinal Education Outcomes (LEO) dataset produced by the Department for Education.

## 6. Adult skills

### 6.1 Conceptual and empirical findings

Learning beyond early formal education tends to be higher for wealthier individuals, and those with previous experience of learning (for instance, those with a higher education degree). The propensity to participate in later-life learning is thus strongly influenced by earlier education experiences, which include the accumulation of non-cognitive skills (Foresight, 2017). Participation in learning also declines with age, particularly among men, and there are lower participation rates among less wealthy socio-economic groups, and those whose jobs are most at risk from automation. A recent survey found that 54% of individuals in the “AB” socioeconomic group have participated in a learning activity in the past three years, compared to only 26% of individuals in the “DE” group (NIACE, 2015). A majority of unskilled workers receive no formal training at work, with employers focusing on more highly-skilled workers (Green et al., 2015). In addition, employers may find it difficult to arrange training for part-time or temporary workers, leading to a fall in training levels for all workers (OECD, 2010).

### 6.2 Overall performance and regional patterns

The UK’s overall performance in terms of adult skills is low by international standards, with numerical proficiency in England and Northern Ireland being significantly below the OECD average, while the proficiency in literacy and ICT-related problem solving was close to the average in 2012 (Rincón Aznar et al, 2015). Adult learning rates are also relatively low, with only 31% of all 25-59 year olds participating in formal education, job-related training, or leisure education in 2009, a rate that has been declining since the early 2000s (Mason, 2010). Regional patterns are difficult to quantify due to significant data constraints, but there is some evidence of lower on-the-job training outside London and the South East, although this could be due to sectoral differences (since training rates are higher in the knowledge-intensive sectors). In a survey of education inequalities across EU member states, Ballas et al. (2012) find that the UK has by far the largest regional disparities in adult participation in lifelong learning. In some city-regions job-related training rates are three times higher than in other locations (Mason, 2010).

There is also significant evidence of a mismatch between adult skills and business demand for skills across the UK regions. Evidence from the PIAAC survey shows that only a third of jobs in England and Wales require a higher education qualification, and around 30% of workers in England have a qualification that is greater than the level required for their job, one of the highest figures for the OECD (second only to Japan) (OECD, 2013). This suggests that there is a

significant level of over-qualification in the UK, with weak demand for degree-qualified workers (Rincón Aznar et al., 2015). However, there are also skills shortages, with employers reporting that more than a fifth of advertised vacancies were “hard to fill because of skill shortages” (Foresight, 2017). Taken together, the evidence shows a lack of basic cognitive skills across the UK population as a whole, but also a significant degree of variation across locations, with a large proportion of younger workers being over-qualified for the available jobs.

The UK Employer Skills Survey (UKCES) shows that skill gaps reported by employers are lowest in London and the South East, and highest in the East and West Midlands, and Yorkshire and the Humber. In addition, the UKCES has found that relevant work experience is a key factor in recruiting new staff, cited by two thirds of employers as significant or critical. There are regional variations in access to work experience, which may explain some of the subsequent gaps in the employment rates of labour market entrants (SMC, 2017).

### *6.3 Gaps in the literature*

Both the academic and policy literatures focus on the supply side, i.e., how to increase the supply of education or training. The demand side is a neglected area of research. This is particularly relevant as there is evidence that workers in the UK have become increasingly over-qualified for existing jobs. An interesting and growing area of research is the idea of a “skills ecosystem”, which argues that policy interventions should address both the supply and demand side, and take into account firm productivity, improving job satisfaction, and stimulating investment and innovation. This approach has been particularly influential in Australia, and more recently also in Scotland (Payne, 2008). There is significant scope for analysing whether this approach could work at a regional level in the rest of the UK.

Large-scale job skill surveys, such as the UK Employer Skills Survey (UK CES), provide a wealth of information, but are only partially representative at the regional level. There is a significant need for new quantitative data sources that could be used to explore regional disparities in job skills, particularly in relation to employer-reported skill deficiencies of current and prospective workers, and of over-qualification (whether workers are over-skilled, or whether they are over-qualified but able to use their skills). There is also an urgent need for better data on job-related training rates by region.

Much of the literature focuses on the skills of pupils/students and younger workers, and there is relatively little research on skills among older or elderly workers. This is an important omission given the rise in life expectancy, and changes to employment patterns among older workers. For instance, older workers often shift into “bridge employment” before retirement (lower-skilled jobs or self-employment). Existing studies show that older workers are less likely to receive training than younger workers, but there is scope for further research to understand the reasons for this, and whether there is scope for policy to address it. The effect of a lack of skills and training among older workers could have significant regional impact on productivity levels, given the uneven distribution of older workers across space.

Training in digital skills is an area of particularly policy relevance that is relatively under-researched in a regional context. New research on digital skills in peripheral and rural locations could be linked to research on infrastructure investment, such as the Welsh superfast broadband project, which is aimed at Welsh businesses (<http://www.cardiff.ac.uk/superfast-broadband-project>). Related to this, there is relatively little research on the extent to which there are threshold effects in the impact of different types of skills (such as cognitive and “soft” skills) on worker productivity.

In addition, there is relatively little research on the return to skills among self-employed workers, due to difficulties in measuring wages and productivity among the self-employed. There is

significant scope for further research on the nature of skills constraints among the self-employed (for instance, difficulties in accessing or paying for training), and the role of policy in addressing these constraints.

## **7. Conclusions**

This paper has reviewed the literature and empirical evidence on productivity and skills, with a focus on the regional level. Overall, the UK has a relatively high level of skills, and labour force composition contributed positively to productivity growth both before and after the financial crisis. However, the UK does relatively badly in overall levels of job-related training and low- and middle-level skills, both of which have decreased over time. There are also very significant regional variations in educational outcomes and skills, at all education levels, and in terms of adult skills and training. These disparities are among the most significant for any OECD country.

There are several gaps in our understanding of these disparities, and they can be generally grouped into four areas. First, there are gaps in the measurement of training, work experience, and adult skill levels, particularly at the regional level. Second, the determinants and effects of variations in non-cognitive (or softer) skills are not well understood. Third, several areas relating to adult skills are under-researched, particularly in the context of older and self-employed workers. Fourth, there is relatively little research, both in the academic and policy contexts, of the demand side for skills.

A number of these gaps in the literature could be researched in a multi-disciplinary context and in close cooperation with research on the other key determinants of productivity, most notably management practices (e.g., performance related pay and job-related training), and infrastructure (e.g. broadband and digital skills, transport and access to higher education, school infrastructure and teacher retention rates).

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