The University of the West of England

What can microdata tell us about labour market and wage dynamics in the Western Gateway Area?

Client Report to Business West and Futures West

June 2024

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Acknowledgements and Disclaimers

The Futures West Foundation was launched in March 2024. It was created to bring business leaders, academics and policy makers together to tackle long-term regional challenges to raise productivity, growth and innovation. The intention is that Futures West will play a crucial role in shaping regional development, economic strategies, and public policies across the Western Gateway Area (WGA), primarily through the provision of an enhanced regional evidence base.

To support the launch of the Foundation, a team at the University of the West of England, Bristol (UWE) have undertaken an analysis of labour markets and wage dynamics in the WGA, with a focus on the Futures West's Priority Sectors. To complete the analysis microdata[1] from the Office for National Statistics' (ONS) Secure Research Service (SRS) were used.

The UWE team have used their professional experience and expertise to provide this analysis for Futures West. They cannot be held responsible, however, for any errors or omissions revealed by future evidence revisions, new publications or policy changes, or indeed, for the consequences of actions taken by the client and/or its partners on the basis of the report.

In support of this report, the authors gratefully acknowledge the financial support of the University of the West of England, ADR UK (Administrative Data Research UK) and the Economic and Social Research Council (Grant No. ES/T013877/1 & ES/Y001184/1). The work is based on analysis of the research-ready datasets from the enriched Annual Survey of Hours and Earnings (ASHE) datasets created as part of the ADRUK/ESRC funded Wage and Employment Dynamics project and microdata from the Annual Population Survey.

[1] The microdata used in this analysis, is only available to academic and government researchers to use in a secure research environment. The data is available at the level of the individual but is de-identified for disclosure purposes.

Contents

1. Executive Summary

This research uses microdata to analyse labour market and wage dynamics across the Western Gateway Area (WGA) and its constituent parts. It compares the performance of the WGA with national 'control' averages.

In the report the WGA is conceptualised as including the upper tier unitary authorities of Bath and North East Somerset (BANES), City of Bristol, North Somerset and South Gloucestershire, Gloucestershire, Swindon, and Wiltshire. Notably, the report explores the extent to which five priority sectors (i.e. Advanced Manufacturing and Engineering (AME); Finance and Insurance Services; Creative Industries, Digital Industries and Environmental Goods and Services Sector) have contributed to the WGA's wage premium.

The findings are set within the context of the UK's national labour market. Nationally and regionally, labour markets are tight, with relatively high rates of employment and self-employment, while, since the COVID pandemic, economic inactivity rates have risen as workers have dropped out of the labour market. There is an ageing population and there are considerable differences in participation rates by age and gender.

The report covers the period 2004 to 2022 to provide descriptive statistics and empirical estimation to support an in-depth understanding of the labour market and the drivers of pay. In terms of the descriptive analysis, the report indicates:

- Wages are highest in London and the South East and lowest in the North East.
- Regional analysis reveals that between 2004 to 2022 wages have risen broadly in line with each other over this period
- The minimum wage has risen faster than the median wage. This indicates that over time, lower-paid workers[2] area receiving a larger share of the overall wage distribution over time, which is going some way to reducing wage inequality.
- Since 2014, the proportion of those receiving low pay (defined as earning less than 2/3rds of the national median wage) has declined sharply.
- Wages in the WGA and its constituent parts are generally above the national comparator group (excluding greater London).
- Individuals in the West of England area received consistently higher wages than other areas of the WGA.
- In 2022, the average wage was approximately 11% higher in the West of England than in Gloucestershire. Understanding the reason for the difference is beyond the scope of this research, but in some part is expected to reflect sectoral composition.

[2] The Low Pay Commission (LPC) monitor trends in the low-paid labour market. They use two definitions: **low-paying occupations** relate to job roles that are often low-paid – for example, 'sales assistants'; **low-paying industries** are based on the main activity of the employer – for example, 'retail trade'.
For a full list of low paying occupations and industries please refer to
https://minimumwage.blog.gov.uk/2023/09/11/the-lpc-has-updated-its-definitions-of-low-paying-sectors/

- Wages in the West of England area are primarily driven by those working in the City of Bristol and South Gloucestershire.

The empirical analysis reveals that part of the explanation for why wages in the WGA are higher than other regions is its sector composition. However, this provides only a partial account, and the paper therefore recommends extensions to the research to allow a fuller identification of the specific regional and local factors.

The empirical analysis revealed that:

- There is a raw pay premium[3] of working in the WGA compared to the national control group. This ranges from a raw gap of 4.3%, which reduces to 2.3% when controlling for all observable factors.
- Priority sectors account for approximately 7% of the WGA pay premium, which suggests supporting these priority sectors has the potential to further drive wage and economic growth of the regional economy.
- Wages in each of the five priority sectors are substantially higher than that for other sectors. The reason is beyond the scope of this research, but it is likely to be due to a combination of factors including high demand for skilled labour, specialised qualifications and skills, and higher productivity.
- Occupation (which is included in our model as a proxy for skills) appears to account for approximately half of the pay premium. This therefore suggests that policy makers may wish to consider occupation and skills base support schemes alongside any industrial support.
- The pay premium is unevenly spread over the region, five of the seven sub-regions receive a pay premium, while North Somerset is in line with the national average and workers in Wiltshire (excluding Swindon) experience a pay penalty when compared to the national comparator group.
- The priority sectors contribute to the pay premium for four upper tier local authority areas, but are less important to three of the sub-regions (i.e. (BANES, North Somerset and Wiltshire). This suggests that restricting support to just the priority sectors will benefit some sub-regions more than others. As such, policy makers may wish to consider how to identify and provide support to other sectors which are more important to these three sub-regions.
- Workers in the Advanced Manufacturing and Engineering (AME) sector in the WGA earn approximately 1.6% more than those working in the AME nationally. Understanding this effect in more detail would enable policy makers to focus resources on building on these industrial strengths and addressing any weaknesses, and enable them to encourage spillovers into other sectors. For example, it would be good to understand the extent to which the pay premium is a result of sub-sector and firm characteristics (e.g. high value, R&D

[3] In this study, a pay premium means that on average, wages in a particular area (i.e. WGA or its constituent sub-regions) are higher than the national comparator group (i.e. GB excluding greater London), whereas a pay penalty would indicate that they are lower than the national comparator group.
Regional pay premium helps align wages with regional economic realities, supporting employee well-being, improving labour market efficiency, and compensating for cost-of-living differences.

intensive), versus having to pay a premium to attract talent to the region due to skill shortages.

- Although individuals working in the Digital Industries sector earn more than other sectors on average, those working in the Digital Industries in the WGA are approximately 3.1% below the national average for this sector. The difference may be explained by the regional sub-sector composition but is worthy of further investigation.

In conclusion, in common with the UK economy in general, the WGA labour market is tight. Within the United Kingdom, wages in the WGA are higher than most, but this varies across the sub-regions.

In terms of pay premiums (and indirectly productivity), recent trends show that the WGA benefits from the positive effects of its industrial structure, and particularly the priority sectors.

However, a significant part of the WGA wage premium remains unexplained. It is suspected that this reflects a range of factors that are worthy of further research, including:

- Cost of living
- Capital stocks (e.g. equipment, buildings, tools, machinery, and other physical resources)
- Education and skills
- Innovation
- Connectivity
- Agglomeration
- Management and ownership
- Environmental quality
- Well-being

At a regional level, the selection of Futures West's five priority sectors is reasonable, but their contribution varies across the sub-regions. Sectors have greater concentration and connection in specific local geographies, local strategies and policies should be tailored to support the individual needs of each area.

2. Introduction

2.1 Research Context

Business West has established the Futures West Foundation which has been created to support Sustainable and Inclusive Economic Growth. The Foundation brings business leaders, academics and policy makers together to tackle long-term regional challenges to raise productivity, growth and innovation. It covers the northern part of South West England and includes the upper tier unitary authorities (UAs) of Bath and North East Somerset (BANES), City of Bristol, North Somerset and South Gloucestershire (combined, these four UAs are known as the West of England), plus Gloucestershire, Swindon, and Wiltshire. In the remainder of the report, these seven upper tier UAs are jointly referred to as the WGA. This should not be confused with the Western Gateway pan-regional partnership geography area, which includes South Wales within its geographical boundary.

Working with regional stakeholders, Futures West aims to develop robust intelligence on which policy can be developed to improve economic, societal and environmental outcomes. Futures West will support the development of a regional knowledge base which can be used to support policy development to encourage growth within the region by providing localised insights and solutions that can be overlooked by national or international policy-focused organisations.

In support of the launch of Futures West, UWE completed an analysis of wage dynamics in the WGA. Preliminary findings were reported at the Flourishing Region: Growing Together Alliance Partner Event in April 2024. This final report extends the analysis to include an econometric analysis of wage dynamics in the WGA.

The research team analyses microdata[4], accessed via ONS's SRS, to provide deeper insights in regional wages, with particular focus on Futures West's priority sectors. Futures West identified several priority sectors which they believe should be targeted for additional support due to their importance to the regional economy and/or potential to drive future growth and following an extensive round of engagements with regional stakeholders. This analysis explores the importance of these priority sectors in wage dynamics.

The report uses microdata from the Annual Population Survey and the enriched Annual Survey of Hours and Earnings (ASHE). The enriched ASHE was created as part of the ADR UK/ESRC funded and UWE led Wage and Employment Dynamics project - see https://www.wagedynamics.com for more details. This data enables a detailed investigation of local differences in wages, while accounting for sector composition.

The primary advantage of this data source is its comprehensiveness. However, access is restricted to approved researchers working on specific, approved projects. A drawback is that

[4] Microdata refer to unit-level data collected from sample surveys, censuses, or administrative systems. They offer detailed insights into the characteristics of individuals but can refer to entities, such as households, businesses, facilities or even specific geographical regions. By enabling the study of relationships and interactions between various phenomena, microdata provide a deeper understanding of socio-economic issues. As a result, they can play a crucial role in project design, policy formulation, targeting interventions, and in monitoring and assessing the impact and outcomes of these initiatives.

the data can be volatile in small geographic areas due to the limited number of observations, necessitating caution when interpreting data.

2.2 Scope of Work

The research team were commissioned to:

- use microdata to conduct a thorough analysis of regional wage dynamics across WGA, paying particular attention to the priority sectors as identified by Futures West.
- assess the impact of workforce, sectors and economic structure on wages.
- provide data-driven recommendations for policy interventions and other strategic initiatives.
- prepare a comprehensive report presenting the findings, analyses, and recommendations.
- provide a short review on the use of trusted research environments (TREs) to support the work of Futures West.

To fulfil the brief, the researchers analysed trends in the raw data and employed econometric techniques to analyse both absolute and relative characteristics. This approach helped to identify factors driving wages and suggested broad causality. The team then used the statistical results and analytical findings to derive policy implications.

Given the potential microdata analysis has in supporting the development of regional intelligence, while also recognising the challenges involved in accessing microdata TREs, the research team also provide a brief review on how data available in these environments can best be used to support the wider work of Futures West.

2.3 Research Approach

This work:

i) Examined individual-level data in detail to:
   a. Compare the national and regional performance with that of the local economies, including South West region, WGA and its constituent parts (e.g. Gloucestershire, Wiltshire, Bath and North East Somerset, South Gloucestershire, City of Bristol and North Somerset).
   b. Illustrate relative positions and gaps over time, revealing how well they performed before and after COVID.
   c. Analyse the Annual Population Survey microdata to compare national and regional employment rates over time.
   d. Explore the enriched ASHE dataset to:
      i. compare wages over time to understand the importance of the priority sectors nationally.
      ii. illustrate how wages in the WGA and its constituent areas relative position with other comparator areas.

iii. describe how the National Minimum Wage (NMW)/ National Living wage (NLW) has grown over time and compare this to average wages.
iv. explain how the proportion of minimum wage workers has changed over time, while comparing the national, regional and local performance.
v. identify whether individuals in the WGA and its constituent part received higher or lower wages than those in other relevant comparator areas (excluding Greater London).
    - Controlling for differences that are specific to each year in the analysis to make sure that any changes over time, such as economic conditions, government policies, or other factors that affect all observations in a given year, do not distort the results of the study.
    - Assessing whether the differences in regional wage performance are due to disparities in individual or job characteristics and /or industry (SIC) or occupation (SOC) composition. In other words, the aim is to identify the root cause in terms of workforce and economic structure.

This research forms a detailed baseline for wages in WGA in both absolute and relative terms. In priority sector terms, it informs discussions of what the WGA does well and where it lags its peers.

The remainder of the report has the following structure:

Background: provides contextual information on:

- WGA.
- Economic Context
- Priority Sectors

Data: describes the data used in the study, providing a description of its origins and variable construction.

Results: presents analyses and identifies the causes of the wage differentials between the WGA and its constituent parts with the national average.

Discussion and Recommendations discusses the main findings of the research and makes several recommendations.

3. Background

3.1 Western Gateway Area (WGA)

The WGA benefits from several natural and cultural assets, including Bath, holding title of UNESCO World Heritage City, Bristol's rich maritime and engineering heritage, and Gloucestershire and Wiltshire's beautiful countryside, steeped in rich history.

The area is home to six universities - the University of Gloucestershire with its focus on sustainability and strong student support services, Royal Agricultural University specialising in agriculture, environmental science, and related subjects, Bath Spa University which is celebrated for its strengths in the Creative Arts, University of the West of England renowned for its student experience and strong research profile focussed on addressing real world issues and the research intensive universities of Bath and Bristol. These universities are hailed for academic excellence and create a hub for research and innovation for the WGA.

Its geography positions the area in a strategic location for attracting people and investment, with excellent connections to the rest of the UK. However, creating a regional economic evidence base is challenging and this can impact its effectiveness in informing policy and decision-making. These challenges include, but are not limited to, the availability and granularity of regional and local economic data; time lags in data collection; inconsistencies in how data is collected, analysed, and reported; and limited local capacity or resources to analyse, and interpret economic data effectively.

In this paper the research team address some of these issues directly by analysing the local labour market using microdata. The microdata used has been collected based on nationally representatively samples and are available at the level of the individual and at low levels of geographies.

In the following section, the economic context and the priority sectors are discussed with reference to the academic and grey literature, as well as supporting the analysis using Annual Population Survey (APS) microdata[5] (currently available until 2020).

3.2 Economic Context

Regional economies are shaped by a milieu of broader economic contexts, which have experienced major disruptions over recent years. The Covid-19 pandemic in 2020 triggered one of the greatest disruptions to global business operations, halting production in many industries,

[5] The APS is a vital resource for labour market analysis in the UK. Its extensive and detailed data on employment, unemployment, earnings, and workforce demographics provide a comprehensive picture of the labour market. It combines data from multiple sources to produce a large, reliable sample for detailed analysis. The survey targets individuals aged 16 and over, residing in private households, including those in communal establishments and short-term residents. APS is conducted continuously throughout the year, with data typically pooled over a 12-month period to improve sample reliability and accuracy.

While the APS is a robust and comprehensive dataset, there are several limitations. For example, the sample may not fully represent small population groups or capture short-term employment dynamics. Differences in data collection methods and respondent reporting may introduce variability and potential biases in the data. Data pooled over a 12-month period may smooth out short-term fluctuations, potentially obscuring recent labour market trends.

and accelerating the prevalence of work life trends such as increased remote working. The emergence of AI is driving structural change, representing a huge opportunity with the potential to increase productivity and hence living standards for many. At the same time, however, the speed of such change may lead to large-scale redundancies across a variety of sectors, potentially increasing inequalities between and within nations.

The global threat of climate change is also influencing economic policy, with the UK committing to achieving net zero by 2050. This represents a huge opportunity but also comes with its own challenges as the economy shifts towards green energy and more sustainable practices. Furthermore, the effects of the UK's exit from the European Union are still unfolding, with considerable implications for labour mobility and trade relationships.

Recent high inflation rates across the UK, driven largely by supply chain disruptions and increased energy prices, prompted rapid monetary policy tightening (National Institute of Economic and Social Research (NIESR), 2024). Albeit nominal and short lived, the UK slipped into a technical recession in the final quarter of 2023, characterised by two successive quarters of negative growth (Office for National Statistics, (ONS) 2024a). This challenging economic landscape creates the conditions for subdued labour markets across the UK.

Navigating these intersecting dynamics requires targeted and nuanced analyses to identify the key sectors driving growth, the location of skill shortages, and to assess the impact of demographic shifts on workforce participation and productivity within individual regions.

Towards the end of 2023, the Organisation for Economic Co-operation and Development (OECD) reported record highs of employment and labour force participation rates across its member countries, at 70.1% and 73.8%, respectively. However, youth unemployment remained high, at 6.7 percentage points above unemployment rates for workers aged 25 and over (OECD, 2024), confirming the long-lasting effects of the pandemic on the world's youth (International Labour Organisation, 2022).

Similarly, the UK labour market appears tight. Figure 1 shows that following the financial crisis, those that are either in employment or self-employed rose from a low of 70% in 2011 to over 76% of the working age population before the COVID pandemic.

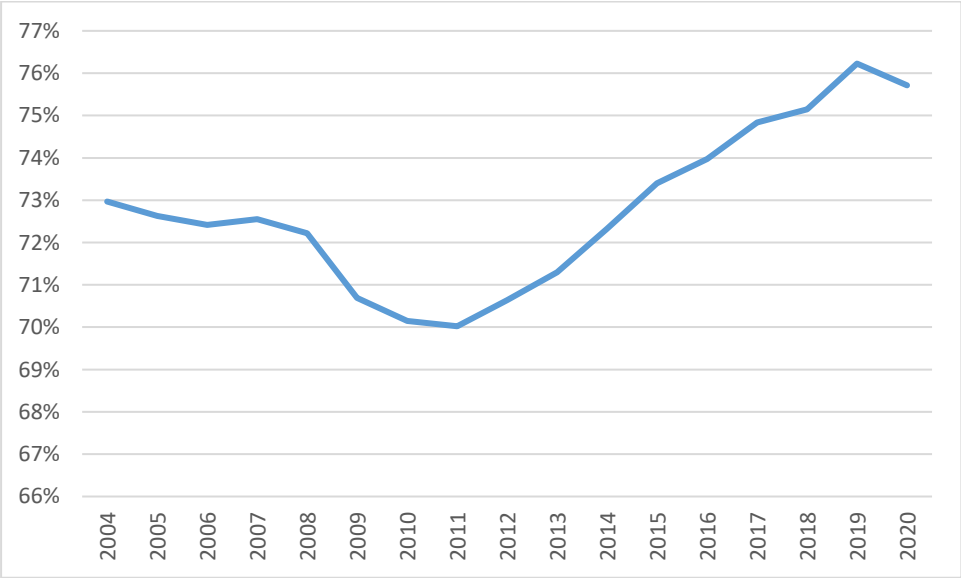

Figure 1: UK Workforce Participation Rates (2004 – 2020)

Source: ONS, APS microdata

There were, however, differences in participation rates between different groups. Figure 2 shows that although the gap between males and females is considerable at around 6 percentage points, this has reduced substantially from over 13 percentage points in 2005.

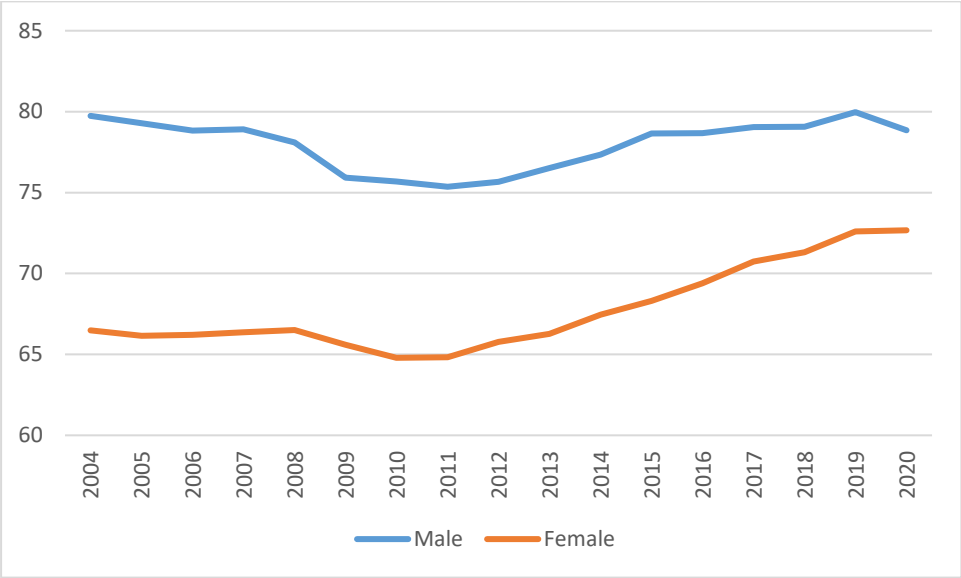

Figure 2: UK Workforce Participation Rates by Gender (2004 – 2020)

Source: ONS, APS microdata

The rate of unemployment is close to record lows, and by 2022 had fallen below pre-pandemic levels (UK Parliament, 2022). However, workers have continued to drop out of the labour market. The UK is the only higher income country in which economic inactivity rates have continued to grow beyond the pandemic (House of Commons, 2023). This is thought to be driven largely by those deciding to take early retirement and by the rise in long-term sickness (ONS, 2022).

Two significant developments to workforce patterns in recent years have been an increased prevalence of self-employed individuals, and the number of people working in the gig economy (Giupponi and Machin, 2022). Furthermore, the proportion of the nation's lowest earners who are self-employed has increased from 15%-23% between 1999 and 2019 (ibid). Figure 3 shows the growth in self-employment up to the COVID pandemic, however the challenging environment for self-employed individuals resulted in a noticeable decline in the proportion of self-employment during the COVID-19 pandemic.

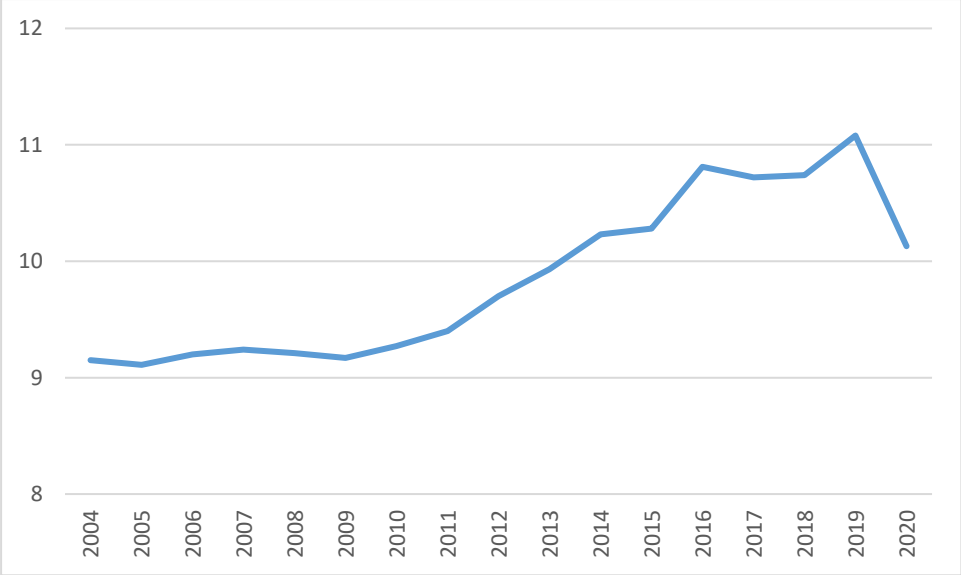

Figure 3: UK Self Employment Rates (2004 – 2020)

Source: ONS, APS microdata

While unemployment rates across the UK are largely returning to pre-Covid levels, there is concern that 'non-standard' or 'alternative' forms of work, such as those found with companies like Deliveroo or Uber, who's employees work as 'self-employed contractors', may be partially masking new structural inequalities (Giupponi and Xu, 2020).

Job vacancies have continued to fall across the UK, but are still above pre-Covid levels (ONS, 2024b). A report conducted by the Department for Work and Pensions found the main reason cited by recruiters for being unable to fill vacancies was a low number of applicants, especially those with the required skills (2023). However, ONS (2024a) reported that the labour market may be cooling, as in their June release they noted the number of vacancies continued to fall and unemployment was rising. They did observe, however, that earnings growth remains relatively strong.

At a regional level, rates of participation in the labour force have been varied. Figure 4 shows that the North East has lagged behind other English regions recoding rates around 71% over the period, while the South West and South East have compared relatively well, achieving rates around 77%.

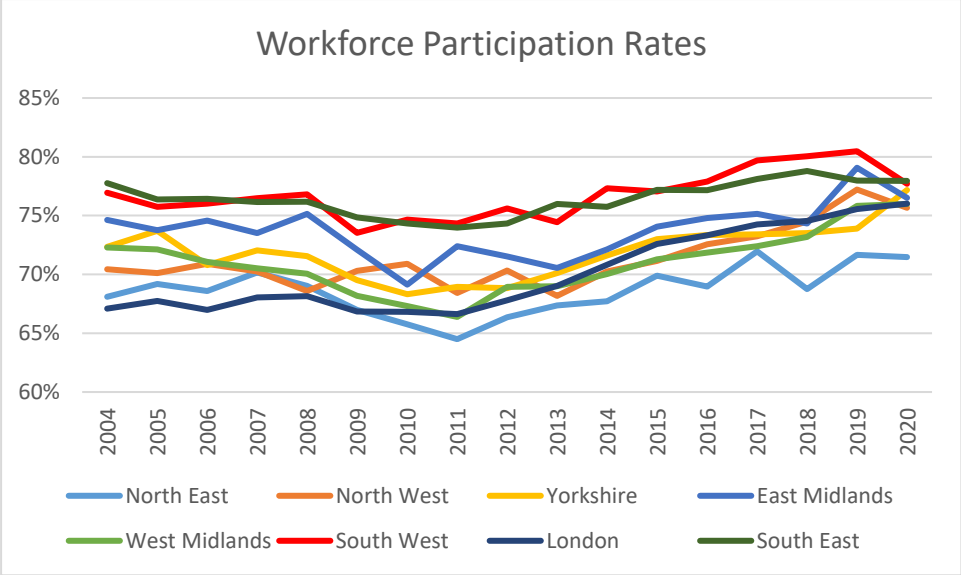

Figure 4: English Regional Workforce Participation Rates (2004 – 2020)

Source: ONS, APS microdata

It is evident that these challenges are felt differently across the regions of the UK. For example, in terms of participation and recruitment, one third of the country witnessed more than twice as many jobseekers as vacancies, and two thirds with more vacancies than job seekers (Local Government Association, 2022). The potential effects of this disparity are enduring poverty in some areas, and stunted growth in others. This highlights the necessity of a nuanced understanding of regional labour market differences, so public policy can properly respond to differing needs.

There are also considerable differences in participation rates by age. Figure 5 shows that there has been a consistent gap of around 20 percentage points for those under 26 and over 56, compared to all other age groups.

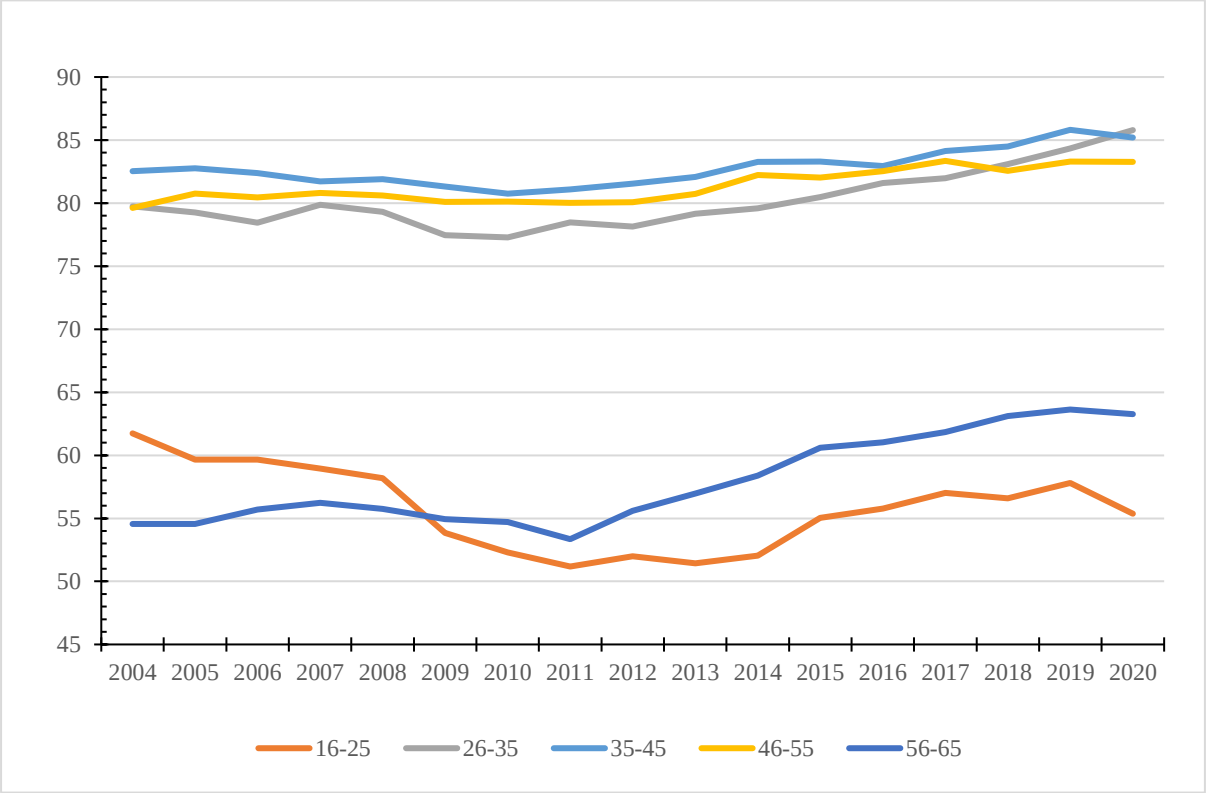

Figure 5: UK Workforce Participation Rates by Age (2004 – 2020)

Source: ONS, APS microdata

Much like the rest of the UK, where more than 1 in 6 (18.4%) people were over the age of 65 in 2021 (ONS, 2022) the WGA's population is ageing. Within the South West, the largest age group has increased from 45-49 in 2011, to 55-59 in 2021, compared with England's largest group at 30-34 years (ONS, 2023a). An ageing population has implications for inactivity rates (e.g. health, retirement), with implications for labour supply and occupational compositions.

Over the past decade, the ageing population reported in the South West is amplified in Wiltshire, North Somerset and South Gloucestershire, where the populations of over 65s has increased by 30.5%, 22%, and 21.8% respectively. Bristol's 65+ population, however, has increased at a lower rate than the 15-64 age bracket, and therefore reverses this trend (ibid).

The proportion of those Not in Education, Employment or Training (NEETs) in the Western England area is high, and in line with the rest of the South West, at 5.8%, compared with England's average of 5.2% (ONS, 2023b). Bristol's NEET population has decreased a full percentage point from 2011 to 2021, making it lower than the countries average, at 5.0%, however, it is still much higher than other comparator regions such as Oxfordshire and Cambridgeshire, at 4.4% and 2.7%, respectively (ibid). This issue signals the need to strengthen connections between education and employment in the area.

Almost every region within WGA has less affordable housing than the UK average, which is over eight times the average annual salary. The most affordable housing is in South Gloucestershire, where on average a house costs 8.2 times an annual salary, which rises to 11.1 times in BANES. The average across the region is 9.3 (ONS, 2023c). Relatedly, 13% of all recorded rough sleepers

in the UK were found in the South West, and while Bristol's share decreased by 15% from 2021-2022, it was still the local authority with the 4th highest estimated number on a single night in autumn 2022 (Department for Levelling Up, Housing & Communities, 2023).

Like many regions in the UK, WGA has both areas of strong growth, and other areas at risk of being left behind. To avoid a two-tiered economy with ever-widening inequalities, it is essential that the pursuit of growth is undertaken in an inclusive and sustainable manner.

3.3 Priority Sectors

Futures West priority sectors are still in development but are likely to include Advanced Manufacturing & Engineering, Fintech, Creative Industries, Digital Technologies, Cyber Security and the Green Economy. These industries were identified as being important following an analysis of economic data, key strategy documents and discussions with policy makers. The decision to initially focus on these sectors was taken based on a variety of criteria, but typically included actual and relative size of the sector; record and potential for productivity and employment growth; internationally competitive, and/or aligned with national priority sectors.

It must be noted that these priority sectors are intrinsically linked and exhibit multiple interdependencies and crossovers, while definitions for the (emerging) sectors are not always consistent throughout the literature and not easily identifiable through current statistical systems. Both factors complicate this type of analysis. For example, there has been much debate in relation to the Creative Industries and whether than should be viewed through a lens of industry (i.e. SIC), occupation (SOC) or a combination of the two (DCMS, 2013). While the green economy is particularly challenging to capture in the SIC coding framework. For example, there is no standard definition of green economy and green jobs, with many authors espousing a bottom-up occupational based approach to measurement (Volero et al., 2021; Whittard et al. 2024).

Given these difficulties, a key challenge for the research team was to be able to produce definitions of sectors which broadly captured the Futures West priority sectors, while also aligning to definitions used within the literature to enable comparisons. As such, the research team have chosen to take a purely sector-based approach (SIC) and look at five key sectors, which either directly or indirectly capture the majority of Future West's priority sectors.

The five sectors explored in more detail in this article are Advanced Manufacturing and Engineering; Finance and Insurance Services; Creative Industries, Digital Industries and (partial) Environmental Goods and Services Sector (EG&SS). It is worth noting that FinTech will be indirectly captured in both the Finance and Digital sectors. As such, the following section outlines the importance of these five sectors to the region, and detail how they have been specified within the research project.

3.3.1 Advanced Manufacturing and Engineering

Defined by the Department of Business and Trade as "production processes that integrate advanced science and technology, including digital and automation, to manufacturing" (2023), the UK's industrial composition enabled it to achieve the fastest manufacturing productivity growth in the G7 between 2010 and 2021 (ONS, 2021), and in 2021 became the world's 8th largest manufacturing nation (Make UK, 2023).

The West of England region is home to the UK's largest aerospace cluster, housing more than 10 world-leading aerospace companies (Invest Bristol and Bath, 2024a), including BAE Systems and Rolls-Royce Holdings, two of the largest Aerospace and Defence companies in Europe (Global Data, 2021). Additionally, in response to the climate emergency, the exploration of hydrogen aviation is growing in prominence, Airbus and GKN Aerospace, each investing significantly in this emerging technology, from their bases within the West of England region. The region generates world class research, with Bristol housing the National Composites Centre, and UWE's Robotics Lab, recognised as a centre of excellence for advanced robotics research internationally.

The Manufacturing sector in Gloucestershire is the regions second largest, employing 13% of the workforce, which exceeds the national figure (Business West, 2023). This includes a strong defence and aerospace sector (Safran, GE Aviation, Moog) and composites (Renishaw). It also includes a strong agri-tech sector, producing the UK's largest and fasting growing network of the sector's SMEs (South West AgriTech, 2023). Gloucestershire is home to two of the most internationally renowned agriculture institutions, the Royal Agricultural University, and Hartbury University and College, and one of the UK's largest agri-tech incubators.

In the Swindon and Wiltshire area, the Advanced Manufacturing and Engineering sector shrunk by 4% between 2016 and 2021 (Hatch, 2022), partially driven by the closure of the Honda plant. A government Science and Innovation Audit Report stressed the need to upskill the workforce in the area to fill the high-end advanced manufacturing jobs (Department for Business, Trade & Industrial Strategy 2017). However, Swindon and Wiltshire still has substantial strengths in engineering, including BMW, Dyson, Knorr-Bremse, Siemens and Johnson-Matthey.

The production of computers and electronics is a key sub-sector for the Western England region, generating £301million and £437million GVA in 2019 in the West of England and Gloucestershire, respectively (Oxford Economics, 2021), with clear mutual benefits with the Digital Technologies sector.

As the world's market increasingly favours cleaner tech, and simultaneously shifts towards what is known as 'Industry 4.0', or the 'cyber industrial revolution', the advanced manufacturing and engineering sector is facing some fundamental changes. Growth in this sector must not compromise on sustainability, and will only succeed if accompanied by training initiatives, specifically in those areas most at risk of being left behind.

In line with Cambridge Econometrics Local Economy Forecasting model and referenced in Leicester and Leicestershire Enterprise Partnership review (2021), the Advanced Manufacturing and Engineering sector has been defined using five-digit Standard Industrial classifications. These have been informed by government and/or industry recommendations and aim to capture a much of the sectors value chain as possible. The full list of industries is detailed in Appendix 1.

3.3.2 Financial and Insurance Services (including FinTech)

The financial and insurance services industry encompasses businesses that manage money and provide financial protection against various risks. This sector is of considerable importance to the regional economy - e.g. the South-West ranks 5th in terms of the UK's financial and professional services GVA. For example, the Western gateway is home to the regional HQ's of Zurich, Nationwide and St James's Place. By nature, the financial and insurance services industry will also capture large elements of the FinTech sector, albeit this FinTech companies are not directly observable within the SIC classification.

FinTech is an emerging sector and derived from combining the words 'financial' and 'technology', fintech can be broadly understood as "technology-enabled financial innovation, which is changing the way financial institutions provide – and consumers and businesses use – financial services" (Bank of England, 2022). Representing 10% of the world's FinTech market share, the UK is at the forefront of the sector's growth (Centre for Finance, Innovation and Technology, 2020), while 47% of FinTech firms are estimated to be located in the West of England area (Whitecap, 2023).

Bristol and Bath fintech ecosystem is nationally significant and is considered to be focussed on impact led finance, with several startups founded on a social focus emerging from the area, such as Hargreaves Lansdown, Triodos, Pismo. Both of Bristol's universities and the University of Gloucestershire teach Master's courses on Fintech, preparing the next generation for the economy's digitisation. The Financial and Business Services sector is projected to represent strong growth across Gloucestershire and is expected to create over 15,000 jobs over the next decade (Strategic Planning Research Unit, 2020).

The finance and insurance services sector has been defined in line with ONS's industry review (2016). The industry is defined at the five-digit SIC level and covers financial service activities, such as insurance, reinsurance and pension funding activities, and activities to support financial services. It also includes the activities of holding companies and the activities of trusts, funds and similar financial entities (see appendix 1.2 for more detail).

3.3.3 Creative Industries

The creative sector in the UK covers a range of industries, including architecture; film, TV and radio; publishing; and advertising and marketing. Creative service exports are strong, and on the rise, growing at 1.5 times the rate of the wider economy over the past decade, contributing £108 billion in GVA annually (DCMS, 2023). Of the £126 billion GVA creative industries contribute to the UK economy, IT, software and computer services are most productive, contributing 44%, followed by and film, TV, radio and photography at 17% (ibid).

In the West of England area, the sector already employs more people proportionally than the national average and is expected to grow over the next decade (WECA, 2021). The region houses the UK's third largest TV cluster, and accounts for £650 million of the UK's GVA from creative industries (WECA, 2023). It houses over 190 production companies, and more than 6,000 creative businesses (Invest Bristol and Bath, 2024b). Bristol is a key hub for creative industries. It was awarded the UNESCO city of film title in 2017 and houses several nationally significant creative businesses, such as the Oscar-winning Aardman Animations (ibid). In Wiltshire, there is an expanding advertising and market research sector, which saw growth in over 7,000 jobs between 2017 and 2021(Hatch, 2023).

In the West of England 47% of creative workers are self-employed, compared with 15% across the region's wider workforce (WECA, 2019). This means that they were not supported by the pandemic support packages offered by the government, and further, that those within this industry are at risk of entering the gig economy. Moreover, the sector is 95% made up of micro-businesses (Creative Industries Federation, 2020) making the sector more vulnerable to economic downturn and shocks. To fully harness the potential of this locally significant sector, these characteristics must be kept in mind when designing policy interventions. Further than

employment, the DCMS emphasises the broader impact of the arts for wellbeing, for example through public health interventions (Evennett, 2024).

There is much debate as to how the Creative Industries sector should be identified within the confines of the standard classification systems, but in line with Digital, Cultural, Media and Sport's (DCMS), this report applies a sector definition based on 13 subsectors (Advertising, Architecture; Arts and antique market; crafts; Design; Designer Fashion: Film and video; Interactive leisure and software; Music; Performing arts; Publishing; Software and computer services; Television and Radio). The mapping of these broad areas to SIC codes is in line with that identified in Creatice Skillset (2013) publication – Classifying and measuring the Creative Industries (see Appendix 1.3 for more detail).

3.3.4 Digital Industries (including Digital Technologies, Cyber Security and FinTech)

The digital industries encompass businesses that create, use, and manage technology to offer services, create products, and enable communication. In essence, the digital industries are all about creating and using technology to make our lives easier, more connected, and more entertaining. They cover everything from the apps on our phones to the internet services that keep us connected.

Globally, the Digital Technologies sector is experiencing rapid expansion. Accelerated by the pandemic (Jaumotte et al., 2023), and the rapid advancement of Artificial Intelligence (AI) technologies, a broad spectrum of industries are embracing digitisation. The Home Office's Digital, Data and Technology Strategy for 2024 (2021) sets out goals to become 'digital by design' across the board. Due to its existing strengths, such as widespread super-fast internet connectivity and a highly skilled workforce, the UK is well positioned to lead the charge towards a productive and progressive digital future.

The Western England region has a strong digital ecosystem, housing the largest tech workforce in the South-West (Whitecap, 2022). This can be ascribed, in part, to the universities and incubators in the area, with several significant institutions residing within the Western England region. In South Gloucestershire the award-winning UMBRELLA project houses a programmable Industrial Internet of Things, which serves as a nationally significant Research & Development testbed, and the £2m Agriculture Digital Innovation Farm 'Tech Box Park' in Hartpury, Gloucestershire supports innovation within the agriculture sector.

The City of Bristol, part of the Silicon Gorge tech cluster, is a hub for innovation and entrepreneurship in the South West, and has a strong presence of university spinouts and accelerator programmes. The University of Bristol has a strong Research and Development focus, with initiatives such as Science Creates, a deep tech ecosystem which fosters innovation for science and engineering startups, leveraging technologies in AI, nano technologies and quantum computing. Additionally, Bristol and Bath are part of the world's number one university business incubator, SETSquared, which, together with three other universities across Exeter, Surrey, and Southampton, nurtures tech businesses through training and access to networks of investors, mentors, and corporate partners. Graphcore, a semiconductor startup company which develops accelerators for AI and machine learning and was Bristol's first 'unicorn' business. Additionally, the new Bristol Digital Futures Institute (BDFI) creates a space in which academics from across multiple disciplines can collaborate to create new digital technology which prioritises sustainability and social inclusion.

With an increasing number of industries relying on digital systems, cyber security is becoming an ever-present priority across sectors. Housing the Government Communications Head Quarters (GCHQ) and the National Cyber Security Centre (NCSC), Cheltenham, Gloucestershire is nationally significant hub of expertise and innovation, attracting a wealth of talent and firms to the area. The density of cyber security firms in Cheltenham, and more widely, Gloucestershire, was 11 and 6 times larger than the rest of the UK, respectively, in 2018, and has continued to grow (Department for Digital, Culture, Media and Sport, 2018). The cyber security sector in Gloucestershire is worth approximately £8.3 billion (Whitecap, 2022).

Despite strong research and investment in the area, the greatest challenge to the Digital Technologies sector is still skills shortages, with over 80% of all advertised job vacancies in the UK requiring at least one digital skill (DCMS, 2021a). The University of Bath's Institute of Coding is a collaboration between industry, research and education experts working towards bridging the UK's digital skills gap, providing free short courses in specialist skills such as cyber security and data programming.

In this report the Digital Industries sector has been classified at the four-digit level as defined by DCMS Digital sector and reported in the Steer Economic Development report (2021) on Regional Digital Ecosystems. The digital sector includes 43 sub-sectors across the broad sections of Information and Communication, Manufacturing, and Wholesale and Retail Trades (see appendix 1.4 for more details).

3.3.5 Environmental Goods and Services Sector (EG&SS) (Partial)

Globally, governments are beginning to respond to the climate emergency, within the UK, this entails a target to achieve net zero emissions by 2050 (The Climate Change Act 2008, 2019). As laid out by the "ten-point plan for a green industrial revolution" (UK Government, 2020), the UK government aims to harness the nation's science and technology expertise to turn the challenges of decarbonising the economy into opportunities for green growth. The UK has already made some positive steps towards the transition to a low carbon economy, reducing emissions by half between 1990 and 2022 (Department for Energy security and Net Zero, 2024), however reaching net zero will require a fundamental shift in the way the economy is powered. It is expected that this shift will require the creation of 250,000 new jobs across the UK (UK Government, 2020).

The West of England Combined Authority has gone further and has set its own target to reach net zero by 2030, and progress is already underway, with a reduction of 17% emissions per person since 2019 (Invest Bristol and Bath, 2024c). In the West of England, the low carbon sector employs 6,000 people across a range of industries (WECA, 2023). This comprises multiple sources of green energy, including waste-to-energy and biomass projects GENeco in Bristol and Suez Environment's Severnside plant in South Gloucestershire. Bristol also houses two green energy providers, Ecotricity and Ovo, with the latter recently receiving certified 'unicorn' status-earning over $1billion (Startup Coalition, 2024).

The University of Bath's Hydrogen Sustainable Transport Economy Accelerator (HSTEA) at Bristol & Bath Science Park aims to accelerate the commercialisation of sustainable transport and hydrogen production in the West of England region. Additionally, in partnership with Oxford university, The University of Bristol is at the cutting edge of nuclear research, forming one half of the South West Nuclear Hub. Furthermore, Western Gateway's 'Severn Edge' vision has been shortlisted as one of the five sites for the world's first nuclear fusion power plant. The project has ambitions to form a low-carbon supercluster in the region and hopes to transform two

decommissioned nuclear sites across Gloucestershire, in a partnership between industry, academia, communities and political leaders (HM Government, 2024).

The climate emergency represents one of the most profound challenges the world has collectively faced to date. Our relationship to consumption must change, with profound implications for labour market dynamics. Although there are increasingly multiple options for decarbonising the economy, this shift will require significant investment in innovation. Further, the opportunity for this transformation to function as a levelling-up exercise must not be squandered and must generate equal opportunities for the least advantaged regions.

However, given the challenges of defining and measuring the green economy using SIC classifications, the research team adopted a classification, loosely based on ONS's (2023) EG&SS breakdown, albeit with some major omissions. The omissions from a full EG&SS include organic farming, renewable energy generation and environmental education amongst others. This is because this fine level of disaggregation is currently not possible within the SIC classification. The sector definition, however, is further enhanced by the SIC classification of the Low Carbon Sector presented in Webber et al. (2014) report on the West of England's priority sectors. An alternative approach considered was to take an occupation-based approach to exploring green jobs (see Whittard et al., 2024). This approach was rejected to maintain comparability to the industrial approach taken for all other priority sectors.

In the remainder of the report, the analysis moves beyond labour market participation and focus specifically on wages. To achieve this, ASHE dataset is used, which is described in some detail in the following section.

4. Data on Wages

This analysis presented in this report utilises administrative data from the ASHE to provide an in-depth understanding of wages in Great Britain and its sub-regions. This section reports on the ASHE dataset and statistical framework used to model wages.

4.1 ASHE

ASHE is as survey run by the ONS and aims to achieve a 1% sample of all Great British employees. Data for ASHE is available from 2004, while it is a continuation of the New Earnings Survey (NES), which began in 1975. The ASHE's large sample size affords detailed analysis, offering nuanced insights into earnings and hours worked across occupations, industries, and sectors. It provides detailed information on the earnings and working hours of employees across the UK. With the use of these microdata sources, sectoral compositions, wage distributions and trends in working patterns can be examined in detail. For example, this dataset offers valuable insights into wage structures, gender pay gaps, regional earnings variations, and sector-specific wage trends.

ASHE is derived from a 1% sample of employees who are members of Pay as You Earn (PAYE) schemes. The survey uses administrative data from HM Revenue and Customs (HMRC) alongside additional information collected from employers. The survey reference date is typically in April each year, ensuring consistency in the temporal comparison of earnings data.

ASHE is subject to rigorous data validation processes to ensure accuracy, including cross-referencing with previous records and correcting outliers. The ASHE dataset includes a wide range of variables related to earnings and employment conditions, such as:

- Gross Pay: Detailed measures of gross weekly, hourly, and annual pay, including basic and overtime pay.
- Hours Worked: Information on paid hours, including both standard and overtime hours.
- Earnings by Characteristics: Breakdown of earnings by gender, age, occupation, industry, and region.
- Work Patterns: Data on full-time and part-time status, permanent and temporary contracts, and other employment conditions.

While ASHE is a robust and comprehensive dataset, it is subject to several limitations. The survey primarily covers PAYE employees, potentially underrepresenting self-employed individuals and those outside PAYE schemes. The survey reflects earnings data from a specific week in April, which may not capture seasonal variations or temporary employment trends. Despite rigorous validation, the accuracy of employer-reported data can vary, and certain anomalies may persist. Whilst an individual's inclusion in the ASHE confirms employment, it does not provide information about other employment statuses, such as 'self-employed' or 'student'.

Standard Industry Classifications (SIC) were employed in the analysis to control for differences in wages across sectors. The SICs experienced a major change during our period of study when SIC indicators were reclassified from SIC2003 and then to the SIC2007. To facilitate an effective analysis and continuity, all SIC2003 codes were reclassified to the SIC2007 codes.

To include analyses of Futures West's Priority Sectors the research team created sector markers within the dataset for Advanced Manufacturing and Engineering, Finance and Insurance,

Creative Industries, Digital Industries, and EG&SS. A full list of the SIC categorisation of these industries can be found in Appendix 1.

The ASHE data set includes a variable relating to the region and local authority district of both the home and work location. Geographical analysis in this report, however, has been undertaken at the level of workplace location. Local authority identifiers were used as the base area and included the following areas:

- Bath and North East Somerset (BANES)
- Bristol City
- North Somerset
- South Gloucestershire
- Swindon
- Wiltshire
- Gloucestershire

These areas were then aggregated up to create higher level Local Enterprise Partnership Area markers as well as aa marker for the WGA. Similar hierarchical merging was undertaken in order to generate area identifiers for comparator areas.

The decision was also taken to exclude Greater London from any wage analysis in order to produce a more balanced and representative understanding of wage patterns across the WGA and rest of the country. This approach avoids the distortions caused by the unique characteristics of London's labour market.

The variables used in this analysis are described in Table 1

Variable	**Categories**	**ASHE variable name**
Geography: WGA	Categorical variable created to identify individuals who work in the WGA	wpost
Geography: Higher level subregions of WGA	Categorical variable created to identify individuals who work in three sub-regions of West of England; Swindon and Wiltshire; and Gloucestershire	wpost
Geography: Lower-level subregions of WGA	Categorical variable created to identify individuals who work in the seven sub-regions of Bath and North East Somerset, City of Bristol, South Gloucestershire, Swindon, Wiltshire and Gloucestershire	wpost
Year	Year of observation in ASHE survey	year
Priority sectors: Advanced Manufacturing and Engineering	Dummy variable to identify whether enterprise is in the advanced manufacturing and engineering sector based on five-digit sic.	industry
Priority sectors: Finance and Insurance services	Dummy variable to identify whether enterprise is in the finance and insurance services sector based on five-digit sic.	industry
Priority sectors: Creative Industries	Dummy variable to identify whether enterprise is in the creative industries sector based on five-digit sic.	industry
Priority sectors: Digital Industries	Dummy variable to identify whether enterprise is in the digital industries sector based on five-digit sic.	industry
Priority sectors: Environmental Goods and Services	Dummy variable to identify whether enterprise is in the environmental goods and services sector based on five-digit sic.	industry

Priority sectors: Other Industries	Dummy variable to identify whether enterprise is in the other sector	industry
Male	Dummy variable	sex
Age Age squared	Continuous variable with squared value to account for non-linear relationship.	age
Tenure Tenure squared	Tenure relates to the length of time an individual has worked for an organisation. It is derived from when he/she first started to work for an organisation.	empsta
Collective agreement	Dummy variable to indicate whether the individual is subject to a collective bargaining agreement	coll_agt
Permanent	Dummy variable to indicate whether job is permanent	permanent
Full time job	Dummy variable to indicate whether job is fulltime	fulltime
Occupation	1 digit occupation	occupation
Interaction term	Geographic variables are interacted with priority sector variables	

In the following section, three aspects of wages are focussed on. Initially the paper provides descriptive statistics of pay, nationally, regionally and for the priority sectors. It then focusses on low pay, before providing an econometric analysis of wages. As such, this article provides a detailed and quantified understanding of how different individual and job characteristics affect wage levels. It is worth noting, however, that ASHE does not include a direct measure of education, therefore, within the analysis, education is indirectly controlled for using proxy variables such as occupation and tenure. This is because higher-skilled occupations often correlate with higher education levels, while tenure can help account for the skills and knowledge that typically increase with both experience and education.

5. Results and discussions

In the following section, the results are reported for average pay rates for various levels of geography and in relation to individual and job characteristics, including an analysis of low pay. The section concludes with regression analysis to provide a detailed examination of the determinants of wages in WGA.

5.1 Descriptive Results: Pay

Figure 6 plots nominal average (median) hourly wages from 2004 to 2022. It shows that wages across all regions have risen broadly in line with each other over this period. Wages were lowest in the North East and highest in the South East (excluding the Greater London region). Residents in the South East on average earned nearly £2 per more per hour than those in the North East, while wages in the South West have broadly mirrored those in the West Midlands. At the start and end of the period, hourly wages in the South West were similar to the total for the UK as a whole (excluding London). However, over the full period, nominal wages in the South West diverged from the national average in the two periods around the financial crisis and COVID. This suggests that they may have been more susceptible to these exogenous shocks, possibly due to its economic structure. However, it is worthy of note that wages were able to bounce back in subsequent periods.

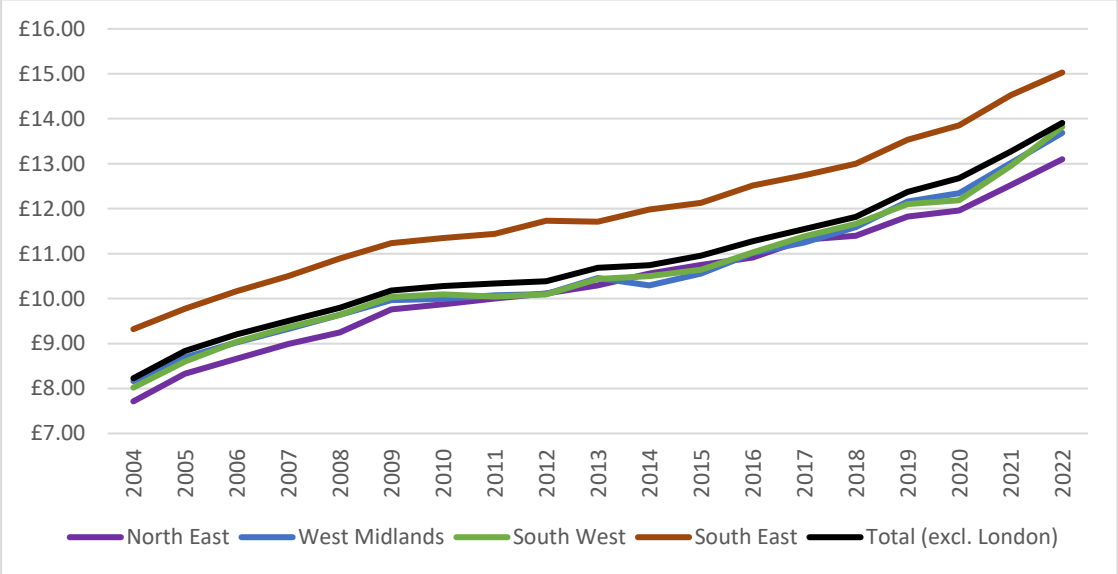

Figure 6: Great British Median Nominal Hourly Wage (2004 – 2022)

Source: ONS, ASHE microdata

When analysing microdata at lower level of geographies, one should always be mindful of the smaller sample sizes. This increases volatility in the data and therefore caution should be applied when interpreting individual changes between years, while more reliance should be placed on medium and long-term trends.

While recognising these limitations, an analysis of the WGA and its constituent Local Enterprise Partnership (LEP) areas (i.e. West of England, Swindon and Wiltshire and Gloucestershire) Figure 7 reveals that prior to 2018, in most years generally all subregions were above the national average (excluding London).

Swindon and Wiltshire witnessed negative nominal wage growth between 2017 and 2020. It is difficult to pinpoint the precise reasons for this, but one contributing factor could have the impact of the closure of Honda's Swindon plant in 2021. The closure was officially announced in 2019, but there were already concerns and uncertainties in the local economy as early as 2017 about the future of the plant. These concerns would have hit both consumer confidence and weakened pay bargaining positions which would be set in the context of an expected loosening of the local labour market.

Wages in Gloucestershire seem to have been negatively affected by the COVID pandemic, but caution should be shown when interpreting short term changes, especially when collected in such unusual times. This temporary blip could partially be explained by challenges with collecting data during this period. The data reveals that wages dropped by approximately 7% in nominal terms between 2019 and 2020, but this was followed by a bounce back in the next years as it returned to trend in 2022, albeit remaining slightly below the national average.

Individuals in the West of England area received consistently higher wages than other areas of the WGA. In 2022, the average wage was approximately 11% higher in the West of England than in Gloucestershire.

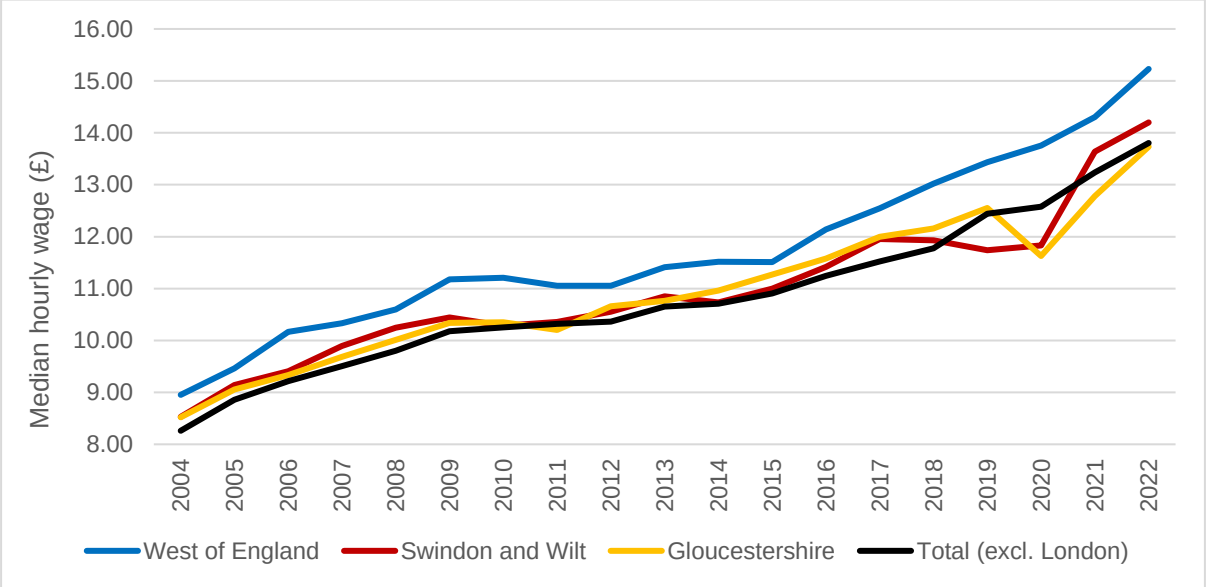

Figure 7: Median Nominal Hourly Wage by Local Enterprise Partnership Area (2004 – 2022)
Source: ONS, ASHE microdata

Figure 8 breaks the analysis down further to the level of upper tier local authority level. Given the reduction in sample size and the increase in volatility, the analysis focusses on medium and long-term trends, rather than individual changes between years. Data for individuals working in Swindon and Wiltshire in 2019 and 2020 are not presented in the figure. This is because the results for this year and region would be based on less than 10 observations. By omitting data with fewer than 10 observations, this balances the need for detailed and useful data with the imperative of maintaining privacy and ensuring the reliability of research findings.

The data shows the West of England advantage is driven by individuals working in the City of Bristol and South Gloucestershire. In 2022, individuals working in North Somerset, receive the lowest hourly wage, earning around 18 per cent less that those working in the City of Bristol.

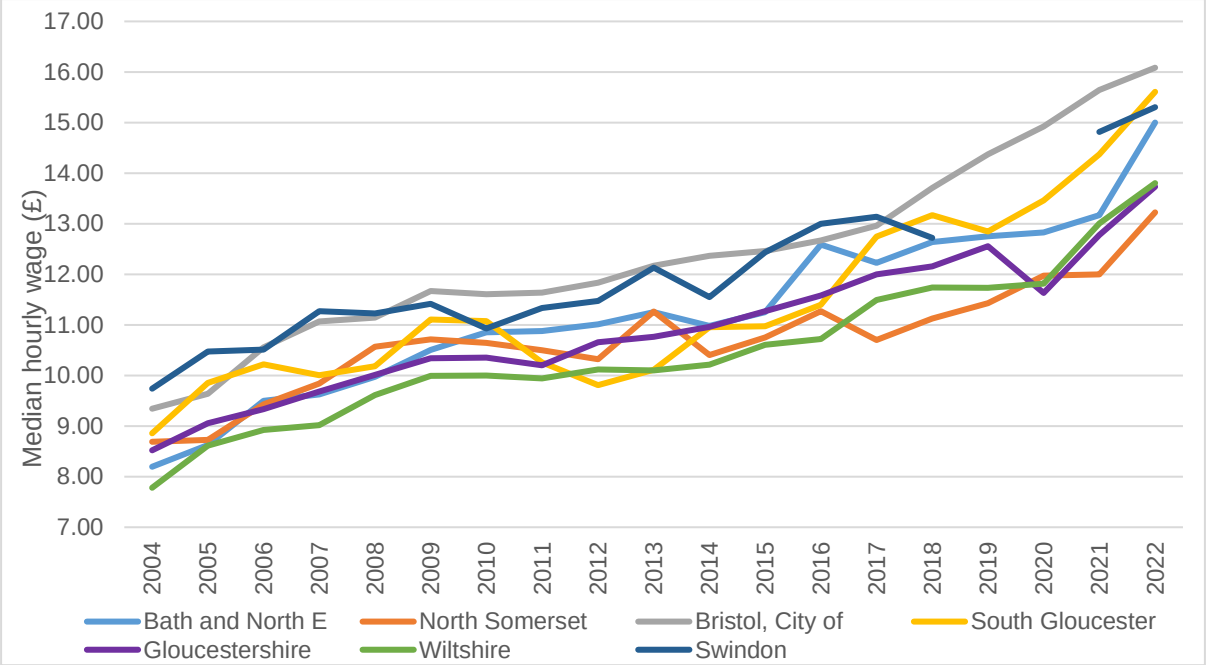

Figure 8: Median Nominal Hourly Wage by Local Authority Area (2004 – 2022)

Source: ONS, ASHE microdata

Figure 9 shows that on average, nationally, wages in each of the priority sectors are higher than that for other sectors, some substantially so. As such, this provides Futures West with reassurance that they are supporting sectors which are likely to be bring wealth to the region.

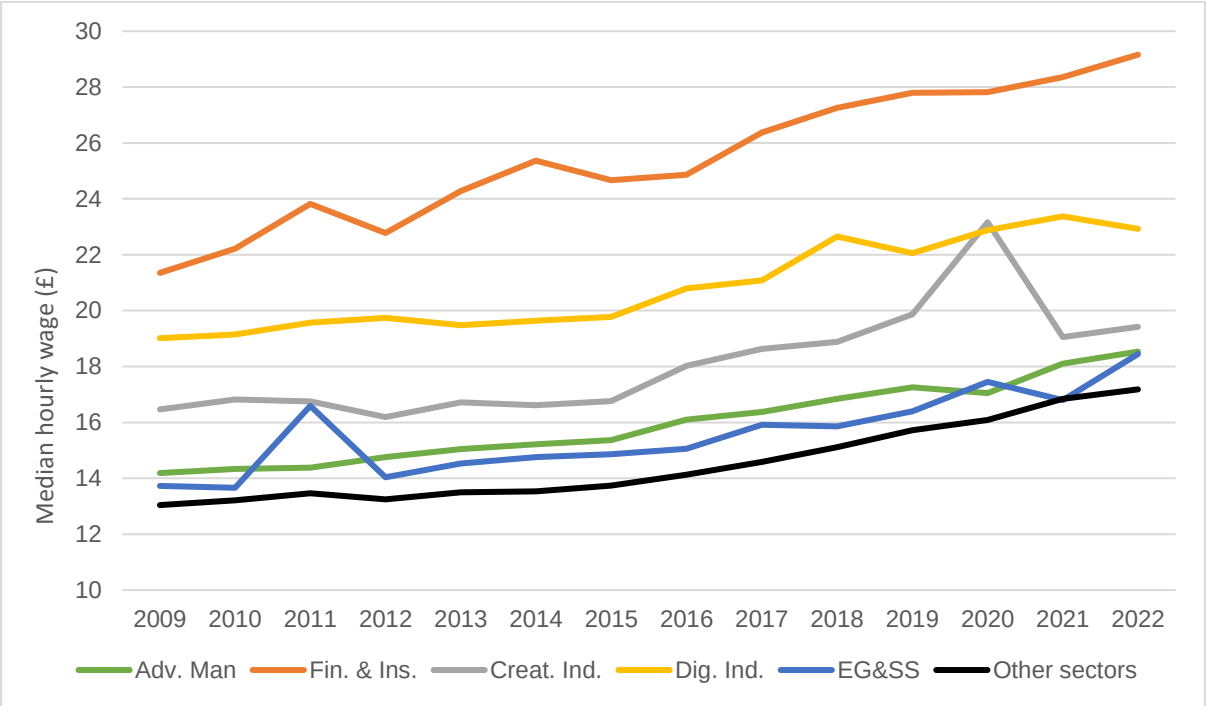

Figure 9: Great British Median Nominal Hourly Wage by Priority Sector (2004 – 2022)

Source: ONS, ASHE microdata

The same is true when looking at the priority sectors within the WGA area. Figure 10 shows that those employed in all the priority sectors in the WGA, on average earn more money than those working in all other sectors in the same region. Those working in the Financial and Insurance sectors in WGA earn nearly 40 per cent more than those working in other sectors. EG&SS and the Create Industries sectors are the two least well-paid priority sectors. However, in the latest period, individuals working in these sectors still earnt in excess of 6 per cent more than those working in other sectors.

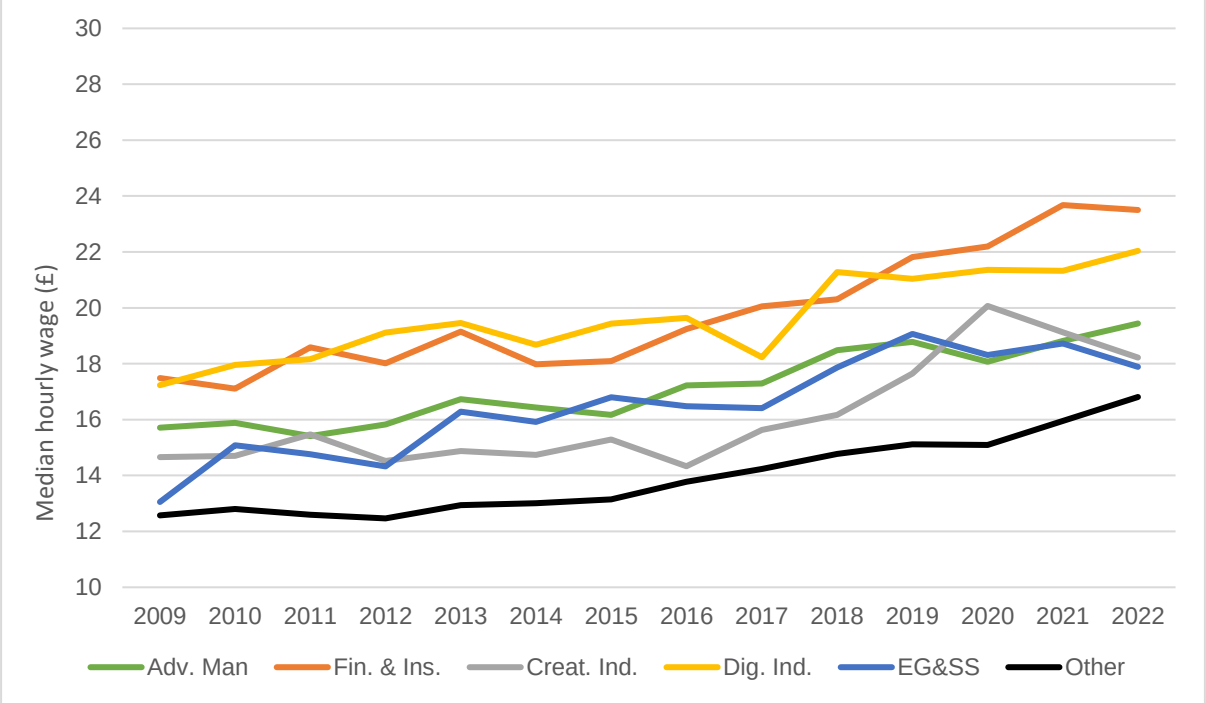

Figure 10: WGA Median Nominal Hourly Wage by Priority Sector (2004 – 2022)

Source: ONS, ASHE microdata

5.2 Descriptive Results: National Minimum Wage and Low Pay

5.2.1 National Minimum Wage

Figure 11 shows that between 2004 and 2022 there has been significant growth in the national minimum wage, with the standard rate almost doubling in nominal terms during that period. It also records the rate of the national minimum wage and the "bite" of the national minimum wage. The bite of the national minimum wage is a term used to describe the ratio of the national minimum wage to the average (median) wage in the economy. It reflects the extent to which the minimum wage affects the wage distribution. If the bite is higher, it means the minimum wage is closer to what the average worker earns.

Figure 11 shows that the bite of the national minimum wage increased from approximately 52% to 62% between 2004 and 2022. This means that the minimum wage has become more significant relative to the average wage over time. This higher bite reflects that the minimum wage has risen faster than the median wage, suggesting that lower-paid workers area receiving a

larger share of the overall wage distribution over time, which goes some way to reducing wage inequality.

The increases in the national minimum wage will have contributed to improving the living standards of low-wage workers, reduced poverty, and stimulated economic demand by increasing the purchasing power of these workers. However, some commentators suggest that if the national minimum wage is set too high, this could lead to potential job losses or reduced hours for low-wage workers. In the UK, to date there is limited evidence of this occurring.

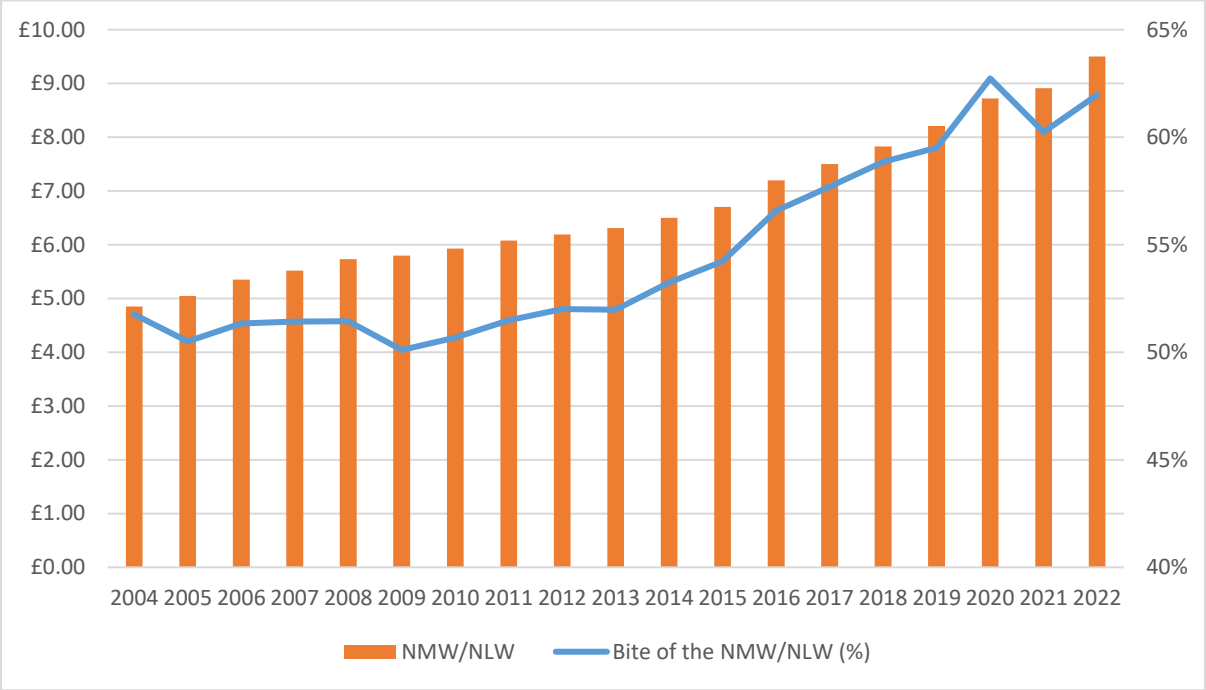

Figure 11: National Minium Wage and its Bite (2004 – 2022)

Source: ONS, ASHE microdata

5.2.2 Low Pay

Low pay is defined as earning less than 2/3rds of the national median wage. Figure 12 shows that the proportion of low pay remained largely static between 2004 and 2014, but since then it has fallen sharply. This means in recent years that fewer people are earning very low wages compared to before. This largely reflects the increases in the NMW over this period and thus indicates that increasing the national minimum wage has been effective. By increasing the lowest wage in the economy, it also has a knock-on effect also pushing up wages throughout the lower end of the age distribution, moving people out of low pay. For the individuals who have moved out of low pay, this will have resulted in improved living standards, with better financial security.

From a regional perspective, Figure 12 reports the rate has fallen more sharply for those working in the South West of England than the national average, albeit the levels still remain slightly above the national average. This decrease in the proportion of low pay suggests that the region's economy is doing well, with businesses offering higher wages which in part may reflect a combination of economic growth, increased demand for labour, and successful regional economic policies. With higher levels of wages, the region could also become more attractive for

higher-skilled workers and businesses looking for a stable and prosperous environment, potentially leading to further economic growth.

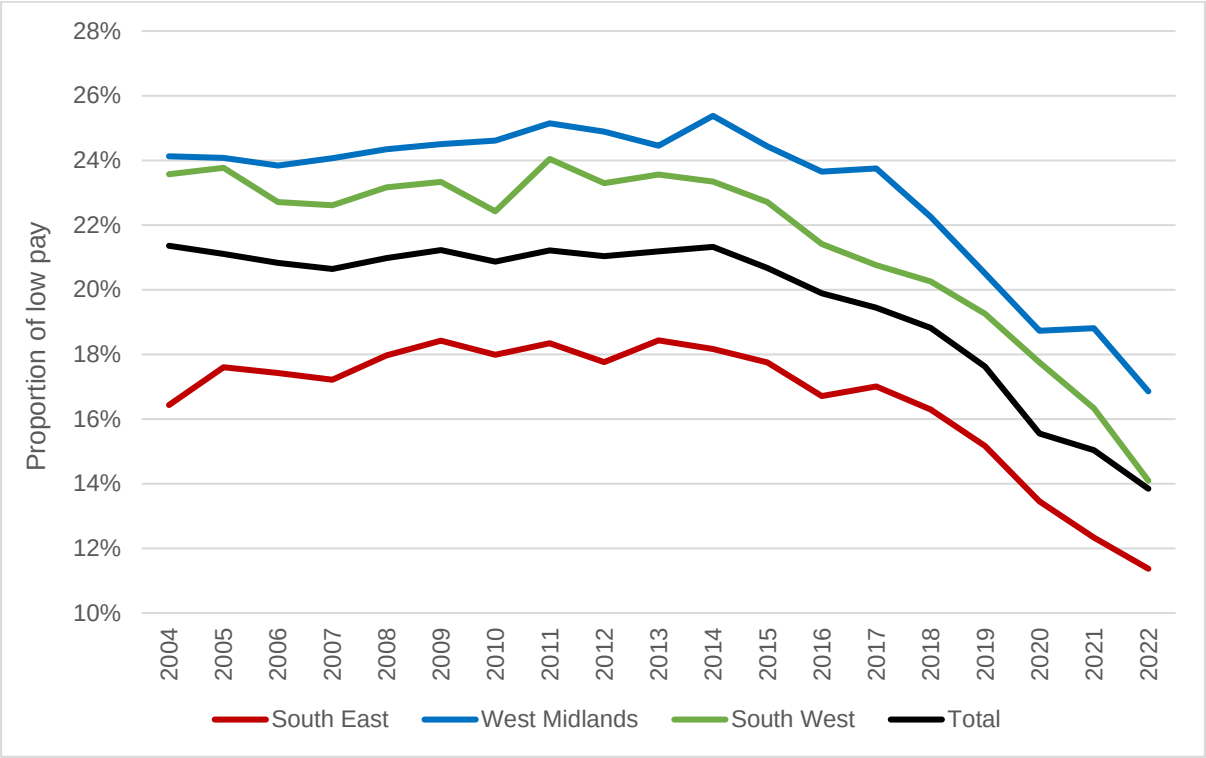

Figure 12: Proportion of Low Pay by Region (2004 – 2022)

Source: ONS, ASHE microdata

The proportion of low pay results for WGA are reported in Figure 13. Due to the smaller sample size, volatility between years is greater and therefore caution should be shown in interpreting short term changes. Figure 13 shows that over the full period, and since 2014 in particular, all LEP areas have seen a drop in the proportion of low pay. However, the drop in the WGA has been less pronounced than across the whole of the South West. This is somewhat explained by the fact that the sub-regions of the WGA started from a lower base (i.e. less proportion in low pay) , partially reflecting its industrial structure which includes a higher concentration of high-tech, high paying industries. In Gloucestershire, however, it may be of some concern to policy makers that the fall in the proportion of low pay was somewhat subdued relative to other WGA subregions over this period.

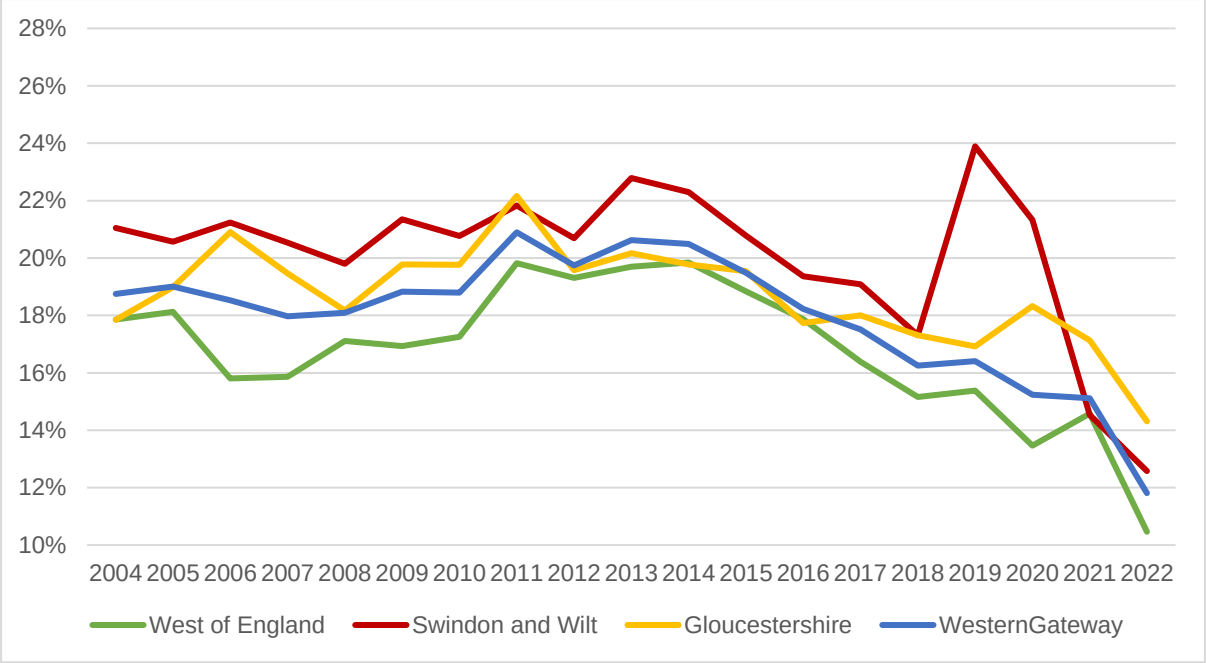

Figure 13: Proportion of Low Pay by WGA (2004 – 2022)

Source: ONS, ASHE microdata

To drive an improvement in the proportion of low-paid workers in the West of England, policymakers can adopt a combination of strategies that focus on economic growth, skills development, and improving working conditions. In line with Futures West's strategy, this would suggest support for priority sectors, encouraging the growth of sectors that typically offer higher wages, alongside measures to help raise skills, training and productivity in sectors where low wages are more prevalent.

In the following section wages are explored in more detail to better understand if there is a wage premium for working in the WGA and its constituent sub-regions. It uses multivariable regression models to explore the contributing factors that both encourage and hinder any such premium.

5.3 Empirical Estimation Results: The WGA Wage Premium

In all the regression tables presented in this report, the coefficients relating to areas represent a percentage difference in wages in that area relative to the sample average across all other areas, which is termed 'a control'.

Two pieces of information are required to understand each column of results. First, any coefficients marked ***, ** or * are found to be statistically significantly different from the sample average. Second, the initial column in each table contains area coefficients that represent the gaps in wages. These gaps are explained using further regression analysis in later columns.

It is widely recognised that individuals in the Greater London region have above average wages than the rest of the country which can skew the analysis. As such, to produce a more balanced understanding of wages in WGA, the analysis excludes those who work in the Greater London

area. Excluding these observations from the regression affects the sample's average wage estimate of the control areas but given the structure of the economy in the UK, the assumption is that this is a more appropriate comparator group. Potentially there is an argument to exclude the whole of the South East as wages in this area are also high and potentially skew such an analysis. This strategy is not followed in this report as the South East is judged to be an important comparator group for the South West, and therefore included in any relative wage analysis.

In the subsequent analysis, several regressions are presented in each table. Each of the tables are structured to progressively build from a basic model (column 1), before introducing other control factors in subsequent columns. This approach allows us to initially identify if there is a (raw) pay premium or pay penalty[6] for working in a specific region, and if so, to explore what is driving any such pay premium/penalty. A pay premium means that on average, wages in the area would be higher than in the comparator group, whereas a pay penalty would indicate that they are lower. Regional pay premium helps align wages with regional economic realities, supporting employee well-being, improving labour market efficiency, and compensating for cost-of-living differences.

The basic model estimates whether there is a pay premium or pay penalty for working in the WGA compared to the control group (i.e. a worker in Great Britain excluding London). Subsequent models include extra explanatory variables in the model to account for their potential influence on pay. In model 2 we control for industry structure and the effect of the priority sectors. In models 3 and 4 add in variables to account for individual and firm characteristics. In the final model (5) we include a control for skills, albeit as we do not have a direct measure of skills in the dataset we proxy this by including occupation which is highly correlated with skills. Given the limitations of the dataset, this final model is our best approximation to explain what is driving wages.

The importance of controlling for additional factors in shown in respect to the R-squared statistic. In the basic model reported in Table 1, the R-squared statistic shows that the model, only explains approximately 5% of the variation in wages. In the final model presented in column 5, when all the available controls are included the R-square rises to approximately 54%. This indicates that the model captures a substantial proportion of the factors influencing wage differences, albeit there are still other 'uncontrolled' factors at work (e.g. capital stock, innovation, management).

The following section explores the results of the regression in detail.

5.3.1 Wage Regressions: WGA

Table 1 presents the results of a regression analyses that seek to identify whether there is a pay premium for working in the WGA. The model uses over 2 million observations of individual wages from 2004-2022. For each of the models (1 to 5), including year dummies which control for any time-specific factors that could affect wages. This includes economic conditions, policy changes, and other macroeconomic factors that might vary from year to year. Including year

[6] A positive coefficient indicates that there is a pay premium for working in the WGA, while a negative coefficient indicates a pay penalty.

dummies helps in obtaining more accurate and reliable estimates of the coefficients for other variables.

Table 1: Determinants of Pay by WGA (OLS): Great Britain Pooled Data (2004-2022)

		Log wage				
		(1)	(2)	(3)	(4)	(5)
Spatial	Western Gateway	0.043***	0.040***	0.044***	0.046***	0.023***
		(0.004)	(0.004)	(0.003)	(0.003)	(0.002)
Industry	Adv. Man. & Eng. (AME)		0.155***	0.045***	0.026***	0.056***
			(0.003)	(0.003)	(0.003)	(0.002)
	Finance & Insurance (FI)		0.243***	0.187***	0.168***	0.150***
			(0.005)	(0.005)	(0.004)	(0.003)
	Creative Industries (CI)		0.109***	0.098***	0.106***	0.005
			(0.008)	(0.007)	(0.007)	(0.006)
	Digital Industries (DI)		0.350***	0.277***	0.279***	0.117***
			(0.005)	(0.005)	(0.005)	(0.004)
	Environmental Goods & Serv.		0.159***	0.099***	0.084***	0.054***
			(0.008)	(0.007)	(0.007)	(0.006)
Individual	Male			0.157***	0.107***	0.120***
				(0.002)	(0.002)	(0.001)
	Age			0.059***	0.052***	0.033***
				(0.000)	(0.000)	(0.000)
	Age squared			-0.067***	-0.057***	-0.035***
				(0.000)	(0.000)	(0.000)
	Tenure			0.020***	0.017***	0.012***
				(0.000)	(0.000)	(0.000)
	Tenure squared			-0.027***	-0.023***	-0.018***
				(0.001)	(0.001)	(0.001)
Firm	Collective agreement				0.082***	0.055***
					(0.001)	(0.001)
	Fulltime				0.188***	0.053***
					(0.002)	(0.001)
Skills	Occupational dummies	N	N	N	N	Y
Time	Year dummies	Y	Y	Y	Y	Y
Number of obs.		2,040,000	2,040,000	1,994,752	1,994,752	1,994,752
R-squared		0.050	0.073	0.228	0.257	0.542
F-statistic		3354.359	3128.613	7408.962	8057.944	14899.478

Source: ONS, ASHE microdata

Note: ***, **, * represents statistical significance at the 1%, 5%, and 10% level, respectively.

Column 1 report estimates the raw wage premium or penalty for working in the WGA, controlling for any time specific factors. The coefficient for the WGA is 0.043, which means that working in the WGA is associated with approximately a 4.3% increase in wages, as compared to the control area – the rest of the country, excluding people working in Greater London. Given that the coefficient is statistically significant at the 1% level (signified by ***), this is interpreted this as being 99 per cent confident that this finding is not just a coincidence, and the WGA wage premium is a real effect.

The model is extended by adding other control factors to investigate their impact on the WGA wage premium. For example, the results reported in column 2 after controlling for the priority sectors show that there are wage premia of working in these industries, albeit the WGA pay premium decreased to 4.0%. This means that approximately 7 per cent (=1-(0.040/0.043) of the wage premium associated with working in WGA was due to the wage effects of working in priority sectors, rather than the location itself. This provides Futures West with confirmatory evidence that these priority sectors are worthy of additional support. This is because nationally they are high earning sectors which are helping to drive up living standards for those working in these sectors.

Controlling for individual characteristics such as gender, age, tenure etc. (column 3), the WGA premium rises again to 4.4%. This increase in the coefficient between column 2 and 3 suggests that the WGA area either has a greater proportion of women and/or younger and/or less experienced workers than the national average. As expected, individual characteristics such as age and gender play an important role in wage equations. The results suggests that policy may wish to focus efforts on promoting gender equality in the workplace; improve access to childcare; investing in vocational training and apprenticeships; and support career advancement through creating career pathway programmes and facilitate job placement services.

Further control for job characteristics is then added, which again slightly increases the WGA wage premium (4.6%). This is due to the structure of employment in the WGA which would appear to have a lower proportion of individuals represented by a collective wage bargaining agreement (e.g. in a union) and/or working fulltime. Again, nuanced responses will be required to address such issues but could include support for childcare provision, encouraging improvements in work-life balance and flexible working arrangements; encouraging enhanced worker protection and rights; and provide legal and logistical support to facilitate collective bargaining processes, including mediation and arbitration services.

In column 5, controls for occupations are added which considerably reduces the pay premium by nearly half to 2.3%. A direct interpretation would mean that occupation is a primary factor in determining wage. Unlike other studies who can directly control for education, it is not possible to do so when using ASHE. Therefore, the occupational variable also indirectly captures education and skills level, and therefore caution should be taken over interpreting these results directly. However, the results warrant further investigation, and additional research is encouraged to determine how much of the premium is driven by education and skills, and how much by occupation.

Understanding this at a detailed level will enable WGA policymakers to identify what type of assistance is required by both individuals and firms. For example, Futures West may wish to consider support for specific occupations to run alongside support for priority sectors. As well as driving improvements in individual living standards, this can also act as a catalyst to drive productivity growth in the region. The importance of occupational support is inferred when looking at the Creative Industry coefficient in column 5. It significantly reduces in size (from 10% to less than 1%) and is not statistically significant. This means that once you control for occupations (which is a proxy for skills), wages in the Creative Industries are no different from the average of all other sectors. As such, this suggest that within the region, consideration should be given to support both creative occupations as well as for the creative industries.

5.3.2 Wage Regressions: Local Enterprise Partnership Area

The analysis was repeated looking at the three LEP areas which are part of the WGA (West of England, Gloucestershire (GFirst) and Swindon and Wiltshire). Table 2 reveals that there is a positive pay premium for individuals working in all of the WGA LEP areas compared to the national average (excluding Greater London).

Table 2: Determinants of Pay by LEP Areas (OLS): Great Britain Pooled Data (2004-2022)

		Log wage				
		(1)	(2)	(3)	(4)	(5)
Spatial	West of England	0.064***	0.060***	0.063***	0.064***	0.033***
		(0.005)	(0.005)	(0.005)	(0.004)	(0.003)
	Swindon & Wiltshire	0.025***	0.023***	0.027***	0.027***	0.015***
		(0.007)	(0.007)	(0.006)	(0.006)	(0.004)
	Gloucestershire	0.021***	0.014*	0.022***	0.027***	0.008*
		(0.008)	(0.008)	(0.007)	(0.007)	(0.005)
Industry	Adv. Man. & Eng.		0.155***	0.045***	0.032***	0.059***
			(0.003)	(0.003)	(0.003)	(0.002)
	Finance & Insurance		0.242***	0.187***	0.179***	0.155***
			(0.005)	(0.005)	(0.004)	(0.003)
	Creative Industries		0.109***	0.098***	0.105***	0.003
			(0.008)	(0.007)	(0.007)	(0.006)
	Digital Industries		0.350***	0.277***	0.282***	0.117***
			(0.005)	(0.005)	(0.005)	(0.004)
	Environmental Goods & Serv.		0.159***	0.099***	0.084***	0.053***
			(0.008)	(0.007)	(0.007)	(0.006)
Individual	Male			0.156***	0.107***	0.120***
				(0.002)	(0.002)	(0.001)
	Age			0.059***	0.052***	0.033***
				(0.000)	(0.000)	(0.000)
	Age squared			-0.067***	-0.057***	-0.035***
				(0.000)	(0.000)	(0.000)
	Tenure			0.020***	0.017***	0.012***
				(0.000)	(0.000)	(0.000)
	Tenure squared			-0.027***	-0.023***	-0.018***
				(0.001)	(0.001)	(0.001)
Firm	Collective agreement				0.082***	0.055***
					(0.001)	(0.001)
	Fulltime				0.188***	0.053***
					(0.002)	(0.001)
Skills	Occupational dummy	N	N	N	N	Y
Time	Year dummy	Y	Y	Y	Y	Y
Number of obs.		2,040,000	2,040,000	1,994,752	1,994,752	1,994,752
R-squared		0.050	0.073	0.228	0.258	0.542
F-statistic		3036.737	2889.720	6934.684	7572.528	14174.44

Source: ONS, ASHE microdata

Note: ***, **, * represents statistical significance at the 1%, 5%, and 10% level, respectively.

Over the period 2004-2022, individuals working in the West of England, earned 6.4% more than the average British worker, while in Swindon and Wiltshire and Gloucestershire this premium was just over 2%. The difference in performance suggests that it is important to develop local economic plans to address specific spatial challenges. Engaging with the local community will ensure that policies are inclusive and address the needs of residents. However, it is important that these plans are not developed in isolation and feed into wider strategic planning at the level of the WGA and national level.

For each of the three LEP regions, a substantial proportion of the pay premium can be attributed to differences in occupational employment. As discussed previously, as education is not directly captured in the regression, the occupation variable can also be viewed indirectly as capturing elements of having a higher educated and skilled workforce. This highlights both the importance of skills, while also indirectly inferring the importance of industry and occupational structure in creating opportunities to absorb these higher-level skills.

For each of the LEP regions, as with the WGA as a whole, the other main contributing factor in the pay premium is the priority sectors. This is shown as the pay-premium for all three sub-regions falls from model 1 to model 2 after the priority sectors are controlled for. Priority sector employment, however, appears to explain a greater proportion of the pay premium in Gloucestershire (33%) than in either Swindon and Wiltshire (8%) or the West of England (6%). This implies that contribution of the priority sectors (e.g. AME) is a key factor in Gloucestershire's higher wages, while the priority sectors are less important in explaining Swindon and Wiltshire and West of England's pay premium. This highlights that there are nuances in relation to each of the LEP regions, and therefore this implies that further detailed disaggregated research at the level of LEP and below is required to unpick the drivers of constrictors of wage growth.

5.3.3 Wage Regressions: Local Authority Area

This section replicates the analysis presented in the previous section but instead of reporting higher level LEP geographies, the analysis presented in this section examines all seven upper tier local authorities in the WGA as separate entities (note Gloucestershire remains unchanged). Table 3 presents the coefficient estimates of the fitted model, which includes our area variables and all other control variables.

Table 3: Determinants of Pay by Local Authority Areas (OLS): Great Britain Pooled Data (2004-2022)

		Log wage				
		(1)	(2)	(3)	(4)	(5)
Spatial	Bath and North East Somerset	0.039***	0.043***	0.051***	0.052***	0.003
		(0.013)	(0.013)	(0.012)	(0.011)	(0.008)
	North Somerset	-0.011	-0.006	0.002	0.002	0.001
		(0.013)	(0.013)	(0.011)	(0.011)	(0.007)
	Bristol, City of	0.112***	0.103***	0.101***	0.097***	0.047***
		(0.008)	(0.007)	(0.007)	(0.007)	(0.005)
	South Gloucestershire	0.038***	0.033***	0.038***	0.045***	0.045***

		(0.009)	(0.009)	(0.008)	(0.007)	(0.005)
	Gloucestershire	0.021***	0.014*	0.022***	0.029***	0.008*
		(0.008)	(0.008)	(0.007)	(0.007)	(0.005)
	Wiltshire	-0.016*	-0.013	-0.004	-0.001	-0.013**
		(0.008)	(0.008)	(0.008)	(0.007)	(0.005)
	Swindon	0.094***	0.085***	0.080***	0.077***	0.063***
		(0.012)	(0.012)	(0.010)	(0.010)	(0.007)
Industry	Adv. Man. & Eng.		0.155***	0.046***	0.026***	0.056***
			(0.003)	(0.003)	(0.003)	(0.002)
	Finance & Insurance		0.241***	0.186***	0.167***	0.149***
			(0.005)	(0.005)	(0.004)	(0.003)
	Creative Industries		0.108***	0.097***	0.106***	0.005
			(0.008)	(0.007)	(0.007)	(0.006)
	Digital Industries		0.350***	0.277***	0.279***	0.116***
			(0.005)	(0.005)	(0.005)	(0.004)
	Environmental Goods & Serv.		0.158***	0.099***	0.083***	0.054***
			(0.008)	(0.007)	(0.007)	(0.006)
Individual	Male			0.156***	0.107***	0.119***
				(0.002)	(0.002)	(0.001)
	Age			0.059***	0.052***	0.032***
				(0.000)	(0.000)	(0.000)
	Age squared			-0.067***	-0.057***	-0.035***
				(0.000)	(0.000)	(0.000)
	Tenure			0.020***	0.017***	0.012***
				(0.000)	(0.000)	(0.000)
	Tenure squared			-0.027***	-0.023***	-0.018***
				(0.001)	(0.001)	(0.001)
Firm	Collective agreement				0.082***	0.055***
					(0.001)	(0.001)
	Fulltime				0.188***	0.052***
					(0.002)	(0.001)
Skills	Occupational dummy	N	N	N	N	Y
Time	Year dummy	Y	Y	Y	Y	Y
Number of obs.		2,038,568	2,038,568	1,994,752	1,994,752	1,994,752
R-squared		0.050	0.073	0.228	0.258	0.542
F-statistic		2557.884	2509.030	6149.334	6761.827	12925.245

Source: ONS, ASHE microdata

Note: ***, **, * represents statistical significance at the 1%, 5%, and 10% level, respectively.

Column 1 shows that of the seven upper tier local authority regions, five record a positive pay premium compared to the national average (excluding Greater London). This ranges from 11.2 per cent in the City of Bristol to 2.1 per cent in Gloucestershire. Although workers in North Somerset appear to experience a slight pay penalty (-1.1%), the coefficient is not significant and therefore it is reasonable to assume that pay in North Somerset is in line with the national average. However, statistical tests (at the 10% level) suggests that workers in Wiltshire (excluding Swindon) experience a pay penalty of 1.6 per cent compared to the national average. The divergence in the level of pay across the local authority economies highlights the need for a

deeper understanding of the evidence at the sub-regional level, in order that interventions can be tailored to meet local need.

In column 2 the model controls for the priority sectors. When accounting for priority sectors the pay premium decreases for four of the seven local authorities (City of Bristol, South Gloucestershire, Gloucestershire and Swindon) suggesting the priority sectors are particularly important for these upper tier local authority areas. For the other three regions, however, the pay premium increased (BANES) or pay penalty decreased (North Somerset and Wiltshire). This suggest that the priority sectors are less important to these regions. Again, this is further evidence that industry support should be tailored to meet the diverse local need across the WGA.

Accounting for individual characteristics (column 3) appears to have a less profound effect on wages in most local authority regions. Of note, however, is the 0.8 percentage point increase in the pay premium in Bath and North East Somerset (BANES), which suggest the need to focus support programmes on gender and younger workers.

When accounting for firm characteristics (column 4) the pay premium increases by 0.7 percentage points in South Gloucestershire. This would suggest that wages are slightly lower in South Gloucestershire due either having a lower proportion of individuals represented by a collective wage bargaining agreement and/or working fulltime.

Finally, in column 5 control for occupations (and indirectly education and skills) are added. This results in a reduction to the pay premium or an increase in the pay penalty for five of the seven upper tier local authorities - occupational composition appears to have little effect on pay differentials in North Somerset or South Gloucestershire. For some sub-regions the effect is substantial, with the City of Bristol and BANES both experiencing a 5-percentage point drop in their pay premium. For these areas in particular, this adds further support to offering occupational based support focussed on skills development which are transferable across sectors, rather than focussing on industry-based support.

5.3.4 Wage Regressions: Priority Sectors – Different effects Across WGA

Table 4 presents an analysis to determine, statistically, whether the WGA is affected differently by the priority sectors. To analyse this, interaction terms in the regression model are introduced. To interpret the model, a positive sign on any of the interaction terms (e.g. Western Gateway and AME) will indicate that individuals working in that sector (e.g. Advanced Manufacturing and Engineering) in the Western Gateway area are earning more money compared to those that work in that sector nationally (e.g. Advanced Manufacturing and Engineering) nationally.

Table 4: Determinants of Pay by WGA Priority Sectors (OLS): Great Britain Pooled Data (2004-2022)

		Log wage		
		(1)	(2)	(3)
Spatial	Western Gateway	0.043***	0.023***	0.021***
		(0.004)	(0.002)	(0.002)
Industry	Adv. Man. & Eng. (AME)		0.056***	0.055***
			(0.002)	(0.002)
	Finance & Insurance (FI)		0.150***	0.148***
			(0.003)	(0.003)

	Creative Industries (CI)		0.005	0.004
			(0.006)	(0.006)
	Digital Industries (DI)		0.117***	0.119***
			(0.004)	(0.004)
	Environmental Goods & Serv.		0.054***	0.052***
			(0.006)	(0.006)
Individual	Male		0.120***	0.120***
			(0.001)	(0.001)
	Age		0.033***	0.033***
			(0.000)	(0.000)
	Age squared		-0.035***	-0.035***
			(0.000)	(0.000)
	Tenure		0.012***	0.012***
			(0.000)	(0.000)
	Tenure squared		-0.018***	-0.018***
			(0.001)	(0.001)
Firm	Collective agreement		0.055***	0.055***
			(0.001)	(0.001)
	Fulltime		0.053***	0.053***
			(0.001)	(0.001)
Skills	Occupational dummies	N	Y	Y
Time	Year dummies	Y	Y	Y
Interactions	Western Gateway & AME			0.017**
				(0.008)
	Western Gateway & FI			0.017
				(0.011)
	Western Gateway & CI			0.015
				(0.023)
	Western Gateway & DI			-0.035**
				(0.014)
	Western Gateway & EG&SS			0.024
				(0.024)
Number of obs.		2,040,000	1,994,752	1,994,752
R-squared		0.050	0.542	0.542
F-statistic		3354.359	14899.478	13209.272

Source: ONS, ASHE microdata

Note: ***, **, * represents statistical significance at the 1%, 5%, and 10% level, respectively.

The results show that over the period (2004-2022) the coefficient for “AME” is 0.055, suggesting that individuals working in this sector nationally receive 5.5 per cent higher wages than the average for all other sectors. By adding the “national AME” coefficient with the “Western Gateway AME” coefficient (0.017) the result is (0.055 + 0.017 =) 0.072. This suggests that individuals working in the AME priority sector in the WoE earn about 7.2 percent more than the average wage for all other sectors in Britain. It also indicates that those working in the AME sector in the WGA earn approximately 1.6% more (=107.2 / 105.5) than those working in the same sector nationally. Given that the Western Gateway & AME coefficient is statistically

significant at the 5% level (**), there is a 95% confidence that this is a real effect and did not occur by chance.

These results reported for the AME in WGA is an important finding and worthy of further investigation. It is important to understand what is driving the higher wages within this sector in the WGA, compared to the national average. For example, this could be due to higher levels of R&D, high value supply chain activity, capital, skills or managerial performance within the region. From a regional policy perspective, understanding this effect in more detail would enable policy makers to focus resources on building on these industrial strengths, while also enable them to encourage spillovers into other sectors. For example, finding ways to encourage further R&D activity and ensuring that key supply chain activity located in the WGA continues to be invested in by the firms concerned. Building on such strengths would help to drive regional wage and productivity growth.

In contrast, although nationally wages are reported to be 11.9% higher when working in the Digital Industries sector compared to other sectors, those working in the Digital industries Sector in the WGA area receive lower wages than those working in the same sector nationally. This is demonstrated by the negative and statistically significant coefficient of working in the Digital industries sector in the WGA (-3.5%). It reveals that the national advantage of working in the Digital Industries sector is reduced from 11.9% to just 8.4% in the WGA, compared to all other sectors. This means that wages in Digital industries in the WGA are approximately 3.1% below the national average for this sector. Some of the difference is likely to be explained by the regional sub-sector composition and/or size of the firm, however, this is an interesting finding and worthy of further investigation. For example, in addition to any industrial composition effect, there may be specific regional barriers and challenges (e.g. connectivity, skills gaps) which are more amenable to regional policy interventions.

The Western Gateway interaction term with Financial and Insurance, Creative Industries and EG&SS are not statistically significant, which suggests that wages in these sectors are no different in the WGA from the national average.

Finally, it is worth noting that even after controlling for industry, individual, firm, occupation (skills) and time, and the WGA Priority Sectors there is still an unexplained pay premium of 2.1% working in the WGA. Although outside the scope of this analysis, it may be possible to match on additional microdata sources to explore the influence of other factors not currently accounted for in the model. This could include capital stocks, education and skills, innovation, connectivity, agglomeration, intrinsic value, management and ownership. Such an approach would help to build on the current knowledge and gain a thorough understanding of the drivers and constrictors of wage (and indirectly productivity) growth in the WGA.

6. Discussions and Recommendations

The research provides a baseline for the wage in the WGA and its constituent parts, relative to a national average. The analysis has identified some interesting findings, which support certain recommendations – these are summarised as follows:

1. There is a pay premium for working in the WGA as a whole, albeit the results vary across sub-regions
    a. **Recommendation:** To ensure that policy is focussed on the appropriate levers, further research is required to fully understand what is driving the pay premiums and pay penalties identified in the WGA and its sub-regions. Factors which were not explored in this analysis, but which may be of particular interest include capital stocks, industrial structure, skills, innovation, connectivity, agglomeration and management.
2. The pay premium is unevenly spread over the region, with some local authorities recording a pay penalty when compared to the national average
    a. **Recommendation:** Tailored support should be focussed on the individual needs of each area that build on their strengths and address areas of weaknesses. These support mechanisms should be developed with the understanding that there are important benefits that spillover to the other constituent parts of the WGA.
    b. **Recommendation:** Individual and firm characteristics play a role in explaining the pay premium. Therefore, nuanced support programmes (e.g. support for women/young workers/flexible working/well-being) can go some way to driving wage growth.
    c. **Recommendation:** Further research is needed to identify which support packages would be most relevant for the different regions across WGA
3. There is a pay premium for working in the priority sectors
    a. **Recommendation:** Although it is challenging to identify the priority subsectors identified by Futures West, at the higher level this report provides evidence that suggests these sectors are worthy of specific support to drive up living standards, while simultaneously drive productivity growth. These sectors play an important role in the economic health of the region and well-being of its population. As such, ways of supporting and encouraging their future growth should be a priority for regional policy makers
    b. **Recommendation:** Additional research should be undertaken to identify the key subsectors that are, or have the potential to, drive growth in wages and productivity within the region.
4. Within the WGA there is an additional premium, over and above the national sector dividend, when working in AME sector. This highlights the economic importance of the AME sector both to the WGA region but also to the UK as a whole.
    a. **Recommendation:** Promote role of the sector in regional and national strategies.
    b. **Recommendation:** Policy makers should focus resources on building on the industrial strengths of this sector in particular, while also fostering partnerships between sectors, encouraging knowledge and management spillovers to other sectors within the regions.
    c. **Recommendation:** Further research is required to understand which sub-sectors within the broader sector definition are driving wage growth, or have the potential to.

5. The national pay premium of working in the Digital industries sector is reduced for those working in the WGA.
    a. **Recommendation:** Further research is required to understand the contribution of different sub-sectors of the regional digital industries sector, and to identify any specific barriers and challenges faced by the regional digital industries sector.
6. Much of the pay premium is accounted for by occupations, albeit this variable indirectly captures elements of education and skills
    a. **Recommendation:** Futures West should consider a dual approach of support for occupations as well as support for industries. This may be particularly relevant when considering support for the creative- and green economy.
    b. **Recommendation:** Further research should be undertaken to better understand how much of the premium is driven by education and skills, and how much by occupation across the WGA and its sub-regions.
7. The proportion of low pay has fallen across the region, albeit falls in Gloucestershire have been modest compared to other regions. This is a strong positive story of inclusive economic growth for the UK and region, highlighting how economic strength and business activity, can combine with national policy interventions to raise the wage levels and well-being of the WGAs less well-off working population.
    a. **Recommendation:** To support people out of low pay in Gloucestershire, policymakers can implement a multifaceted approach primarily focusing on education, skills development (e.g. vocational training and life-long learning programmes) and employment practices (e.g. support for flexible working arrangements).

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8. Appendix

Appendix 1: Review on the use of TREs to support the work of Futures West

In accordance with the brief, the following section is included as a standalone review to provide an overview of TREs and how they can be used to further support the work of Futures West.

There is a large amount of economic and social data stored within 'trusted research environments' (TREs) available to bona fide researchers. For our purposes, the most relevant ones are the SecureLab run by the UK Data Service and the Secure Researcher Service (SRS) run by the Office for National Statistics. Both hold the full range of ONS business and social surveys, with all the necessary detail for research. In addition, the SRS also holds administrative microdata from government sources through the Administrative Data Research (ADR) programme, such as detailed education or tax data.

These provide a key resource for understanding local economy and are widely used by academic researchers and private sector economic consulting firms. The range of data and the level of detail make them suitable for addressing a wide range of policy questions, generating bespoke local area statistics, and providing comparisons between regions. As the data has been collected for a long time, it is possible to look at changes over time; in some cases, it is possible to follow the same workers and/or businesses over long periods. This enables one to study the direct impact of economic policy on individuals and organisations. Finally, for businesses there is typically information on both where the company is registered and where it carries out its activities (if it is a multi-site operation). This allows one to identify some additional regional variations in economic activity.

There is also interest in using these secure environments to develop machine learning models of the economy. At present, this is a relatively under-explored use of the data, but it is expected to grow.

However, these TREs are not a complete solution to data needs, for two reasons.

First, there is the data itself. Although the data held by the TREs is very wide-ranging, they are not necessarily linkable together. For example, individuals in one survey are very unlikely to be in another survey; moreover, the datasets do not contain direct identifiers (name, full address, National Insurance numbers) which would allow individuals to be linked together. The exception to this is the business data. All the business are linked to a central 'spine' and so can be linked when they are included in a survey; and large businesses are always included in the surveys, so one can combine information from them. Smaller businesses will only be sampled occasionally, and surveys tend to be asked about business activity at a national level, rather than the activity at individual establishment, so there are limits on the sorts of inference that can be safely drawn. Nevertheless, the range and quality of analysis that can be drawn from the microdata is considerably more than that available from published statistics.

The second limitation is the way that TREs are constructed. They are meant to represents a secure research environment; only research outputs are released, and all releases must be checked against disclosure rules to ensure that no confidential data is inadvertently released in a statistic. Statistics can take up to five days before release, and the disclosure rules may mean that very geographically detailed information cannot be released. In addition, access to the data is granted for a specific research project; it is not currently on an ongoing basis for regional authorities, for example, to extract a arrange of data when they like. These restrictions do not greatly affect research using the confidential data, but they limit the opportunity to, for example, produce ad hoc statistics at short notice or generate 'live' models for regional authorities to interrogate.

It is worth noting that the operational problems may be addressed by the planned replacement for the SRS, the Integrated Data Service (IDS). This is intended to provide a much more dynamic interface to government data, and potentially provide real-time answers to research questions. The specification of a project proposal is also under review. However, this is very new territory, and early days; it is not yet clear how researcher will interrogate the data, nor how clearance processes will work. Currently the UWE team is engaging with the IDS team, as both researchers and data governance specialists, to help shape the future direction of the IDS.

Appendix 2: Sector Definitions

Appendix 1.1: Advanced Manufacturing and Engineering

10110: Processing and preserving of meat

10120: Processing and preserving of poultry meat

10130: Production of meat and poultry meat products

10200: Processing and preserving of fish, crustaceans and molluscs

10310: Processing and preserving of potatoes

10320: Manufacture of fruit and vegetable juice

10390: Other processing and preserving of fruit and vegetables

10410: Manufacture of oils and fats

10420: Manufacture of margarine and similar edible fats

10511: Liquid milk and cream production

10512: Butter and cheese production

10519: Manufacture of milk products (other than liquid milk and cream, butter, cheese) nec

10520: Manufacture of ice cream

10611: Grain milling

10612: Manufacture of breakfast cereals and cereals-based foods

10620: Manufacture of starches and starch products

10710: Manufacture of bread; manufacture of fresh pastry goods and cakes

10720: Manufacture of rusks and biscuits; manufacture of preserved pastry goods and cakes

10730: Manufacture of macaroni, noodles, couscous and similar farinaceous products

10810: Manufacture of sugar

10821: Manufacture of cocoa, and chocolate confectionery

10822: Manufacture of sugar confectionery

10831: Tea processing

10832: Production of coffee and coffee substitutes

10840: Manufacture of condiments and seasonings

10850: Manufacture of prepared meals and dishes

10860: Manufacture of homogenised food preparations and dietetic food

10890: Manufacture of other food products nec

10910: Manufacture of prepared feeds for farm animals

10920: Manufacture of prepared pet foods

11010: Distilling, rectifying and blending of spirits

11020: Manufacture of wine from grape

11030: Manufacture of cider and other fruit wines

11040: Manufacture of other non-distilled fermented beverages

11050: Manufacture of beer

11060: Manufacture of malt

11070: Manufacture of soft drinks; production of mineral waters and other bottled waters

12000: Manufacture of tobacco products

13100: Preparation and spinning of textile fibres

13200: Weaving of textiles

13300: Finishing of textiles

13910: Manufacture of knitted and crocheted fabrics

13921: Manufacture of soft furnishings

13922: Manufacture of canvas goods, sacks etc

13923: Manufacture of household textiles (other than soft furnishings of 13921)

13931: Manufacture of woven or tufted carpets and rugs

13939: Manufacture of carpets and rugs (other than woven or tufted) nec

13940: Manufacture of cordage, rope, twine and netting

13950: Manufacture of non-wovens and articles made from non-wovens, except apparel

13960: Manufacture of other technical and industrial textiles

13990: Manufacture of other textiles nec

14110: Manufacture of leather clothes

14120: Manufacture of workwear

14131: Manufacture of men's outerwear, other than leather clothes and workwear

14132: Manufacture of women's outerwear, other than leather clothes and workwear

14141: Manufacture of men's underwear

14142: Manufacture of women's underwear

14190: Manufacture of other wearing apparel and accessories

14200: Manufacture of articles of fur

14310: Manufacture of knitted and crocheted hosiery

14390: Manufacture of other knitted and crocheted apparel

15110: Tanning and dressing of leather; dressing and dyeing of fur

15120: Manufacture of luggage, handbags and the like, saddlery and harness

15200: Manufacture of footwear

16100: Sawmilling and planing of wood

16210: Manufacture of veneer sheets and wood-based panels

16220: Manufacture of assembled parquet floors

16230: Manufacture of other builders' carpentry and joinery

16240: Manufacture of wooden containers

16290: Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials

17110: Manufacture of pulp

17120: Manufacture of paper and paperboard

17211: Manufacture of corrugated paper and paperboard; manufacture of sacks and bags of paper

17219: Manufacture of paper and paperboard containers other than sacks and bags

17220: Manufacture of household and sanitary goods and of toilet requisites

17230: Manufacture of paper stationery

17240: Manufacture of wallpaper

17290: Manufacture of other articles of paper and paperboard

18110: Printing of newspapers

18121: Manufacture of printed labels

18129: Printing (other than printing of newspapers and printing on labels and tags) nec

18130: Pre-press and pre-media services

18140: Binding and related services

18201: Reproduction of sound recording

18202: Reproduction of video recording

18203: Reproduction of computer media

19100: Manufacture of coke oven products

19201: Mineral oil refining

19209: Other treatment of petroleum products (excluding mineral oil refining petrochemicals

manufacture)

20110: Manufacture of industrial gases

20120: Manufacture of dyes and pigments

20130: Manufacture of other inorganic basic chemicals

20140: Manufacture of other organic basic chemicals

20150: Manufacture of fertilisers and nitrogen compounds

20160: Manufacture of plastics in primary forms

20170: Manufacture of synthetic rubber in primary forms

20200: Manufacture of pesticides and other agrochemical products

20301: Manufacture of paints, varnishes and similar coatings, mastics and sealants

20302: Manufacture of printing ink

20411: Manufacture of soap and detergents

20412: Manufacture of cleaning and polishing preparations

20420: Manufacture of perfumes and toilet preparations

20510: Manufacture of explosives

20520: Manufacture of glues

20530: Manufacture of essential oils

20590: Manufacture of other chemical products nec

20600: Manufacture of man-made fibres

21100: Manufacture of basic pharmaceutical products

21200: Manufacture of pharmaceutical preparations

22110: Manufacture of rubber tyres and tubes; retreading and rebuilding of rubber tyres

22190: Manufacture of other rubber products

22210: Manufacture of plastic plates, sheets, tubes and profiles

22220: Manufacture of plastic packing goods

22230: Manufacture of builders' ware of plastic

22290: Manufacture of other plastic products

23110: Manufacture of flat glass

23120: Shaping and processing of flat glass

23130: Manufacture of hollow glass

23140: Manufacture of glass fibres

23190: Manufacture and processing of other glass, including technical glassware

23200: Manufacture of refractory products

23310: Manufacture of ceramic tiles and flags

23320: Manufacture of bricks, tiles and construction products, in baked clay

23410: Manufacture of ceramic household and ornamental articles

23420: Manufacture of ceramic sanitary fixtures

23430: Manufacture of ceramic insulators and insulating fittings

23440: Manufacture of other technical ceramic products

23490: Manufacture of other ceramic products

23510: Manufacture of cement

23520: Manufacture of lime and plaster

23610: Manufacture of concrete products for construction purposes

23620: Manufacture of plaster products for construction purposes

23630: Manufacture of ready-mixed concrete

23640: Manufacture of mortars

23650: Manufacture of fibre cement

23690: Manufacture of other articles of concrete, plaster and cement

23700: Cutting, shaping and finishing of stone

23910: Production of abrasive products

23990: Manufacture of other non-metallic mineral products nec

24100: Manufacture of basic iron and steel and of ferro-alloys

24200: Manufacture of tubes, pipes, hollow profiles and related fittings, of steel

24310: Cold drawing of bars

24320: Cold rolling of narrow strip

24330: Cold forming or folding

24340: Cold drawing of wire

24410: Precious metals production

24420: Aluminium production

24430: Lead, zinc and tin production

24440: Copper production

24450: Other non-ferrous metal production

24460: Processing of nuclear fuel

24510: Casting of iron

24520: Casting of steel

24530: Casting of light metals

24540: Casting of other non-ferrous metals

25110: Manufacture of metal structures and parts of structures

25120: Manufacture of doors and windows of metal

25210: Manufacture of central heating radiators and boilers

25290: Manufacture of other tanks, reservoirs and containers of metal

25300: Manufacture of steam generators, except central heating hot water boilers

25400: Manufacture of weapons and ammunition

25500: Forging, pressing, stamping and roll-forming of metal; powder metallurgy

25610: Treatment and coating of metals

25620: Machining

25710: Manufacture of cutlery

25720: Manufacture of locks and hinges

25730: Manufacture of tools

25910: Manufacture of steel drums and similar containers

25920: Manufacture of light metal packaging

25930: Manufacture of wire products, chain and springs

25940: Manufacture of fasteners and screw machine products

25990: Manufacture of other fabricated metal products nec

26110: Manufacture of electronic components

26120: Manufacture of loaded electronic boards

26200: Manufacture of computers and peripheral equipment

26301: Manufacture of telegraph and telephone apparatus and equipment

26309: Manufacture of communication equipment (other than telegraph and telephone apparatus and

equipment)

26400: Manufacture of consumer electronics

26511: Manufacture of electronic instruments and appliances for measuring, testing, and navigation,

except industrial process control equipment

26512: Manufacture of electronic industrial process control equipment

26513: Manufacture of non-electronic instruments and appliances for measuring, testing and navigation, except industrial process control equipment

26514: Manufacture of non-electronic industrial process control equipment

26520: Manufacture of watches and clocks

26600: Manufacture of irradiation, electromedical and electrotherapeutic equipment

26701: Manufacture of optical precision instruments

26702: Manufacture of photographic and cinematographic equipment

26800: Manufacture of magnetic and optical media

27110: Manufacture of electric motors, generators and transformers

27120: Manufacture of electricity distribution and control apparatus

27200: Manufacture of batteries and accumulators

27310: Manufacture of fibre optic cables

27320: Manufacture of other electronic and electric wires and cables

27330: Manufacture of wiring devices

27400: Manufacture of electric lighting equipment

27510: Manufacture of electric domestic appliances

27520: Manufacture of non-electric domestic appliances

27900: Manufacture of other electrical equipment

28110: Manufacture of engines and turbines, except aircraft, vehicle and cycle engines

28120: Manufacture of fluid power equipment

28131: Manufacture of pumps

28132: Manufacture of compressors

28140: Manufacture of other taps and valves

28150: Manufacture of bearings, gears, gearing and driving elements

28210: Manufacture of ovens, furnaces and furnace burners

28220: Manufacture of lifting and handling equipment

28230: Manufacture of office machinery and equipment (except computers and peripheral equipment)

28240: Manufacture of power-driven hand tools

28250: Manufacture of non-domestic cooling and ventilation equipment

28290: Manufacture of other general-purpose machinery nec

28301: Manufacture of agricultural tractors

28302: Manufacture of agricultural and forestry machinery (other than agricultural tractors)

28410: Manufacture of metal forming machinery

28490: Manufacture of other machine tools

28910: Manufacture of machinery for metallurgy

28921: Manufacture of machinery for mining

28922: Manufacture of earthmoving equipment

28923: Manufacture of equipment for concrete crushing and screening roadworks

28930: Manufacture of machinery for food, beverage and tobacco processing

28940: Manufacture of machinery for textile, apparel and leather production

28950: Manufacture of machinery for paper and paperboard production

28960: Manufacture of plastics and rubber machinery

28990: Manufacture of other special-purpose machinery nec

29100: Manufacture of motor vehicles

29201: Manufacture of bodies (coachwork) for motor vehicles (except caravans)

29202: Manufacture of trailers and semi-trailers

29203: Manufacture of caravans

29310: Manufacture of electrical and electronic equipment for motor vehicles

29320: Manufacture of other parts and accessories for motor vehicles

30110: Building of ships and floating structures

30120: Building of pleasure and sporting boats

30200: Manufacture of railway locomotives and rolling stock

30300: Manufacture of air and spacecraft and related machinery

30400: Manufacture of military fighting vehicles

30910: Manufacture of motorcycles

30920: Manufacture of bicycles and invalid carriages

30990: Manufacture of other transport equipment nec

31010: Manufacture of office and shop furniture

31020: Manufacture of kitchen furniture

31030: Manufacture of mattresses

31090: Manufacture of other furniture

32110: Striking of coins

32120: Manufacture of jewellery and related articles

32130: Manufacture of imitation jewellery and related articles

32200: Manufacture of musical instruments

32300: Manufacture of sports goods

32401: Manufacture of professional and arcade games and toys

32409: Manufacture of games and toys (other than professional and arcade games and toys) nec

32500: Manufacture of medical and dental instruments and supplies

32910: Manufacture of brooms and brushes

32990: Other manufacturing nec

33110: Repair of fabricated metal products

33120: Repair of machinery

33130: Repair of electronic and optical equipment

33140: Repair of electrical equipment

33150: Repair and maintenance of ships and boats

33160: Repair and maintenance of aircraft and spacecraft

33170: Repair and maintenance of other transport equipment

33190: Repair of other equipment

33200: Installation of industrial machinery and equipment

35210: Manufacture of gas

58110: Book publishing

58120: Publishing of directories and mailing lists

58130: Publishing of newspapers

58141: Publishing of learned journals

58142: Publishing of consumer, business and professional journals and periodicals

58190: Other publishing activities

61300: Satellite telecommunications activities

61900: Other telecommunications activities

64202: Activities of production holding companies

71121: Engineering design activities for industrial process and production

71122: Engineering related scientific and technical consulting activities

71129: Other engineering activities (not including engineering design for industrial process and production or engineering related scientific and technical consulting activities)

71200: Technical testing and analysis

72110: Research and experimental development on biotechnology

72190: Other research and experimental development on natural sciences and engineering

Appendix 1.2: Financial and Insurance Services

64.11 Central banking

64.19/1 Banks

64.19/2 Building societies

64.20/1 Activities of agricultural holding companies

64.20/2 Activities of production holding companies

64.20/3 Activities of construction holding companies

64.20/4 Activities of distribution holding companies

64.20/5 Activities of financial services holding companies

64.20/9 Activities of other holding companies (not including agricultural, production, construction, distribution and financial services holding companies) not elsewhere classified (n.e.c.)

64.30/1 Activities of investment trusts

64.30/2 Activities of unit trusts

64.30/3 Activities of venture and development capital companies

64.30/4 Activities of open-ended investment companies

64.30/5 Activities of property unit trusts

64.30/6 Activities of real estate investment trusts

64.91 Financial leasing

64.92/1 Credit granting by non-deposit taking finance houses and other specialist consumer credit grantors

64.92/2 Activities of mortgage finance companies

64.92/9 Other credit granting (not including credit granting by non-deposit taking finance houses and other specialist consumer credit grantors and activities of mortgage finance companies) n.e.c.

64.99/1 Security dealing on own account

64.99/2 Factoring

64.99/9 Other financial service activities, except insurance and pension funding, (not including security dealing on own account and factoring) n.e.c.

65.11 Life insurance

65.12 Non-life insurance

65.20/1 Life reinsurance

65.20/2 Non-life reinsurance

65.30 Pension funding

66.11 Administration of financial markets

66.12 Security and commodity contracts brokerage

66.19 Other activities auxiliary to financial services, except insurance and pension funding

66.21 Risk and damage evaluation

66.22 Activities of insurance agents and brokers

66.29 Other activities auxiliary to insurance and pension funding

66.30 Fund management activities

Appendix 1.3: Creative Industries

73.11 Advertising agencies

73.12 Media representation

71.11 Architectural activities

74.10 Specialised design activities

47.78/1 Retail sale in commercial art galleries

47.79/1 Retail sale of antiques, including antique books, in stores

74.10 Specialised design activities

14. Manufacture of wearing apparel

15.2 Manufacture of footwear

15.12 Manufacture of luggage, handbags, and the like, saddlery and harness

74.10 Specialised design activities

18.20/2 Reproduction of video recording

74.20 Photographic activities

59.11/1 & 59.11/2 Motion picture and video production activities

59.12 Motion picture, video and TV post production activities

59.13/1 & 59.13/2 Motion picture and video distribution activities

59.14 Motion picture projection activities

59.20 Sound recording and music publishing activities

18.20/ 1 Reproduction of sound recording

90.01 Performing arts

90.02 Support activities to performing arts

90.03 Artistic creation

90.04 Operation of arts facilities

78.10/ 1 Motion picture, television and other theatrical casting

18.11 Printing of newspapers

18.13 Pre-press and pre-media services

58.11 Book publishing

58.13 Publishing of newspapers

58.14 Publishing of journals and periodicals

58.19 Other publishing activities

63.91 News agency activities

18.20/3 Reproduction of computer media

58.29 Other software publishing

58.21 Publishing of computer games

62.01/ 1 Ready-made interactive leisure and entertainment software development

60.10 Radio broadcasting

60.20 Television programming and broadcasting activities

59.11/3 TV programme production activities

59.12 Motion picture, video and TV post production activities

59.13/3

Appendix 1.4: Digital Economy

2611 Manufacture of electronic components

2612 Manufacture of loaded electronic boards

2620 Manufacture of computers and peripheral equipment

2630 Manufacture of communication equipment

2640 Manufacture of consumer electronics

2680 Manufacture of magnetic and optical media

4651 Wholesale of computers, computer peripheral equipment and software

4652 Wholesale of electronic and telecommunications equipment and parts

5811 Book publishing

5812 Publishing of directories and mailing lists

5813 Publishing of newspapers

5814 Publishing of journals and periodicals

5819 Other publishing activities

5821 Publishing of computer games

5829 Other software publishing

5911 Motion picture, video and television programme production activities

5912 Motion picture, video and television programme post-production activities

5913 Motion picture, video and television programme distribution activities

5914 Motion picture projection activities

5920 Sound recording and music publishing activities

6010 Radio broadcasting

6020 Television programming and broadcasting activities

6110 Wired telecommunications activities

6120 Wireless telecommunications activities

6130 Satellite telecommunications activities

6190 Other telecommunications activities

6201 Computer programming activities

6202 Computer consultancy activities

6203 Computer facilities management activities

6209 Other information technology and computer service activities

6311 Data processing, hosting and related activities

6312 Web portals

6391 News agency activities

6399 Other information service activities n.e.c.

9511 Repair of computers and peripheral equipment

9512 Repair of communication equipment

Appendix 1.5: Environmental Goods and Services (excluding production of renewable energy, in-house environmental activities, organic agriculture, education, public services, environmental charities)

02.1 - Silviculture and other forestry activities

02.4 Support services to forestry

23.1 - manufacture of glass and glass products.

23.43 - manufacture of ceramic insulators and insulating fittings

26.5 - manufacture of instruments and appliances for measuring, testing and navigation; watches and clocks

33.1 repair of fabricated products, machinery and equipment

36. - Natural water: water treatment and supply services

37. - Sewerage Services; sewage sludge

38. - Waste collection. Treatment and disposable services

39. - Remediation services and other waste management services

43.12 - Site preparation

43.22 – Plumbing, heat and air conditioning installation

43.29 - other construction installation

71.2 Technical testing and analysis

72.1 Research and experimental development on natural sciences and engineering

72.2 Research and experimental development on social sciences and humanities

74.901 Environmental consulting activities