



Counting on the recovery

The role for numeracy skills in 'levelling up' the UK

April 2021



Pro Bono Economics uses economics to empower the social sector and to increase wellbeing across the UK. We combine project work for individual charities and social enterprises with policy research that can drive systemic change. Working with 400 volunteer economists, we have supported over 500 charities since our inception in 2009.

National Numeracy is an independent charity with a clear vision: that everyone in the UK gets on with numbers so they can get on in life. Our work improves how people understand and work with numbers at work, home and school, sparking better opportunities and brighter futures.

KPMG LLP, a UK limited liability partnership, operates from 21 offices across the UK with approximately 16,000 partners and staff. KPMG is a global network of professional firms providing Audit, Tax, Legal and Advisory services. For over 150 years, we've been supporting businesses to grow, our people to achieve and our communities to thrive.



Contents

Foreword – Andy Haldane	4
Foreword – Bina Mehta	5
Summary	6
Adult Numeracy in the UK	9
Conclusion	22
Annex A: Numeracy in the UK nations and regions of England	23
Annex B: Methodology	36



Foreword

This is a report produced by a charity which I founded (Pro Bono Economics) for a charity where I am Vice-Chair (National Numeracy). Mine is not a disinterested view.

Most surprising, for me, is the continuing level of disinterest shown in numeracy by policymakers, politicians and the public. The UK faces a numeracy crisis, plain and simple. As this report makes clear, this crisis is having significant economic costs, especially for those least-advantaged in society.

This cost can be counted in lost earnings – the £25 billion the report finds would be added to our collective pay packets if numeracy skills could be levelled-up. The cost comes in widening regional disparities, since numeracy skills are weakest in regions whose incomes are lowest. And these costs have been increased by Covid, which has hit hardest those whose numeracy skills are fewest.

Looking ahead, one of the key tasks of economic policy will be to return people to well-paying jobs in left-behind parts of the country. Rising to this challenge was never going to be easy. But this report makes clear that tackling the adult numeracy crisis, at source, could help us rise to this challenge, by boosting job and income prospects for those living in the UK's least-advantaged regions.

Tackling the UK's numeracy crisis was a public policy priority before Covid crisis struck. In the light of Covid, it has now become both a national necessity and a national opportunity to level-up jobs, incomes and regions.



Andy Haldane

Bank of England Chief Economist, co-founder of Pro Bono Economics & Vice-chair of National Numeracy

Numeracy, literacy and lifelong learning are the building blocks of social mobility. They lay the foundations for a healthy, inclusive economy – which will prove critical as we look towards recovery in the wake of COVID-19.

In this extraordinarily challenging year, the pandemic has had a profound impact on us all, but it has affected those from disadvantaged backgrounds the most.

This report reminds us that this isn't a marginal problem: over half of the working-age population have low numeracy skills. And in parts of the country, that's felt even more acutely.

We must double down on our efforts to improve the nation's essential skills, powering social mobility, lifelong learning, and productivity. Improving numeracy skills is an integral part of KPMG's social mobility strategy. We support our communities through all stages of life: from number confidence programmes with primary schools, to maths tuition for secondary school students. In addition, we are the proud Founding Supporter of National Numeracy Day.

Since its launch in 2018, National Numeracy Day has raised awareness of this key issue, prompting over 100,000 adults to improve their numeracy skills. On 19 May this year, many thousands more will take those first important steps to improve their number confidence.

But there is more to be done. Later this year, we will be working with National Numeracy as they form a new alliance of committed businesses who can take this cause to the next level, helping people to fulfil their potential and ensure the UK economy recovers after COVID-19.

There is no single silver bullet, but bringing together business, policymakers and charities and turning the dial on poor numeracy is a great place to start. Please join us on this journey.



Bina Mehta

Chair, KPMG in the UK

Summary

Basic numeracy skills play a critical role in our day-to-day lives. They enable people to manage their finances – helping them to understand vital information such as payslips, taxes, pensions and credit card agreements. They help people at home, enabling them to understand nutritional information, discounts at the shops as well as bus and train timetables. And they help people at work, supporting the effective use of spreadsheets, the operation of cash registers and the accurate measurement of products and materials. Research has shown that people with lower numeracy skills are more likely to earn less, are at higher risk of unemployment and are even more likely to experience worse health outcomes.

Despite the importance of numeracy skills, data from the Organisation for Economic Cooperation and Development (OECD) suggests that 57% of the working age population in England and 60% of the working age population in Northern Ireland have low numeracy skills, with other data sources suggesting broadly similar levels in Wales and Scotland. This places the nations of the UK behind the average for the OECD and well behind the leading countries such as Japan, where just 36% of the adult population have low numeracy skills.

That leaves a significant proportion of the UK population without the skills essential for navigating modern life, and with a reduced earning potential. We estimate that the 16 million workers in the UK with low numeracy skills are currently earning an average of nearly £1,600 less per year than they could if they had a basic level of numeracy.

The Covid pandemic has shone a harsh light on the UK's weakness in this area. The impact of the economic crisis has been disproportionately felt by those with low numeracy skills. Though people with low numeracy skills made up 52% of the workforce prior to the pandemic, our analysis suggests that 59% of those who have lost their jobs so far in the crisis have low numeracy skills – the equivalent of around 560,000 people.

In the aftermath of the crisis, there is an opportunity to pivot the structure of the UK economy further towards higher skill, higher growth sectors. If the right investments in numeracy skills are made, it could both support those who have lost jobs back into employment and provide the foundations for a stronger path for future growth.

Improving numeracy skills could also play a valuable part in the government's levelling up agenda. Numeracy skills are not evenly distributed across the regions and nations of the UK. The North East, West Midlands and Yorkshire and the Humber, for example, all have a higher

proportion of working age adults with low numeracy skills than the rest of the UK, with an estimated average of 64% of adults with low numeracy compared to a national average of 58%.

At present, the average wage in these three regions is around 12% below the average for the UK - the equivalent of £3,400 per worker. While improving numeracy skills would not close this gap on its own, the relationship between numeracy skills and earnings estimated in the literature suggest that the 3.7 million workers in these regions with low numeracy skills experience an income differential that could be as much as £1,700 per person each year.

With the Covid crisis and its impacts on our economy evident and plans to level up the economy through the recovery becoming real, the need for a national debate on numeracy is now an urgent one.

All parts of UK society have a role to play in improving adult numeracy skills.

- **Government** – working with learning providers, local businesses and charities such as National Numeracy – should consider how number confidence and basic skills development can be integrated into the support provided to out-of-work individuals to help them access the jobs and opportunities that will be available during the economic recovery. There should be a particular focus on low wage areas as a potential lever to support the levelling-up agenda.
- **Business** can help to build the skills necessary for a resilient and adaptable workforce, both for their own staff and the communities they operate in. This will help them to remain competitive within a changing economy and support social mobility more broadly.
- **Individuals** with low numeracy should consider accessing opportunities to develop their number confidence and numeracy skills to thrive within an ever-changing global economy.

If all parts of society can get behind improving adult numeracy in the UK, the benefits would be manifold. For individuals, it would support them to find employment, earn higher wages and lead healthier lives. But it could also support the government's efforts both to level up the whole of the country by increasing wages in the regions, and to make the UK economy match-fit to lead the way in the industries of the future.

Estimated number of jobs
lost for individuals with low
numeracy skills so far
during the Covid crisis

560,000

Estimated average wage
differential due to low
numeracy skills

£1,600

per year

16 million

workers in the UK are
believed to have low
numeracy skills

Estimated proportion of working
age adults in the UK with low
numeracy skills is

58%

Adult numeracy in the UK

Being numerate means having the number confidence and numeracy skills to use numbers and data to make good decisions in daily life. At work, numeracy skills are important for giving the correct change, weighing, and measuring accurately, using spreadsheets and understanding data. In everyday life, numeracy skills are key to understanding price discounts, the length of time before a train arrives, as well as to manage diet and nutrition.

There are a range of methods available to measure and classify numeracy skills, and different approaches are taken by each of the nations of the UK. More still are used by major international organisations.¹ This report uses the measure of numeracy adopted by the OECD, as it enables our analysis to align with the most recent, robust studies exploring the relationship between numeracy, wages and employment. The OECD's Survey of Adult Skills provides a rigorous, consistent measure of adult numeracy skills across 20 countries. It included a representative sample of nearly 9,000 adults across England and Northern Ireland conducted between 2011 and 2012.

Throughout this report we have broken numeracy skills into three broad categories, using the OECD's approach:

- **Low Numeracy Skills:** This is the equivalent of OECD Level 2 and below. Adults with skills at this level may not be able to understand their pay slips, work out discounts such as 10% or 50% off and convert bills from monthly to quarterly or annual amounts, for example.²
- **Basic numeracy skills:** This is the equivalent of OECD Level 3. Adults with skills at this level are comfortable calculating simple percentages, converting units of measure and interpreting basic data represented in tables and graphs. More complex numeracy skills such as working out a household budget or understand mortgage and credit card products may be challenging.
- **Advanced numeracy skills:** This is the equivalent of OECD Levels 4 and 5. Adults at this level are comfortable solving problems that require several different steps in unfamiliar contexts. They are likely to be confident using statistics and probability as well as abstract mathematical ideas.

¹ Comparisons between the OECD definitions of numeracy skills and others used within the nations of the UK are available on the National Numeracy website:

<https://www.nationalnumeracy.org.uk/about/what-numeracy/what-do-adult-numeracy-levels-mean>.

² For examples of problems that someone with low numeracy might find challenging, see: National Numeracy (2019): *Numerate nation? What the UK thinks about numbers*.

Although the OECD PIAAC data is now nearly 10 years old, it represents the most up-to-date, comprehensive measure of numeracy skills for the population within the UK. More recent indicators suggest that levels of numeracy remain low and are unlikely to have changed significantly since the OECD data was collected.³

³ For example, a survey of 2000 adults completed on behalf of National Numeracy in 2018 found that 56% of respondents were unable to correctly answer more than two of five questions designed to test functional numeracy, see: National Numeracy (2019): *Building a numerate nation: confidence, belief and skills*.

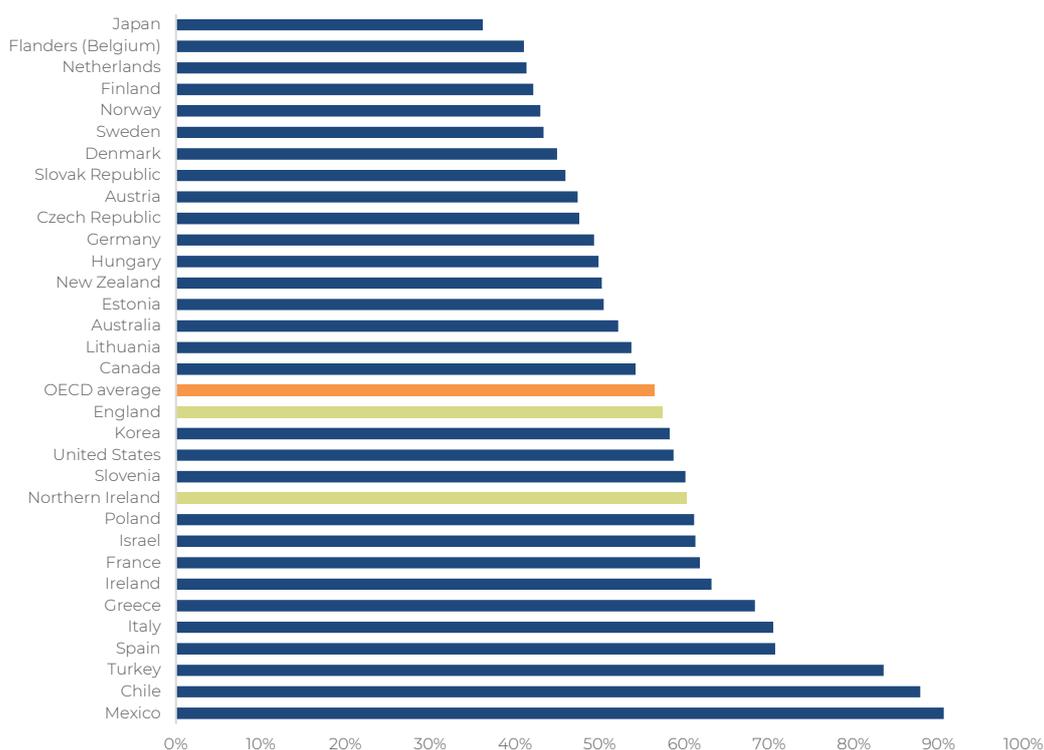
The UK lags behind on basic numeracy skills

The UK has some of the best Universities in the world and more Nobel laureates than anywhere bar the USA. Yet while its higher education sector is a thing of global envy and a core competitive strength, the UK struggles on the international stage when it comes to basic numeracy skills.

57% of the working age adult population in England are estimated to have low numeracy skills – meaning that, at best, they have the numeracy level expected of children leaving primary school. That percentage rises to 60% of adults in Northern Ireland. Although comparable data is not available for Scotland and Wales, evidence from other sources suggests that they have broadly similar levels of numeracy skills to England.⁴ This would suggest there could be as many as 24 million working age adults in the UK living with low numeracy skills⁵.

This puts the countries of the UK below the average of other OECD nations, and means that it lags well behind the leader Japan, where an estimated 36% of the working age adult population have low numeracy skills.⁶

Figure 1: The proportion of adult population with low numeracy skills



Source: OECD PIAAC 2011, low numeracy skills are defined as Level 2 or below

⁴ The National Survey of Adult Skills in Wales 2010 and data provided from National Numeracy (2019).

⁵ Working age adults includes both those that are in work and those that are out of work either due to being unemployed, in full-time education, looking after family, long-term sick or having retired early.

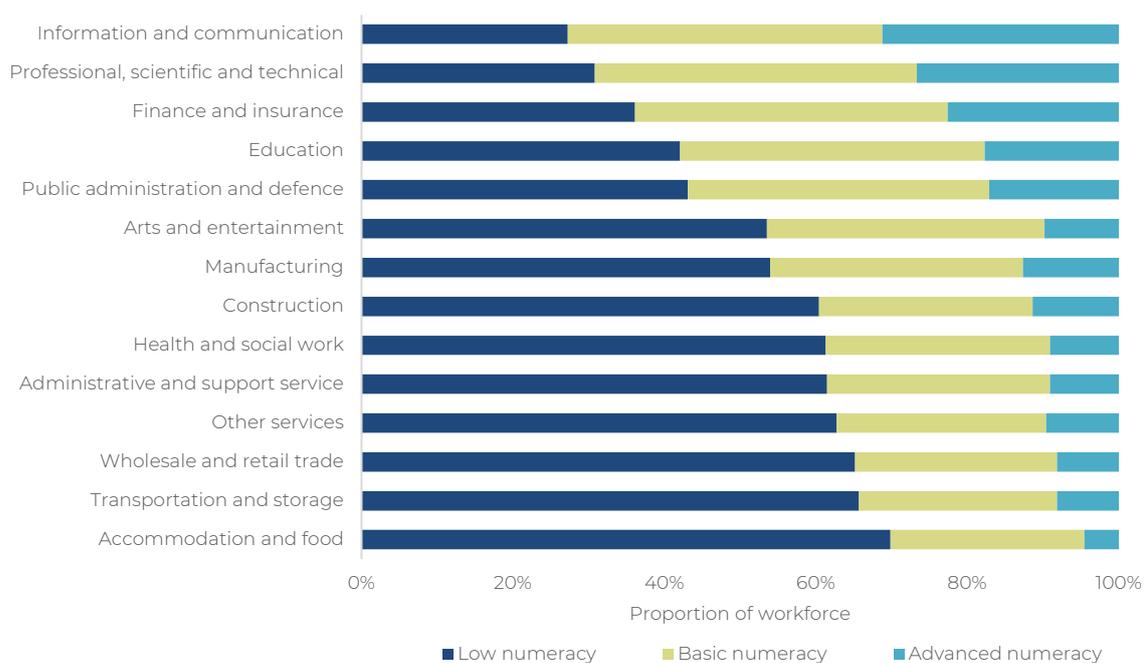
⁶ OECD (2018): *Survey of Adult Skills (PIAAC): Full selection of indicators*, Table A2.3. Scotland and Wales did not participate in the OECD study.

Numeracy varies significantly across sectors

An individual's ability with maths can have a significant impact on their likelihood of being in work: 67% of those out of work in England have low numeracy skills compared to 52% of those in work.⁷ But it can also affect the kind of jobs that are available to them. Beneath the national average, there are significant variations in the level of numeracy skills across those employed in different sectors of the economy.

The “information and communication”, “professional, scientific and technical” and “finance and insurance” sectors typically have a far higher proportion of employees with both basic and advanced numeracy skills compared to other sectors. Meanwhile, sectors such as the “accommodation and food”, “transportation and storage” and “wholesale and retail trade” typically have far lower levels of numeracy – with around just 30% of employees having basic or advanced levels of numeracy.⁸

Figure 2: Numeracy skills by sector



Source: PBE analysis of OECD PIAAC data, details provided in Annex B

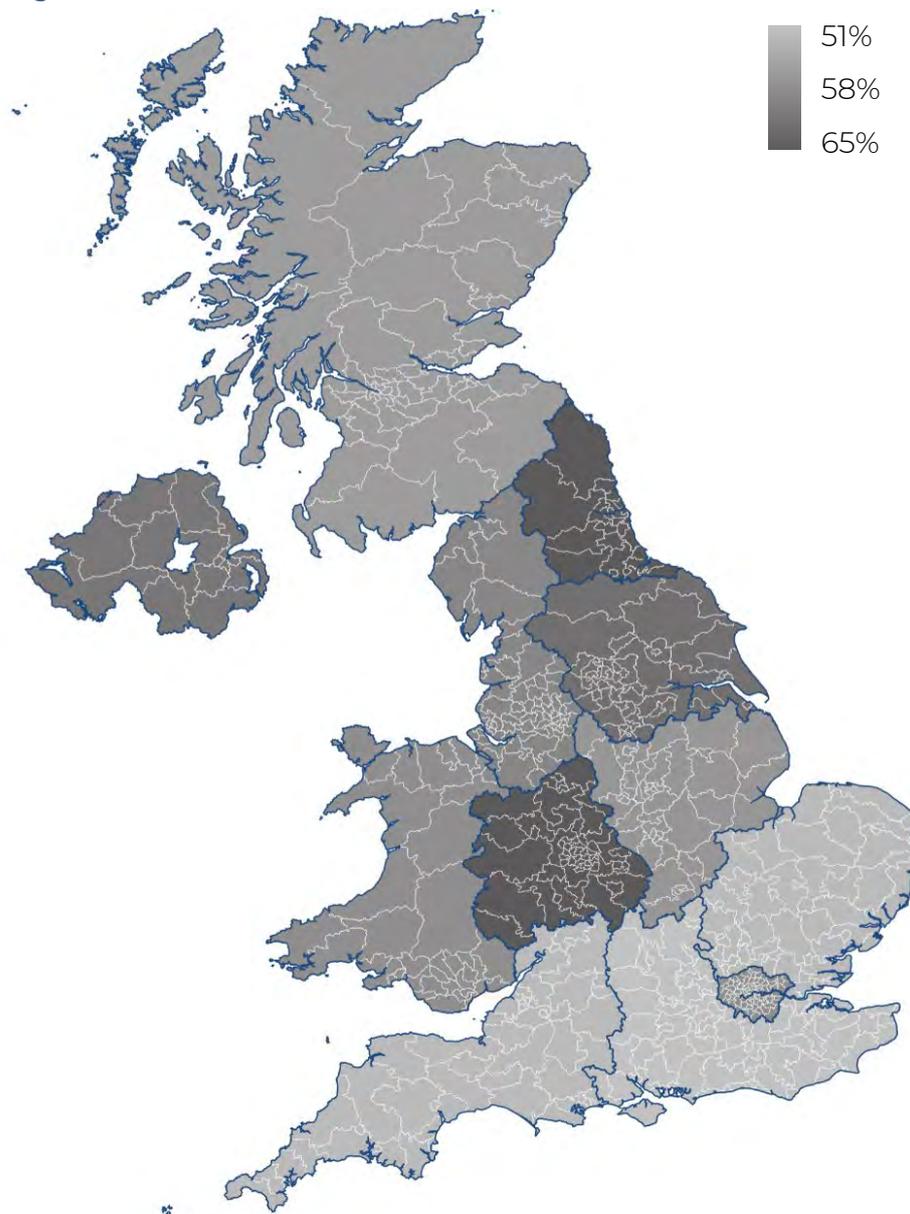
⁷ These figures demonstrate the correlation between numeracy skills and likelihood of being employed but more robust studies have demonstrated a statistically significant link. See: Hanushek E, Schwerdt G, Wiederhold S, Woessmann L (2015): *Returns to skills around the world: evidence from PIAAC*, European Economic Review, 73, De Coulon A, Marcenaro-Gutierrez O, Wignoles A (2011): *The value of basic skills in the British labour market*, Oxford Economic Papers, 63(1), pp. 27-48 and Grinyer J (2005): *Literacy, numeracy and the labour market: further analysis of the skills for life survey*, DfEE Research Paper 251.

⁸ Note that there were insufficient sample sizes to estimate the levels of numeracy in the “agriculture, forestry and fishing”, “mining and quarrying”, “electricity, gas, steam and air conditioning supply”, “water supply”, “real estate” and “people employed by households”. Combined these sectors had 59% of employees with low numeracy skills, 33% with basic numeracy skills and 8% with advanced numeracy skills.

Across the UK, different levels of numeracy can be seen

Levels of numeracy also vary significantly across different regions of England and the nations of the UK. The South East and East of England perform the strongest, with 51% of adults having low numeracy skills. The North East, West Midlands and Yorkshire and the Humber have the largest proportions of adults with low numeracy skills, with 62%-65% of adults having low numeracy skills.

Figure 3: Proportion of adults with low numeracy skills in nations and regions of the UK



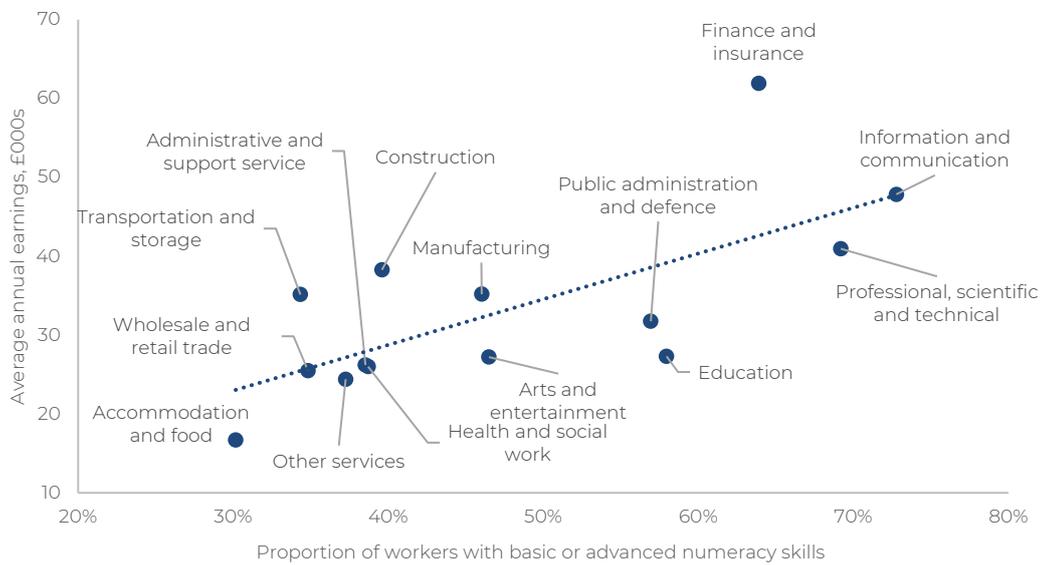
Source: PBE analysis of OECD PIAAC data

Numeracy impacts household incomes

The accumulation of skills, often described as the development of human capital, has long been viewed by economists as a critical factor involved in driving the earnings of individuals as well as the structure and the long-term performance of a modern economy.⁹

At a simple level, those sectors with a greater proportion of employees with the highest levels of numeracy also tend to have the highest average earnings: the three sectors with the highest proportion of workers with basic or advanced numeracy skills have an average wage in excess of £47,000 while the bottom three have an average wage of under £25,000.¹⁰

Figure 4: Numeracy skills and average earnings in 2020 by sector



Source: PBE analysis of OECD PIAAC data and ONS

Numeracy skills are just one of a wide range of different factors that will drive these sectoral differences in wages, however, the specific link between numeracy skills and wages has been established by a number of more rigorous studies at the individual level. For example, one analysis of the OECD PIAAC data estimates the impact of numeracy skills on wages by controlling for a range of other factors that affect earnings, including levels of education, years of work experience, gender, age, parents' education and levels of other basic skills such as literacy and digital skills. The study

⁹ See for example, Hanushek A (2013): *Economic growth in developing countries: the role of human capital*, Economics of Education Review, 37, pp. 204-212.

¹⁰ Mean wage for each sector weighted by the number of people employed in that sector in 2020.

provides good evidence that lower numeracy skills are significantly associated with lower earnings.¹¹

If we apply the relationship between numeracy skills and earnings estimated in the literature to the UK context, it suggests that the average worker in the UK with low numeracy skills are currently earning around 6.5% less than they would if they had a basic level of numeracy skills – the equivalent of nearly £1,600 less per year.¹²

It is conceptually challenging to assess the aggregate impact of these losses in earnings across all of the workers with low numeracy skills in the UK – if numeracy skills improved for a large number of workers then it is likely that the potential wage premium due to improved numeracy skills would be smaller than those currently estimated in the literature.¹³

However, as an illustrative scenario of the maximum potential total scale of this income differential, a £1,600 increase in wages for the estimated 16 million people in work in the UK with low numeracy skills is the equivalent of a total differential in income of £25 billion per year in 2020 prices.¹⁴

Levelling up numeracy to level up the regions

With numeracy skills not evenly distributed across the UK, developing skills in those regions of the UK with the lowest levels of numeracy could support a structural change to the economy that could ultimately boost the incomes of individuals and households in line with the government's objectives to level up.

For example, average income in the three regions of the UK with the lowest levels of numeracy – the North East, West Midlands and Yorkshire and the Humber – is around 12% below the average for the UK, the equivalent of £3,400 per worker. Numeracy skills will not close this gap on their own and there will always be some need for roles in sectors that do not require high numeracy skills. However, the relationship between numeracy skills and earnings estimated in the literature suggest that the average income differential for those in these regions with low numeracy skills could be as much as £1,700. With 3.7 million workers in these regions with low numeracy skills, these wage differentials could make a substantial difference. Figure 5 summarises the potential impact that low numeracy

¹¹ Hanushek E, Schwerdt G, Wiederhold S, Woessmann L (2015): *Returns to skills around the world: evidence from PIAAC*, European Economic Review, 73, pp103-130. These differences could be experienced through the impact of numeracy skills on both reduced earning potential within a sector and the initial choice of career path made by individuals.

¹² Full details of these calculations are provided in Annex B of this report.

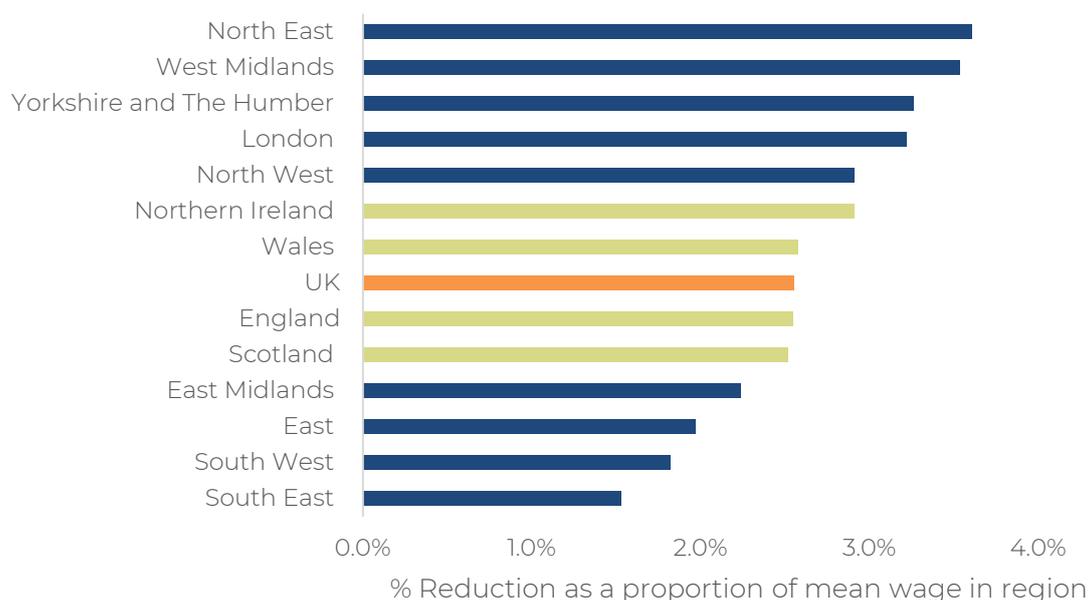
¹³ This issue is discussed in more detail in Annex B of the report.

¹⁴ Full details of these calculations are provided in Annex B of this report.

skills could be having on wages in each of the regions, expressed as a percentage of the average wage.

Turning the development of numeracy skills into meaningful changes for regions cannot happen overnight. It would require accompanying structural developments in the regional economies, with the creation of new jobs in high skill, high wage sectors that can take best advantage of these skills. However stronger numeracy skills could provide a basic building block that could support these valuable changes.

Figure 5: Estimated average wage differential due to low numeracy skills



Source: PBE analysis of OECD PIAAC and ONS data. Percentage impact on average wage is weighted by the proportion of workforce in region with low numeracy skills.

Job losses from Covid are likely to have fallen on sectors that employ a large proportion of individuals with low numeracy skills

Covid has deepened a range of structural inequalities faced by the UK, having had a disproportionate impact on the employment prospects of people from Black Asian and Minority Ethnic communities, young people and women.¹⁵ Given the uneven effect of the pandemic on certain sectors, Covid is also likely to have had also had a disproportionate impact on those with low numeracy skills. Between September 2019 and September 2020, there was a reduction of more than 950,000 jobs in the economy, but more than a third of this reduction came from just two sectors with a high

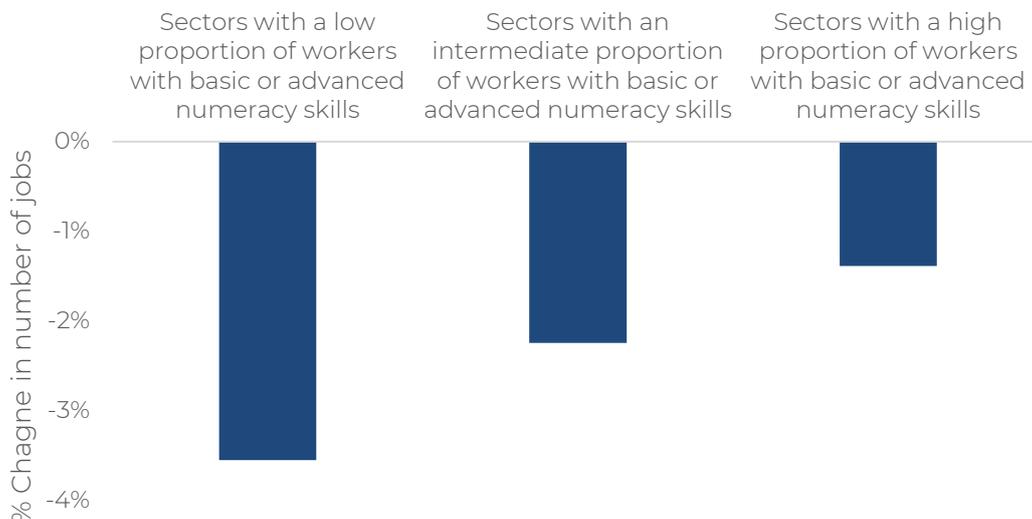
¹⁵ See, for example: Bracke P, Croxson K, Leary J, Wood J (2021): *Covid and the UK's BAME communities – an economic perspective*, Financial Conduct Authority and Resolution Foundation (2020): *Covid has created a U-shaped crisis as majority of young adults and pensioners stopped working*.

proportion of workers with low numeracy skills; the “administrative and support services”¹⁶ and “food and accommodation” sectors.

By dividing up the sectors of the economy based on the proportion of workers with basic or advanced numeracy skills, it is possible to see that: 713,000 jobs have been lost from sectors with a low proportion of workers with basic or advanced numeracy skills (3.6%); 184,000 jobs have been lost from sectors with an intermediate proportion of workers with basic or advanced numeracy skills (2.2%); while just 81,000 jobs have been lost from sectors with the highest proportion of workers with basic or advanced numeracy skills (1.4%).¹⁷

We estimate that around 59% of those who have lost their jobs so far in the crisis have low numeracy skills – the equivalent of around 560,000 people.¹⁸ This position is likely to worsen further as the furlough scheme comes to an end, as the proportion of staff furloughed is far higher in key sectors with a higher proportion of workers with low numeracy skills than the rest of the economy.¹⁹

Figure 6: Percentage change in jobs between September 2019 and September 2020



Source: PBE analysis and ONS

There have been significant differences in how the crisis has affected the economies of different regions of England and nations of the UK. In the North West, for example, the Covid crisis has resulted in a 3.3% reduction in

¹⁶ Which includes travel and tourism services.

¹⁷ This is based on whether sectors fall into the top third (>58%), middle third (44%-58%) or lower third (<44%) of the range of numeracy levels, as measured by the proportion of workers with basic or advanced numeracy skills. We have excluded those sectors with insufficient sample sizes in the OECD PIAAC study, as outlined above. Full details provided in Annex B.

¹⁸ Based on levels of numeracy in each sector in the OECD PIAAC study.

¹⁹ See HM Revenue & Customs (2020): *Coronavirus Job Retention Scheme Statistics: December 2020*

jobs compared to the national average of 2.7%. We estimate that 75,000 jobs likely to have been held by individuals with low numeracy skills have been lost in the region since September 2019. Similarly, in the West Midlands the regional economy has experienced a 5.5% reduction in the number of jobs, leading to around 104,000 jobs likely to have been held by individuals with low numeracy skills having been lost since September 2019.

Numeracy as part of a faster, fairer recovery that helps make the UK fit for the future

With the UK beginning to look towards a world beyond Covid, it is essential to ask where the employment opportunities are likely to arrive for the estimated 560,000 individuals with low numeracy skills who have lost their jobs.

The recovery is expected to take some time, with an extended period of heightened unemployment and slower jobs growth compared to recent years. The Office of Budget Responsibility (OBR) has forecast that unemployment is likely to increase further from the 1.3 million estimated at the end of 2020 – peaking at 2.2 million at the end of 2021 – and not returning to pre-crisis levels for several years to come²⁰. Yet a somewhat faster, fairer recovery may be possible if improvements in adult numeracy were supported.

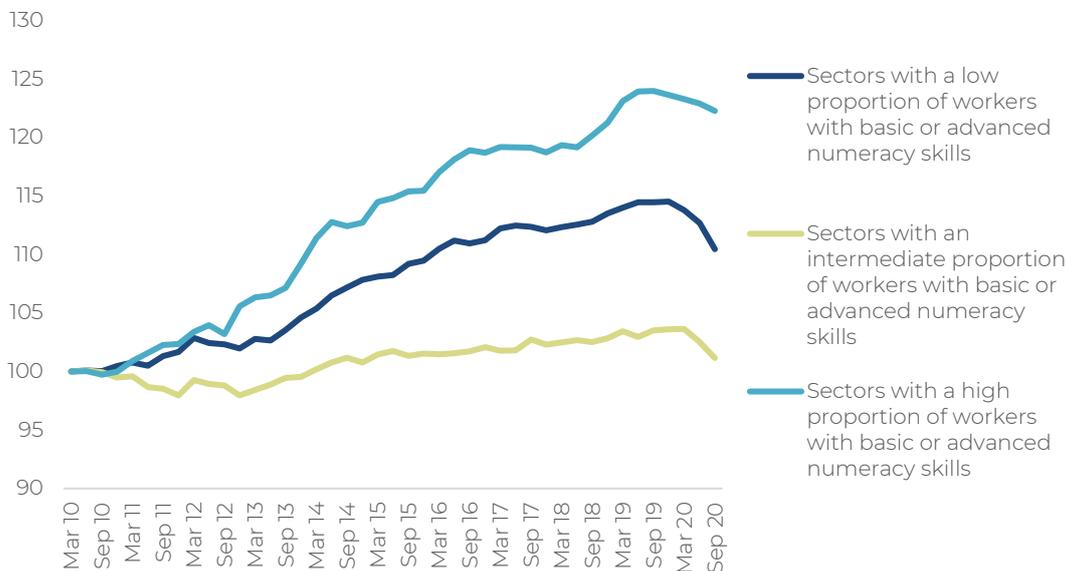
The recession in 1980 saw a significant structural change associated with de-industrialisation of parts of the UK economy. This resulted in a large, long-lasting employment shock that was felt very unevenly across different sectors. The 2008 financial crisis, on the other hand, resulted in a sharper, cyclical shock to the economy with much shorter-lived impacts and less of a dramatic structural shift.

It is too early to say whether the current crisis will result in fundamental, long-term changes to the structure of the economy or whether those sectors that have been hit the hardest will bounce back the strongest. However, if we look at the recent history, it can provide an indication of how the long-term structure of the economy is changing.

Sectors with a high proportion of workers with basic or advanced numeracy skills have experienced by far the most rapid growth in employment over the last decade – with the number of jobs increasing by 24% over the ten years up to the start of the current crisis. They have also been least affected by the current crisis.

²⁰ OBR (2021): *Economic and fiscal outlook – March 2021*

Figure 7: Index of jobs by numeracy level of sector (2010=100)²¹



Source: PBE analysis of OECD PIAAC data and ONS. Jobs are defined by ONS as headcount.

It seems plausible that the sectors with a high proportion of workers with basic or advanced numeracy skills will continue their strong employment growth. Near term survey evidence from KPMG and the Recruitment & Employment Confederation suggests that recruitment consultancies were seeing the biggest increases in demands for permanent staff in sectors with a high proportion of workers with basic or advanced numeracy skills such as “IT & Computing”, “Accounting/Financial” and “Engineering”.²²

However, the fate of sectors with a low proportion of workers with basic or advanced numeracy skills is much less clear, and a rebound much less visible. Low numeracy skill sectors have experienced the second fastest rate of increase – growing by 15% over the last ten years – while jobs in sectors with an intermediate proportion of workers with basic or advanced numeracy skills have grown by just 4%.²³ The sectors with a low proportion of workers with basic or high numeracy skills that have experienced the most significant growth over the ten years prior to the coronavirus crisis include the “accommodation and food” and “administrative and support services” sectors. These are the two sectors that have been hardest hit by the current crisis and, while we would expect some degree of bounce-back

²¹ Sectors are classified based on the levels of numeracy observed in 2011-2012 in the OECD PIAAC study.

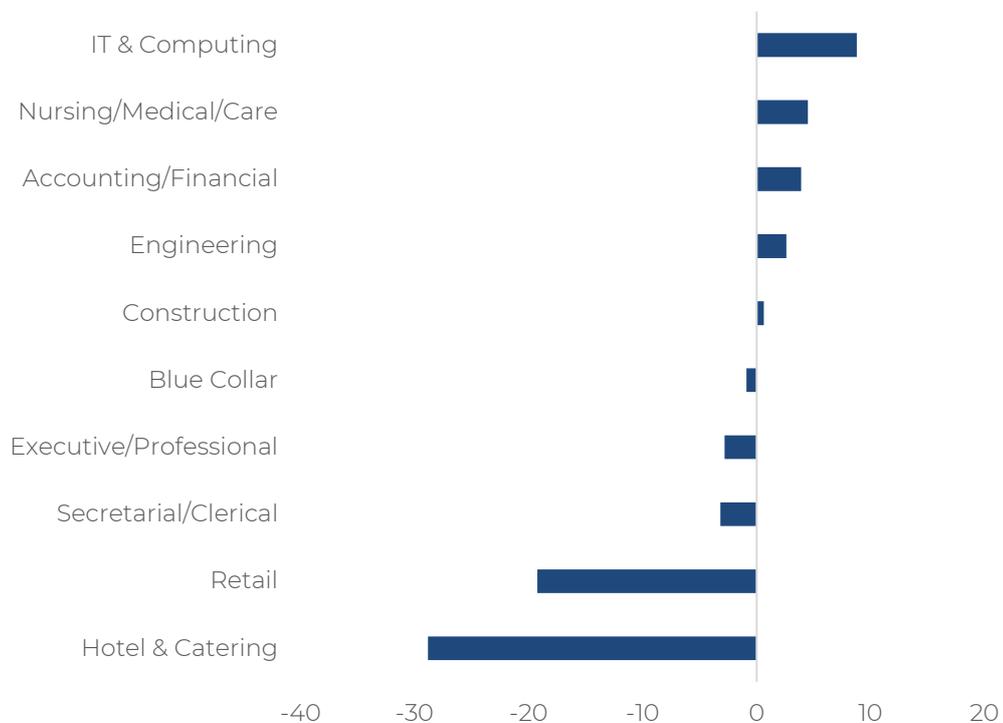
²² KPMG & Recruitment and Employment Confederation (2021): *UK report on jobs*, based on change in demand for roles between December 2020 and January 2021.

²³ This pattern reflects the “hollowing out” of the job market – with the tendency for jobs at the top and bottom of the income distribution tending to experience a bigger increase in their share of employment compared to the middle. For further discussion See McIntosh (2013): *Hollowing out and the future of the labour market*, BIS Research Paper Number 134.

as restrictions are lifted, it is unclear whether the growth in jobs for these sectors will continue at the same rate we have seen over the last decade. Meanwhile, KPMG and the Recruitment & Employment Confederation's surveys show that the biggest reductions in the demand for roles were, unsurprisingly, in the "Hotel & Catering" and "Retail" sectors that employ a higher proportion of individuals with low numeracy skills.

There is one exception to this broad pattern that is worth noting: there has been a recent expansion in the number of roles in nursing, medical and care sectors which is likely to overlap with ONS's "Health and Social Care" sector, that has traditionally included a large number of workers with low numeracy skills.

Figure 8: Index of demand for permanent vacancies (>0 means an increase in demand relative to previous month)



Source: KPMG & Recruitment and Employment Confederation (2021)

Overall, it seems like that while there will be some opportunities to absorb additional low numeracy skill roles in the "transport and storage" and "health and social care" sectors as the economy recovers, we can be far more confident in the potential for job opportunities in sectors with a high proportion of workers with basic or advanced numeracy skills such as the "professional scientific and technical" and "information and communication" sectors.

A transition towards a higher wage, higher numeracy economy

For those individuals with low numeracy skills who have recently lost their jobs developing basic numeracy skills could support a valuable transition to higher pay, higher growth sectors. Making this change does not require setting unrealistic expectations for skill improvements. Our evidence suggests that 42% of the workforce in sectors with a high proportion of workers with basic or advanced numeracy skills have a basic, rather than advanced, level of numeracy skills – suggesting that manageable improvements in numeracy skills could support this transition.

However, there is a virtuous circle between the skills in an economy's workforce and its sectoral structure.²⁴ While sectors with a high proportion of workers with basic or advanced numeracy skills have experienced the most rapid growth in employment over the last decade, there is also the opportunity to further stimulate this growth by supporting the development of essential skills across the wider workforce.

A broader focus on the development of basic numeracy skills across the workforce could provide strategic support for accelerating a structural shift towards high skill, high wage sectors, supporting policymakers' ambitions to lead the world in the industries of the future.²⁵

²⁴ See, for example, Blundell R, Green D, Jin W (2016): *The UK wage premium puzzle: how did a large increase in university graduates leave the education premium unchanged?*

²⁵ HM Government (2018): *Industrial Strategy: building a Britain fit for the future.*

Conclusion

With the UK lagging behind international peers, it is clear that there is scope for further improvement in adult numeracy skills. The Covid crisis and its impacts on our economy bring urgency to this debate: many low-numeracy adults have been left without a job and are lacking the skills needed to access employment in more stable industries.

The recovery from the crisis also brings opportunity. The UK can choose to actively pivot its economy towards high skill, high wage sectors. Such a significant structural shift can help to support the levelling up agenda, boosting wage growth for those regions and individuals that need it most. Structural changes take time and need to be built on the solid foundations of a skilled and adaptable workforce – of which numeracy skills will be an important component.

All parts of society have a role to play in improving adult numeracy skills.

- **Government** – working with learning providers, local businesses and charities such as National Numeracy – should consider how number confidence and basic skills development can be integrated into the support provided to out-of-work individuals to help them access the jobs and opportunities that will be available during the economic recovery. There should be a particular focus on low wage areas as a potential lever to support the levelling-up agenda.
- **Business** can help to build the skills necessary for a resilient and adaptable workforce, both for their own staff and the communities they operate in. This will help them to remain competitive within a changing economy and support social mobility more broadly.
- **Individuals** with low numeracy should consider accessing opportunities to develop their number confidence and numeracy skills to thrive within an ever-changing global economy.

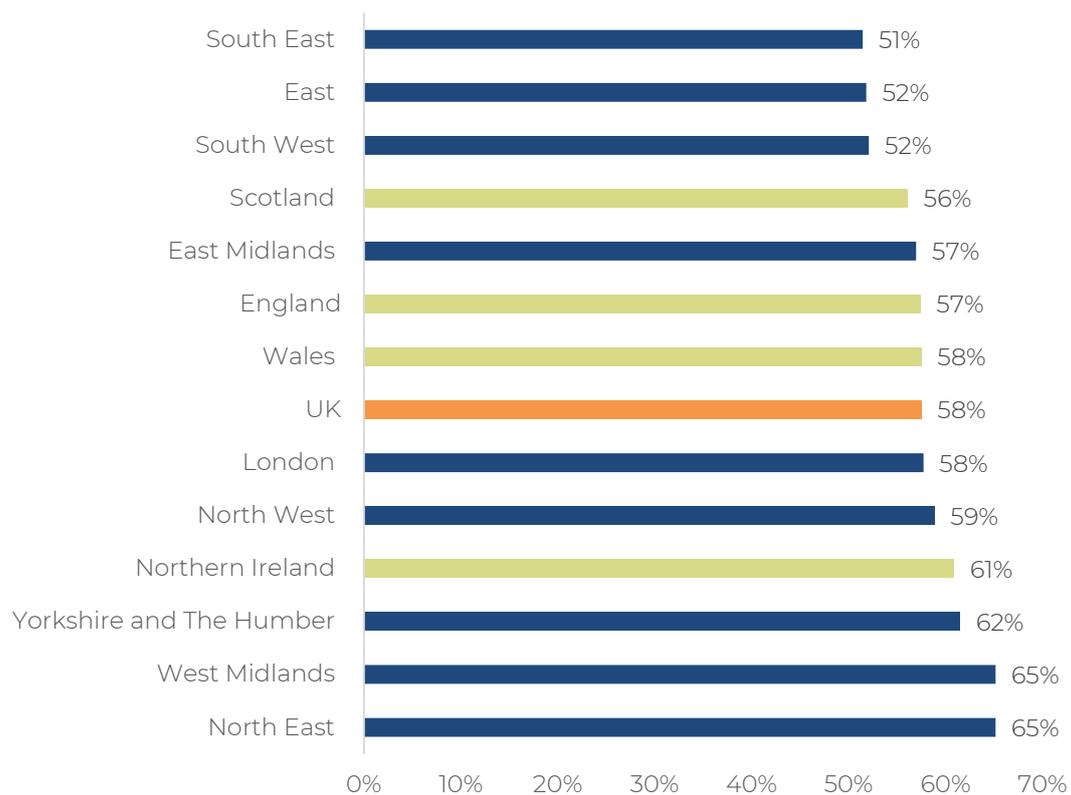
If all parts of society can get behind a drive to improve adult numeracy in the UK, the benefits would be manifold. For individuals, evidence suggests it could support them to find employment, earn higher wages and make better decisions in their daily lives.²⁶ But it could also support the government's efforts both to level up the whole of the country by increasing wages in the regions, and support further development in higher skill, higher growth sectors.

²⁶ Hanushek et al. (2015) also explores the link between numeracy skills and the likelihood of being in employment. For health and financial outcomes see: Sabates R, Parsons S (2012): *The contribution of basic skills to health related outcomes during adulthood: evidence from the BCS70*, BIS Research Paper 91 and National Numeracy (2018): *Improving numeracy to increase financial capability*, National Numeracy

Annex A: Numeracy in the UK nations and regions of England

We provide further details of numeracy levels and its impacts on the economies of the nations of the UK and regions of England below.

Figure A1: Proportion of adults with low numeracy skills in nations and regions of the UK



Source: PBE analysis of OECD PIAAC data and ONS

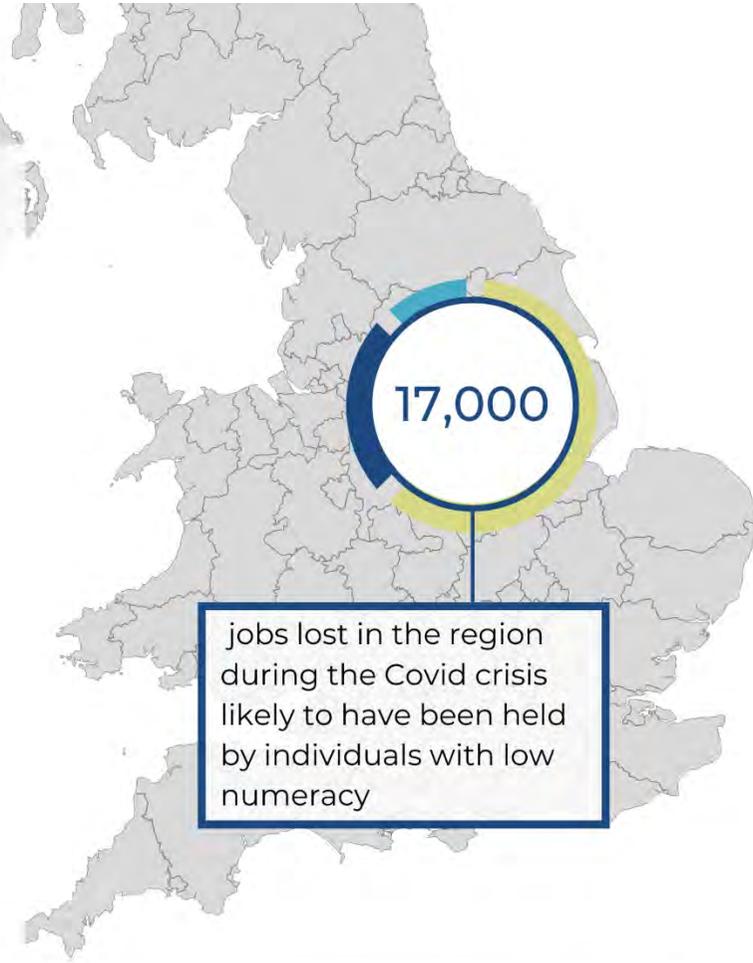
The East Midlands

The region has an estimated 1.7 million adults with low numeracy skills. At 57% of all adults, this is a slightly lower proportion than the 58% of adults seen across the whole of the UK.

Employment in sectors with a high proportion of workers with basic or advanced numeracy skills was disproportionately low in the region in 2020 compared to the national average, with a noticeably higher proportion of jobs in Manufacturing and Wholesale and Retail sectors compared to the UK as a whole.

In 2020, the average wage in the region was £28,200 – this is around 11% lower than the UK average. Low numeracy skills are associated with a £1,200 differential in wages within the region – the equivalent of 2.2% of the average wage.

The regional economy has performed better than many during the Covid pandemic, with a 1.1% reduction in the number of jobs compared to the national average of 2.7%. We estimate that 16,000 (62%) of the 26,000 jobs lost in the region between September 2019 and September 2020 were for individuals with low numeracy skills.



57% of adults in the region have low numeracy skills.

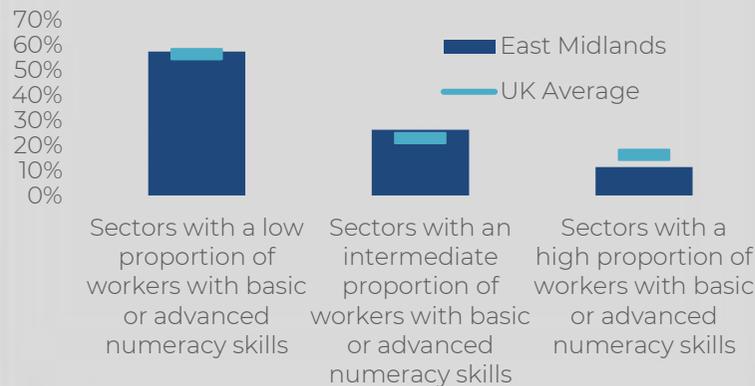


meaning that there are

1,700,000

adults in the East Midlands with low numeracy skills

Proportion of employment by numeracy of sectors in 2020



Low numeracy skills means the average wage in the region is



2.2% less

which means losses of



£1,200

to workers with low numeracy

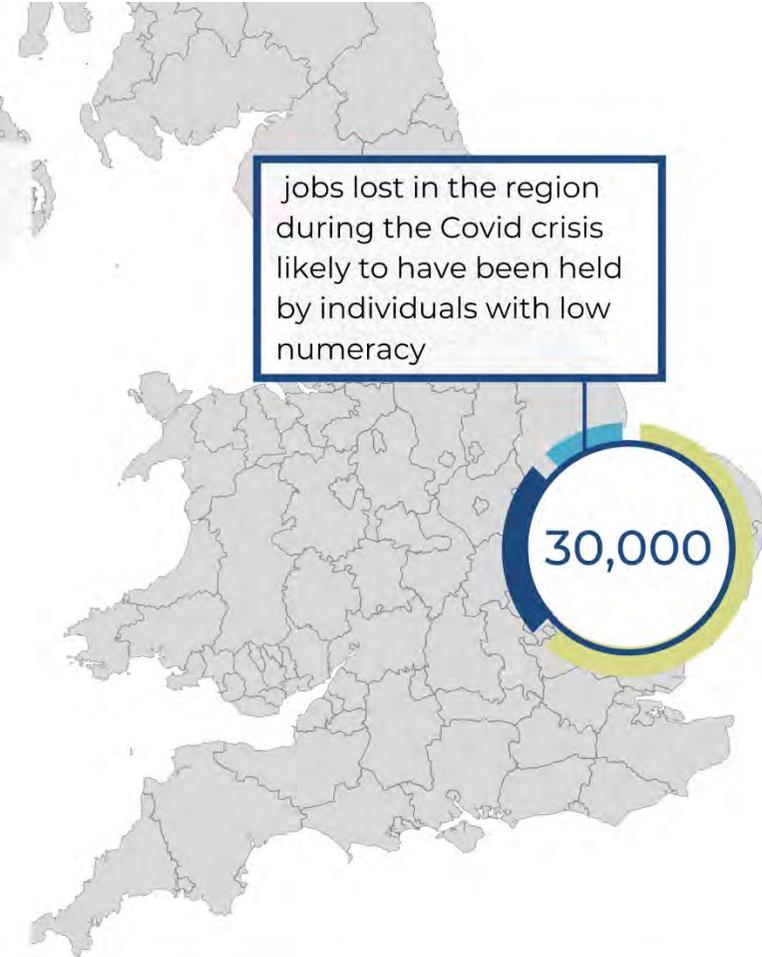
The East of England

The region has an estimated 1.9 million adults with low numeracy skills, the equivalent of 52% of all adults. This makes the East of England a relatively strong performer for numeracy skills compared to the equivalent figure of 58% for the whole of the UK.

Employment in sectors with a high proportion of workers with basic or advanced numeracy skills in the region is broadly in line with the national average, supported by a relatively high proportion of workers employed in the Professional Scientific and Technical Activities sector. A relatively high proportion of jobs are in the low-numeracy construction sector.

In 2020, the average wage in the region was £29,500 – this is around 7% lower than the UK average. Low numeracy skills are associated with a £1,200 differential in wages within the region – the equivalent of 2.0% of the average wage.

The regional economy has performed better than many during the Covid pandemic, with a 1.7% reduction in the number of jobs compared to the national average of 2.7%. However, an estimated 29,000 jobs likely to have been held by individuals with low numeracy skills have been lost since September 2019.



52% of adults in the region have low numeracy skills.

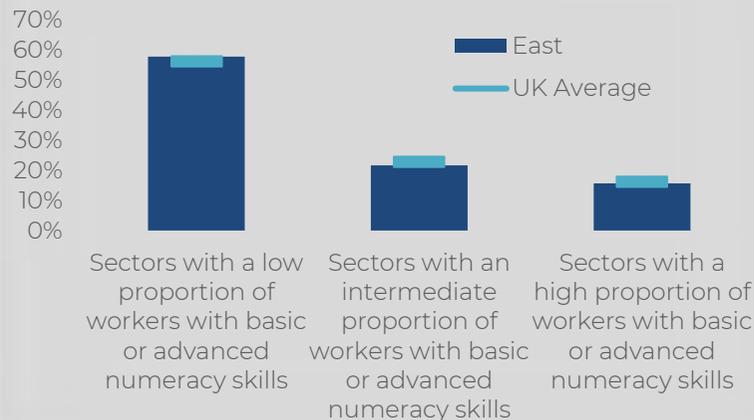


meaning that there are

1,900,000

adults in the East of England with low numeracy skills

Proportion of employment by numeracy of sectors in 2020



Low numeracy skills means the average wage in the region is



2.0% less

which means losses of

£1,200

to workers with low numeracy



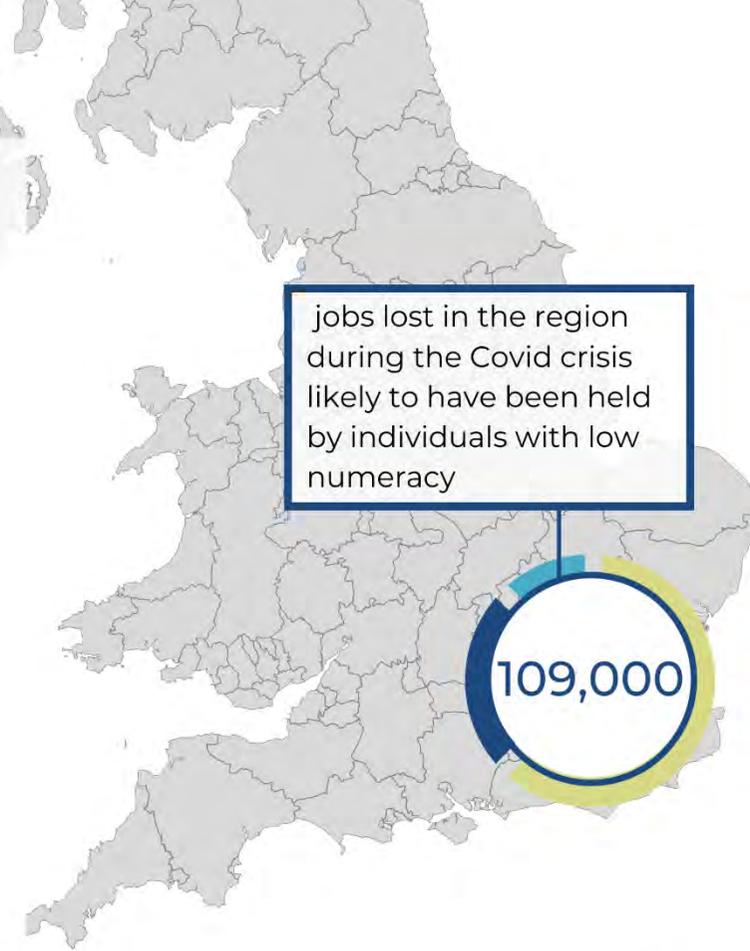
London

The region has 3.5 million adults with low numeracy skills, the equivalent of 58% of all adults – broadly in line with the national average.

Employment in sectors with a high proportion of workers with basic or advanced numeracy skills is significantly higher compared to the national average, with the highest proportions of workers employed in all three of the high skill sectors: Information and Communication; Finance and Insurance, and Professional Scientific and Technical.

In 2020, the average wage in the region was £47,300 – this is around 50% above the national average, however, there is considerable disparity within the region. Low numeracy skills are associated with a £2,900 differential in wages within the region – the equivalent of 3.2% of the average wage.

The regional economy has been hit harder than average during the Covid pandemic, with a 3.2% reduction in the number of jobs compared to the national average of 2.7%. An estimated 109,000 jobs likely to have been held by individuals with low numeracy skills have been lost in London since September 2019.



58% of adults in the region have low numeracy skills.

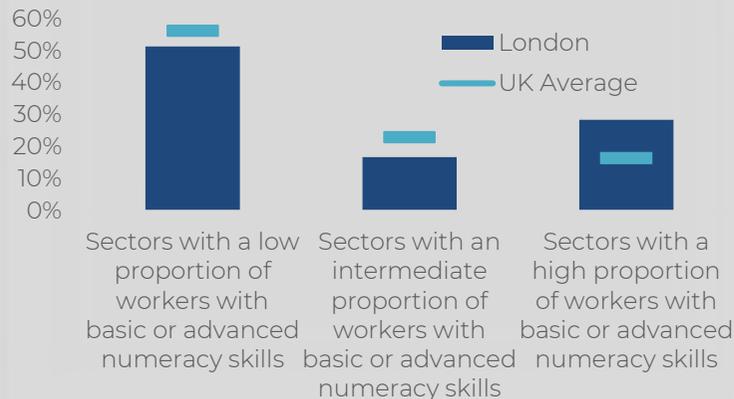


meaning that there are

3,500,000

adults in London with low numeracy skills

Proportion of employment by numeracy of sectors in 2020



Low numeracy skills means the average wage in the region is



3.2% less

which means losses of



£2,900

to workers with low numeracy

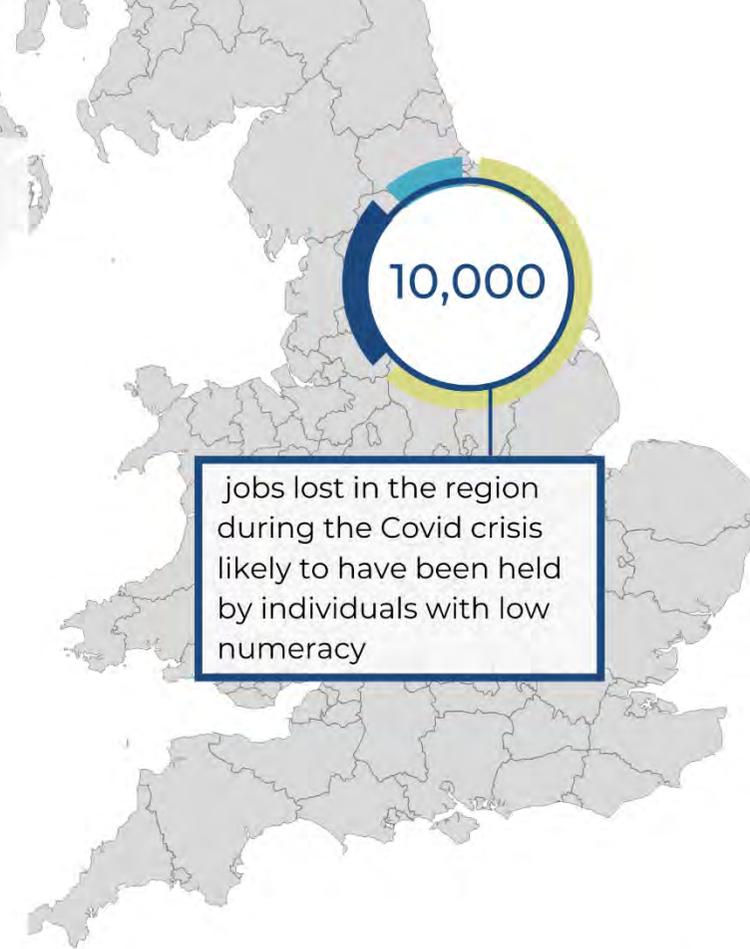
The North East

The region has an estimated 1.1 million adults with low numeracy skills. At around 65% of the adult population of the region, it makes the North East one of the worst performing regions in the UK and noticeably behind the UK average of 58%.

Employment in sectors with a high proportion of workers with basic or advanced numeracy skills is low compared to the national average, with a relatively high proportion of regional jobs in the Human Health and Social Care and Food and Accommodation sectors as well as Public Administration.

In 2020, the average wage in the region was £27,000 – this is around 15% lower than the UK average. Low numeracy skills are associated with a £1,600 differential in wages within the region – the equivalent of 3.6% of the average wage.

The regional economy has fared relatively well during the Covid crisis with a 1.9% reduction in the number of jobs, compared to the national average of 2.7%. However, an estimated 10,000 jobs likely to have been held by individuals with low numeracy skills have been lost since September 2019.



65% of adults in the region have low numeracy skills.

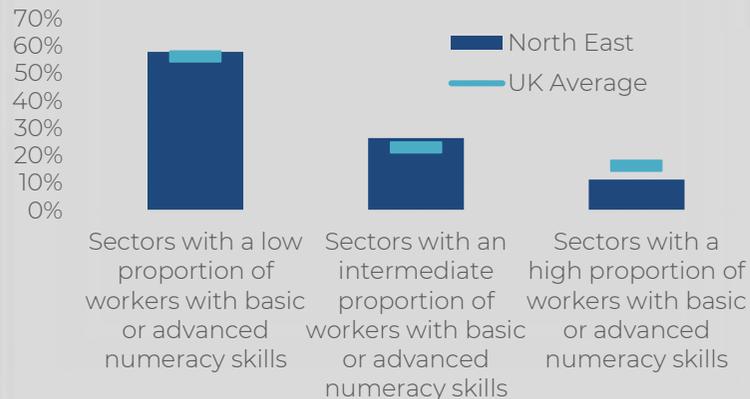


meaning that there are

1,100,000

adults in the North East with low numeracy skills

Proportion of employment by numeracy of sectors in 2020



Low numeracy skills means the average wage in the region is



3.6% less

which means losses of



£1,600

to workers with low numeracy

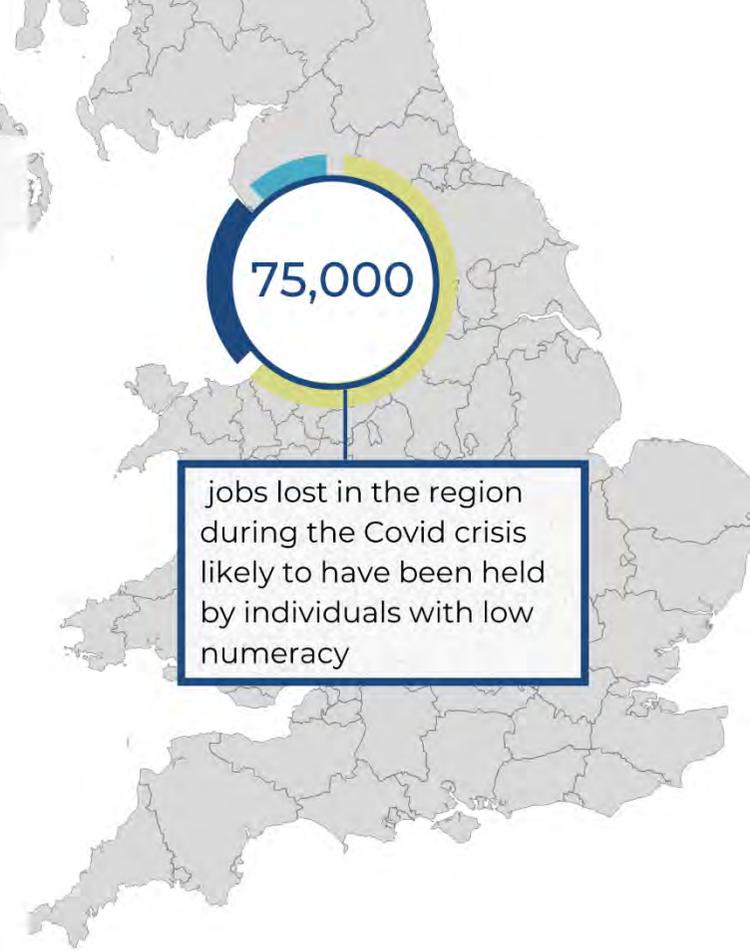
The North West

The region has an estimated 2.6 million working age adults with low numeracy skills. This is the equivalent of 59% of the adult population, leaving the North West slightly behind the UK average of 58%.

Employment in sectors with a high proportion of basic or advanced numeracy skills is slightly lower than the national average, with a relatively high proportion of regional jobs in the Wholesale and Retail, Transport and Storage and Human Health and Social Work sectors.

In 2020, the average wage in the region was £28,700 – this is around 9% lower than the UK average. Low numeracy skills are associated with a £1,500 differential in wages within the region – the equivalent of 2.9% of the average wage.

The region has felt a worse than average impact from the Covid crisis, with a 3.3% reduction in the number of jobs, compared to the national average of 2.7%. An estimated 75,000 jobs likely to have been held by individuals with low numeracy skills have been lost since September 2019.



59% of adults in the region have low numeracy skills.

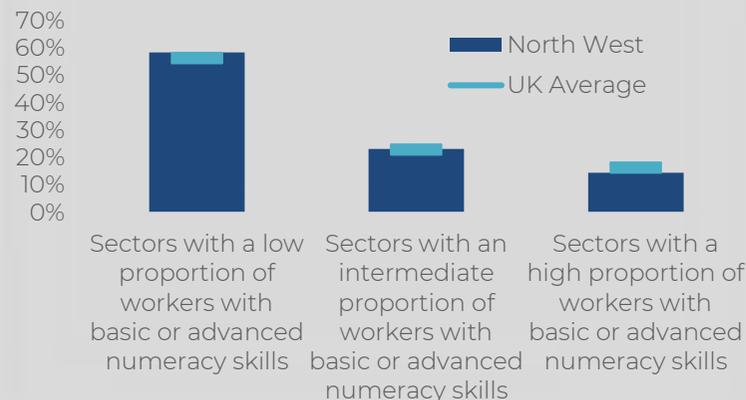


meaning that there are

2,600,000

adults in the North West with low numeracy skills

Proportion of employment by numeracy of sectors in 2020



Low numeracy skills means the average wage in the region is



2.9% less

which means losses of

£1,500

to workers with low numeracy

Northern Ireland

Northern Ireland has an estimated 700,000 working age adults with low numeracy skills. This is the equivalent of 61% of the adult population, leaving it slightly behind the UK average of 58%.

The proportion of employment in sectors with a high proportion of workers with basic or advanced numeracy skills is the lowest of any nation in the UK, with a relatively high proportion of regional jobs in the Wholesale and Retail, Public Administration and Human Health and Social Work sectors.

In 2020, the average wage in Northern Ireland was £27,000 – this is around 14% lower than the UK average. Low numeracy skills are associated with a £1,500 differential in wages within Northern Ireland – the equivalent of 2.9% of the average wage.

Northern Ireland has experienced a slightly smaller than average economic impact from the Covid crisis, with a 2.4% reduction in the number of jobs, compared to the national average of 2.7%. However, an estimated 14,000 jobs likely to have been held by individuals with low numeracy skills have been lost since September 2019.



61% of adults in Northern Ireland have low numeracy skills.

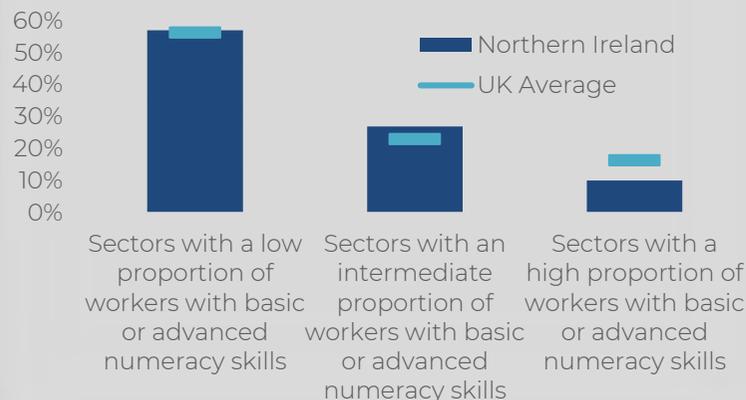


meaning that there are

700,000

adults in the region with low numeracy skills

Proportion of employment by numeracy of sectors in 2020



Low numeracy skills means the average wage in the region is



2.9% less

which means losses of

£1,500

to workers with low numeracy

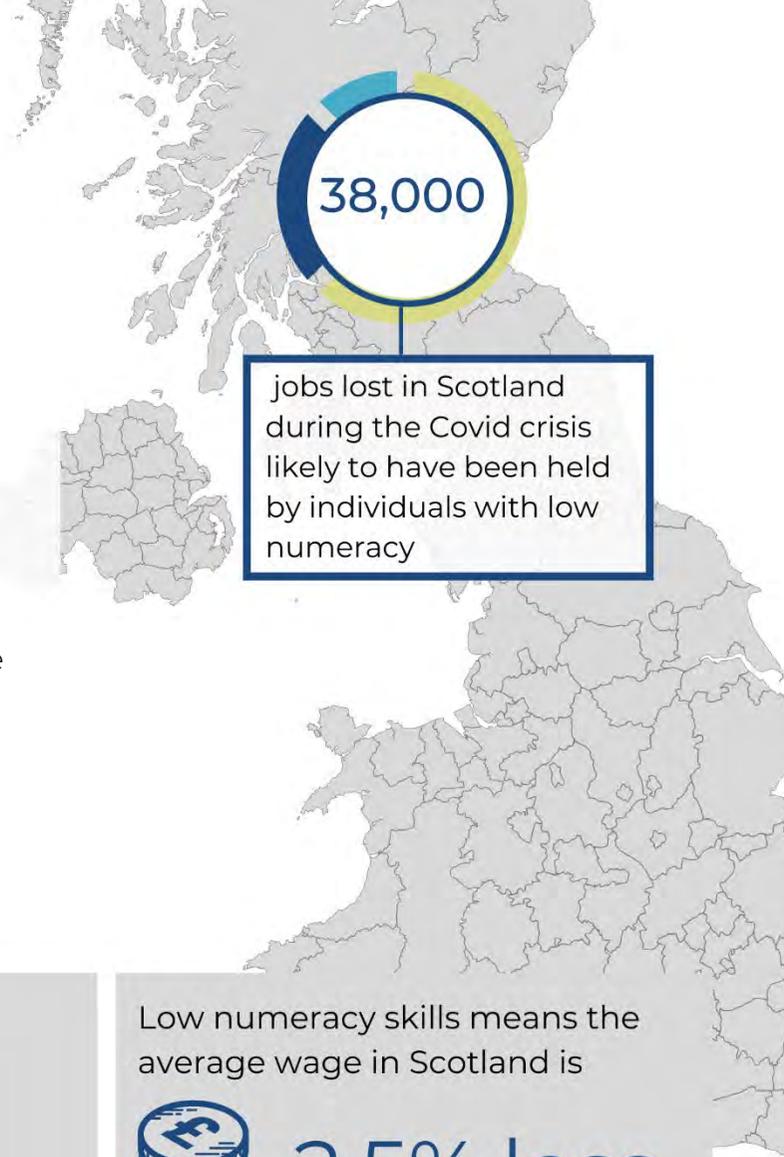
Scotland

An equivalent measure of numeracy skills in Scotland is not available as they did not participate in the OECD's PIAAC study. However, evidence from National Numeracy surveys suggests that they may perform slightly better than average for the UK – we estimate that around 56% of adults have low numeracy skills compared to a national average of 58%. This is the equivalent of 1.9 million working age adults.

Scotland has a relatively high proportion of jobs in sectors with a low proportion of workers with basic or advanced numeracy skills such as the Accommodation and Food, Public Administration, Health and Social Work and Arts and Entertainment sectors.

In 2020, the average wage in Scotland was £29,700 – this is around 6% lower than the UK average. Low numeracy skills are associated with a £1,500 differential in wages within Scotland – the equivalent of 2.5% of the average wage.

Scotland has experienced a smaller than average impact from the Covid crisis, with a 1.9% reduction in the number of jobs, compared to the national average of 2.7%.



56% of adults in Scotland have low numeracy skills.

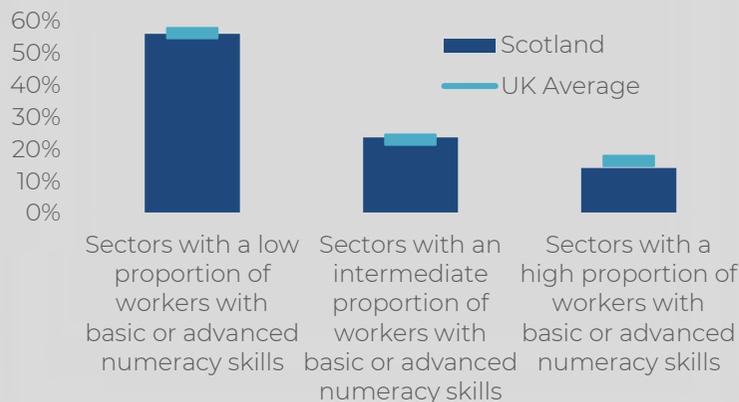


meaning that there are

1,900,000

adults in Scotland with low numeracy skills

Proportion of employment by numeracy of sectors in 2020



Low numeracy skills means the average wage in Scotland is



2.5% less

which means losses of



£1,500

to workers with low numeracy

The South East

An estimated 51% of the working age population in the South East have low numeracy skills, making it the strongest performing region in England. However, given the large population of this area, this is still the equivalent of 2.9 million adults with low numeracy skills.

Employment in sectors with a high proportion of workers with basic or advanced numeracy skills is slightly above the national average, supported by a relatively high proportion of workers employed in the Information and Communication, Professional Scientific and Technical Activities and Education sectors.

In 2020, the average wage in the region was £32,200 – this is above the national average. However, low numeracy skills are still associated with a £1,000 differential in wages within the region – the equivalent of 1.5% of the average wage.

The regional economy has performed worse than average during the Covid pandemic with a 3.2% reduction in the number of jobs compared to the national average of 2.7%. As a result, around 100,000 jobs likely to have been held by individuals with low numeracy skills have been lost since September 2019.



51% of adults in the region have low numeracy skills.

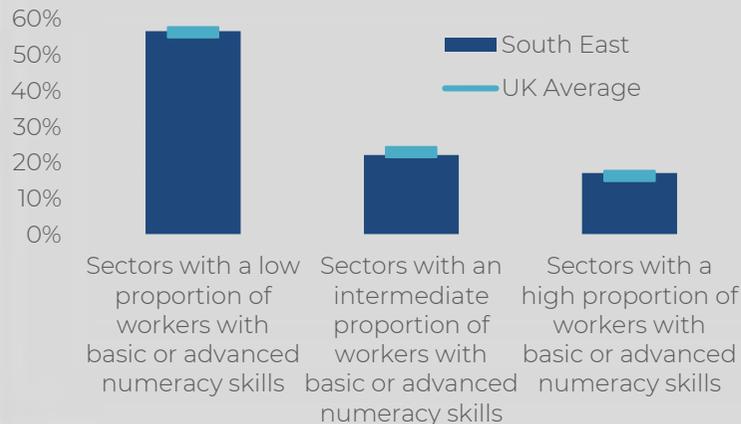


meaning that there are

2,900,000

adults in the South East with low numeracy skills

Proportion of employment by numeracy of sectors in 2020



Low numeracy skills means the average wage in the region is



1.5% less

which means losses of



£1,000

to workers with low numeracy

The South West

The South West performs relatively well in terms of numeracy skills – it has 1.7 million working age adults with low numeracy skills, the equivalent of 52% of adults (compared to a national average of around 58%).

Employment in sectors with a high proportion of workers with basic or advanced numeracy skills is slightly above the national average, supported by a relatively high proportion of workers employed in the Information and Communication, Professional Scientific and Education sectors.

However, average wages in 2020 were £27,200 - 14% below the national average. Low numeracy skills are associated with a £1,000 differential in wages within the region – the equivalent of 1.8% of the average wage.

The regional economy has performed worse than average during the Covid pandemic, with a 3.4% reduction in the number of jobs compared to the national average of 2.7%. As a result, around 59,000 jobs likely to have been held by individuals with low numeracy skills have been lost since September 2019.

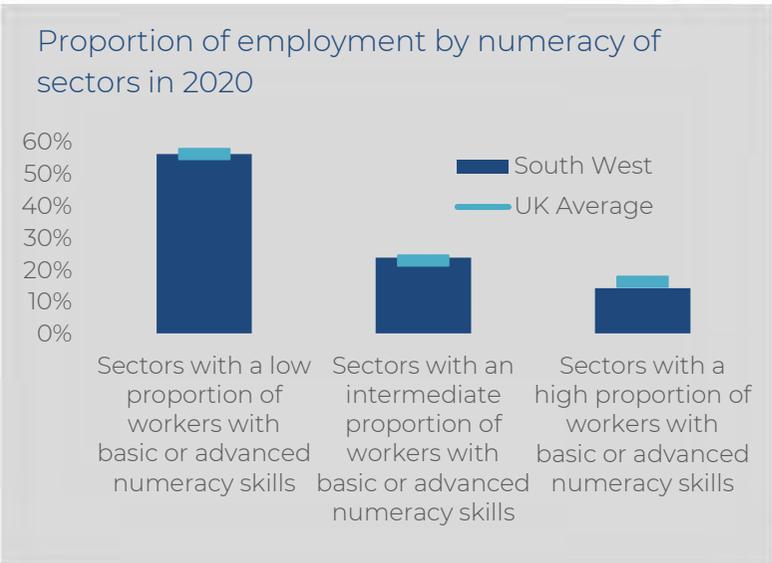


52% of adults in the region have low numeracy skills.

meaning that there are

1,700,000

adults in the South West with low numeracy skills



Low numeracy skills means the average wage in the region is

1.8% less

which means losses of

£1,000

to workers with low numeracy

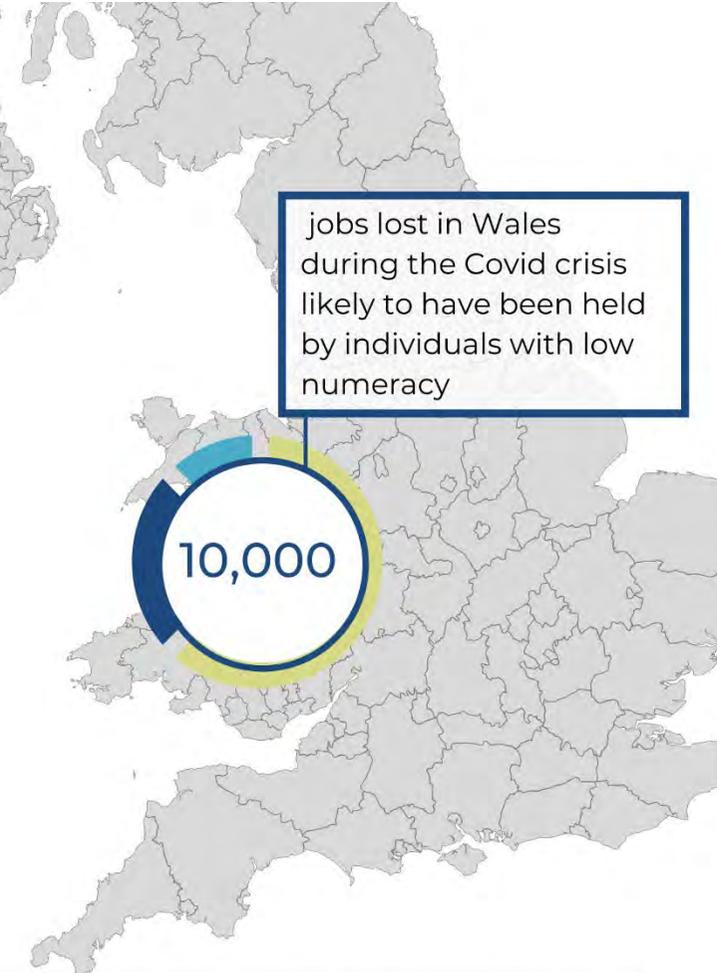
Wales

Wales did not participate in the OECD PIAAC study. The National Survey of Adult Skills in Wales 2010 suggests that around 50% of the population has low numeracy skills, however, differences in the approach to measurement mean that we believe the equivalent figure to the OECD PIAAC study is likely to be close to the UK average of 58%, the equivalent of 1.1 million working age adults.

However, the proportion of employment in sectors with a high proportion of workers with basic or advanced numeracy skills is the lowest in the UK.

In 2020, the average wage in Wales was £26,200 – this is around 17% lower than the UK average. Low numeracy skills are associated with a £1,300 differential in wages within the region – the equivalent of 2.6% of the average wage.

The Welsh economy has performed much better than average during the Covid pandemic with a 1.4% reduction in the number of jobs compared to the national average of 2.7%. Around 10,000 jobs likely to have been held by individuals with low numeracy skills have been lost since September 2019.



58% of adults in Wales have low numeracy skills.

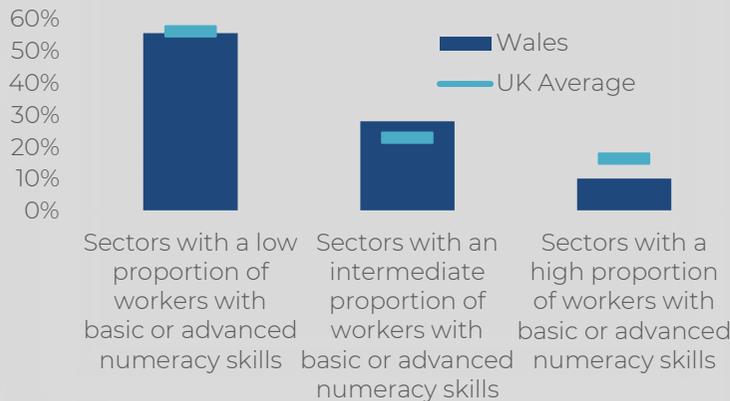


meaning that there are

1,100,000

adults in Wales with low numeracy skills

Proportion of employment by numeracy of sectors in 2020



Low numeracy skills means the average wage in Wales is



2.6% less

which means losses of



£1,300

to workers with low numeracy

The West Midlands

There are an estimated 2.3 million working age adults with low numeracy skills in the West Midlands. This is 65% of adults – well above the average for the UK (58%) making the West Midlands one of the worst performing regions for numeracy skills in the country.

Employment in sectors with a high proportion of workers with basic or advanced numeracy skills was disproportionately low in the region prior to the crisis compared to the national average, with a noticeably higher proportion of jobs in Manufacturing and Transport & Storage compared to the UK as a whole.

Average wages in the region for 2020 were £29,300, around 7% below the national average. Low numeracy skills are associated with a £1,700 differential in wages within the region – the equivalent of 3.5% of the average wage.

The regional economy has been particularly hard-hit by the Covid pandemic, with a 5.5% reduction in the number of jobs compared to the national average of 2.7%. As a result, around 104,000 jobs likely to have been held by individuals with low numeracy skills have been lost since September 2019.



65% of adults in the region have low numeracy skills.

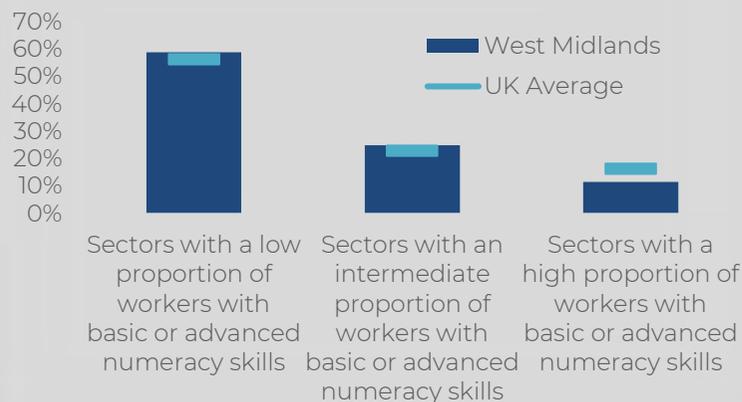


meaning that there are

2,300,000

adults in the West Midlands with low numeracy skills

Proportion of employment by numeracy of sectors in 2020



Low numeracy skills means the average wage in the region is



3.5% less

which means losses of



£1,700

to workers with low numeracy

Yorkshire and the Humber

There are an estimated 2.1 million working age adults with low numeracy skills in the region. This is 62% of adults – well above the average for the UK (58%), making the region one of the worst performing regions for numeracy skills in England.

Employment is relatively high in sectors with a low proportion of workers with basic or advanced numeracy skills including the Manufacturing, Human Health and Social Work, and Education sectors.

Average wages in the region for 2020 were £27,500, around 13% below the national average. Low numeracy skills are associated with a £1,600 differential in wages within the region – the equivalent of 3.3% of the average wage.

The regional economy has performed significantly better than average during the Covid pandemic, with a negligible change in the number of jobs compared to the national average of a 2.7% decline. As such, we estimate that there has been no significant change in the number of jobs likely to have been held by individuals with low numeracy skills in the region during the crisis.



62% of adults in the region have low numeracy skills.

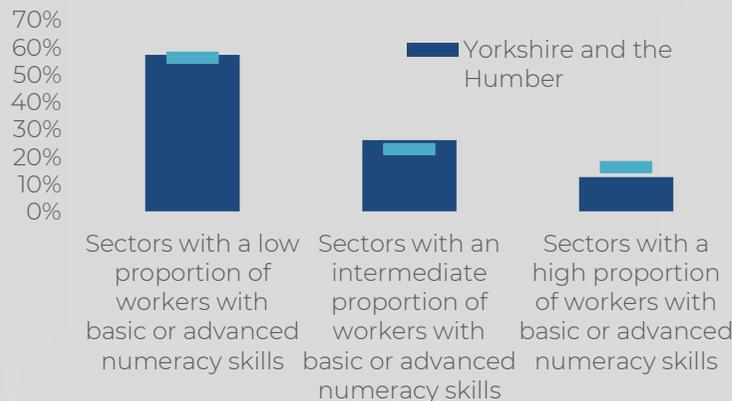


meaning that there are

2,100,000

adults in Yorkshire and the Humber with low numeracy skills

Proportion of employment by numeracy of sectors in 2020



Low numeracy skills means the average wage in the region is



3.3% less

which means losses of



£1,600

to workers with low numeracy

Annex B: Technical Annex

This annex provides more detailed information about the analysis used in this report. The analysis is structured around five key questions:

- How does the proportion of working age adults with low numeracy skills vary by sector?
- How many jobs lost during the Covid crisis are likely to have been held by individuals with low numeracy skills?
- How does the proportion of working age adults with low numeracy skills vary by region?
- How many jobs likely to have been held by individuals with low numeracy skills have been lost in each region during the Covid crisis?
- What wage differentials is low numeracy likely to impose on workers in the UK?

We outline the approach taken for each of these steps, providing estimates on an unrounded basis for the purposes of transparency.

Data on numeracy skills

The Survey of Adult Skills is part of the OECD PIAAC programme of assessment and analysis of adult skills. This survey provides high-quality, consistent measures of adults' proficiency in key information-processing skills - literacy, numeracy and problem solving – across more than 40 countries.

England and Northern Ireland participated in Round 1 of the survey conducted between 2011 and 2012. We have used the data made available through the Public Use Files for a sample of 8,892 individuals across the two countries.

At a national level, the findings from the OECD PIAAC study for England are broadly consistent with the results of the Skills for Life Survey (2011), with both studies highlighting a significant proportion of adults with low numeracy skills. However, the two studies use different definitions of numeracy levels, with the OECD PIAAC study finding a slightly higher proportion of adults in the lowest three categories compared to the Skills for Life Survey. We have chosen to use the results from the OECD PIAAC study over the Skills for Life Survey due to the consistency in approach taken between England and Northern Ireland and the depth of evidence examining the relationship between the OECD measure of numeracy and wage levels.²⁷

²⁷ See Hanushek E, Schwerdt G, Wiederhold S, Woessmann L (2015): *Returns to skills around the world: evidence from PIAAC*, European Economic Review, 73, pp103-130.

Wales and Scotland did not participate in the OECD PIAAC study so we have inferred their levels of numeracy from other sources:

- **Scotland:** To the best of our knowledge there is no publicly available national assessment of adult numeracy skills in Scotland. Instead we have drawn on evidence from two representative surveys by National Numeracy that highlight Scotland tends to perform slightly better than England on adult numeracy scores.²⁸ We have used this to adjust the scores for England from the OECD PIAAC study to provide an assessment of numeracy levels in Scotland.
- **Wales:** The National Survey of Adult Skills in Wales 2010 used a definition of numeracy skills that is broadly in line with that used in the Skills for Life (2011) survey in England. It concludes that around 51% of adults in Wales have numeracy skills at a Entry Level 3 or below, compared to 49% found in England. Given this similarity, we assume that the levels of numeracy in Wales are the same as the average seen across a population weighted estimate for the rest of the UK, with 58% of adults at OECD PIAAC Level 2 or below, compared to 57% for England.

Definitions of numeracy skills

Throughout this report we have defined levels of numeracy as follows:

- **Low Numeracy:** OECD PIAAC Level 2 and below. Adults with skills at this level may not be able to understand their pay slip, may struggle to confidently operate a cash machine or pay household bills.
- **Basic Numeracy:** OECD PIAAC Level 3. Adults with skills at this level are comfortable calculating simple percentages, converting units of measure and interpreting basic data represented in tables and graphs. More complex numeracy skills such as working out a household budget or comparing the cost of different products may be challenging.
- **Advanced Numeracy:** OECD PIAAC Level 4 and Level 5. Adults at this level are comfortable solving problems that require several different steps in unfamiliar contexts. They are likely to be confident using statistics and probability as well as abstract mathematical ideas.

Comparisons between the OECD definitions of numeracy skills and standardised measures used within the nations of the UK are available on the National Numeracy [website](#)

²⁸ See the following reports: <https://www.ipsos.com/ipsos-mori/en-uk/numeracy-nation-what-uk-thinks-about-numbers> and https://www.nationalnumeracy.org.uk/sites/default/files/datasource4_-_top_level_results_from_yougov.pptx

How does the proportion of working age adults with low numeracy skills vary by sector?

The OECD PIAAC sample was selected to be nationally representative in both Northern Ireland and England and was stratified by region. This means that, whilst the sample should be unbiased and therefore provide a representative picture of the levels of numeracy across different sectors, it was not specifically designed for this purpose and there is no guarantee that there will be sufficient sample size in each sector. As such we do not report findings for any sectors with fewer than 100 observations in the sample. Of the original sample of 8,892 observations, 6,917 had an employment sector identified in the dataset. Table B1 summarises our raw findings from the analysis.

Table B1. Breakdown of numeracy levels by SIC Code industrial sector

	Number of observations	Low numeracy	Basic numeracy	Advanced numeracy
Agriculture, forestry and fishing	87	N/A	N/A	N/A
Mining and quarrying	19	N/A	N/A	N/A
Manufacturing	671	54%	33%	13%
Electricity, gas, steam and air conditioning supply	24	N/A	N/A	N/A
Water supply; sewerage, waste management and remediation activities	54	N/A	N/A	N/A
Construction	420	60%	29%	11%
Wholesale and retail trade; repair of motor vehicles and motorcycles	977	65%	27%	8%
Transportation and storage	288	66%	26%	8%
Accommodation and food service activities	398	70%	25%	5%
Information and communication	227	27%	42%	31%
Financial and insurance activities	239	36%	41%	23%
Real estate activities	60	N/A	N/A	N/A
Professional, scientific and technical activities	376	31%	42%	27%
Administrative and support service activities	297	61%	30%	9%
Public administration and defence; compulsory social security	591	43%	40%	17%
Education	765	42%	40%	18%
Human health and social work activities	984	61%	30%	9%
Arts, entertainment and recreation	175	54%	36%	10%
Other service activities	245	63%	27%	10%
People employed by households	20	N/A	N/A	N/A
Total	6,917	55%	32%	13%

Source: PBE analysis of OECD PIAAC Public Use Files for England and Northern Ireland. Observations are weighted using the SPFWTO weights provided in the dataset

These sectors were then identified as:

- **Sectors with a low proportion of workers with basic and advanced skills:** The lower third of the range of numeracy skills with a combined total proportion of basic and advanced skills of less than 44%.
- **Sectors with an intermediate proportion of workers with basic and advanced skills:** The middle third of the range of numeracy skills with a combined total proportion of basic and advanced skills of more than 44% but less than 58%.
- **Sectors with a high proportion of workers with basic and advanced numeracy skills:** The top third of the range of numeracy skills with a combined total proportion of basic and advanced skills of more than 58%.

This is summarised in Table B2 below:

Table B2. Classifications used for sectors

Numeracy classification	Sectors
Sectors with a low proportion of workers with basic and advanced skills	<ul style="list-style-type: none"> • Construction • Wholesale and retail trade • Transportation and storage • Accommodation and food service activities • Administrative and support service activities • Human health and social work activities • Other service activities
Sectors with an intermediate proportion of workers with basic and advanced skills	<ul style="list-style-type: none"> • Manufacturing • Public administration and defence • Education • Arts, entertainment and recreation
Sectors with a high proportion of workers with basic and advanced skills	<ul style="list-style-type: none"> • Information and communication • Financial and insurance activities • Professional, scientific and technical activities

How many jobs lost during the Covid crisis are likely to have been held by individuals with low numeracy skills?

We use data from the Office of National Statistics on the change in the number of jobs in each sector between September 2019 and September

2020²⁹ and multiply this by the proportion of individuals in each sector with low numeracy skills to estimate the number of jobs lost where the employees have low levels of numeracy. Table B3 summarises our findings.

Table B3. Breakdown of changes in employment by industry

	Change in number of jobs Sep19-Sep20 (000s)	Proportion with low numeracy	Number with low numeracy
Agriculture, forestry and fishing	27	59%*	16
Mining and quarrying	-4	59%*	-2
Manufacturing	-113	54%	-61
Electricity, gas, steam and air conditioning supply	5	59%*	3
Water supply; sewerage, waste management and remediation activities	-10	59%*	-6
Construction	-89	60%	-54
Wholesale and retail trade; repair of motor vehicles and motorcycles	-114	65%	-74
Transportation and storage	-32	66%	-21
Accommodation and food service activities	-134	70%	-94
Information and communication	-33	27%	-9
Financial and insurance activities	-9	36%	-3
Real estate activities	17	59%*	10
Professional, scientific and technical activities	-39	31%	-12
Administrative and support service activities	-242	61%	-149

²⁹ ONS (2020): JOBS05: *Workforce jobs by region and industry*. The 15 December 2020 release was the latest data available at the time of writing. We have chosen to compare September 2020 against September 2019 to exclude the impact of seasonality in the pattern of jobs across sectors.

Public administration and defence; compulsory social security	43	43%	19
Education	-14	42%	-6
Human health and social work activities	-59	61%	-36
Arts, entertainment and recreation	-100	54%	-54
Other service activities	-43	63%	-27
People employed by households	-7	59%*	-4
Total	-950	55%	-564

Source: ONS & PBE analysis of OECD PIAAC Public Use Files for England and Northern Ireland.

* Sectors with insufficient sample sizes are pooled and average 59% of workers with low numeracy skills.

This provides an indicative measure of the number of jobs likely to have been held by individuals with low numeracy skills lost based on the sectoral distribution of job losses. It does not take into account evidence that those with lower numeracy are more likely to be out-of-work³⁰ which may indicate that, even within a given sector, those with low numeracy are at greater risk of being made unemployed.

How does the proportion of working age adults with low numeracy skills vary by region?

We start by analysing the OECD PIAAC data, using the population weights provided in the OECD sample. 35 (0.4%) individuals in the sample were excluded due to missing data.

³⁰ De Coulon et al. (2011), Hanushek et al. (2015) and Grinyer J (2005): *Literacy, numeracy and the labour market: further analysis of the skills for life survey*, DfEE Research Paper 251 all demonstrate that low numeracy skills are associated with a reduced likelihood of being in employment.

Table B4. Breakdown of numeracy levels by for English regions and nations in OECD PIAAC

	Number of observations	Proportion with low numeracy in 2011
North East	299	71%
North West	714	59%
Yorkshire and The Humber	544	59%
East Midlands	458	62%
West Midlands	540	65%
East	560	52%
London	623	58%
South East	805	51%
South West	535	52%
Northern Ireland	3726	61%
England	5131 ³¹	57%
England & Northern Ireland	8,857	58%

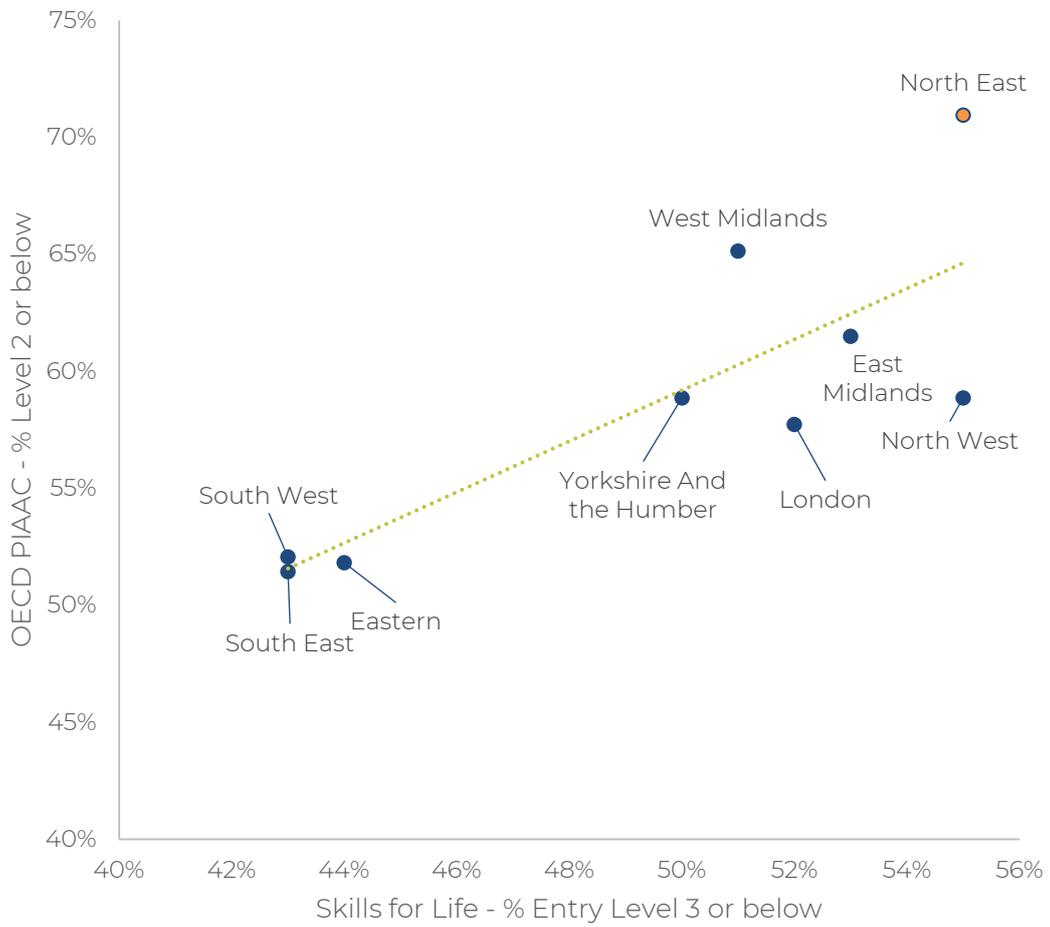
Source: PBE analysis of OECD (2011) PIAAC Public Use Files for England and Northern Ireland.

Figure B5 shows the estimates for English regions from the OECD PIAAC study against the findings from the Skills for Life survey. It highlights that there is generally strong alignment between the datasets. However, the OECD PIAAC data estimates for the North East region stands out as notably higher than other regions compared to the findings from the Skills for Life survey. After comparing the relative positioning of the North East region against other regions in two other surveys from 2019 it appears that the OECD PIAAC estimates for the North East are unusually high³². In discussion with project stakeholders it was agreed to adjust the OECD PIAAC estimate for the North East downwards to align with its relative position in the Skills for Life Survey.

³¹ This total is bigger than the summation of observations for individual English regions as there were 53 observations for England that were missing data on specific region. These observations were included in the overall assessment for England.

³² Data provided by National Numeracy and relates to findings reported in: Ipsos Mori (2019): *Numerate Nation? What the UK thinks about numbers*, and National Numeracy (2019).

Figure B5. Comparison of numeracy levels in OECD PIAAC study and Skills for Life survey



Source: PBE analysis of OECD PIAAC Public Use Files for England and Skills for Life (2011) survey

Table B6 provides a summary of our final assumed levels of low numeracy in each region.

Table B6. Breakdown of assumed numeracy levels for English Regions and nations of the UK

	Assumed proportion with low numeracy
North East	65%
North West	59%
Yorkshire and The Humber	59%
East Midlands	62%
West Midlands	65%
East	52%
London	58%
South East	51%
South West	52%
Wales	58%
Scotland	56%
Northern Ireland	61%
England	57%
UK	58%

How many jobs likely to have been held by individuals with low numeracy skills have been lost in each region during the Covid crisis?

We extend the analysis presented above by using the ONS's breakdown of changes in the number of jobs between September 2019 and September 2020 by sector and region using the following formula:

$$N_r = \sum_{s=1}^{20} (j_{r,s} \times p_s)$$

Where:

N_r = Number of low jobs likely to have been held by individuals with low numeracy skills lost in region or nation r

$j_{r,s}$ = change in the number jobs from ONS data for region or nation r and sector s

p_s = the proportion of jobs in sector s held by low numeracy workers

This provides an indicative measure of the number of jobs likely to have been held by individuals with low numeracy skills lost in the region based on the industrial structure and change in the number of jobs for that region. It does not take into account the fact that the levels of numeracy for workers within a given sector could vary across different regions according to the nature of the work they do (e.g. differentiation between head office staff and operational staff). Table B7 summarises our estimates.

Table B7. Estimated losses of jobs likely to have been held by individuals with low numeracy skills by regions of England and UK nation, 000s

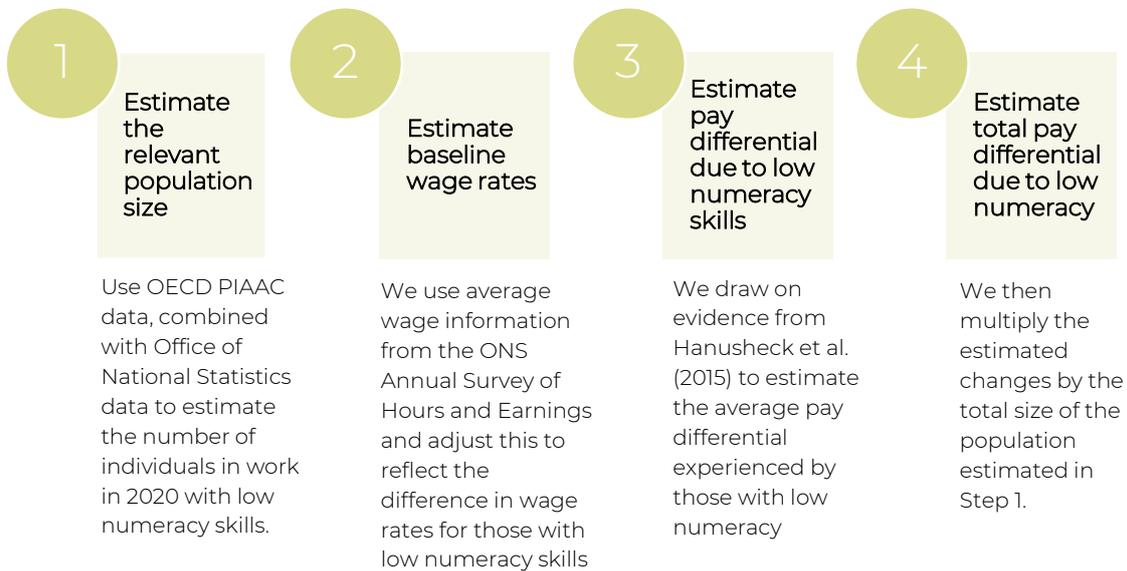
	Change in all jobs Sep 2019 – Sep 2020	Change in jobs likely to have been held by individuals with low numeracy skills
North East	-23	-11
North West	-129	-76
Yorkshire and The Humber	0	3
East Midlands	-26	-17
West Midlands	-164	-103
East	-55	-30
London	-195	-109
South East	-160	-98
South West	-102	-59
Wales	-21	-11
Scotland	-53	-39
Northern Ireland	-22	-13
England	-854	-501
UK	-950	-564

Source: ONS & PBE analysis of OECD PIAAC Public Use Files for England and Northern Ireland.

What wage differentials is low numeracy likely to impose on workers in the UK?

We use a four-step process to estimate the impact that low numeracy skills could have on wage levels across the UK: 1) we estimate the total number of people in employment with low numeracy skills, 2) we estimate the baseline wages of individuals with low numeracy, 3) we estimate the differential in wages due to low numeracy skills, 4) we aggregate these estimates together to calculate the total value of wage differentials.

Figure B8. Summary of approach to estimating the total pay differential due to low numeracy skills



Step 1: Estimate the relevant population size

We use ONS data³³ to estimate the number of individuals in work for each region. We then adjust our estimates of the proportion of adults in each region with low numeracy skills to reflect the fact that individuals with low numeracy are disproportionately more likely to be unemployed³⁴ and use these to estimate the number of individuals in work with low numeracy skills for each region, summarised as follows:

$$P_r = (w_r \times p_r \times \alpha)$$

Where:

P_r = in work population with low numeracy skills in region or nation r

W_r = the number of individuals in work in region or nation r

p_r = proportion of adults in region r with low numeracy skills

³³ Rates of employment taken from ONS (2021): *Labour market in the regions of the UK: February 2021*, with population estimates taken from ONS(2020): *Annual Population Survey estimates of the country of birth and nationality of residents in the UK, by region and age group, 2004 to 2018*.

³⁴ Using the OECD PIAAC data we find that for England as a whole 52% of individuals in work have low numeracy skills compared to 67% of people out of work. This is a 9% reduction compared to the average for the whole sample (57%), as such we reduce each regional estimate for the proportion of all working age adults with low numeracy by 9%. The equivalent figure for Northern Ireland was 12%.

α = adjustment factor for the reduced likelihood that an individual has low numeracy skills if they are in work³⁵

Table B9 summarises our estimates.

Table B9. Estimated number of individuals in work with low numeracy skills for English regions and nations of the UK

	Number of people in work, 000s (w_r)	Proportion with low numeracy skills (p_r)	Number in work with low numeracy skills, 000s (P_r) ³⁶
North East	1,183	59%	704
North West	3,370	54%	1,811
Yorkshire and The Humber	2,505	56%	1,406
East Midlands	2,237	52%	1,163
West Midlands	2,680	59%	1,594
East	2,914	47%	1,379
London	4,559	53%	2,403
South East	4,398	47%	2,065
South West	2,573	48%	1,223
Wales	1,399	53%	735
Scotland	2,548	51%	1,306
Northern Ireland	826	53%	442
England	26,428	52%	13,746
UK	31,185	52%	16,229

Step 2: Estimate baseline wage rates

The baseline level of wages earned by individuals with low levels of numeracy will be affected by a range of other factors that might be correlated with an individual's numeracy such as the level of other basic skills, education, their choice of which sector to work in and socio-economic background – these all need to be reflected in our baseline. We therefore estimate baseline wage rates by taking average wage rates for

³⁵ Due to insufficient sample sizes for people out of work in the OECD PIAAC dataset we have not made different adjustments for each region. This adds additional uncertainty to our regional estimates.

³⁶ Final estimates in the table may differ from the product of previous two columns due to rounding.

each region from the ONS³⁷ and adjusting them downwards to reflect the fact that individuals with low numeracy skills tend to earn less³⁸. We use the following formula:

$$E_{low,r} = (E_r \times \beta_r)$$

Where:

$E_{low,r}$ = Estimated average annual earnings for individuals with low numeracy in region or nation r

E_r = Mean annual earnings in region or nation r

β_r = Ratio of mean earnings in a region to average earnings for individuals with low numeracy taken from OECD PIAAC data for region or nation r

Our estimates are summarised in Table B10 below.

Table B10. Estimated baseline wage rates

	Mean wage in the region (E_r)	Adjustment factor for wage (β)	Mean wage in the region for those with low numeracy ($E_{low,r}$)
North East	£26,995	0.73	£19,657
North West	£28,652	0.78	£22,211
Yorkshire and The Humber	£27,494	0.87	£23,860
East Midlands	£28,210	0.67	£19,000
West Midlands	£29,347	0.73	£21,370
East	£29,527	0.79	£23,458
London	£47,345	0.78	£36,862
South East	£32,217	0.69	£22,378
South West	£27,207	0.73	£19,856
Wales	£26,249	0.75	£19,801
Scotland	£29,706	0.75	£22,409
Northern Ireland	£27,061	0.83	£22,450
England	£32,262	0.75	£24,255
UK	£31,590	0.75	£23,830

³⁷ ONS (2020): *Earnings and hours worked, UK region by industry by two-digit SIC: ASHE Table 5, Table 5.7a*

³⁸ In OECD PIAAC data we find that monthly earnings averaged £2,039 across all those working in England, whereas those with low numeracy skills averaged £1,533 – 25% lower than the mean. The equivalent figure was 17% in Northern Ireland. We adjust regional means by these national estimates (with Wales and Scotland adjusted by a population weighted mean of these two figures).

Step 3: Estimate wage differential due to low numeracy skills

The development of human capital, or the accumulation of skills, has long been viewed by economists as a critical factor driving the long-term productivity and earnings of individuals.³⁹ There is a wealth of evidence demonstrating the impact that numeracy skills have on the level of an individual's wages.

For example, the National Child Development Study (NCDS)⁴⁰ suggests that males with low numeracy skills tend to earn 9% less than those with higher levels of numeracy.⁴¹ This has been supported by evidence from the later British Cohort Study⁴² which has demonstrated that a one standard deviation⁴³ improvement in numeracy skills is associated with 11-12% higher earnings.⁴⁴

The most up-to-date estimates of the relationship between numeracy and wages we are aware of is provided by Hanushek et al. (2015). It draws on the same OECD PIAAC data we have used in our analysis and outlines a number of outcomes for the UK using a variety of different controls. We use results from one of the most complete specifications available, incorporating both numeracy and literacy skills as explanatory variables alongside a number of controls for individual characteristics (such as years of education), to consider the impacts of these effects on wages.⁴⁵ This model estimates that a one standard deviation improvement in numeracy skills increases wages by 12.4% - broadly in line with other estimates from other sources.⁴⁶

In order to apply this evidence to our data we need to assess the average improvement required by those within our low numeracy group before they would reach the threshold for Level 3 numeracy. We have calculated that for each region using the OECD PIAAC data, expressed in standard deviations, multiplied this by the strength of the relationship from Hanushek to identify the overall % change in wages we would expect⁴⁷. We apply this percentage change to our baseline wage rates to give an

³⁹ See for example, Hanushek A (2013): *Economic growth in developing countries: the role of human capital*, *Economic of Education Review*, 37, pp. 204-212.

⁴⁰ A longitudinal study following a nationally representative cohort of individuals born in 1958.

⁴¹ Machin S, McIntosh S, Vignoles A and Viitanen T (2001): *Basic skills, soft skills and labour market outcomes: secondary analysis of the National Child Development Study*, DfEE Research Report 250.

⁴² A longitudinal study following a representative sample of individuals born in Britain in 1970.

⁴³ A standard deviation is a measure of the spread of data around its average value. It is often used in the social sciences as a standardized "yardstick" to compare the size of impact that one variable has on another.

⁴⁴ De Coulon A, Marcenaro-Gutierrez O, Wignoles A (2011): *The value of basic skills in the British labour market*, *Oxford Economic Papers*, 63(1), pp. 27-48.

⁴⁵ Table A3 in Hanushek et al. (2015).

⁴⁶ In practice we adjust the overall impact to provide age-specific assumptions in our analysis based on the age-based specifications produced by Hanushek et al. (2015). Full details are available in Annex A.

⁴⁷ For Wales and Scotland we have assumed that the average improvement required to reach the Level 3 numeracy threshold is the same as for England.

estimated monetary value of the wage differential for individuals with low numeracy skills.

$$Diff_r = E_{low_r} \times \delta_r \times \Delta E$$

Where:

$Diff_r$ = The differential in wages for an individual with low numeracy skills in region or nation r

E_{low_r} = Estimated average annual earnings for individuals with low numeracy in region or nation r

δ_r = average change in numeracy skills required to lift someone from low numeracy to basic numeracy skills in region or nation r, expressed in standard deviations

ΔE = change in wage rate due to low numeracy skills taken from Hanushek et. al (2015) = 12.4%

We demonstrate this process in more detail using the North East region as an example:

- We calculate from the OECD PIAAC data that the average individual with low numeracy is around 37 points away from the Level 3 numeracy threshold.
- The standard deviation of the national data is 55, so expressed as a standard deviation this is $37/55 = 0.67$ standard deviations.
- We know from Hanushek et al. (2015) that a one standard deviation improvement in numeracy skills is associated with a 12.4% rise in pay. So a 0.67 standard deviation improvement is associated with $0.67 * 12.4\% = 8.3\%$
- The average wage for individuals in the North East with low numeracy was estimated in Figure 3 as £19,657 so the wage differential is estimated as $8.3\% * £20,364 = £1,637$.

It is important to highlight that these wage differences will be driven by both differences in progression within a particular sector that are associated with numeracy skills as well as the original choice of which sector an individual chooses to work in.

The results for all regions are summarised in Table B11.

Table B11. Estimated wage differential for regions of England and UK nations due to low numeracy skills

	Average required improvement in numeracy to meet threshold for basic skills (δ_r)	Wage gap due to low numeracy skills (%)	Average wage differential due to low numeracy skills (Gap _r)
North East	0.67	8.3%	£1,637
North West	0.56	7.0%	£1,552
Yorkshire and The Humber	0.54	6.7%	£1,597
East Midlands	0.52	6.4%	£1,215
West Midlands	0.66	8.2%	£1,745
East	0.42	5.2%	£1,229
London	0.63	7.8%	£2,892
South East	0.38	4.7%	£1,048
South West	0.42	5.2%	£1,042
Wales	0.52	6.5%	£1,288
Scotland	0.52	6.5%	£1,458
Northern Ireland	0.53	6.6%	£1,472
England	0.52	6.5%	£1,578
UK	0.52	6.5%	£1,551

Step 4: Estimate total wage differential due to low numeracy

We take the estimate wage differentials from Step 3 and multiply them by the number of people with low numeracy skills employed in each region from Step 1 to estimate the total value of wage differentials due to low numeracy skills. This is then expressed as a % change in the total value of wages earned in the region⁴⁸, as summarised in Table B12.

⁴⁸ This is based on the mean wage for each region and the total number of individuals employed, as provided in Table 6.

Table B12. Estimated total wage differentials for regions of England and UK nations due to low numeracy skills

	Total value of wage differential due to low numeracy skills (bn)	As a % of total income generated by workers in region
North East	£1.2	3.6%
North West	£2.8	2.9%
Yorkshire and The Humber	£2.2	3.3%
East Midlands	£1.4	2.2%
West Midlands	£2.8	3.5%
East	£1.7	2.0%
London	£6.9	3.2%
South East	£2.2	1.5%
South West	£1.3	1.8%
Wales	£0.9	2.6%
Scotland	£1.9	2.5%
Northern Ireland	£0.7	2.9%
England	£21.7	2.5%
UK	£25.2	2.6%

The estimated total value of wage differentials due to low numeracy of £25.2bn is broadly in line with a 2014 report from Pro Bono Economics that estimated a £17bn reduction in wages for 2012.⁴⁹ The higher level reflects the growth in wages over the period as well as the use of alternative, more up-to-date, sources of data and evidence based on the OECD PIAAC study.

Key assumptions behind the analysis

Our analysis is based on several key underlying assumptions:

- We assume that the estimated employment effects taken from Hanushek et al. (2015) represent a good causal estimate of the impact of low numeracy on wage rates and likelihood of being employed. Their analysis incorporates controls for factors such as work experience, age and other skills. They also find that more complex analytical techniques that test for causality continue to find a robust relationship between numeracy and wages. However, it remains possible that there are still unobserved characteristics that

⁴⁹ PBE (2014): *Cost of outcomes associated with low levels of adult numeracy in the UK*.

affect both wage levels and levels of numeracy and therefore bias the results we are using.

- We have not incorporated any “general equilibrium effects” in our analysis. In a theoretical example where all individuals with low numeracy skills suddenly received support to reach our basic threshold for numeracy this would reduce the wage premium for numeracy skills (and effectively reduce the scale of the total wage differentials we have identified in this paper). The scale of this effect is uncertain – in a small open economy such as the UK the effects could be relatively limited provided that the economy re-structures over time towards high skills, high wage sectors. This was demonstrated in an Institute of Fiscal Studies analysis of historical changes in skill levels in the UK that highlighted that the proportion of people with a university degree by age 30 more than doubled between those born in 1965-69 compared to those born 10 years later, and yet the high skill wage premium remained largely unchanged in the UK over this period as firms adapted their production approach to make use of the more highly skilled labour force.⁵⁰ Analysis of educational interventions in the USA have also estimated that these broader General Equilibrium Effects may reduce estimated wage benefits by around 10% when compared to a “partial equilibrium” approach similar to the one used in this study.⁵¹ On this basis we believe that our estimates of the total wage differentials are useful as an indicative scenario for the total potential scale of wage increases that could be possible with improved numeracy but should not be treated as precise estimates.
- We have assumed that the relationship between numeracy skills and wages is the same in all regions of the UK and that it will have remained stable over time. It is possible that the percentage wage differential from low numeracy would vary between different regions of the UK based on the pre-existing mixture of industrial sectors. It is also possible that the increasing introduction of automation and Artificial Intelligence technologies will have altered the wage impact of numeracy skills since the Hanushek paper was originally written. Unfortunately, there is no evidence on which to provide a more up-to-date or detailed differentiation of evidence across different regions at this time.

⁵⁰ Blundell R, Green D, Jin W (2016): *The UK wage premium puzzle: how did a large increase in university graduates leave the education premium unchanged?* Institute for Fiscal Studies Working Paper W16/01.

⁵¹ Heckman J, Lochner L, Taber C (1999): *Human capital formation and general equilibrium treatment effects: a study of tax and tuition policy*, Fiscal Studies vol20(1), pp25-40.



AUTHOR: JON FRANKLIN

Pro Bono Economics, Chief Economist

jon.franklin@probonoeconomics.com



@ProBonoEcon



www.probonoeconomics.com



020 3632 2668