Journal of Cleaner Production 494 (2025) 145025

Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro

Working towards an environmentally sustainable and equitable future? New evidence on green jobs from linked administrative data in the UK

Damian Whittard [a,b,*], Peter Bradley [b], Van Phan [a], Felix Ritchie [a]

[a] Data Research and Access Governance Network Research Group - University of the West of England, Department of Accounting, Economics and Finance, UWE, Bristol, Coldharbour Lane, Bristol BS16 1QY, UK
[b] Sustainable Economies Research Group - University of the West of England, Department of Accounting, Economics and Finance, UWE, Bristol, Coldharbour Lane, Bristol BS16 1QY, UK

ARTICLE INFO

Handling Editor: Liu Yu

Keywords:
Social inclusivity
Green jobs
Inequality
Multivariate quantitative methods
Net zero
Pay gap

ABSTRACT

Given the urgency of the transition to net-zero, there is a need for a robust evidence base to support an environmentally sustainable and equitable economy. Employing a linked administrative dataset and using both cross sectional and panel estimation techniques, this study examines employment opportunities and estimates the economic benefits of working in green occupations. Consistent with social role theory, the results indicate that individuals are more likely to work in green occupations if they are white, male, full-time, not represented by a collective agreement, and work for an SME or foreign owned business.

Contributing to the international literature on pay in green jobs, the study reports a pay premium of four percent after controlling for other factors. Employees covered by collective agreements receive additional pay benefits, yet representation is less prevalent in directly green occupations. In line with research into attitude-behaviour gaps, the study demonstrates that while personal travel behaviours and green employment choices are often inconsistent, when they align this yields a pay dividend.

The research makes an important and novel contribution by showing that green employment can partially mitigate inter-occupation pay gaps, while identifying that persistent gender and ethnic pay disparities remain within green occupations. Females appear particularly disadvantaged by domestic and childcare responsibilities. This study also reports sector effects, with more traditional industries such as manufacturing and construction exhibiting entrenched gender biases. The results highlight the need to integrate considerations of inequality into theoretical frameworks that aim to understand and conceptualise the uptake of green jobs.

1. Introduction

The climate crisis is the largest market failure ever (Stern, 2006). Addressing this and other urgent key global environmental pressures (Caesar et al., 2024) is potentially the greatest challenge facing humanity in the 21st century. Globally this has led to major international initiatives including the Paris Agreement and United Nation Sustainable Development Goals, albeit neither are without their critics (Evans and Musvipwa, 2017).

Green jobs are at the core of this transition, having an important role in delivering environmental management strategies that promote sustainable economic development and cleaner production (Van der Ree, 2019). This evolution also provides an opportunity to address embedded labour market inequalities; supporting a socially equitable transition to net zero is integral to delivering on the sustainable development goals (Bracarense and Bracarense Costa, 2024).

Green jobs have the potential to address inequalities as they are often associated with new and emerging industries and jobs. This allows for a fresh start enabling practices to be explicitly designed to prioritise equity. Without sufficient prioritisation, however, the transition could perpetuate and potentially deepen, rather than reduce, inequality (Pearl-Martinez and Stephens, 2016). This transition also provides the opportunity to address entrenched disparities present in traditional industries, albeit evidence of such success is limited (Lazoroska et al., 2024).

Governments and organisations can support this socially equitable

* Corresponding author. Data Research and Access Governance Network Research Group - University of the West of England, Department of Accounting, Economics and Finance, UWE, Bristol, Coldharbour Lane, Bristol, BS16 1QY, UK.
E-mail address: damian2.whittard@uwe.ac.uk (D. Whittard).

https://doi.org/10.1016/j.jclepro.2025.145025
Received 27 July 2024; Received in revised form 17 January 2025; Accepted 11 February 2025
Available online 12 February 2025

transition tying green project subsidies and contracts to diversity targets and green human resource management processes can be used to encourage diversity in recruitment and retention (Renwick et al., 2013). Green jobs are often associated with higher-level skills (Consoli et al., 2016), suggesting that green jobs can address pay gaps across the whole economy, albeit little is known about pay gaps within green jobs.

In order to derive this evidence, one of the key challenges is defining and measuring the diverse nature of the green economy. Bowen et al. (2018) and Sulich (2020) find that there is currently no international consensus on how to define and measure a green job. Rodríguez (2019) reports that the task is under permanent construction with no bounded content and meaning, while Van der Ree (2019) argues that green jobs can be viewed through the lens of final output or through the production process.

Several different approaches have been used, including looking at: jobs within green industries (e.g. Unay-Gailhard and Bojnec, 2019); jobs within businesses operating in a green way (e.g. Pinzone et al., 2019); and green jobs within businesses or industries of any kind (e.g. Valero et al., 2021). Theoretically, these different approaches can generate vastly different estimates of green jobs. To create a consistent data collection framework within the UK, the Office for National Statistics (ONS) published their revised definition.

> ***"Employment in an activity that contributes to protecting or restoring the environment, including those that mitigate or adapt to climate change."*** (ONS, 2023a, p.3)

Internationally relatively little is known about the characteristics of those that work in green jobs, how they are structured and which companies are creating green jobs. Bradley et al. (2024b) reports that this is an important research gap which needs to be addressed at a national level.

Outside of the US, the financial returns of working in a green job are under-researched, yet pay is an important consideration in job choice (Jurgensen, 1978; Locke et al., 1980). If pay premiums exist and are not communicated, this is clearly a missed opportunity to incentivise individuals into green jobs, particularly because those transitioning often entail costs to retrain and re-skill. Green jobs also have the potential to serve as a catalyst for social equity, but little is known how the transition is impacting different groups.

To help fill these critical research gaps, this paper explores the following:

[1] What are the characteristics of the people that work in green jobs?
[2] What are the characteristics of green jobs and the firms that employ them?
[3] Is there a pay advantage for working in a green job?
[4] If so, how does this impact on different groups?

This study uses England and Wales as a case study to explore both employment opportunities and pay in relation to green jobs. The research uses a new linked administrative dataset based on high quality earnings information to estimate the economic benefit of working in a green occupation. New knowledge is presented about the attributes of those who work in green occupations and the characteristics of the jobs and the employers. Furthering work on attitude-behaviour gaps, the study provides evidence that personal travel behaviours and green employment choices are not consistent, yet when they are there is a pay dividend. The research adds to the international literature of pay in green jobs, estimating a positive pay premium. Finally, the research provides an original contribution revealing that working in a green occupation can offset some of the inter-occupation pay gap, yet within these occupations, gender and ethnic pay gaps persist. The study emphasises the need for inequalities to be captured by theory that attempts to understand and conceptualise the uptake of green jobs.

2. Theory and evidence

This section is presented in two parts, the first focusses on green jobs, while the second focusses on pay.

2.1. Green jobs

Pettinger (2017) broadly defines green collar work, as "work intended to counter environmental degradation" (p1). The theory of green collar work is an emerging framework for understanding and categorising employment within the labour market which aims to explain the types of roles, skills, and economic contributions made by workers in environmentally focused jobs (Deitche, 2010; Pearce and Stilwell, 2008). It highlights that green jobs are not only a necessary response to climate change, but also a potential source of economic growth, job creation, and social inclusivity (Jones, 2009).

Green jobs are concentrated in new, changing and growing sectors and have potential to create opportunities for greater social inclusivity. They have wide ranging distributional implications in terms of sectors, geography and skills, (Zachmann et al., 2018). Ciocirlan (2023) provides additional support for inclusivity, implying that if organisations want to develop a sustainable competitive advantage, they must pay attention to the match between green employees and their jobs. Consoli et al.'s (2016) empirical analysis noted green jobs exhibit higher levels of education and work experience, while Harvey et al. (2010) found that younger generations are more engaged with environmental concerns.

Littig (2017) reports that the green economy model promised the reconciliation of economy and ecology, the creation of new green jobs, and the reduction of social inequalities, but they report that gender issues have been sidelined. The role of government is important in ensuring social inclusivity with Nademi and Kalmarzi (2025) arguing there is a need for targeted incentives to stimulate private sector investment in green activities.

Green industries provide opportunities for women to enter traditionally male-dominated fields. This presents a unique opportunity to challenge gender norms and establish pathways for women. Lapatinas et al. (2024) explores the relationship between knowledge accumulation and gender norms. They suggest that adaptable gender norms are linked to a nation's economic complexity and knowledge accumulation.

There may be reasons why green jobs are likely to be more inequitable. Social role theory proposes that societal expectations, divisions of labour and stereotyping shape roles (Eagly and Wood, 2012; Koenig an Eagly, 2014). The theory implies that through socialisation, these roles influence self-perception and interpersonal dynamics, leading to ingrained gender and ethnic stereotypes. Empirically there is some support for a lack of inclusivity in green jobs. McClure et al. (2017) reported that US green collar workers had limited socio-demographic profiles, being more likely to be male and white compared to non-green worker population, albeit the case in other countries such as the UK is largely unknown. For example, Bradley et al. (2024a), in a systematic review of empirical research into green jobs, uncovered just two studies on gender and none in relation to ethnicity. They also reported that practitioners identified a key gap in the literature in relation to "fair, inclusive, and equitable [growth]" (p.19).

The theory of green collar work and social role theory prepose different outcomes in terms of green jobs and inclusivity. The limited empirical evidence outside the US is an important research gap that this study addresses by testing the following proposed hypothesis based on McClure et al. (2017) findings:

H1. ***People working in green jobs are more likely to be male and white***

As well as the individual characteristics, the job and company characteristics are also important. Bradley et al. (2021, 2024b) presents a framework for supporting opportunities for place-based green jobs and sustainable living. In the paper, they identify understanding qualities of different types of green jobs as a research gap. Empirically, evidence is

limited, but exceptions include Liao and Cheng (2020) who undertook experiments and reported that a firm's attractiveness was positively related to environmental innovation. In addition, Aldieri et al. (2019) examined the role of environmental spillovers based on local innovation at the firm level. They reported that the bigger the firm is, the higher its investments in green research will be (p.763). As such, the following hypothesis is tested.

H2. ***Green jobs are predominantly found in large firms (i.e. >250 employees)***

Social role theory implies that the characteristics of the job go some way to shaping job role expectations. The theory emphasises societal and cultural norms and stereotypes influencing career choices and opportunities. Littig (2017) argues that for a fair and just socio-ecological transformation there is a need for "a redistribution of work, less working hours, and the flexibility of work-time". These attributes collectively position green jobs as a vital mechanism for narrowing the gender pay gap, while promoting sustainable economic growth. It has been suggested that many of the newly created green jobs, such as those in the service sector, can offer flexible work arrangements, but there has been limited research into the structure or green jobs and the gender dimension (Unay-Gailhard and Bojnec, 2019).

Eagly and Wood (2012) reported that women continue to take responsibility for the majority of childcare and housework even when both spouses are employed full-time. This means that if green industries and occupations have rigid structures and offer less flexible working practices, this can indirectly discriminate against particular groups. For green jobs, this is unknown and therefore this study considers the following hypothesis.

H3. ***Green jobs are more likely to be full-time positions***

2.2. Pay

The distribution of jobs amongst different groups is one thing, but the distribution of pay within those jobs is of equal concern for a socially equitable transition.

Green jobs have significant potential to help close the gender and ethnic pay gaps by capitalising on their rapid growth and demand for diverse skill sets. Training is important and Kuersteiner and Ordal (2023) argue that policies are urgently needed to promote these skills in socially disadvantaged racial communities. Support for this is provided by Nademi and Kalmarzi (2025) who stress the importance of policies to ensure diversity and equal opportunities in the green transition. Others point to the importance of having women in leadership positions (He and Jiang, 2019).

In the economics literature, neo-classical theory posits that workers are paid by their marginal product (Hicks, 1963), while the theory of green collar work highlights that "a green-collar worker is an environmentalist" (Harvey et al., 2010, p501). Given individuals working in green occupations may be more motivated, standard economic theory would suggest they may be more productive and therefore receive higher wages. However, the idea of compensating wage differentials or "equalising differences" (Rosen, 1986) reveals that wages may be lower. In this model workers value a job based on various attributes, for example, nature of commute and intrinsic benefit of personal fulfilment. As such, workers may accept a lower wage to enhance job satisfaction and overall well-being. This trade-off may be particularly pronounced for those seeking to work in a green job. For example, Ciocirlan (2023) empirically analysed the match between green employees and their jobs, noting the employees hold ecological beliefs, values, and an environmental identity. Lanfranchi and Pekovic (2014) reported that green employees feel more useful and equitably recognised at work, while they are also more likely to work uncompensated overtime hours.

Empirical studies on wage effects of green employment tend to focus on the US economy and report generally higher wages (Bowen et al., 2018; Kim and Jeong, 2016). Vona et al. (2019) estimate that US green employment tends to be highly skilled and commands a wage premium of 4%. Outside of the US, Antoni et al. (2015) estimated a wage premium in relation to renewable energy related jobs in Germany, while Jackman and Moore (2021) estimated a 7% pay premium in Barbados. The lack of green jobs wage research outside of the US has in some part been due to the lack of high-quality, large scale and longitudinal data on which to base such studies.

This study aims to directly test these competing predictions in the following hypothesis.

H4. ***Working in a green job is associated with a pay premium compared to non-green jobs***

Theory on green collar work highlights the potential of green jobs to promote social equity, emphasises that equitable pay, advancement pathways, and expanded training are essential for making green jobs accessible to diverse groups. Access to skills development is particularly important, as Xie et al. (2020) reports that green training is positively related to career growth.

In contrast, social role theory would suggest that well-paid [green] jobs align with traditional "male" trait (e.g. assertiveness, leadership, and technical skills), while lower valued and lower paying [green] jobs align with "female" traits (e.g. communication and support). It also highlights that the prevalence of gendered caregiving roles can significantly impact wages. Women are often expected to assume primary caregiving responsibilities for children and family, which affects their career trajectory and earning potential. Green jobs have the potential to foster programs to encourage women to enter science, technology, engineering, and math (STEM) fields, which typically offer higher wages and growth opportunities. VÃisquez et al. (2022), however, reported that the participation of women in environmental STEM careers remains low.

Given the contrasting theories, the limited empirical studies into the equity of pay in the green jobs sector the final hypothesis is tested.

H5. ***If there is a pay premium for working in a green job, its impact varies across different groups***

3. Material and methods

This section starts by describing the approach used to create the final dataset (Fig. 1) applied in this study. The following sub-section then sets out the empirical methods and calculations used in the study.

Fig. 1 shows the three datasets, the key variables and the linkage method to create the dataset used in the study. The main data sources for the analysis are Annual Survey of Hours and Earnings (ASHE), O*NET and Census 2011

3.1. Data

The study benefits from the fact that the data on working hours and wages are based on high-quality employer payroll data provided via the UK's ASHE. ASHE is a mandatory employer survey, based on a random sample of 1% of those in employment (circa 180,000 per). Every year

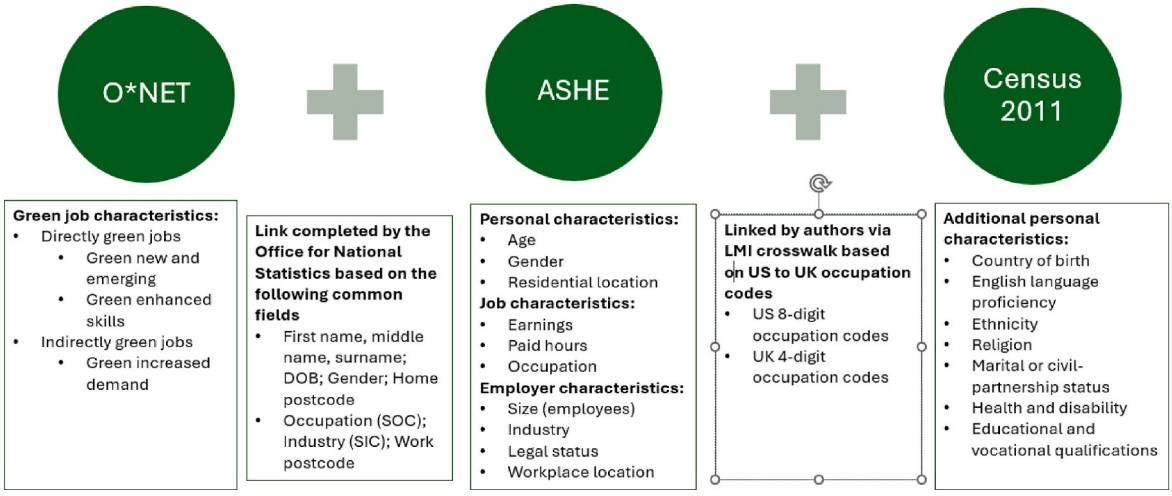


Fig. 1. ASHE, O*NET and Census 2011 linked dataset.
Source: Authors creation

the sample is based on the same last two digits of the national insurance number. This means that any individual selected is included for their entire working life and therefore can be tracked overtime. In addition, ASHE is an employee-employer dataset, which allows for characteristics of the firm to be accounted for within the analysis (Aghion et al., 2023). It's main limitation, however, is that it has limited information on the individual characteristics.

Building on the work of Valero et al. (2021), who previously linked O*NET data to a UK household survey, this study identifies green jobs by linking US O*NET data to ASHE. The benefit of using O*NET data is that it takes an occupation-level classification based on the greenness of their related tasks (O*NET, 2010). The value of the task and occupation-based approach is that it captures green employment across sectors. This, therefore, broadens the definition of green jobs beyond those just working in green industries. The main limitation of this study is that it makes the key assumption that tasks undertaken within occupations are the same in the UK and US, and that those occupations considered green in the US are also considered green in the UK.

To identify green jobs, O*NET uses a concept of the green economy[1] and greening of occupations[2] (Dierdorff et al., 2009). This informed the development of the three green occupational categories which are used in this analysis – Green New and Emerging (GN&E)[3] Green Enhanced Skills (GES)[4] and Green Increased Demand (GID). For the two directly green categories (GN&E and GES), O*NET provides a green task statement (green tasks associated with O*NET-SOC occupations); GID does not directly have any green tasks as they relate to increased demand due to the greening of the economy. This separation is helpful at the results can be analyse separately for directly and indirectly green occupations.

The US O*NET data is updated annually, capturing changes in the greenness of occupations. The US data on green jobs is mapped to the UK's ASHE via occupation codes using international occupation classifications. To do so, the study employs a direct crosswalk between the ONET-SOC (8-digit) and UK SOC systems (4-digit)[5] developed by the 'LMI for All'[6] data portal (Department for Education, 2019). The initial mapping generates a binary variable, where 0 indicates non-green and 1 indicates green – this is a maximum estimate of green occupations.

UK occupation codes are more aggregated compared to the detailed US O*NET occupations. Consequently, whole occupational categories in the UK may be classified as green even if only a single sub-category is considered green in the US O*NET. To address this potential limitation and avoid issues of double counting, in line with Dickerson and Morris (2019), a revised weighted is used to create a continuous measure of green jobs. This is akin to the greenness of the job and therefore provides a more cautious estimate.

An example of this approach is as follows:

- A UK occupation (OCC1) has three US occupations attached to it, one of which is green. The US green occupation accounts for 20% of the employment from the three US occupations matched to the UK occupation.
  - o OCC1 initial weighted = 1 * 0.2 = (0.2)
- The US green occupation is mapped to two UK occupations (OCC1 and OCC2). The employment share between OCC1 and OCC2 is 40% and 60% respectively.
  - o Therefore, the final estimate for OCC1 = 0.2 * 0.4 = 0.08

In the regression analysis, both binary and continuous measures of greenness are used to test the robustness of the results (see Appendix B). However, the preferred measure reported in the main study uses the

[1] The green economy encompasses the economic activity related to reducing the use of fossil fuels, decreasing pollution and greenhouse gas emissions, increasing the efficiency of energy usage, recycling materials, and developing and adopting renewable sources of energy. (p.3).

[2] The greening of occupations refers to the extent to which green economy activities and technologies increase the demand for existing occupations, shape the work and worker requirements needed for occupational performance, or generate unique work and worker requirements. (p.4).

[3] New occupations that have been created in the move to a sustainable economy (e.g. Sustainability Officer).

[4] Occupations where tasks, skills and knowledge requirements has significantly altered due to the transition to a sustainable economy (e.g. Energy Efficient Retrofit Engineer).

[5] The Standard Occupational Classification (SOC) four-digit code is the most detailed classification, identifying specific job roles (e.g. 2122 Mechanical Engineer).

[6] 'LMI for All' is a UK online data portal funded by the Department for Education which brings together existing national sources of high-quality labour market information (LMI). LMI for All also includes knowledge, skills and abilities from the US O*Net system which has been mapped to the UK Standard Occupational Classification (SOC).

continuous variable, unless otherwise stated.

To include additional individual characteristics, ASHE employee records from 2010, 2011 and 2012 were linked to the Census 2011 through probabilistic matching (Forth et al., 2022). This matching enables a detailed look at the demographic characteristics of those individuals working in green jobs, allowing estimates to be made of any pay differentials incurred by specific groups working in green jobs.

After linking the Census to ASHE, the dataset contains around 0.5 percent of the population of employees in England and Wales in 2011. Fixed and semi-fixed characteristics identified from the census are then be carried across individuals for the full period. This is a potential limitation as certain variables are fluid but are treated as fixed over the period (e.g. gender). A further potential limitation is the attrition in the match rate as the data moves further away from 2011 – this fall from 74% in 2011 to 48% in 2018 (Forth et al., 2022). This is unaccounted for in the analysis, but the authors acknowledge that this could be a potential source of sample bias, if either the match rate, attrition rate and/or profile of those joining/leaving is not random.

3.2. Empirical methods

The data runs from 2011 until 2018 - 2011 this was the first year for which O*NET data is available and the year of the ASHE-Census linkage. For robustness, two different measures of green occupations are used (i.e. binary or continuous but bounded between 0 and 1) to estimate several cross sectional and panel models (e.g. Ordinary Least Squares, Censored Tobit, Logit).

In the simplest form, the (cross-sectional) model is estimated as:

$$Y_i = \beta X_i + \beta Z_i + \beta F_i + \beta S_i + \beta R_i + \beta I_i + \epsilon_i \quad (1)$$

Where Y_i is a marker of an individual working in a green occupation. When using the continuous measure, it can be conceptualised as representing either the greenness of the occupation, or a weighted probability of working in a green occupation.

The dependent variable is replaced with its constituent parts (GN&E, GES and GID) to explore the effects for different types of green occupations. The vector X includes individual characteristics, while job characteristics are captured in vector Z. The set of firm characteristics are captured in vector F, while S, R and I capture sector, region and interaction terms respectively. To account for the fact that observations within the same occupation group may be correlated, all models are estimated by clustering the standard errors by occupation.[7]

In the cross-sectional analysis of likelihood of working in a green occupation, a Tobit model is used to account for the fact that the dependent variable is bounded between 0 and 1. To estimate the panel fixed effects model of working in a green job, we use a Logit model using the binary measure of green jobs. To benefit from the full panel and reduce potential bias from this source, a model is run that allows for unobserved heterogeneity across individuals to be treated as a fixed effect,. The Logit model estimated is as follows:

$$\log\left(\frac{p_{it}}{1-p_{it}}\right)_i = \alpha_i + \gamma_{it}\beta + \epsilon_{it} \quad (2)$$

In the model, $\log\left(\frac{p_{it}}{1-p_{it}}\right)$ is the natural logarithm of the probability of individual *i* working in a green occupation at time *t*. and γ_{it} is a vector of explanatory variables.

For the pay premium regressions, the dependent variable (Y) is log of real hourly wage.[8] A continuous measure of green occupations is used to explore whether there is a pay premium or pay penalty for working in a green occupation. A stepwise approach is used, adding various vectors of controls (i.e. individual, job, firm, sector, region and interactions). The initial (cross-sectional) model estimated is as follows:

$$logY_i = \alpha_i + G_i\beta 1 + \epsilon_i \quad (3)$$

$logY_i$ represents the log of real basic hourly pay. β1 is the coefficient for the greenness of the occupation.

Following this, the model is rerun for those individuals working in green occupations and those working in all other (brown) occupations. This provides a clearer understanding of how certain characteristics impact on pay for those working in green jobs compared to those jobs. Again, both the cross section and panel fixed effect estimations are used.

4. Results and discussions

4.1. Descriptive analysis

4.1.1. Green occupations

Fig. 2 uses the binary measure of green jobs and reveals that 32% of occupations were classed as being green in 2018. When the continuous measure is used approximately 16% of all occupations are green - these estimates are in line with Bowen et al. (2018) who estimated an overall share of the green employment being 19% in the US, while Valero et al. (2021) estimated 17% in the UK using household survey data.

The raw data revealed that 70% of all green occupations were filled by men, compared to 52% of all employment (ONS, 2023). Green occupations accounted for one in three occupations for white workers; this dropped to less than one in four for Black and Black British workers. Since employment rates for this group are below that for white counterparts – 69% compared to 77% (Gov.UK, 2023) - the green occupation employment disadvantage is compounded.

Overall, when looking at gender and ethnicity (two well-known sources of inequity) there is prima facie evidence that a shift to green employment is likely to have differential effects. Given the enhanced opportunities green employment can offer to individuals as society transforms to a net zero economy, it is notable that the inequalities embedded in the wider labour market are evident in green occupations.

4.1.2. Pay

This study examine pay using the ASHE linked to Census dataset in 2018. The analysis reports preliminary evidence of a pay premium as the median wage of those working in green occupations was £15.54 per hour, compared to just £12.57 for those working in all brown occupations.

The gender breakdown reveals that women working in green occupations earn 19% more than females working in brown occupations, but receive 12% less per hour than their male counterparts. This gap in gender pay for green occupations is below the national estimate for all employees (14.9%) (ONS, 2022). Fig. 3 shows that for all ethnic groups there is a pay premium for working in a green occupation, yet it shows that Black and Black British and other ethnic groups working in green occupations earn 2.1% and 3.8% less than white workers respectively.

The negative pay gap for female and some ethnic workers in green occupations further compounds the inequality experienced in terms of working in a green occupation. In line with the broader labour market, not only are they less likely to be employed in a green occupation than their male/white counterpart, but they are also likely to face a pay penalty compared to them. The reduction in the gender pay gap with national estimates, however, provides tentative evidence that green jobs do go some way to offsetting gender pay gaps in the overall population. There are many factors at work here, and these issues are explored in more detail in the multivariate analysis.

4.2. Empirical estimation

To further investigate the characteristics of those who are employed

[7] A list of all variables used in the regression is included in Appendix A.

[8] Nominal wages in ASHE are converted to real hourly wages using the Consumer Price Index.

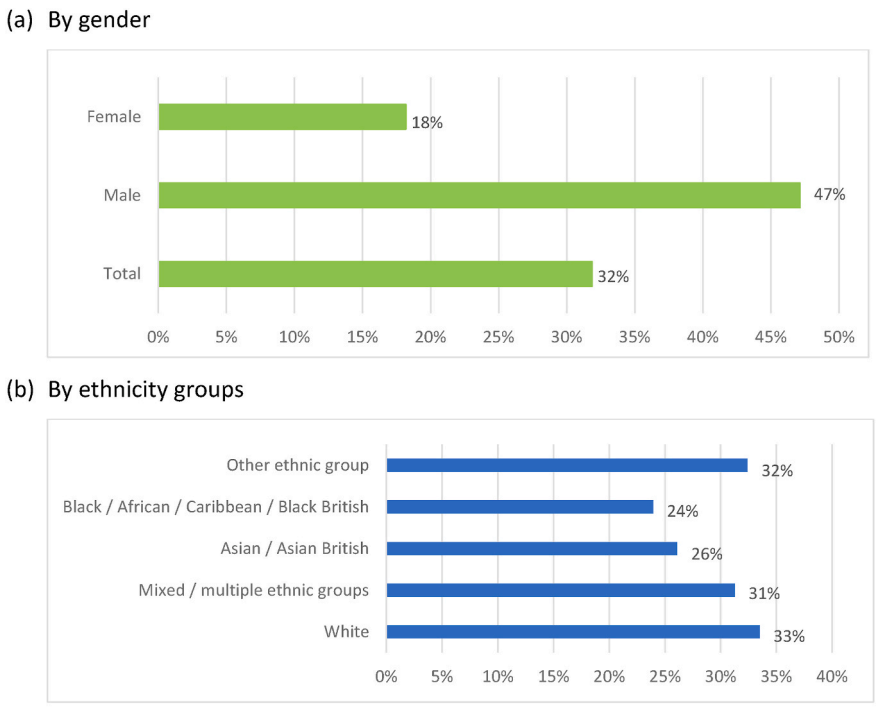


Fig. 2. Share of green employment by gender and ethnicity (2018): binary measure. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)
Source: Authors calculations based on ASHE linked to Census 2011 and O*NET

in green occupations, the regression approach outlined in Section 3 is applied. Only a selection of the variables of interests are reported in line with the hypothesis tested. For example, although education is controlled for in all models, and a significant determinant of both green employment and pay, it is omitted from all tables.

4.2.1. Green occupation

The dependent variable is working in a green occupation (continuous but bunded between 0 and 1), and types of green occupations (again bounded between 0 and 1). These are estimated using a Tobit regression. Columns 1 and 5 estimate the likelihood/intensity of working in any type of green occupations, while models presented in columns 2–4 explore the drivers of different types of green occupations (i.e. directly green - columns 2 and 3, and indirectly green - column 4).

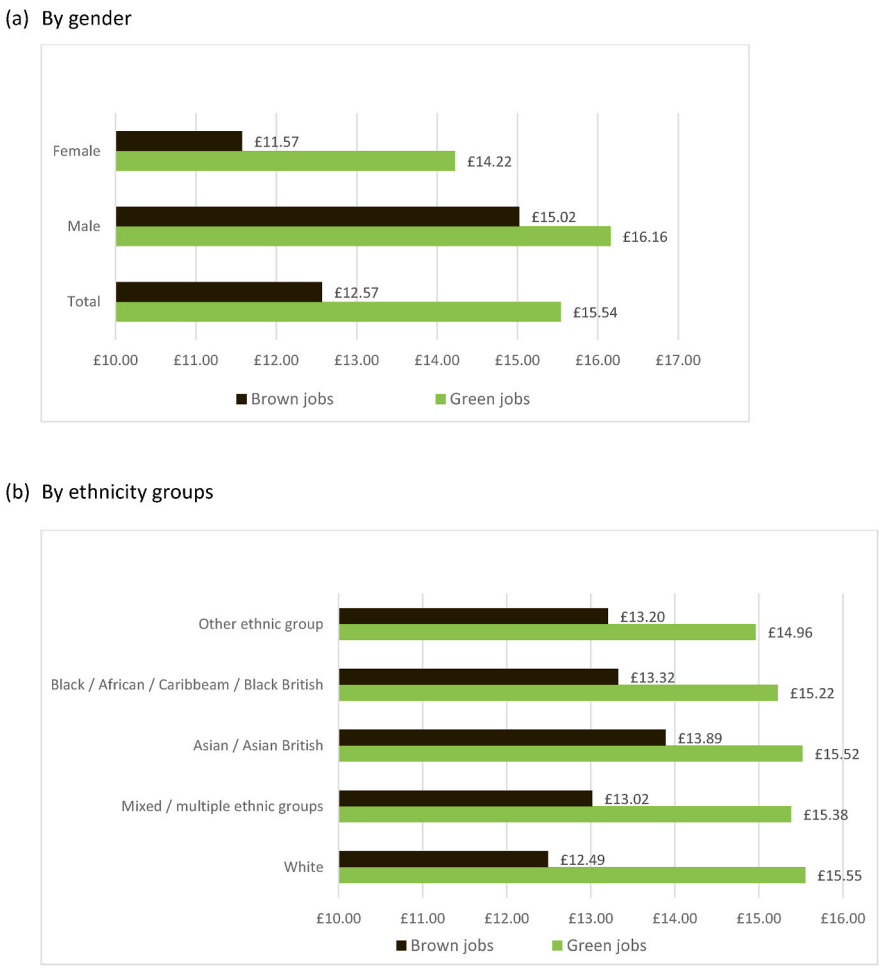
The results provide support for the first hypothesis – **people working in green jobs are more likely to be male and white**. This is counter to the theory of green collar worker that posits that green jobs have the potential for greater social inclusivity. These findings highlight that inequalities that are present in the wider labour market are also present in green jobs.

The gender differences are demonstrated by the highly significant negative coefficient for females in models 1 to 4, albeit significance drops to the 5% level for green occupations requiring 'green enhanced skills (model 2). To unpack the drivers of the gender split, the female variable is interacted with other terms and the results reported in model 5. After including the interacted terms, the female coefficient becomes positive but is insignificant, implying an underlying complexity. In line with literature on the gender pay gap and social role theory, the interaction terms reveal that female employment opportunities are negatively affected by various factors including having childcare responsibilities (the significance of which increases with age of the child) and sector specific challenges (i.e. female * construction - 5% significance). As such, to increase the proportion of women in green (and non-green) jobs, organisations may wish to adopt supportive childcare policies and practices. Female interacted with age is also important (5% significance) as the results suggest that women's employment in green occupations increases with age in line with men but declines at a faster rate (i.e. female * age squared[9]). This may be related to females having children and its effect on employment, but requires further investigation.

In terms of ethnicity, the results also highlight that Asian and Black minority ethic groups are less likely to be employed in a green occupation than white workers, particularly in directly green occupations (models 2 and 3). The results are highly significant, albeit significance drops slightly to the 5% level for Asian/Asian British workers working in green new and emerging occupations. There is theoretical support that this may in some part be driven by discrimination. For example, field experiments have shown that racial discrimination in hiring continues to persist in the British labour market (Heath and Di Stasio, 2019). Given that the lack of opportunity is only in relation to directly green jobs, this may provide some empirical support of social role theory which indicates that cultural norms can impact the types of jobs and career paths that are deemed appropriate for different ethnic groups (Koenig an Eagly, 2014).

The results indicate that the second hypothesis - ***green jobs are predominantly found in the large firms (>250)*** - cannot be supported**.** This is demonstrated by the size of the coefficient increasing as the company size reduces**.** Caution should be shown when interpreting this effect, particularly for micro enterprises (<10 employees), given that the decreasing statistical significance of the coefficients with size of company. However, for small (10–49) and medium sized companies (50–249), there is strong statistical support, indicating that this effect is real and robust.

[9] To aid the presentation of the table, the squared terms in the model (age and experience) are calculated as x2/1000. This has the effect of increasing the size of the age-squared coefficient.



Source: Authors calculations based on ASHE linked to Census 2011 and O*NET

Fig. 3. Median hourly pay in green and brown occupations by gender and ethnicity (2018). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)
Source: Authors calculations based on ASHE linked to Census 2011 and O*NET

There are several other personal characteristics and job characteristics that negatively affect the chances of working in a green occupation. The study confirms the third hypothesis - ***green jobs are more likely to be full-time positions.*** This is shown with the negative coefficients for part-time working, albeit statistical significance varies across the different models. Of note is the fact that green occupations which are new and emerging are more likely to be part time, and this result is highly significant, while indirectly green jobs - i.e. jobs that have been created due to increased demand of greening of the economy (model 4), show they are just as likely to be part-time as full-time. Further support around inflexibility of the directly green jobs can be inferred by the negative coefficient on hourly paid, which is statistically significant at the 1% level for directly green jobs. In line with social role theory, this embedded inflexibility in new and emerging occupations may be a form of indirect discrimination by gender and for ethnic groups with highly collectivistic cultures (Forbes et al., 2009).

Other interesting results around characteristics include the fact that company ownership matters; working for a foreign owned company is positively correlated with working in a green occupation. This is a novel finding and worthy of further investigation, however, this a more complex story which deserves a separate treatment, and so we limit ourselves here to just noting the impact.

Finally, those who use public transport less likely to work in green occupations, particularly directly green (models 2 and 3). This is somewhat counterintuitive and contrasts with the work on environmental identity considered as part of green collar worker theory (Ciocirlan, 2023). One would expect that those working in green occupations may be more environmentally driven and therefore prone to take public transport but there appears to be an attitude-behaviour gap (Terlau and Hirsch, 2015). This may be the effect of location of employment, distance travel to work, or other workplace factors. It was not possible to control for in this study, but this is a finding worthy of further investigation.

To benefit from the full power of the 2011–2018 dataset, the analysis is repeated using a Logit Panel Fixed Effect Model, presented in Table 2.

In line with wider labour market studies, Table 2 reveals that as individuals become older, they are more likely to work in a green occupation, but this effect is not linear and diminishes with age. The panel confirms that those working in more flexible employment (part-time, hourly-paid) are considerably less likely to work in green occupations (1% significance) – a potential form of indirect discrimination.

The panel supports that those working in small and medium sized companies and/or working for a foreign owned company are more likely to work in directly green occupations (1% and 5% significance). Of note is that being affected by collective agreement, a proxy for working in a unionised workplace, is negatively associated with working in a green new and emerging occupation (column 3), but positively associated with working in an indirectly green occupation (column 4). A potential explanation is that directly green jobs are in new and emerging sectors, predominately based in small and medium size companies, and workers

Table 1
Selected coefficients of characteristics of greenness of job (bounded 0–1): cross sectional Tobit regressions.

	Green Occupation	Green Enhanced Skills	Green New and Emerging	Green in Demand	Green Occupation
	(1)	(2)	(3)	(4)	(5)
Female	−0.275***	−0.161**	−0.179***	−0.198***	0.002
Age	0.009*	0.006	0.006	0.001	0.011*
Age-squared	−0.097*	−0.057	−0.070	−0.008	−0.084
Ethnicity (ref: White)					
Asian/Asian British	−0.088*	−0.112***	−0.090**	0.016	−0.086
Black/Black British	−0.064	−0.133***	−0.116***	0.059	−0.021
Qualification (ref: none)					
Apprenticeship	0.101	0.120*	0.307***	0.038	0.068
Dependent child (ref: none)					
Pre-school	0.027	0.005	0.026*	0.010	0.038*
Primary school	−0.009	−0.008	−0.008	−0.020	0.015
Senior school	−0.016	−0.021	0.004	−0.016	0.019
Public transport user	−0.066*	−0.076**	−0.075***	−0.016	−0.090**
Basic paid hours	0.008**	0.007	0.002	0.003	0.006
Part-time	−0.186**	−0.138**	−0.236***	−0.088	−0.173*
Hourly paid	−0.193**	−0.173***	−0.294***	−0.002	−0.120
Enterprise Size (ref: 250+ employees)					
0–9 employees	0.293*	0.192**	0.131	0.179**	0.351**
10–49 employees	0.138**	0.117***	0.073*	0.045	0.149***
50–249 employees	0.114***	0.089**	0.041*	0.056*	0.111***
Collective agreement	0.037	−0.022	−0.057**	0.103**	0.125**
Foreign owned	0.085***	0.021	0.056***	0.071***	0.073***
Sector (ref: Public)					
Construction	0.610***	0.361***	0.462***	0.282***	0.755***
Interaction Terms					
Female * age					0.006
Female * age-squared					−0.171**
Female * Apprenticeship					−0.222*
Female * pre-school child					−0.068*
Female * primary school child					−0.086**
Female * senior school child					−0.090***
Female * construction					−0.409**
Additional controls					
Personal characteristics	Y	Y	Y	Y	Y
Job characteristics	Y	Y	Y	Y	Y
Sector and region	Y	Y	Y	Y	Y
Other interactions	N	N	N	N	Y
Clustered by occupation	Y	Y	Y	Y	Y
Observations	34009	34009	34009	34009	34009
Pseudo R-Squared	0.14	0.13	0.17	0.14	0.15

Notes: Columns (1–4) reports the results with different alternative measurements of green jobs as a dependent variable. Column (5) extends the column (1) results by adding interaction terms with female. The squared term is calculated by $x^2/1000$.
Occupations are clustered at the SOC four-digit level (unit group). The corresponding robust standard errors and AIC/BIC scores are calculated but not reported. ***, **, * represents statistical significance at the 1%, 5%, and 10% level, respectively.

in green occupations may see themselves as professional or skilled labour; all are associated with lower rates on collectivism and unionisation. These findings on characteristics of the job (i.e. collective agreement) and employer (i.e. ownership) are a novel finding in the green jobs literature, and address a key research gap (Bradley et al., 2024b).

4.2.2. *Pay penalties or premia in green occupations*

This study now turns to the pay impacts of green jobs. Table 3 reports OLS estimates of pay differentials of working in green occupations.

Contrary to compensating wage differentials theory, which would suggest a pay penalty in green jobs which is offset by intrinsic benefit of personal fulfilment, Table 3 provides support for our fourth hypothesis - **Working in a green job is associated with a pay premium compared to non-green jobs** – and reports a pay premium.

Given the dependent variable is in log form and the independent variable represents the greenness of the job (continuous measure), the coefficient represents the percentage change in wage from moving from a non-green job (0) to a fully green job (1). The model reports that without controlling for other confounding factors, on average moving from a non-green job to a fully green job is associated with an approximately 33% higher hourly pay. This initial estimate infers that there is an economic incentive, or premium associated with green jobs, most likely reflecting the higher demand for such jobs, combined with the specialised skills required as well as other contributory factors.

To explore this premium further, individual characteristics (e.g. female, age, education, gender etc.) are introduced (column 2), which considerably improves the explanatory power of the model, while the premium reduces to approximately 21%.

Model 5 is the preferred specification as it includes confounders as selected by utilising the Least Absolute Shrinkage and Selection Operator (LASSO), has the highest adjusted R-squared, and records the lowest AIC/BIC scores. In this model the green occupational pay premium is reduced to 15% but is still somewhat higher than in previous studies (e.g. Vona et al., 2019; Valero et al., 2021; Jackman and Moore, 2021).

In Table 4 the full panel is used to generate more precise estimates, using fixed effects to control for unobserved heterogeneity. Some additional interaction terms are also incorporated to enable the inclusion of some of the non-time varying variables from the census (e.g. gender, ethnicity) with time varying characteristics (e.g. green occupation). By doing so, it is possible to develop a deeper understanding of how effects can vary across groups within the panel data framework.

The fixed effects model generates more plausible estimates of the pay premium of working in a green occupation. This ranges from 10% in the

Table 2
Selected coefficients characteristics of greenness of job: Logit Panel Logistic Fixed Effect (2011–2018): binary measure.

	Green Occupation	Green Enhanced Skills	Green New and Emerging	Green in Demand
	(1)	(2)	(3)	(4)
Age	0.210***	0.214***	0.253***	0.072***
Age-squared	−1.945***	−2.258***	−2.384***	−0.648***
Basic paid hours	0.008***	0.007***	0.006***	0.009***
Experience	−0.007	0.006	−0.004	−0.012**
Experience-squared	0.496***	0.086	0.384**	0.277
Part-time	−0.514***	−0.602***	−0.636***	−0.357***
Hourly paid	−0.413***	−0.445***	−0.508***	−0.156***
Enterprise Size (ref: 250+ employees)				
0–9 employees	0.067	0.116	−0.204	0.092
10–49 employees	0.102	0.163**	0.340***	0.173**
50–249 employees	0.074**	0.184***	0.182***	0.007
Collective agreement	0.062***	−0.033	−0.088***	0.166***
Foreign owned enterprise	0.052**	0.066**	0.144***	0.078***
Additional controls				
Sector and region	Y	Y	Y	Y
Fixed effect	Y	Y	Y	Y
Observations	652128	652128	652128	652128
Pseudo R-Squared	0.06	0.05	0.05	0.04

Note: This table shows the result of the logit panel fixed effect model for 2011–2018 – the dependent variable is binary (0, 1). Columns (1–4) reports the results with different alternative measurements of green jobs as a dependent variable. The squared term is calculated by $x^2/1000$. The corresponding robust standard errors and AIC/BIC scores are calculated but not reported. ***, **, * represents statistical significance at the 1%, 5%, and 10% level, respectively.

raw model (1) to 4% in the final model (5) – this is in line with estimates of US green employment wage premium (Vona et al., 2019). Table 6 shows positive coefficients for the interaction terms of green occupations and females (significant at 1% level), and green occupations with black and other minority ethnic groups (significant at 10% level). This implies that working in green occupations can potentially offset some of the gender and ethnic pay gaps generally experienced in the wider labour market.

4.2.3. Pay in green occupations

To further explore the experience of different groups, a cross-sectional model is run for those that work just in green occupations, the results are presented in Table 5.

In support of the fifth hypothesis – **If there is a pay premium for working in a green job, the impact varying across different groups**, the cross-sectional analysis reveals that the same pay inequalities (gender and ethnicity) present in the wider labour market are still present when looking solely at green occupational employment. It is also noteworthy that those taking public transport were less likely to be working in a green job (see Table 1); however, those that do receive a pay premium (column 1–3). The reason for this is unclear and worthy of further investigation but may reflect that when an environmental identity is matched with a green job, the employees are more productive and hence paid more.

To uncover nuanced patterns of gender inequality, several terms are interacted with being female (e.g. female and being married). The results presented in Table 5 reveal that there is an effect over and above the additive effect of the two terms independently. In line with the general labour market, of note is the negative effect that domestic responsibilities seem to have on female pay in green occupations (i.e. female and married; female and senior school dependent child – both at 5% significance).

There are also increased disadvantages for females working in green occupations for micro companies (i.e. female & 0–9 employees). This may reflect that very small companies often lack standardised pay scales or HR departments to enforce equitable compensation. There is also a disadvantage in specific sectors. For example, there is a negative effect of being female and working in the manufacturing sector (5% significance) that suggests entrenched gender biases remain in traditional industries. Although only significant at the 10% level, there is also a negative effect of being female and working in a green occupation in finance or law. This requires further investigation but may reflect the rigid employment structures and long working hours culture of these industries, which can indirectly discriminate against women.

It is noteworthy that when comparing intra-occupational pay gaps

Table 3
Selected coefficients of drivers of pay: stepwise OLS cross section regression (2018).

	Log real hourly wage	Log real hourly wage	Log real hourly wage	Log real hourly wage	Log real hourly wage
	(1)	(2)	(3)	(4)	(5)
Green occupation	0.333***	0.212***	0.193***	0.170***	0.152**
Female		−0.183***	−0.170***	−0.153***	−0.030
Age		0.021***	0.020***	0.019***	0.025***
Age-squared		−0.241***	−0.222***	−0.220***	−0.279***
Ethnicity (reg. white)					
Mixed/multiple ethnic groups		0.022	−0.009	−0.045*	−0.068
Asian/Asian British		−0.053**	−0.083***	−0.118***	−0.142***
Black/Black British		−0.066***	−0.072***	−0.147***	−0.177***
Other ethnic group		−0.041	−0.045	−0.078**	−0.076*
Additional controls					
Personal characteristics	N	Y	Y	Y	Y
Job and employer characteristics	N	N	Y	Y	Y
Sector and region	N	N	N	Y	Y
Interaction terms	N	N	N	N	Y
Clustered by occupation	Y	Y	Y	Y	Y
Observations	174512	73252	33906	33882	33882
Adj. R-Squared	0.03	0.31	0.40	0.44	0.45

Note: This table shows the results of wage regressions with the logarithm of real hourly pay as a dependent variable. Column (1) report the univariate regression while the results of multivariable regressions are shown in columns (2–4). More control variables are added in the corresponding columns. The squared term is calculated by $x^2/1000$. Occupations are clustered at the SOC four-digit level (unit group). The corresponding robust standard errors and AIC/BIC scores are calculated but not reported. ***, **, * represents statistical significance at the 1%, 5%, and 10% level, respectively.

Table 4
Selected coefficients of drivers of pay: stepwise panel fixed effects regression (2011–2018).

	Log real hourly wage	Log real hourly wage	Log real hourly wage	Log real hourly wage	Log real hourly wage
	(1)	(2)	(3)	(4)	(5)
Green Occupational Marker	0.096***	0.076***	0.063***	0.060***	0.041***
Age		0.091***	0.084***	0.083***	0.072***
Age-squared		−0.873***	−0.773***	−0.761***	−0.659***
Interaction Terms					
Green occupation * Female					0.028***
Green occupation * Black/Black British					0.035*
Green occupation * Other					0.066*
Additional controls					
Personal characteristics	N	Y	Y	Y	Y
Job and employer characteristics	N	N	Y	Y	Y
Sector and region	N	N	N	Y	Y
Additional interaction terms	N	N	N	N	Y
Fixed Effects	Y	Y	Y	Y	Y
Observations	1398000	1375696	648007	647443	313228
Adj. R-Squared overall	0.04	0.09	0.12	0.13	0.09

Note: This table shows the results of wage regressions for the panel data 2011–2018 with the logarithm of real hourly pay as a dependent variable. Column (1) report the univariate regression while the results of multivariable regressions are shown in columns (2–4). More control variables are added in the corresponding columns. Lasso regression with control variables and interaction terms is applied to the model which is shown in column (5). The squared term is calculated by $x^2/1000$. The corresponding robust standard errors and AIC/BIC scores are calculated but not reported. ***, **, * represents statistical significance at the 1%, 5%, and 10% level, respectively.

Table 5
Selected coefficients on pay of green occupations: stepwise OLS cross section regression (2018).

	Log real hourly wage	Log real hourly wage	Log real hourly wage	Log real hourly wage
	(1)	(2)	(3)	(4)
Female	−0.181***	−0.171***	−0.148***	−0.329
Ethnicity (ref: White)				
Asian/Asian British	−0.101***	−0.113***	−0.152***	−0.159***
Black/Black British	−0.124***	−0.093***	−0.177***	−0.211***
Married	0.066***	0.068***	0.072***	0.086***
Dependent child (ref: none)				
Pre-school	0.047***	0.051***	0.047***	0.048***
Primary school	0.046***	0.058***	0.059***	0.068***
Senior school	0.023***	0.030***	0.032***	0.041***
Public transport user	0.166***	0.107***	0.035*	0.029
Enterprise Size (ref: 250+ employees)				
0–9 employees		−0.128**	−0.093	−0.094
10–49 employees		−0.048***	−0.063***	−0.079***
Sector (ref: Public)				
Manufacturing			0.151***	0.199***
Finance/Law			0.132***	0.176***
Interaction Terms				
Female * Married				−0.052**
Female * senior school child				−0.043**
Female * employer size (0–9 employees)				−0.209**
Female * employer size (10–49 employees)				0.078*
Female * Manufacturing				−0.129**
Female * Finance/Law				−0.089*
Additional controls				
Personal characteristics	Y	Y	Y	Y
Job and employer characteristics	N	Y	Y	Y
Sector and region	N	N	Y	Y
Additional Interactions	N	N	N	Y
Clustered by occupation	Y	Y	Y	Y
Observations	24601	14364	14353	14353
Adj. R-Squared	0.25	0.33	0.38	0.39

Note: This table shows the results of wage regressions conditional being in the green jobs. Personal characteristics is controlled in the column (1) while column (2) also control for job and employer characteristics. Columns (3–4) extend the model by adding sector and region controls. Occupations are clustered at the SOC four-digit level (unit group). Interaction terms are added in the column (4). The corresponding robust standard errors and AIC/BIC scores are calculated but not reported. The AIC/BIC scores are calculated but not reported ***, **, * represents statistical significance at the 1%, 5%, and 10% level, respectively.

for green occupations (Table 5) with the results for non-green occupations (Table 6), the (marginally) smaller coefficients reveal that the gender pay gap are similar but potentially less pronounced in green occupations. This implies that the gap still exists but is narrower in green jobs than brown. However, the evidence suggests that pay gaps for Asian/Asian British and Black/Black British ethnic groups is larger in green jobs than brown.

The findings of the study are that inequalities experienced in the wider labour market also appear within green occupations, albeit marginally reduced for females. As such, the evidence suggests that action may be required to address these embedded inequalities before they become entrenched. If not, this may reinforce the divide and

Table 6
Selected coefficients on pay of NON-green occupations: stepwise OLS cross section regression (2018).

	Log real hourly wage	Log real hourly wage	Log real hourly wage	Log real hourly wage
	(1)	(2)	(3)	(4)
Female	−0.190***	−0.177***	−0.161***	0.018
Ethnicity (ref: White)				
Asian/Asian British	−0.040	−0.069***	−0.102***	−0.149***
Black/Black British	−0.047	−0.066**	−0.135***	−0.175***
Additional controls				
Personal characteristics	Y	Y	Y	Y
Job and employer characteristics	N	Y	Y	Y
Sector and region	N	N	Y	Y
Interactions	N	N	N	Y
Clustered by occupation	Y	Y	Y	Y
Observations	48651	19542	19529	19529
Adj. R-Squared	0.31	0.40	0.45	0.45

Note: This table shows the results of wage regressions conditional being in a NON green job. Personal characteristics is controlled in the column (1) while column (2) also control for job and employer characteristics. Columns (3–4) extend the model by adding occupation and region controls. Interaction terms are added in the column (4). Occupations are clustered at the SOC four-digit level (unit group). The corresponding robust standard errors and AIC/BIC scores are calculated but not reported. ***, **, * represents statistical significance at the 1%, 5%, and 10% level, respectively.

ultimately limit personal commitment to greening of the economy and threaten the transition to net-zero.

A panel fixed effect model is then used to explore pay effects in green jobs in more detail.

The results confirmed that individual (model 1), job and employer (model 2), and sector and region (model 3) effects were all important in understanding pay for green occupations (most variables at 1% significance). Many of these findings are novel to the green jobs literature. For example, affected by collective agreements (proxy for unionisation) adds between 0.6 and 0.9% hourly basic pay (significant at 1% level). This confirms the benefit of working in a green occupation and being covered by a collective pay agreement, yet Table 2 shows that union membership is less prevalent in new and emerging green occupations.

Table 7 shows that pay increases with age by approximately 9% per year initially, but the relationship is linear and reduces slightly over time. However, Model (4) introduces female interaction terms and shows that for females the rate of increase is lower initially, but declines at a slower rate. This is worthy of further investigation, but the initial slower rate increase may represent women facing systemic barriers including starting salary gaps (which can impact their overall pay trajectory), less access to training and development, and limited negotiation or advancement opportunities. There are also some sector effects of note, which again is a novel contribution to the literature. For example, working in the manufacturing and construction sectors are associated with approximately a 9% and 7% increase in green occupational pay respectively, compared to working in the public sector. However, the negative coefficient for females working in the manufacturing (1% significance level) and construction sectors (10% level) indicates that this pay advantage is attenuated – this provides further evidence of embedded gender biases in more traditional fields. The pay premium for sales and services, is also considerably diminished for females, albeit this is only at the 10% level. This highlights the need for further work to understand the nuanced effect across different sectors.

Table 7
Selected coefficients on pay of green occupations: panel fixed effects (2011–2018).

	Log real hourly wage	Log real hourly wage	Log real hourly wage	Log real hourly wage
	(1)	(2)	(3)	(4)
Age	0.093***	0.087***	0.086***	0.083***
Age-squared	−0.873***	−0.795***	−0.785***	−0.762***
Basic paid hours	−0.007***	−0.009***	−0.009***	−0.011***
Experience	0.007***	0.005***	0.005***	0.005***
Experience-squared	−0.115***	−0.090***	−0.086***	−0.070***
Part-time		−0.055***	−0.052***	−0.053***
Hourly paid		−0.008***	−0.006***	−0.008***
Enterprise size (ref: 250+ employees)				
0–9 employees		−0.055***	−0.050***	−0.031
10–49 employees		−0.042***	−0.046***	−0.039***
50–249 employees		−0.015***	−0.018***	−0.025***
Collective agreement		0.009***	0.006***	0.006***
Foreign owned enterprise		0.019***	0.014***	0.015***
Sector (ref: Public)				
Manufacturing			0.066***	0.089***
Utilities			0.095***	0.093***
Construction			0.060***	0.068***
Sales			0.010	0.026*
Services			0.029***	0.043***
Health			−0.023*	−0.030
Interaction terms				
Female * age				−0.029***
Female * age squared				0.292***
Female * basic paid hours				0.002***
Female * time in job				0.001
Female * time in job squared				−0.070**
Female * Manufacturing				−0.093***
Female * Utilities				0.017
Female * Construction				−0.056*
Female * Sales				−0.074***
Female * Services				−0.050**
Additional controls				
Region	N	N	Y	Y
Other interactions	N	N	N	Y
Fixed effects	Y	Y	Y	Y
Observations	441358	245553	245340	124937
Adj. R-Squared overall	0.09	0.10	0.11	0.08

Note: This table shows the results of wage regressions conditional being in the green jobs for the panel data from 2011 to 2018. Personal characteristics is controlled in the column (1) while column (2) also control for job and employer characteristics. Columns (3–4) extend the model by adding sector and region controls. Interaction terms with females are added in the column (4). The squared term is calculated by $x^2/1000$. The corresponding robust standard errors and AIC/BIC scores are calculated but not reported. ***, **, * represents statistical significance at the 1%, 5%, and 10% level, respectively.

5. Conclusion and discussions

This study explores the characteristics of UK employment in green occupations and the potential impact these roles can have on pay. In contrast to the theory of green collar work which emphasises social inclusivity, this study finds that male and white workers are disproportionately overrepresented in green occupations. There is a pay premium

for working in a green occupation and the evidence implies working a green job can go some way towards offsetting the gender and ethnic pay gaps in the wider labour market. However, in line with social role theory, we challenge the assumption that green jobs inherently lead to equitable outcomes, revealing persistent inequalities in pay. There are sector specific challenges, particularly is some of the more traditional sectors which may reflect entrenched gender bias. Given that the inequalities of the wider labour market appear to be embedded within green jobs, this would indicate that there is an important role for policy to play if the green transition is to deliver social inclusivity alongside economic growth and job creation.

Counterintuitively, and in support of the research into attitude-behaviour gaps, our initial results show that those taking public transport were less likely to be working in a green job, albeit those that take public transport and work in a green job do receive a pay premium. This may reflect that when an environmental identity is matched with a green job, the employees are more productive and receive higher pay. However, it is also likely to be capturing an effect of where these jobs are located, potentially in more prosperous urban areas. Understanding why this is the case, is beyond the scope of this research paper but requires further investigation.

Similarly, those working in green jobs are less likely to be represented by collective agreements, but those that are represented receive a pay premium. The finding should be of interest to unions who may wish to target awareness and education campaigns of the benefits of membership to those working in green occupations. This study also reports that salaried workers, fulltime employees, those working in smaller business, and for foreign owned companies are more likely to work in a green job. These findings matter for green jobs policy, for example, targeting SMEs and foreign owned companies for grants, tax incentives, or regulatory support may enhance the capacity for green jobs growth. To promote an equitable transition, these efforts may be linked to measures which promote the creation of inclusive environments.

Contrary to compensating wage differentials theory, the research adds to the international literature of pay in green jobs. In line with Vona et al. (2019) US study, we estimate a 4% pay premium when working in a green job. This is an important result which could help accelerate the transition to net zero if it can be used to incentivise the supply side of the equation (i.e. labour) to upskill, search out and secure green employment, given the financial rewards for doing so.

The principal limitation of the research relates to the linking of the O*NET and ASHE datasets. The linkage assumes the same task and occupational structure between US and UK economy. As such, the results should therefore be used to convey a sense of proportion of any such relationship, rather than be interpreted as a precise estimate.

Our investigation has highlighted some key areas worthy of further research, these include exploring both the attitude-behaviour gap and the link between environmental identity and pay. In addition, our results suggest that further investigation is needed into the reasons smaller businesses have greener occupations, which could be due to agility, less bureaucracy, and closer ties with local communities and environmental issues.

An advantage of our study is its focus on the pre-pandemic period, which represents a relatively recent era of 'normality' in the UK's labour market. As more contemporary data become available, future research could investigate the longitudinal effects encompassing both the pre- and post-pandemic periods.

The lack of an international consensus on definition and measurement has limited research into green jobs, yet we encourage different approaches to defining, measuring and analysing green jobs. The various approaches enrich our understanding, albeit this needs to be balanced with efforts to ensure clarity, comparability and policy needs are met.

This study highlights the importance of extending and deepening the understanding of gender and ethnicity and ensuring its incorporation into theory that attempts to understand and conceptualise the transition to a green economy and green jobs.

CRediT authorship contribution statement

Damian Whittard: Writing – original draft, Visualization, Validation, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Peter Bradley:** Writing – review & editing, Supervision, Project administration, Investigation, Conceptualization. **Van Phan:** Writing – review & editing, Visualization, Methodology, Investigation, Data curation. **Felix Ritchie:** Writing – review & editing, Supervision, Investigation, Formal analysis.

Funding sources

This work is supported by ADR UK (Administrative Data Research UK). ADR UK is a partnership transforming the way researchers access the UK's wealth of public sector data, to enable better informed policy decisions that improve people's lives. ADR UK is an Economic and Social Research Council (ESRC) investment (part of UK Research and Innovation). [Grant number: ES/Y001184/1 and ES/T013877/1].

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

This work contains statistical data from ONS which is Crown Copyright. The use of the ONS statistical data in this work does not imply the endorsement of the ONS in relation to the interpretation or analysis of the statistical data. This work uses research datasets which may not exactly reproduce National Statistics aggregates. The analysis was conducted in the Secure Research Service, part of the Office for National Statistics.

The authors would like to thank delegates at the Economic Statistics Centre of Excellence and the Wales institute of Social and Economic Research and Data conferences, as well as John Forth, Carl Singleton and Alex Bryson for their helpful suggestions to develop the manuscript.

Appendices.

Appendix A

Table A1
List of variables used in the ASHE and ASHE-Census 2011 dataset

Variable	Categories	ASHE-Census
Basic hourly wage	Continuous variable calculated by the ratio of basic weekly earning to the total number of basic weekly paid hours	bpay/bhr
Female	Dummy variable	sex
Age Age-squared	Continuous variable with squared value	age age_squared
Ethnicity	Categorical variable (white; mixed/multiple ethnic groups; Asian/Asian British; Black/African/Caribbean/Black British; Other ethnic group	aggethpuk11
Education	Categorical variable: Self-reported level of highest qualification. Grouped into five categories - no qualification, up to A-level, apprenticeship, Other/vocational qualification, degree or above)	hlqpuk11
Marital status	Dummy variable (1for those married or in a registered same-sex civil partnership)	marstat
Born outside UK	Dummy variable	aggcobpuk113
Health – Fair to very bad	Dummy variable (0,1) for self-reported health created from a five-point scale of very good health, good health, fair health, bad health and very bad health	health
Dependent child	Categorical variable to indicate whether the individual is responsible for a dependent child – four categories include no dependent child in family; pre-school age (0–4); primary school (5–11) or senior school (12–18)	dpcefamuk11
Public transport user	Dummy variable whether individual is a public transport user	ptranspuk11
Disability	Dummy variable for those who report a disability that interferes with their day-to-day activity	disability
Basic paid hours	Basic weekly paid hours worked	bhr
Experience Experience-squared	Continuous variable and squared term. Time in job calculated by year of observation, minus employment start year plus one	empstart_y
Part-time job	Dummy variable to indicate whether job is part-time	fulltime
Hourly paid	Dummy variable to indicate whether the individual was hourly paid	hourly_paid
Size of employer	Categorical variable for the employer size band. Four categories of 0–9, 10–49, 50 to 249 and 250 and over.	emp_size_band
Collective agreement	Dummy variable to indicate whether the individual is subject to a collective bargaining agreement	coll_agt
Foreign owned enterprise	Dummy variable to indicate whether the individual works for a foreign owned company	for_own
Sector	Categorical variable −11 industrial sectors	sector
Region	Categorical variable – government office region at workplace (NUTS1: North East, North West, Yorkshire, East Midlands, West Midlands, South West, East, London, South East, Wales)	region

Variable	Categories	O*NET/LMI Crosswalk
Green Occupation (Binary Variable)	Dummy variable to identify UK occupations which match to one or more of the US green occupations identified via the O*NET project. The main variable is further disaggregated to created derived variable markers for green tasks; green new and emerging; green enhanced skills; and green in demand	max_green_occ max_green_task max_GN&E max_GES max_GID
Green Occupation continuous variable)	Continuous variable which weights occupation date to identify probability or greenness of occupation.	wght_mean_green_occ wght_mean_green_task wght_mean_GN&E wght_mean_GES wght_mean_GID

Appendix B. Regressions

Appendix B1
Characteristics of working in green occupations (2018): censored Tobit regression

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Green Occupation	Green Task	Green Enhanced Skills	Green New and Emerging	Green in Demand	Green Occupation & Interactions	Green Occupation & Female interactions
Female	−0.275***	−0.233***	−0.161**	−0.179***	−0.198***	−0.272***	0.002
Age	0.009*	0.009	0.006	0.006	0.001	0.009*	0.011*
Age-squared	−0.097*	−0.091	−0.057	−0.070	−0.008	−0.100*	−0.084
Mixed/multiple ethnic groups	0.039	0.001	−0.042	0.037	0.026	0.034	−0.000
Asian/Asian British	−0.088*	−0.135***	−0.112***	−0.090**	0.016	−0.078*	−0.086
Black/Black British	−0.064	−0.161***	−0.133***	−0.116***	0.059	−0.062	−0.021
Other	0.012	−0.080	−0.077	−0.033	0.062	0.003	−0.005
Up to A′ level	0.005	0.076	0.030	0.191***	−0.044	−0.016	−0.004
Apprenticeship	0.101	0.196**	0.120*	0.307***	0.038	0.080	0.068
Other	0.063	0.073**	0.048*	0.102***	0.013	0.056	0.044
Degree or higher	0.038	0.216**	0.111	0.311***	−0.185**	0.007	−0.049
Married	0.028*	0.044***	0.035***	0.026*	−0.003	0.029*	0.036*

(*continued on next page*)

Appendix B1 (*continued*)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Green Occupation	Green Task	Green Enhanced Skills	Green New and Emerging	Green in Demand	Green Occupation & Interactions	Green Occupation & Female interactions
Born outside UK	−0.029	−0.083**	−0.057*	−0.074***	0.053	−0.027	−0.020
Health - Fair to very bad	−0.022	−0.047*	−0.034*	−0.040*	0.017	−0.023	−0.032
Dependent - pre-school child	0.027	0.015	0.005	0.026*	0.010	0.021	0.038*
Dependent - primary school child	−0.009	−0.006	−0.008	−0.008	−0.020	−0.011	0.015
Dependent - senior school child	−0.016	−0.018	−0.021	0.004	−0.016	−0.015	0.019
Public Transport User	−0.066*	−0.100***	−0.076**	−0.075***	−0.016	−0.073**	−0.090**
Disability - no limit activity	0.004	0.002	0.002	0.004	0.009	−0.001	0.040
Basic paid hours	0.008**	0.007*	0.007	0.002	0.003	0.007**	0.006
Experience	−0.000	−0.002	−0.003	−0.000	0.002	0.001	0.000
Experience-squared	0.006	0.095**	0.067*	0.074*	−0.085*	−0.024	−0.056
Part-time	−0.186**	−0.206***	−0.138**	−0.236***	−0.088	−0.180**	−0.173*
Hourly paid	−0.193**	−0.259***	−0.173***	−0.294***	−0.002	−0.152**	−0.120
0-9	0.293*	0.227*	0.192**	0.131	0.179**	0.258*	0.351**
10-49	0.138**	0.123***	0.117***	0.073*	0.045	0.117**	0.149***
50-249	0.114***	0.091**	0.089**	0.041*	0.056*	0.097***	0.111***
Collective agreement	0.037	−0.048	−0.022	−0.057**	0.103**	0.130**	0.125**
Foreign owned enterprise	0.085***	0.033	0.021	0.056***	0.071***	0.060***	0.073***
Primary	0.671***	0.603***	0.420***	0.386***	0.270**	0.711***	0.780***
Manufacturing	0.631***	0.480***	0.348***	0.366***	0.439***	0.659***	0.701***
Utilities	0.678***	0.558***	0.380***	0.435***	0.384***	0.697***	0.733***
Construction	0.610***	0.570***	0.361***	0.462***	0.282***	0.652***	0.755***
Sales	0.306*	0.229	0.177	0.210	0.143	0.422**	0.496***
Services	0.417**	0.204	0.174	0.122	0.272	0.483***	0.564***
Finance/Law	0.312***	0.266**	0.211**	0.195**	0.141*	0.360***	0.404***
Health	−0.072	0.008	0.042	−0.097	−0.233*	−0.046	−0.080
Creative	0.312**	0.302*	0.254*	0.096	0.100	0.322**	0.301**
Other	0.209	0.136	0.118	0.121	0.097	0.232	0.188
North East	−0.011	−0.096**	−0.076**	−0.069**	0.095**	−0.023	−0.000
North West	−0.003	−0.046	−0.033	−0.046	0.072*	−0.016	−0.035
Yorkshire and Humberside	−0.000	−0.063*	−0.042	−0.064**	0.064	−0.012	−0.015
East Midlands	0.035	−0.027	−0.019	−0.019	0.095	0.024	0.031
West Midlands	0.003	−0.054*	−0.046*	−0.032	0.066	−0.007	0.003
South West	−0.071*	−0.095***	−0.069***	−0.081***	0.015	−0.072*	−0.083*
East	−0.020	−0.047	−0.030	−0.041*	0.035	−0.016	−0.029
South East	−0.031	−0.038	−0.031	−0.012	0.016	−0.033	−0.044
Wales	−0.079	−0.140***	−0.104***	−0.081**	0.035	−0.086	−0.076
Scotland	0.055	0.119*	0.071	0.115*	0.049	0.043	0.038
Pre-university education & experience						0.001	0.001
Apprenticeship & experience						0.000	0.001
Other qualifications & experience						−0.001	−0.001
Degree or higher & experience						0.002	0.003
Union membership with size of employer						−0.000**	−0.000**
Female & age							0.006
Female & age_squared							−0.171**
Female & Mixed/multiple ethnic groups							0.058
Female & Asian/Asian British							0.026
Female & Black/Black British							−0.120
Female & Other							−0.025
Female & Up to A′ level							−0.027
Female & Apprenticeship							−0.222*
Female & Other							0.008
Female & Degree or higher							0.103
Female & Married							−0.035
Female & Born outside UK							−0.016
Female & Health - Fair to very bad							0.011
Female & Dependent - pre-school child							−0.068*

(*continued on next page*)

Appendix B1 (*continued*)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Green Occupation	Green Task	Green Enhanced Skills	Green New and Emerging	Green in Demand	Green Occupation & Interactions	Green Occupation & Female interactions
Female & Dependent - primary school child							−0.086**
Female & Dependent - senior school child							−0.090***
Female & Public Transport User							0.051
Female & Disability - no limit activity							−0.111***
Female & Basic paid hours							0.002
Female & Time in job							−0.000
Female & Time in job squared							0.139
Female & Part-time							0.020
Female & Hourly paid							−0.098
Female & 0–9							−0.653
Female & 10–49							−0.137
Female & 50–249							−0.060
Female & Collective agreement							−0.006
Female & Foreign owned enterprise							−0.046
Female & Primary							−0.240
Female & Manufacturing							−0.049
Female & Utilities							−0.010
Female & Construction							−0.409**
Female & Sales							−0.121
Female & Services							−0.192
Female & Finance/Law							−0.073
Female & Health							0.053
Female & Creative							0.094
Female & Other							0.125
Female & North East							−0.064
Female & North West							0.050
Female & Yorkshire and Humberside							0.002
Female & East Midlands							−0.009
Female & West Midlands							−0.029
Female & South West							0.035
Female & East							0.039
Female & South East							0.030
Female & Wales							−0.033
Female & Scotland							0.039
Constant	−0.779***	−0.947***	−0.779***	−0.836***	−0.630***	−0.796***	−0.957***
Observations	34009	34009	34009	34009	34009	34009	34009
Clustered by occupation	359	359	359	359	359	359	359
Pseudo R-Squared	0.14	0.14	0.13	0.17	0.14	0.15	0.15
Adj. R-Squared							
AIC	50458	38802	32376	27329	33151	49833	49488
BIC	50888	39232	32807	27759	33581	50305	50365

*p < 0.10 **p < 0.05 ***p < 0.01.

Appendix B2

Characteristics of working in green occupations (2018): OLS (1–5) and OLS LASSO regressions (6–10)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Green Occupation	Green Task	Green Enhanced Skills	Green New and Emerging	Green in Demand	Green Occupation	Green Task	Green Enhanced Skills	Green New and Emerging	Green in Demand
Female	−0.100***	−0.059***	−0.036**	−0.028***	−0.043**	−0.100***	−0.059***	−0.036**	−0.028***	−0.043**
Age	0.004*	0.003*	0.002*	0.002*	0.001	0.004**	0.003*	0.002*	0.002*	0.000
Age-squared	−0.034*	−0.025*	−0.018	−0.019**	−0.004	−0.034*	−0.025*	−0.018	−0.019**	
Mixed/multiple ethnic groups	0.009	−0.004	−0.014**	0.005	0.015	0.009	−0.004	−0.014**	0.005	0.014
Asian/Asian British	−0.035**	−0.039***	−0.031***	−0.016***	0.007	−0.035**	−0.039***	−0.031***	−0.016***	0.007
Black/Black British	−0.019	−0.036***	−0.028***	−0.016***	0.021	−0.019	−0.036***	−0.028***	−0.016***	0.022
Other	−0.009	−0.030	−0.027	−0.005	0.017	−0.009	−0.030	−0.027	−0.005	0.017
Up to A′ level	0.004	0.015	0.001	0.021***	−0.013	0.004	0.015	0.001	0.021***	−0.013
Apprenticeship	0.043	0.039	0.011	0.039***	0.006	0.043	0.039	0.011	0.039***	0.006
Other	0.022*	0.016*	0.009	0.009**	0.005	0.022*	0.016*	0.009	0.009**	0.006
Degree or higher	0.020	0.058**	0.025	0.045***	−0.050*	0.020	0.058**	0.025	0.045***	−0.050*
Married	0.013**	0.015***	0.011***	0.006**	−0.002	0.013**	0.015***	0.011***	0.006**	−0.002
Born outside UK	−0.011	−0.023***	−0.016**	−0.010***	0.014	−0.011	−0.023***	−0.016**	−0.010***	0.014
Health - Fair to very bad	−0.010	−0.011*	−0.008	−0.006*	0.004	−0.010	−0.011*	−0.008	−0.006*	0.004
Dependent - pre-school child	0.013*	0.008	0.005	0.005	0.004	0.013*	0.008	0.005	0.005	0.004
Dependent - primary school child	0.002	0.005	0.003	0.001	−0.003	0.002	0.005	0.003	0.001	−0.003
Dependent - senior school child	−0.002	−0.001	−0.003	0.004	−0.002	−0.002	−0.001	−0.003	0.004	−0.002
Public Transport User	−0.023**	−0.021***	−0.013*	−0.009***	−0.002	−0.023**	−0.021***	−0.013*	−0.009***	−0.002
Disability - no limit activity	0.001	−0.001	0.000	−0.002	0.002	0.001	−0.001	0.000	−0.002	0.002
Basic paid hours	0.002*	0.002	0.002	0.000	0.001	0.002*	0.002	0.002	0.000	0.001
Experience	−0.000	−0.001	−0.001	0.000	0.001	−0.000	−0.001	−0.001	0.000	0.001
Experience-squared	0.002	0.033**	0.017*	0.016	−0.033**		0.033**	0.017*	0.016	−0.033**
Part-time	−0.034	−0.014	−0.004	−0.020***	−0.012	−0.034	−0.014	−0.004	−0.020***	−0.013
Hourly paid	−0.062**	−0.064***	−0.038***	−0.047***	0.010	−0.062**	−0.064***	−0.038***	−0.047***	0.010
0-9	0.131**	0.101**	0.079**	0.027	0.035	0.131**	0.101**	0.079**	0.027	0.035
10-49	0.045**	0.031**	0.035***	0.006	0.011	0.045**	0.031**	0.035***	0.006	0.011
50-249	0.042***	0.024**	0.027**	0.003	0.013*	0.042***	0.024**	0.027**	0.003	0.013*
Collective agreement	0.015	−0.013	−0.005	−0.010**	0.031*	0.015	−0.013	−0.005	−0.010**	0.031*
Foreign owned enterprise	0.033***	0.008	0.005	0.007**	0.022**	0.033***	0.008	0.005	0.007**	0.022**
Primary	0.259***	0.205***	0.121***	0.089**	0.044*	0.260***	0.205***	0.121***	0.089**	0.044*
Manufacturing	0.233***	0.125***	0.068***	0.079***	0.097***	0.233***	0.125***	0.068***	0.079***	0.097***
Utilities	0.270***	0.183***	0.096***	0.099***	0.078**	0.270***	0.183***	0.096***	0.099***	0.078**
Construction	0.232***	0.185***	0.081***	0.113**	0.043**	0.232***	0.185***	0.081***	0.113**	0.043**
Sales	0.111**	0.078***	0.051**	0.052**	0.021	0.111**	0.078***	0.051**	0.052**	0.021
Services	0.149**	0.070**	0.056**	0.031**	0.071	0.149**	0.070**	0.056**	0.031**	0.071
Finance/Law	0.098***	0.069***	0.046***	0.033***	0.020*	0.098***	0.069***	0.046***	0.033***	0.020*
Health	0.017	0.034	0.027	0.015	−0.022*	0.017	0.034	0.027	0.015	−0.022*

(*continued on next page*)

Appendix B2 (*continued*)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Green Occupation	Green Task	Green Enhanced Skills	Green New and Emerging	Green in Demand	Green Occupation	Green Task	Green Enhanced Skills	Green New and Emerging	Green in Demand
Creative	0.085***	0.066**	0.053**	0.027**	0.011	0.085***	0.066**	0.053**	0.027**	0.011
Other	0.053	0.036	0.027	0.024	0.008	0.054	0.036	0.027	0.024	0.008
North East	−0.002	−0.023**	−0.020**	−0.008	0.026*	−0.002	−0.023**	−0.020**	−0.008	0.026*
North West	−0.003	−0.012	−0.010	−0.009*	0.013	−0.003	−0.012	−0.010	−0.009*	0.013
Yorkshire and Humberside	−0.004	−0.015	−0.009	−0.010*	0.013	−0.004	−0.015	−0.009	−0.010*	0.013
East Midlands	0.011	−0.006	−0.008	0.001	0.019	0.011	−0.006	−0.008	0.001	0.019
West Midlands	0.003	−0.012	−0.012*	−0.002	0.016	0.003	−0.012	−0.012*	−0.002	0.016
South West	−0.027*	−0.024***	−0.016**	−0.012***	−0.001	−0.027*	−0.024***	−0.016**	−0.012***	−0.001
East	−0.008	−0.010	−0.007	−0.004	0.003	−0.008	−0.010	−0.007	−0.004	0.003
South East	−0.011	−0.010	−0.010	−0.001	−0.002	−0.011	−0.010	−0.010	−0.001	−0.002
Wales	−0.026	−0.032***	−0.024***	−0.011*	0.009	−0.026	−0.032***	−0.024***	−0.011*	0.009
Scotland	0.032	0.041*	0.005	0.030	−0.010	0.032	0.041*	0.005	0.030	−0.010
Constant	−0.020	−0.043	−0.051	−0.008	0.024	−0.020	−0.043	−0.051	−0.008	0.031
Observations	34009	34009	34009	34009	34009	34009	34009	34009	34009	34009
Clustered by occupation	359	359	359	359	359	359	359	359	359	359
Pseudo R-Squared										
Adj. R-Squared	0.18	0.13	0.09	0.10	0.11	0.18	0.13	0.09	0.10	0.11
AIC	11375	−3923	−22112	−28280	−19830	11373	−3923	−22112	−28280	−19831
BIC	11796	−3501	−21690	−27858	−19408	11786	−3501	−21690	−27858	−19418

*p < 0.10 **p < 0.05 ***p < 0.01.

Appendix B3
Characteristics of working in green occupations (2011–2018): Panel Logistic Fractional Responses Model using GLM

	(1)	(2)	(3)	(4)	(5)
	Green Occupation	Green Task	Green Enhanced Skills	Green New and Emerging	Green in Demand
Age	0.054***	0.068***	0.088***	0.084***	0.016***
Age-squared	−0.540***	−0.636***	−0.835***	−0.949***	−0.138***
Basic paid hours	0.017***	0.022***	0.023***	0.003***	0.010***
Experience	−0.006***	−0.000	0.002*	0.014***	−0.016***
Experience-squared	0.227***	0.143***	0.017	0.081**	0.229***
Part-time	−0.659***	−0.900***	−0.866***	−1.232***	−0.468***
Hourly paid	−0.417***	−0.810***	−0.685***	−1.152***	0.192***
0-9	0.228***	0.061	0.139*	−0.099	0.383***
10-49	0.235***	0.380***	0.396***	0.107***	0.079***
50-249	0.203***	0.348***	0.311***	0.066***	0.095***
Collective agreement	0.167***	−0.150***	−0.113***	−0.227***	0.496***
Foreign owned enterprise	0.122***	0.078***	0.080***	0.114***	0.093***
Primary	1.701***	1.251***	1.245***	1.276***	1.687***
Manufacturing	1.727***	1.156***	1.181***	1.219***	1.912***
Utilities	1.901***	1.619***	1.456***	1.563***	1.750***
Construction	1.840***	1.571***	1.338***	1.625***	1.639***
Sales	1.023***	0.748***	0.786***	0.756***	1.216***
Services	1.260***	0.737***	0.888***	0.521***	1.679***
Finance/Law	1.132***	0.817***	0.890***	0.690***	1.319***
Health	−0.332***	−0.248***	0.128***	−0.577***	−0.850***
Creative	0.709***	0.631***	0.753***	0.155***	0.828***
Other	0.736***	0.530***	0.660***	0.561***	0.773***
North East	0.110***	−0.053**	−0.092***	−0.138***	0.366***
North West	0.130***	0.100***	0.055***	−0.009	0.228***
Yorkshire and Humberside	0.185***	0.060***	0.060***	−0.050***	0.353***
East Midlands	0.271***	0.112***	0.087***	0.035**	0.439***
West Midlands	0.198***	0.081***	0.033**	−0.023	0.359***
South West	0.038***	0.049***	0.009	−0.055***	0.122***
East	0.124***	0.086***	0.071***	0.011	0.193***
South East	0.088***	0.055***	0.037***	0.062***	0.101***
Wales	0.104***	0.072***	0.009	0.038*	0.222***
Scotland	0.110***	0.058***	0.016	−0.019	0.231***
Constant	−4.293***	−5.439***	−6.068***	−5.086***	−4.780***
Observations	652128	652128	652128	652128	652128
AIC	494928	267214	248750	201106	307728
BIC	495303	267590	249126	201482	308103

*p < 0.10 **p < 0.05 ***p < 0.01.

Appendix B4

Characteristics of working in green occupations (2011–2018): panel fixed effects - OLS (1–5), OLS LASSO (6–10) and Logit binary dependent variable (11)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	Green Occ.	Green Task	Green Enhanced Skills	Green New and Emerging	Green in Demand	Green Occ.	Green Task	Green Enhanced Skills	Green New and Emerging	Green in Demand	Green Occ.
Age	0.012***	0.014***	0.005***	0.005***	0.003***	0.012***	0.014***	0.005***	0.005***	0.003***	0.210***
Age-squared	−0.109***	−0.001	−0.049***	−0.045***	−0.025***	−0.109***	−0.001	−0.049***	−0.045***	−0.025***	−1.945***
Basic paid hours	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.008***
Experience	−0.001***	−0.002***	−0.000	−0.000**	−0.001***	−0.001***	−0.002***	−0.000	−0.000**	−0.001***	−0.007
Experience-squared	0.030***	0.081***	0.007**	0.013***	0.012***	0.030***	0.081***	0.007**	0.013***	0.012***	0.496***
Part-time	−0.016***	−0.005***	−0.006***	−0.004***	−0.007***	−0.016***	−0.005***	−0.006***	−0.004***	−0.007***	−0.514***
Hourly paid	−0.017***	−0.010***	−0.008***	−0.009***	−0.002***	−0.017***	−0.010***	−0.008***	−0.009***	−0.002***	−0.413***
0-9	−0.002	−0.001	0.000	−0.003	0.003	−0.002	−0.001	0.000	−0.003	0.003	0.067
10-49	0.013***	0.003	0.001	0.005***	0.006***	0.013***	0.003	0.001	0.005***	0.006***	0.102
50-249	0.009***	0.009***	0.007***	0.004***	−0.001	0.009***	0.009***	0.007***	0.004***	−0.001	0.074**
Collective agreement	0.002***	−0.002***	−0.001***	−0.002***	0.005***	0.002***	−0.002***	−0.001***	−0.002***	0.005***	0.062***
Foreign owned enterprise	0.002***	0.001	−0.000	0.001**	0.002***	0.002***	0.001	−0.000	0.001**	0.002***	0.052**
Primary	0.076***	0.042***	0.027***	0.028***	0.025***	0.076***	0.042***	0.027***	0.028***	0.025***	1.409***
Manufacturing	0.082***	0.034***	0.025***	0.024***	0.036***	0.082***	0.034***	0.025***	0.024***	0.036***	1.298***
Utilities	0.162***	0.077***	0.054***	0.037***	0.074***	0.162***	0.077***	0.054***	0.037***	0.074***	1.639***
Construction	0.084***	0.037***	0.028***	0.027***	0.033***	0.084***	0.037***	0.028***	0.027***	0.033***	1.061***
Sales	0.032***	0.020***	0.007***	0.013***	0.014***	0.032***	0.020***	0.007***	0.013***	0.014***	0.238***
Services	0.048***	0.020***	0.011***	0.009***	0.030***	0.048***	0.020***	0.011***	0.009***	0.030***	0.345***
Finance/Law	0.052***	0.023***	0.015***	0.012***	0.026***	0.052***	0.023***	0.015***	0.012***	0.026***	0.737***
Health	−0.009**	0.008***	0.007***	0.005**	−0.021***	−0.009**	0.008***	0.007***	0.005**	−0.021***	−0.625***
Creative	0.014***	0.012***	0.009***	0.003	0.003	0.014***	0.012***	0.009***	0.003	0.003	0.166*
Other	0.041***	0.014***	0.009***	0.016***	0.019***	0.041***	0.014***	0.009***	0.016***	0.019***	0.681***
North East	0.002	−0.008***	−0.005**	0.001	0.005**	0.002	−0.008***	−0.005**	0.001	0.005**	0.101
North West	0.010***	−0.000	0.003***	0.002	0.005***	0.010***	−0.000	0.003***	0.002	0.005***	0.188***
Yorkshire and Humberside	0.006**	−0.004*	−0.000	−0.001	0.008***	0.006**	−0.004*	−0.000	−0.001	0.008***	0.183***
East Midlands	0.008***	−0.005**	−0.001	−0.001	0.010***	0.008***	−0.005**	−0.001	−0.001	0.010***	0.229***
West Midlands	−0.006**	−0.005***	−0.004***	−0.004***	0.002	−0.006**	−0.005***	−0.004***	−0.004***	0.002	−0.092
South West	0.001	−0.005**	−0.002	−0.005***	0.007***	0.001	−0.005**	−0.002	−0.005***	0.007***	0.165**
East	0.006***	−0.000	−0.001	−0.001	0.007***	0.006***	−0.000	−0.001	−0.001	0.007***	0.060
South East	−0.000	−0.004**	−0.003***	−0.001	0.003**	−0.000	−0.004**	−0.003***	−0.001	0.003**	0.045
Wales	0.006	−0.005*	−0.001	0.002	0.006***	0.006	−0.005*	−0.001	0.002	0.006***	0.213**
Scotland	0.008***	−0.001	−0.000	−0.004***	0.010***	0.008***	−0.001	−0.000	−0.004***	0.010***	0.260***
Constant	−0.151***	−0.489***	−0.074***	−0.071***	−0.019***	−0.151***	−0.489***	−0.074***	−0.071***	−0.019***	
Observations	652128	652128	652128	652128	652128	652128	652128	652128	652128	652128	119458
Adj/Pseudo. R-Squared	0.10	0.01	0.05	0.05	0.05	0.10	0.01	0.05	0.05	0.05	0.06
AIC	−963919	−1250558	−1662691	−1720667	−1564590	−963919	−1250558	−1662691	−1720667	−1564590	86514
BIC	−963544	−1250182	−1662315	−1720291	−1564214	−963544	−1250182	−1662315	−1720291	−1564214	86824

*p < 0.10 **p < 0.05 ***p < 0.01.

Appendix B5

Drivers of pay: stepwise OLS cross section regression (2018) – continuous measure of green occupation, dependent variable: log real hourly wage

	(1)	(2)	(3)	(4)	(5)
	Basic	Individual	Job & Employer	Sector & Region	Interactions & Linear Lasso
Green occupation:Continuous	0.333***	0.212***	0.193***	0.170***	0.152**
Female		−0.183***	−0.170***	−0.153***	−0.030
Age		0.021***	0.020***	0.019***	0.025***
Age-squared		−0.241***	−0.222***	−0.220***	−0.279***
Mixed/multiple ethnic groups		0.022	−0.009	−0.045*	−0.068
Asian/Asian British		−0.053**	−0.083***	−0.118***	−0.142***
Black/Black British		−0.066***	−0.072***	−0.147***	−0.177***
Other		−0.041	−0.045	−0.078**	−0.076*
Up to A′ level		0.177***	0.124***	0.121***	0.131***
Apprenticeship		0.186***	0.155***	0.145***	0.191***
Other		0.094***	0.092***	0.083***	0.083***
Degree or higher		0.614***	0.503***	0.476***	0.467***
Married		0.044***	0.056***	0.058***	0.092***
Born outside UK		0.019	0.008	−0.020	−0.014
Health - Fair to very bad		−0.070***	−0.066***	−0.065***	−0.071***
Dependent - pre-school child		0.041***	0.056***	0.057***	0.053***
Dependent - primary school child		0.027***	0.047***	0.046***	0.053***
Dependent - senior school child		0.009	0.017**	0.021***	0.040***
Public Transport User		0.107***	0.077***	0.018*	0.024
Disability - no limit activity		0.045***	0.031***	0.025**	0.032**
Basic paid hours		0.000	−0.013***	−0.012***	−0.014***
Experience		0.008***	0.007***	0.007***	0.007***
Experience-squared		−0.032	−0.006	−0.030	−0.023
Part-time			−0.339***	−0.310***	−0.343***
Hourly paid			−0.219***	−0.188***	−0.202***
0-9			−0.148***	−0.136**	−0.194***
10-49			−0.027*	−0.038***	−0.054***
50-249			−0.003	−0.008	−0.011
Collective agreement			0.002	0.006	−0.006
Foreign owned enterprise			0.047***	0.042***	0.055***
Primary				0.115*	0.091
Manufacturing				0.034	0.044
Utilities				0.064	0.061
Construction				0.168***	0.194***
Sales				−0.116**	−0.114*
Services				−0.004	0.008
Finance/Law				0.020	0.021
Health				−0.082*	−0.157***
Creative				−0.108**	−0.111*
Other				−0.107	−0.171*
North East				−0.293***	−0.309***
North West				−0.264***	−0.271***
Yorkshire and Humberside				−0.268***	−0.269***
East Midlands				−0.264***	−0.270***
West Midlands				−0.239***	−0.244***
South West				−0.259***	−0.264***
East				−0.210***	−0.207***
South East				−0.170***	−0.171***
Wales				−0.314***	−0.338***
Scotland				−0.059*	−0.092**
Green occupation & Female					0.048
Green occupation & Mixed/multiple ethnic groups					0.009
Green occupation & Asian/Asian British					−0.040
Green occupation & Black/Black British					−0.045
Green occupation & Other					0.053
Pre-university education & experience					0.001
Apprenticeship & experience					−0.001
Other qualifications & experience					0.002
Degree or higher & experience					0.001
Union membership with size of employer					0.000
Female & age					−0.010***
Female & age_squared					0.109***
Female & Mixed/multiple ethnic groups					0.035
Female & Asian/Asian British					0.075***
Female & Black/Black British					0.082**
Female & Other					−0.053
Female & Up to A′ level					−0.054***
Female & Apprenticeship					−0.150***
Female & Other					−0.058**
Female & Degree or higher					−0.031
Female & Married					−0.075***
Female & Born outside UK					−0.009
Female & Health - Fair to very bad					0.010

(*continued on next page*)

Appendix B5 (*continued*)

	(1)	(2)	(3)	(4)	(5)
	Basic	Individual	Job & Employer	Sector & Region	Interactions & Linear Lasso
Female & Dependent - pre-school child					−0.003
Female & Dependent - primary school child					−0.025*
Female & Dependent - senior school child					−0.049***
Female & Public Transport User					−0.015
Female & Disability - no limit activity					−0.017
Female & Basic paid hours					0.004***
Female & Time in job					−0.000
Female & Time in job squared					−0.036
Female & Part-time					0.073**
Female & Hourly paid					0.036**
Female & 0–9					0.210
Female & 10–49					0.052*
Female & 50–249					0.011
Female & Collective agreement					0.027*
Female & Foreign owned enterprise					−0.039***
Female & Primary					0.149
Female & Manufacturing					−0.048
Female & Utilities					0.017
Female & Construction					−0.101**
Female & Sales					−0.005
Female & Services					−0.025
Female & Finance/Law					−0.002
Female & Health					0.088**
Female & Creative					0.006
Female & Other					0.120
Female & North East					0.033
Female & North West					0.016
Female & Yorkshire and Humberside					0.002
Female & East Midlands					0.015
Female & West Midlands					0.013
Female & South West					0.011
Female & East					−0.006
Female & South East					0.001
Female & Wales					0.053*
Female & Scotland					0.089
Constant	2.538***	1.851***	2.505***	2.758***	2.715***
Observations	174512	73252	33906	33882	33882
Clustered by occupation	367	367	359	359	359
Adj. R-Squared	0.03	0.31	0.40	0.44	0.45
AIC	257801	81800	33907	31494	31243
BIC	257821	82020	34169	31924	32162

*p < 0.10 **p < 0.05 ***p < 0.01.

Appendix B6

Drivers of pay: stepwise OLS cross section regression (2018) – binary measure of green occupation, dependent variable: log real hourly wage

	(1)	(2)	(3)	(4)	(5)
	Basic	Individual	Job & Employer	Sector & Region	Interaction & Linear Lasso
Green occupation:Binary	0.170**	0.108**	0.094**	0.077*	0.050
Female		−0.189***	−0.176***	−0.159***	−0.006
Age		0.021***	0.020***	0.020***	0.025***
Age-squared		−0.243***	−0.225***	−0.222***	−0.284***
Mixed/multiple ethnic groups		0.020	−0.009	−0.045*	−0.084**
Asian/Asian British		−0.055**	−0.084***	−0.120***	−0.160***
Black/Black British		−0.067***	−0.072***	−0.148***	−0.194***
Other		−0.043	−0.048	−0.081***	−0.097**
Up to A′ level		0.175***	0.125***	0.122***	0.131***
Apprenticeship		0.185***	0.154***	0.145***	0.191***
Other		0.095***	0.094***	0.084***	0.084***
Degree or higher		0.614***	0.506***	0.480***	0.468***
Married		0.046***	0.058***	0.060***	0.094***
Born outside UK		0.018	0.006	−0.022	−0.016
Health - Fair to very bad		−0.071***	−0.067***	−0.067***	−0.074***
Dependent - pre-school child		0.043***	0.058***	0.058***	0.054***
Dependent - primary school child		0.028***	0.049***	0.048***	0.055***
Dependent - senior school child		0.009	0.018**	0.021***	0.041***
Public Transport User		0.106***	0.077***	0.017*	0.020
Disability - no limit activity		0.045***	0.030***	0.024**	0.032**
Basic paid hours		0.000	−0.012***	−0.012***	−0.014***
Experience		0.008***	0.007***	0.007***	0.007***
Experience-squared		−0.031	−0.007	−0.030	−0.024

(*continued on next page*)

Appendix B6 (*continued*)

	(1)	(2)	(3)	(4)	(5)
	Basic	Individual	Job & Employer	Sector & Region	Interaction & Linear Lasso
Part-time			−0.336***	−0.307***	−0.342***
Hourly paid			−0.220***	−0.191***	−0.206***
0-9			−0.135***	−0.123**	−0.175***
10-49			−0.025	−0.036***	−0.050***
50-249			−0.002	−0.006	−0.007
Collective agreement			0.003	0.007	−0.004
Foreign owned enterprise			0.049***	0.043***	0.057***
Primary				0.129**	0.113
Manufacturing				0.043	0.063
Utilities				0.081	0.087
Construction				0.182***	0.218***
Sales				−0.106**	−0.099
Services				0.010	0.027
Finance/Law				0.025	0.032
Health				−0.078	−0.153***
Creative				−0.105**	−0.104*
Other				−0.105	−0.167*
North East				−0.294***	−0.310***
North West				−0.265***	−0.272***
Yorkshire and Humberside				−0.269***	−0.270***
East Midlands				−0.265***	−0.271***
West Midlands				−0.240***	−0.245***
South West				−0.262***	−0.268***
East				−0.211***	−0.208***
South East				−0.172***	−0.173***
Wales				−0.316***	−0.340***
Scotland				−0.057*	−0.090**
Green occupation & Female					0.120**
Green occupation & Mixed/multiple ethnic groups					0.064
Green occupation & Asian/Asian British					0.020
Green occupation & Black/Black British					0.017
Green occupation & Other					0.121
Pre-university education & experience					0.001
Apprenticeship & experience					−0.001
Other qualifications & experience					0.002
Degree or higher & experience					0.002
Union membership with size of employer					−0.000
Female & age					−0.010***
Female & age_squared					0.115***
Female & Mixed/multiple ethnic groups					0.044
Female & Asian/Asian British					0.085***
Female & Black/Black British					0.093***
Female & Other					−0.043
Female & Up to A′ level					−0.055***
Female & Apprenticeship					−0.151***
Female & Other					−0.060**
Female & Degree or higher					−0.034
Female & Married					−0.077***
Female & Born outside UK					−0.007
Female & Health - Fair to very bad					0.012
Female & Dependent - pre-school child					−0.005
Female & Dependent - primary school child					−0.027*
Female & Dependent - senior school child					−0.050***
Female & Public Transport User					−0.011
Female & Disability - no limit activity					−0.018
Female & Basic paid hours					0.004**
Female & Time in job					−0.000
Female & Time in job squared					−0.035
Female & Part-time					0.073**
Female & Hourly paid					0.041**
Female & 0–9					0.191
Female & 10–49					0.048
Female & 50–249					0.008
Female & Collective agreement					0.026*
Female & Foreign owned enterprise					−0.041***
Female & Primary					0.133
Female & Manufacturing					−0.070*
Female & Utilities					−0.009
Female & Construction					−0.124**
Female & Sales					−0.017
Female & Services					−0.043
Female & Finance/Law					−0.011
Female & Health					0.086**
Female & Creative					−0.004

(*continued on next page*)

Appendix B6 (*continued*)

	(1)	(2)	(3)	(4)	(5)
	Basic	Individual	Job & Employer	Sector & Region	Interaction & Linear Lasso
Female & Other					0.116
Female & North East					0.033
Female & North West					0.017
Female & Yorkshire and Humberside					0.002
Female & East Midlands					0.015
Female & West Midlands					0.012
Female & South West					0.014
Female & East					−0.005
Female & South East					0.002
Female & Wales					0.055*
Female & Scotland					0.088
Constant	2.537***	1.841***	2.487***	2.739***	2.687***
Observations	174512	73252	33906	33882	33882
Clustered by occupation	367	367	359	359	359
Adj. R-Squared	0.02	0.30	0.40	0.44	0.44
AIC	259396	82218	34201	31770	31460
BIC	259416	82439	34462	32200	32379

*p < 0.10 **p < 0.05 ***p < 0.01.

Appendix B7

Drivers of pay of green jobs: stepwise OLS cross section regression (2018) - dependent variable: log real hourly wage

	(1)	(2)	(3)	(4)	(5)
	Individual	Job & Employer	Sector & Region	Interaction	Linear Lasso
Female	−0.181***	−0.171***	−0.148***	−0.329	−0.171*
Age	0.027***	0.024***	0.026***	0.025***	0.027***
Age-squared	−0.301***	−0.261***	−0.286***	−0.280***	−0.299***
Mixed/multiple ethnic groups	0.004	−0.004	−0.048	−0.061	−0.061
Asian/Asian British	−0.101***	−0.113***	−0.152***	−0.159***	−0.159***
Black/Black British	−0.124***	−0.093***	−0.177***	−0.211***	−0.211***
Other	−0.034	0.016	−0.012	−0.048	−0.048
Up to A′ level	0.210***	0.168***	0.163***	0.137***	0.136***
Apprenticeship	0.244***	0.221***	0.209***	0.219***	0.220***
Other	0.113***	0.115***	0.108***	0.084***	0.084**
Degree or higher	0.600***	0.543***	0.522***	0.486***	0.485***
Married	0.066***	0.068***	0.072***	0.086***	0.085***
Born outside UK	−0.003	−0.032	−0.054***	−0.044**	−0.044**
Health - Fair to very bad	−0.076***	−0.075***	−0.078***	−0.073***	−0.073***
Dependent - pre-school child	0.047***	0.051***	0.047***	0.048***	0.048***
Dependent - primary school child	0.046***	0.058***	0.059***	0.068***	0.067***
Dependent - senior school child	0.023***	0.030***	0.032***	0.041***	0.042***
Public Transport User	0.166***	0.107***	0.035*	0.029	0.029
Disability - no limit activity	0.058***	0.033*	0.020	0.020	0.020
Basic paid hours	−0.001	−0.014***	−0.014***	−0.015***	−0.015***
Experience	0.007***	0.007***	0.008***	0.006***	0.006***
Experience-squared	−0.013	−0.018	−0.027	−0.023	−0.020
Part-time		−0.399***	−0.372***	−0.354***	−0.339***
Hourly paid		−0.170***	−0.159***	−0.166***	−0.167***
0-9		−0.128**	−0.093	−0.094	−0.102
10-49		−0.048***	−0.063***	−0.079***	−0.079***
50-249		−0.013	−0.013	−0.009	−0.009
Collective agreement		−0.020	−0.011	−0.005	−0.005
Foreign owned enterprise		0.077***	0.060***	0.063***	0.064***
Primary			0.234***	0.256***	0.252***
Manufacturing			0.151***	0.199***	0.195***
Utilities			0.194***	0.235***	0.231***
Construction			0.307***	0.358***	0.355***
Sales			0.032	0.079	0.075
Services			0.126***	0.159***	0.156***
Finance/Law			0.132***	0.176***	0.173***
Health			0.016	−0.017	−0.020
Creative			−0.028	−0.013	−0.025
Other			0.033	0.059	0.056
North East			−0.362***	−0.362***	−0.360***
North West			−0.292***	−0.294***	−0.292***
Yorkshire and Humberside			−0.313***	−0.304***	−0.303***
East Midlands			−0.309***	−0.305***	−0.303***
West Midlands			−0.278***	−0.276***	−0.274***
South West			−0.302***	−0.292***	−0.291***
East			−0.255***	−0.255***	−0.253***
South East			−0.204***	−0.204***	−0.202***

(*continued on next page*)

Appendix B7 (*continued*)

	(1)	(2)	(3)	(4)	(5)
	Individual	Job & Employer	Sector & Region	Interaction	Linear Lasso
Wales			−0.394***	−0.400***	−0.399***
Scotland			−0.125**	−0.164***	−0.162***
Pre-university education & experience				0.002*	0.002*
Apprenticeship & experience				−0.001	−0.001
Other qualifications & experience				0.003	0.003
Degree or higher & experience				0.002	0.002
Union membership with size of employer				−0.000	−0.000
Female & age				0.006	
Female & age_squared				−0.073	−0.010
Female & Mixed/multiple ethnic groups				0.027	0.026
Female & Asian/Asian British				0.028	0.026
Female & Black/Black British				0.108*	0.106*
Female & Other				0.164	0.167
Female & Up to A′ level				−0.014	−0.013
Female & Apprenticeship				−0.061	−0.063
Female & Other				−0.055	−0.054
Female & Degree or higher				0.021	0.024
Female & Married				−0.052**	−0.049**
Female & Born outside UK				−0.019	−0.019
Female & Health - Fair to very bad				−0.024	−0.023
Female & Dependent - pre-school child				−0.003	
Female & Dependent - primary school child				−0.038	−0.034
Female & Dependent - senior school child				−0.043**	−0.043**
Female & Public Transport User				0.009	0.007
Female & Disability - no limit activity				−0.003	−0.004
Female & Basic paid hours				0.006**	0.005***
Female & Time in job				−0.000	
Female & Time in job squared				−0.015	−0.027
Female & Part-time				0.035	
Female & Hourly paid				0.032	0.032
Female & 0–9				−0.209**	
Female & 10–49				0.078*	0.077*
Female & 50–249				−0.014	−0.015
Female & Collective agreement				−0.017	−0.017
Female & Foreign owned enterprise				−0.021	−0.022
Female & Primary				0.102	0.110
Female & Manufacturing				−0.129**	−0.121***
Female & Utilities				−0.083	−0.075
Female & Construction				−0.145	−0.140
Female & Sales				−0.092	−0.084
Female & Services				−0.048	−0.041
Female & Finance/Law				−0.089*	−0.082*
Female & Health				0.019	0.025
Female & Creative				−0.026	
Female & Other				−0.051	−0.045
Female & North East				0.006	
Female & North West				0.007	
Female & Yorkshire and Humberside				−0.034	−0.039*
Female & East Midlands				−0.015	−0.019
Female & West Midlands				−0.004	−0.008
Female & South West				−0.028	−0.034
Female & East				0.007	
Female & South East				0.004	−0.001
Female & Wales				0.024	0.020
Female & Scotland				0.202*	0.194*
Constant	1.820***	2.502***	2.636***	2.658***	2.615***
Observations	24601	14364	14353	14353	14353
Clustered by occupation	142	141	141	141	141
Adj. R-Squared	0.25	0.33	0.38	0.39	0.39
AIC	29169	15221	14114	14098	14084
BIC	29355	15448	14493	14870	14796

*p < 0.10 **p < 0.05 ***p < 0.01.

Appendix B8

Drivers of pay of NON-green jobs: stepwise OLS cross section regression (2018) - dependent variable: log real hourly wage

	(1)	(2)	(3)	(4)	(5)
	Individual	Job and Employer	Sector and Region	Interactions	Linear LASSO
Female	−0.190***	−0.177***	−0.161***	0.018	0.018
Age	0.018***	0.018***	0.016***	0.024***	0.024***
Age-squared	−0.218***	−0.202***	−0.186***	−0.277***	−0.277***
Mixed/multiple ethnic groups	0.026	−0.012	−0.043	−0.078	−0.078
Asian/Asian British	−0.040	−0.069***	−0.102***	−0.149***	−0.149***
Black/Black British	−0.047	−0.066**	−0.135***	−0.175***	−0.175***
Other	−0.047	−0.092**	−0.126***	−0.083*	−0.083*
Upto A′ level	0.154***	0.093***	0.093***	0.113***	0.113***
Apprenticeship	0.107***	0.068**	0.072**	0.137***	0.137***
Other	0.087***	0.078***	0.069***	0.079***	0.079***
Degree or higher	0.612***	0.474***	0.447***	0.437***	0.437***
Married	0.036***	0.051***	0.051***	0.105***	0.105***
Born outside UK	0.026	0.031	−0.001	0.012	0.012
Health - Fair to very bad	−0.069***	−0.061***	−0.060***	−0.076***	−0.076***
Dependent - pre-school child	0.039***	0.063***	0.063***	0.060***	0.060***
Dependent - primary school child	0.019*	0.041***	0.038***	0.037***	0.037***
Dependent - senior school child	0.002	0.008	0.012	0.038***	0.038***
Public Transport User	0.081***	0.059***	0.010	0.017	0.017
Disability - no limit activity	0.039***	0.028**	0.027**	0.033	0.033
Basic paid hours	0.001	−0.012***	−0.011***	−0.013***	−0.013***
Experience	0.009***	0.006***	0.007***	0.007***	0.007***
Experience-squared	−0.049	0.004	−0.034	−0.020	−0.020
Part-time		−0.306***	−0.277***	−0.309***	−0.309***
Hourly paid		−0.252***	−0.209***	−0.249***	−0.249***
0-9		−0.140*	−0.173*	−0.443***	−0.443***
10-49		−0.005	−0.015	−0.011	−0.011
50-249		0.003	−0.006	−0.021	−0.021
Collective agreement		0.014	0.019	−0.000	−0.000
Foreign owned enterprise		0.021	0.022*	0.040**	0.040**
Primary			0.143	0.076	0.076
Manufacturing			0.031	0.027	0.027
Utilities			0.074	0.030	0.030
Construction			0.129*	0.168**	0.168**
Sales			−0.145**	−0.170**	−0.170**
Services			−0.020	−0.007	−0.007
Finance/Law			0.000	−0.016	−0.016
Health			−0.104*	−0.194***	−0.194***
Creative			−0.113**	−0.118*	−0.118*
Other			−0.150	−0.267**	−0.267**
North East			−0.253***	−0.261***	−0.261***
North West			−0.253***	−0.267***	−0.267***
Yorkshire and Humberside			−0.246***	−0.250***	−0.250***
East Midlands			−0.239***	−0.250***	−0.250***
West Midlands			−0.221***	−0.229***	−0.229***
South West			−0.241***	−0.257***	−0.257***
East			−0.188***	−0.166***	−0.166***
South East			−0.158***	−0.154***	−0.154***
Wales			−0.271***	−0.284***	−0.284***
Scotland			−0.005	−0.011	−0.011
Pre-university education & experience				0.000	0.000
Apprenticeship & experience				−0.002	−0.002
Other qualifications & experience				0.001	0.001
Degree or higher & experience				0.002	0.002
Union membership with size of employer				0.000	0.000
Female & age				−0.012***	−0.012***
Female & age_squared				0.142***	0.142***
Female & Mixed/multiple ethnic groups				0.056	0.056
Female & Asian/Asian British				0.092***	0.092***
Female & Black/Black British				0.075*	0.075*
Female & Other				−0.124	−0.124
Female & Upto A′ level				−0.043**	−0.043**
Female & Apprenticeship				−0.121***	−0.121***
Female & Other				−0.048*	−0.048*
Female & Degree or higher				−0.028	−0.028
Female & Married				−0.092***	−0.092***
Female & Born outside UK				−0.018	−0.018
Female & Health - Fair to very bad				0.024	0.024
Female & Dependent - pre-school child				−0.011	−0.011
Female & Dependent - primary school child				−0.009	−0.009
Female & Dependent - senior school child				−0.051***	−0.051***
Female & Public Transport User				−0.019	−0.019
Female & Disability - no limit activity				−0.019	−0.019
Female & Basic paid hours				0.003*	0.003*

(*continued on next page*)

Appendix B8 (*continued*)

	(1)	(2)	(3)	(4)	(5)
	Individual	Job and Employer	Sector and Region	Interactions	Linear LASSO
Female & Time in job				−0.000	−0.000
Female & Time in job squared				−0.040	−0.040
Female & Part-time				0.056	0.056
Female & Hourly paid				0.073***	0.073***
Female & 0–9				0.482***	0.482***
Female & 10–49				0.000	
Female & 50–249				0.028	0.028
Female & Collective agreement				0.033	0.033
Female & Foreign owned enterprise				−0.037**	−0.037**
Female & Primary				0.143	0.143
Female & Manufacturing				−0.017	−0.017
Female & Utilities				0.084	0.084
Female & Construction				−0.100	−0.100
Female & Sales				0.033	0.033
Female & Services				−0.041	−0.041
Female & Finance/Law				0.026	0.026
Female & Health				0.109**	0.109**
Female & Creative				0.003	0.003
Female & Other				0.212**	0.212**
Female & North East				0.011	0.011
Female & North West				0.027	0.027
Female & Yorkshire and Humberside				0.010	0.010
Female & East Midlands				0.020	0.020
Female & West Midlands				0.015	0.015
Female & South West				0.027	0.027
Female & East				−0.035	−0.035
Female & South East				−0.009	−0.009
Female & Wales				0.026	0.026
Female & Scotland				−0.006	−0.006
Constant	1.926***	2.562***	2.826***	2.742***	2.742***
Observations	48651	19542	19529	19529	19529
Clustered by occupation	225	218	218	218	218
Adj. R-Squared	0.31	0.40	0.45	0.45	0.45
AIC	52705	18791	17408	17167	17165
BIC	52907	19027	17802	17979	17969

*p < 0.10 **p < 0.05 ***p < 0.01.

Appendix B9

Drivers of pay of greenness of jobs: stepwise panel fixed effect regression (2011–2018) – continuous measure of green occupation, dependent variable: log real hourly wage

	(1)	(2)	(3)	(4)	(5)
	Base model	Individual	Job & Employer	Sector & Region	Interaction & Lasso Linear
Green Occupational Marker	0.096***	0.076***	0.063***	0.060***	0.038***
Age		0.091***	0.084***	0.083***	0.084***
Age-squared		−0.873***	−0.773***	−0.761***	−0.798***
Basic paid hours		−0.005***	−0.009***	−0.009***	−0.009***
Experience		0.009***	0.005***	0.005***	0.006***
Experience-squared		−0.118***	−0.069***	−0.073***	−0.071***
Part-time			−0.067***	−0.064***	−0.055***
Hourly paid			−0.041***	−0.039***	−0.030***
0-9			−0.042***	−0.044***	−0.026
10-49			−0.021***	−0.027***	−0.032***
50-249			0.002	−0.003	−0.005
Collective agreement			0.017***	0.016***	0.008***
Foreign owned enterprise			0.018***	0.015***	0.015***
Primary				0.081***	0.088***
Manufacturing				0.059***	0.063***
Utilities				0.069***	0.064***
Construction				0.042***	0.036***
Sales				−0.021***	−0.041***
Services				−0.040***	0.001
Finance/Law				−0.010**	−0.010
Health				−0.017***	−0.004
Creative				−0.070***	−0.082***
Other				−0.020***	−0.022
North East				−0.060***	−0.045***
North West				−0.064***	−0.046***
Yorkshire and Humberside				−0.058***	−0.049***
East Midlands				−0.072***	−0.054***
West Midlands				−0.056***	−0.048***

(*continued on next page*)

Appendix B9 (*continued*)

	(1)	(2)	(3)	(4)	(5)
	Base model	Individual	Job & Employer	Sector & Region	Interaction & Lasso Linear
South West				−0.054***	−0.058***
East				−0.057***	−0.036***
South East				−0.044***	−0.029***
Wales				−0.070***	−0.041***
Scotland				−0.059***	−0.046***
Green occupation & Female					0.036***
Green occupation & Mixed/multiple ethnic groups					0.021
Green occupation & Asian/Asian British					0.012
Green occupation & Black/Black British					0.036**
Green occupation & Other					0.063*
Pre-university education & experience					−0.001
Apprenticeship & experience					0.002***
Other qualifications & experience					−0.002***
Degree or higher & experience					0.001
Union membership with size of employer					0.000***
Female & age					−0.028***
Female & age_squared					0.314***
Female & Basic paid hours					−0.001***
Female & Time in job					−0.000
Female & Time in job squared					−0.032*
Female & Part-time					−0.020***
Female & Hourly paid					−0.004
Female & 0–9					−0.018
Female & 10–49					0.003
Female & 50–249					0.010*
Female & Collective agreement					−0.005*
Female & Foreign owned enterprise					−0.006*
Female & Primary					−0.154***
Female & Manufacturing					−0.051***
Female & Utilities					0.020
Female & Construction					−0.027
Female & Sales					−0.032***
Female & Services					−0.069***
Female & Finance/Law					−0.007
Female & Health					−0.037**
Female & Creative					0.009
Female & Other					−0.001
Female & North East					−0.014
Female & North West					−0.022**
Female & Yorkshire and Humberside					0.002
Female & East Midlands					−0.004
Female & West Midlands					−0.012
Female & South West					0.009
Female & East					−0.042***
Female & South East					−0.023***
Female & Wales					−0.024*
Female & Scotland					−0.017
Constant	2.506***	0.510***	0.787***	0.868***	1.148***
Observations	1398000	1375696	648007	647443	313228
Adj. R-Squared overall	0.04	0.09	0.12	0.13	0.15
AIC	−615232	−776163	−484441	−487227	−261127
BIC	−615208	−776078	−484281	−486840	−260317

*p < 0.10 **p < 0.05 ***p < 0.01.

Appendix B10

Drivers of pay of green jobs: stepwise Logit panel fixed effect regression (2011–2018) – binary measure of green occupation, dependent variable: log real hourly wage

	(1)	(1)	(3)	(4)	(5)	(6)
	Base model	Individual	Job & Employer	Sector & Region	Interaction	Lasso - linear
Green Occupational Marker: Binary	0.050***	0.042***	0.036***	0.033***	0.020***	0.020***
Age		0.091***	0.084***	0.083***	0.084***	0.084***
Age-squared		−0.873***	−0.773***	−0.762***	−0.799***	−0.799***
Basic paid hours		−0.005***	−0.009***	−0.009***	−0.009***	−0.009***
Experience		0.009***	0.005***	0.005***	0.006***	0.006***
Experience-squared		−0.118***	−0.069***	−0.073***	−0.071***	−0.071***
Part-time			−0.066***	−0.064***	−0.055***	−0.055***
Hourly paid			−0.041***	−0.039***	−0.030***	−0.030***
0-9			−0.042***	−0.044***	−0.026	−0.026
10-49			−0.021***	−0.027***	−0.032***	−0.032***
50-249			0.002	−0.003	−0.004	−0.005
Collective agreement			0.017***	0.015***	0.008***	0.008***

(*continued on next page*)

Appendix B10 (*continued*)

	(1)	(1)	(3)	(4)	(5)	(6)
	Base model	Individual	Job & Employer	Sector & Region	Interaction	Lasso - linear
Foreign owned enterprise			0.018***	0.015***	0.015***	0.015***
Primary				0.080***	0.087***	0.087***
Manufacturing				0.059***	0.062***	0.062***
Utilities				0.071***	0.066***	0.066***
Construction				0.042***	0.036***	0.036***
Sales				−0.020***	−0.040***	−0.040***
Services				−0.038***	0.002	0.002
Finance/Law				−0.010**	−0.010	−0.010
Health				−0.016***	−0.004	−0.004
Creative				−0.069***	−0.082***	−0.082***
Other				−0.020***	−0.023*	−0.023*
North East				−0.061***	−0.045***	−0.044***
North West				−0.064***	−0.045***	−0.044***
Yorkshire and Humberside				−0.059***	−0.049***	−0.048***
East Midlands				−0.072***	−0.054***	−0.052***
West Midlands				−0.056***	−0.048***	−0.046***
South West				−0.054***	−0.058***	−0.055***
East				−0.056***	−0.036***	−0.035***
South East				−0.044***	−0.030***	−0.028***
Wales				−0.070***	−0.041***	−0.039***
Scotland				−0.059***	−0.046***	−0.045***
Green occupation & Female					0.043***	0.043***
Green occupation & Mixed/multiple ethnic groups					0.030	0.030
Green occupation & Asian/Asian British					0.018	0.018
Green occupation & Black/Black British					0.044**	0.044**
Green occupation & Other					0.077**	0.076**
Pre-university education & experience					−0.001	−0.001
Apprenticeship & experience					0.002***	0.002***
Other qualifications & experience					−0.002***	−0.002***
Degree or higher & experience					0.001	0.001
Union membership with size of employer					0.000***	0.000***
Female & age					−0.028***	−0.028***
Female & age_squared					0.317***	0.317***
Female & Basic paid hours					−0.001***	−0.001***
Female & Time in job					−0.000	−0.000
Female & Time in job squared					−0.033*	−0.033*
Female & Part-time					−0.021***	−0.020***
Female & Hourly paid					−0.004	−0.004
Female & 0–9					−0.018	−0.017
Female & 10–49					0.004	0.004
Female & 50–249					0.010*	0.010*
Female & Collective agreement					−0.005*	−0.005*
Female & Foreign owned enterprise					−0.006*	−0.006*
Female & Primary					−0.154***	−0.154***
Female & Manufacturing					−0.051***	−0.051***
Female & Utilities					0.017	0.018
Female & Construction					−0.027	−0.027
Female & Sales					−0.032***	−0.033***
Female & Services					−0.070***	−0.071***
Female & Finance/Law					−0.007	−0.007
Female & Health					−0.036**	−0.037**
Female & Creative					0.009	0.009
Female & Other					−0.001	−0.001
Female & North East					−0.014	−0.017
Female & North West					−0.022**	−0.025***
Female & Yorkshire and Humberside					0.002	−0.001
Female & East Midlands					−0.004	−0.007
Female & West Midlands					−0.012	−0.015*
Female & South West					0.009	
Female & East					−0.043***	−0.045***
Female & South East					−0.023***	−0.026***
Female & Wales					−0.024*	−0.027**
Female & Scotland					−0.017	−0.020
Constant	2.505***	0.507***	0.784***	0.863***	1.145***	1.145***
Observations	1398000	1375696	648007	647443	313228	313228
Adj. R-Squared overall	0.03	0.09	0.12	0.13	0.15	0.15
AIC	−614243	−775841	−484282	−486992	−261081	−261082
BIC	−614219	−775756	−484122	−486605	−260271	−260283

*p < 0.10 **p < 0.05 ***p < 0.01.

Appendix B11

Drivers of pay of green jobs: stepwise panel fixed effect regression (2011–2018) – continuous measure of green occupation, dependent variable: log real hourly wage

	(1)	(3)	(5)	(8)
	Individual	Job & Employer	Sector & Region	Interaction & Lasso
Age	0.093***	0.087***	0.086***	0.083***
Age-squared	−0.873***	−0.795***	−0.785***	−0.762***
Basic paid hours	−0.007***	−0.009***	−0.009***	−0.011***
Experience	0.007***	0.005***	0.005***	0.005***
Experience-squared	−0.115***	−0.090***	−0.086***	−0.070***
Part-time		−0.055***	−0.052***	−0.053***
Hourly paid		−0.008***	−0.006***	−0.008***
0-9		−0.055***	−0.050***	−0.031
10-49		−0.042***	−0.046***	−0.039***
50-249		−0.015***	−0.018***	−0.025***
Collective agreement		0.009***	0.006***	0.006***
Foreign owned enterprise		0.019***	0.014***	0.015***
Primary			0.095***	0.105***
Manufacturing			0.066***	0.089***
Utilities			0.095***	0.093***
Construction			0.060***	0.068***
Sales			0.010	0.026*
Services			0.029***	0.043***
Finance/Law			−0.007	0.005
Health			−0.023*	−0.030
Creative			−0.012	0.013
Other			0.011	0.033
North East			−0.025***	−0.039***
North West			−0.049***	−0.045***
Yorkshire and Humberside			−0.047***	−0.053***
East Midlands			−0.055***	−0.046***
West Midlands			−0.034***	−0.041***
South West			−0.042***	−0.044***
East			−0.036***	−0.026***
South East			−0.030***	−0.023***
Wales			−0.029***	−0.026**
Scotland			−0.033***	−0.034***
Pre-university education & experience				−0.000
Apprenticeship & experience				0.002***
Other qualifications & experience				−0.003***
Degree or higher & experience				0.001
Union membership with size of employer				0.000
Female & age				−0.029***
Female & age_squared				0.292***
Female & Basic paid hours				0.002***
Female & Time in job				0.001
Female & Time in job squared				−0.070**
Female & Part-time				−0.001
Female & Hourly paid				0.004
Female & 0–9				−0.029
Female & 10–49				−0.022
Female & 50–249				0.006
Female & Collective agreement				−0.009**
Female & Foreign owned enterprise				−0.004
Female & Primary				−0.102
Female & Manufacturing				−0.093***
Female & Utilities				0.017
Female & Construction				−0.056*
Female & Sales				−0.074***
Female & Services				−0.050**
Female & Finance/Law				−0.023
Female & Health				−0.034
Female & Creative				−0.002
Female & Other				−0.053
Female & North East				−0.004
Female & North West				−0.010
Female & Yorkshire and Humberside				−0.002
Female & East Midlands				−0.007
Female & West Midlands				0.054***

(*continued on next page*)

Appendix B11 (*continued*)

	(1)	(3)	(5)	(8)
	Individual	Job & Employer	Sector & Region	Interaction & Lasso
Female & South West				0.010
Female & East				−0.019
Female & South East				−0.007
Female & Wales				0.005
Female & Scotland				0.040
Constant	0.662***	0.871***	0.896***	1.187***
Observations	441358	245553	245340	124937
Adj. R-Squared overall	0.09	0.10	0.11	0.08
AIC	−403873	−260635	−261576	−134090
BIC	−403807	−260499	−261232	−133408

*p < 0.10 **p < 0.05 ***p < 0.01.

Appendix B12

Drivers of pay of non-green jobs: stepwise panel fixed effect regression (2011–2018) - dependent variable: log real hourly wage

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Individual	Job	Employer	Sector	Region	Other interaction	Female interaction	Lasso
Age	0.084***	0.081***	0.075***	0.074***	0.074***	0.061***	0.074***	0.074***
Age-squared	−0.795***	−0.766***	−0.669***	−0.660***	−0.659***	−0.549***	−0.715***	−0.715***
Basic paid hours	−0.006***	−0.007***	−0.009***	−0.009***	−0.009***	−0.009***	−0.008***	−0.008***
Experience	0.008***	0.008***	0.004***	0.004***	0.004***	0.005***	0.005***	0.005***
Experience-squared	−0.114***	−0.114***	−0.060***	−0.066***	−0.065***	−0.077***	−0.062***	−0.062***
Part-time		−0.054***	−0.053***	−0.052***	−0.052***	−0.052***	−0.027***	−0.027***
Hourly paid		−0.050***	−0.049***	−0.046***	−0.046***	−0.036***	−0.037***	−0.037***
0-9			−0.026	−0.033**	−0.033**	−0.033	−0.020	−0.020
10-49			−0.001	−0.005	−0.004	−0.021**	−0.035**	−0.035**
50-249			0.012***	0.009***	0.009***	0.013***	0.011*	0.011*
Collective agreement			0.016***	0.014***	0.014***	0.003	0.003	0.003
Foreign owned enterprise			0.014***	0.015***	0.015***	0.011***	0.015***	0.015***
Primary				0.054**	0.053**	−0.019	0.028	0.028
Manufacturing				0.020***	0.020***	−0.012	−0.003	−0.003
Utilities				0.049***	0.050***	0.055***	0.036	0.036
Construction				−0.007	−0.006	−0.029**	−0.027	−0.027
Sales				−0.046***	−0.046***	−0.092***	−0.083***	−0.083***
Services				−0.094***	−0.095***	−0.083***	−0.043***	−0.043***
Finance/Law				−0.030***	−0.031***	−0.031***	−0.026**	−0.026**
Health				−0.032***	−0.033***	−0.044***	−0.029*	−0.029*
Creative				−0.097***	−0.100***	−0.119***	−0.148***	−0.148***
Other				−0.039***	−0.041***	−0.039***	−0.012	−0.012
North East					−0.058***	−0.045***	−0.033**	−0.033**
North West					−0.057***	−0.050***	−0.035***	−0.035***
Yorkshire and Humberside					−0.047***	−0.035***	−0.042***	−0.042***
East Midlands					−0.057***	−0.048***	−0.050***	−0.050***
West Midlands					−0.050***	−0.053***	−0.051***	−0.051***
South West					−0.040***	−0.051***	−0.061***	−0.061***
East					−0.058***	−0.063***	−0.055***	−0.055***
South East					−0.036***	−0.039***	−0.031***	−0.031***
Wales					−0.067***	−0.050***	−0.043***	−0.043***
Scotland					−0.050***	−0.061***	−0.034**	−0.034**
Pre-university education & experience						−0.001	−0.001	−0.001
Apprenticeship & experience						0.003**	0.003**	0.003**
Other qualifications & experience						−0.001	−0.001	−0.001
Degree or higher & experience						0.001	0.001	0.001
Union membership with size of employer						0.000***	0.000***	0.000***
Female & age							−0.023***	−0.023***
Female & age_squared							0.288***	0.288***

(*continued on next page*)

Appendix B12 (*continued*)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Individual	Job	Employer	Sector	Region	Other interaction	Female interaction	Lasso
Female & Basic paid hours							−0.002***	−0.002***
Female & Time in job							−0.001	−0.001
Female & Time in job squared							−0.026	−0.026
Female & Part-time							−0.042***	−0.042***
Female & Hourly paid							0.002	0.002
Female & 0–9							−0.021	−0.021
Female & 10–49							0.020	0.020
Female & 50–249							0.003	0.003
Female & Collective agreement							0.000	0.000
Female & Foreign owned enterprise							−0.008	−0.008
Female & Primary							−0.085	−0.085
Female & Manufacturing							−0.017	−0.017
Female & Utilities							0.053	0.053
Female & Construction							−0.001	−0.001
Female & Sales							−0.018	−0.018
Female & Services							−0.079***	−0.079***
Female & Finance/Law							−0.010	−0.010
Female & Health							−0.023	−0.023
Female & Creative							0.058***	0.058***
Female & Other							−0.049*	−0.049*
Female & North East							−0.020	−0.020
Female & North West							−0.025**	−0.025**
Female & Yorkshire and Humberside							0.014	0.014
Female & East Midlands							0.008	0.008
Female & West Midlands							−0.001	−0.001
Female & South West							0.020	0.020
Female & East							−0.014	−0.014
Female & South East							−0.013	−0.013
Female & Wales							−0.012	−0.012
Female & Scotland							−0.052**	−0.052**
Constant	0.630***	0.796***	0.915***	0.979***	1.023***	1.327***	1.327***	1.327***
Observations	934347	934347	402455	402455	402104	188292	188292	188292
Adj. R-Squared overall	0.07	0.09	0.09	0.10	0.10	0.07	0.14	0.14
AIC	−581670	−590221	−320376	−321620	−321763	−168440	−169106	−169106
BIC	−581600	−590127	−320235	−321370	−321403	−168055	−168396	−168396

Data availability

The authors do not have permission to share data.

References

Aghion, P., Bergeaud, A., Blundell, R., Griffith, R., 2023. Social Skills and the Individual Wage Growth of Less Educated Workers. IZA Discussion Papers. No. 16456.

Aldieri, L., Carlucci, F., Cirà, A., Ioppolo, G., Vinci, C.P., 2019. Is green innovation an opportunity or a threat to employment? An empirical analysis of three main industrialized areas: the USA, Japan and Europe. J. Clean. Prod. 214, 758–766.

Antoni, M., Janser, M., Lehmer, F., 2015. The hidden winners of renewable energy promotion: insights into sector-specific wage differentials. Energy Policy 86, 595–613. https://doi.org/10.1016/j.enpol.2015.07.027.

Bowen, A., Kuralbayeva, K., Tipoe, E.L., 2018. Characterising green employment: the impacts of 'greening' on workforce composition. Energy Econ. 72, 263–275.

Bracarense, N., Bracarense Costa, P.A., 2024. Green jobs: sustainable path for environmental conservation and socio-economic stability and inclusion. Rev. Polit. Econ. 36 (1), 351–372.

Bradley, P., 2021. An institutional economics framework to explore sustainable production and consumption. Sustain. Prod. Consum. 27, 1317–1339.

Bradley, P., Everard, M., Whittard, D., Vendrame, V., Mulholland, J., Terwilliger, J., 2024a. A framework for supporting opportunities for green jobs and sustainable

living. UWE, Bristol Discussion Paper. pp. 1-39. Avaiable online bradley_a-framework-for-supporting-opportunities-for-green-jobs-and-sustainable-living.pdf.
Bradley, P., Whittard, D., Green, E., Brookes, I., Hannah, R., 2024b. Identifying key empirical research in relation to green jobs: a review and reflection with practitioners. Manuscript submitted for publication, pp.1-39.
Caesar, L., Sakschewski, B., Andersen, L.S., Beringer, T., Braun, J., Dennis, D., Gerten, D., Heilemann, A., Kaiser, J., Kitzmann, N.H., Loriani, S., Lucht, W., Ludescher, J., Martin, M., Mathesius, S., Paolucci, A., Wierik, S., Rockström, J., 2024. Planetary Health Check Report 2024. Potsdam Institute for Climate Impact Research, Potsdam, Germany. Available at: https://d1gwxouzo4hr10.cloudfront.net/planetaryhealthcheck2024_report.pdf. Accessed 3.10.24.
Ciocirlan, C.E., 2023. Have me do, and I'll always be true: exploring the match between green employees and their jobs. J. Clean. Prod. 383, 135471.
Consoli, D., Marin, G., Marzucchi, A., Vona, F., 2016. Do green jobs differ from non-green jobs in terms of skills and human capital? Res. Pol. 45 (5), 1046–1060.
Deitche, S.M., 2010. Green Collar Jobs: Environmental Careers for the 21st Century. Bloomsbury Publishing USA.
Department for Education, 2019. *LMI for All* – available at. www.lmiforall.org.uk.
Dickerson, A., Morris, D., 2019. The Changing Demand for Skills in the UK. Centre for Vocational Education Research, Research Paper, p. 20.
Dierdorff, E.C., Norton, J.J., Drewes, D.W., Kroustalis, C.M., Rivkin, D., Lewis, P., 2009. Greening of the World of Work: Implications for O* NET®-SOC and New and Emerging Occupations.
Eagly, A.H., Wood, W., 2012. Social role theory. Handbook of theories of social psychology 2, 458–476.
Evans, H.C., Musvipwa, R., 2017. The sustainable development goals, the Paris agreement and the addis agenda: neo-liberalism, unequal development and the rise of a new imperialism. Knowledge for Justice Critical Perspectives from Southern African-Nordic Research Partnerships, pp. 37–56.
Forth, J., Phan, V., Ritchie, F., Whittard, D., Stokes, L., Bryson, A., Singleton, C., 2022. Ashe – census 2011 data linkage: user guide for drop 2 of the ASHE-census 2011 dataset. Available online. https://www.wagedynamics.com/wp-content/uploads/2023/01/ASHE-CEW11-User-Guide-Version-2.1-Drop-2.pdf.
Gov.UK, 2023. Ethnicity facts and figures. Available online: https://www.ethnicity-facts-figures.service.gov.uk/work-pay-and-benefits/employment/employment/latest/. (Accessed 7 January 2024).
Harvey, D.M., Bosco, S.M., Emanuele, G., 2010. The impact of "green-collar workers" on organizations. Management Research Review 33 (5), 499–511.
He, X., Jiang, S., 2019. Does gender diversity matter for green innovation? Bus. Strat. Environ. 28 (7), 1341–1356.
Heath, A.F., Di Stasio, V., 2019. Racial discrimination in Britain, 1969–2017: a meta-analysis of field experiments on racial discrimination in the British labour market. Br. J. Sociol. 70 (5), 1774–1798.
Hicks, J., 1963. The Theory of Wages. Springer.
Jackman, M., Moore, W., 2021. Does it pay to be green? An exploratory analysis of wage differentials between green and non-green industries. J. Econ. Dev. 23 (3), 284–298.
Jones, V., 2009. The Green Collar Economy: How One Solution Can Fix Our Two Biggest Problems. Harper Collins.
Jurgensen, C.E., 1978. Job preferences (What makes a job good or bad?). J. Appl. Psychol. 63 (3), 267.
Kim, D., Jeong, J., 2016. Electricity restructuring, greenhouse gas emissions efficiency and employment reallocation. Energy Policy 92, 468–476.
Koenig, A.M., Eagly, A.H., 2014. Evidence for the social role theory of stereotype content: observations of groups' roles shape stereotypes. J. Pers. Soc. Psychol. 107 (3), 371.
Kuersteiner, S., Ordal, H., 2023. Disparities in green jobs by race and ethnicity. Sustainability and Climate Change 16 (2), 136–149.
Lanfranchi, J., Pekovic, S., 2014. How green is my firm? Workers' attitudes and behaviors towards job in environmentally-related firms. Ecol. Econ. 100, 16–29.
Lapatinas, A., Litina, A., Zanaj, S., 2024. The relationship between knowledge accumulation and gender norms. Humanities and Social Sciences Communications 11 (1), 1–11.
Lazoroska, D., Palm, J., Kojonsaari, A.R., 2024. Gender-based opportunity structure in the energy sector: a literature review on women's networking and mentoring. Energy, Sustainability and Society 14 (1), 67.
Liao, Z., Cheng, J., 2020. Can a firm's environmental innovation attract job seekers? Evidence from experiments. Corp. Soc. Responsib. Environ. Manag. 27 (2), 542–551.
Littig, B., 2017. Good Green Jobs for Whom?: a feminist critique of the green economy. In: Routledge Handbook of Gender and Environment. Routledge, pp. 318–330.
Locke, E.A., Feren, D.B., McCaleb, V.M., Shaw, K.N., Denny, A.T., 1980. The relative effectiveness of four methods of motivating employee performance. Changes in working life 363 (1), 388.
McClure, L.A., LeBlanc, W.G., Fernandez, C.A., Fleming, L.E., Lee, D.J., Moore, K.J., Caban-Martinez, A.J., 2017. Green collar workers: an emerging workforce in the environmental sector. J. Occup. Environ. Med. 59 (5), 440–445.
Nademi, Y., Kalmarzi, H.S., 2025. Breaking the unemployment cycle using circular economy: sustainable jobs for sustainable futures. J. Clean. Prod., 144655
O*NET, 2010. O*NET Green Task Development Project Available online: www.onetcenter.org/reports/GreenTask.html (accessed on 1 September 2023).
ONS, 2022. Gender pay gap in the UK: 2022. Newport. Available online: https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/bulletins/genderpaygapintheuk/2022. (Accessed 1 September 2023).
ONS, 2023. A02 SA: Employment, unemployment and economic inactivity for people aged 16 and over and aged from 16 to 64 (seasonally adjusted). Newport, 2023d. Available online: https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/datasets/employmentunemploymentandeconomicinactivityforpeopleaged16andoverandagedfrom16to64seasonallyadjusteda02sa/current (accessed on 1 September 2023).
Pearce, A., Stilwell, F., 2008. 'Green-collar' jobs: employment impacts of climate change policies. J. Aust. Polit. Econ. (62), 120–138. The.
Pearl-Martinez, R., Stephens, J.C., 2016. Toward a gender diverse workforce in the renewable energy transition. Sustain. Sci. Pract. Pol. 12 (1), 8–15.
Pettinger, L., 2017. Green collar work: conceptualizing and exploring an emerging field of work. Sociology Compass 11 (1), e12443.
Pinzone, M., Guerci, M., Lettieri, E., Huisingh, D., 2019. Effects of 'green' training on pro-environmental behaviors and job satisfaction: evidence from the Italian healthcare sector. J. Clean. Prod. 226, 221–232. https://doi.org/10.1016/j.jclepro.2019.04.048.
Renwick, D.W., Redman, T., Maguire, S., 2013. Green human resource management: a review and research agenda. Int. J. Manag. Rev. 15 (1), 1–14.
Rodríguez, J.L., 2019. The promotion of both decent and green jobs through cooperatives. Boletín Asoc. Int. Derecho Coop. 54, 115–129.
Rosen, S., 1986. The theory of equalizing differences. Handb. Labor Econ. 1, 641–692.
Stern, N., 2006. Stern Review: the Economics of Climate Change. Web, United Kingdom: N. p.
Terlau, W., Hirsch, D., 2015. Sustainable consumption and the attitude-behaviour-gap phenomenon-causes and measurements towards a sustainable development. Proceedings in Food System Dynamics, pp. 199–214.
Unay-Gailhard, I., Bojnec, S., 2019. The impact of green economy measures on rural employment: green jobs in farms. J. Clean. Prod. 208, 541–551. https://doi.org/10.1016/j.jclepro.2018.10.160.
Vāisquez, P., Gã³mez, E., Gallego, V., Potes, A., 2022. Integrating gender equity in vocational studies to transform agricultural activities towards green and inclusive businesses. Eur. J. Sustain. Dev. 11 (4) pp.141–141.
Valero, A., Li, J., Muller, S., Riom, C., Nguyen-Tien, V., Draca, M., 2021. Are 'green' Jobs Good Jobs? How Lessons from the Experience To-Date Can Inform Labour Market Transitions of the Future. Granthan Research Institute on Climate Change and the Environment, London.
Van der Ree, K., 2019. Promoting green jobs: decent work in the transition to low-carbon, green economies. In: The ILO@ 100. Brill Nijhoff, pp. 248–272.
Vona, F., Marin, G., Consoli, D., 2019. Measures, drivers and effects of green employment: evidence from US local labor markets, 2006–2014. J. Econ. Geogr. 19 (5), 1021–1048.
Xie, X., Zhu, Q., Qi, G., 2020. How can green training promote employee career growth? J. Clean. Prod. 259, 120818.
Zachmann, G., Fredriksson, G., Claeys, G., 2018. The distributional effects of climate policies. Bruegel Blueprint Series 28.