Institute *for the* Future of Work

Report

Governing the Innovation Ecosystem:
How Perceived Rights and Worker Voice Shape the Distribution of Risk and Benefit

Magdalena Soffia, Abigail Gilbert, Joe Atkinson, Semeli Hadjiloizou, and Joana Geisler

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Executive Summary

Innovation ecosystems shape the conditions under which automation unfolds. Core to innovation ecosystems are institutions: the ideas, rules, and resources which steer how technology is designed, developed and deployed.

This study examines how well our innovation ecosystem is working by assessing who benefits and who bears risks through technological transition – looking above the level of firms, to the whole economy. Drawing on a survey sample of over 5,000 UK working adults, we analyse six distinct automation archetypes: high or low discretion augmentation, intensification, telepresence, matching, and displacement. Each reflects a different change to the terms and conditions and quality of work. Each reflects a different strategy by firms to secure value.

We find that the 'winners' and 'losers' of automation reflect some common and historic inequalities that transcend the relevance of sectors suggesting that there is something wrong in how our innovation ecosystem is working. At present, patterns of automation reinforce and entrench existing inequalities. Higher-level occupations are more likely to experience 'good' automation in the form of high-discretion augmentation, where technology enhances autonomy, learning, and decision-making. In contrast, lower-level roles are more exposed to monitoring via algorithmic management systems. Younger workers are more exposed to several forms of automation, although many of these differences reduce once different levels of technological exposure are taken into account. Ethnic inequalities are more persistent: Black and Asian workers, are disproportionately exposed to the most risky automation types, reflecting both higher digital exposure and deeper structural inequalities.

To explore what might contribute to this, we look at the extent to which workers perceive they have rights at work, and how this comes to shape their experiences of technological change. 'Perceived rights' reflect real differences in rights, and differences in understanding or sense of power to question, negotiate and challenge automation outcomes. In this report, we think about perceived rights as part of 'countervailing power' through the adoption process. We do this by looking at different kinds of voice mechanisms.

We find that older, higher-paid, and professional workers tend to perceive higher rights at work, while workers in routine, service, and care occupations perceive lower rights. The research further demonstrates that whether workers are given a voice at work, and the type of HR philosophy, also shape perceived rights. Pay, training, and access to representation explain more variation in perceived rights than demographics alone.

Importantly, workers who perceive stronger rights are more likely to experience good forms of automation and less likely to encounter monitoring and algorithmic control. Even where workers report no access to formal voice mechanisms, the sole perception of higher rights appears to protect them against harmful forms of automation.

But how rights come to be perceived is also important. We find that access to unions is associated with greater perceived rights, consistent with the role unions can play in building awareness of rights and supporting workers to exercise them. This reflects the fact that rights alone are not enough: institutional context shapes how these determine outcomes in practice. Unions are a form of institutional strength which can help support the good implementation of automation, in flexible ways, without and in complement to specific regulation.

However, in organisations with non-union voice mechanisms, perceived rights can paradoxically be associated with greater exposure to monitoring and control, suggesting a risk

of “false security” without real bargaining power. For this reason, our work strongly supports the role of unions in ensuring countervailing power is effective. Workplace voice alone is not enough.

HR philosophy also plays a dual role. Among employees, an employee-centred HR philosophy is strongly associated with high-discretion augmentation and strengthens the positive relationship between perceived rights and this form of automation. However, the interaction between employee-centred HR philosophy and perceived rights is also associated with higher intensification, telepresence, matching and displacement at higher levels of perceived rights.. Employee-centred HR practices therefore do not appear uniformly protective when different levels of rights awareness are considered. This highlights the complexity of organisational strategies that promote engagement while potentially intensifying work.

Key findings and recommendations

Anticipatory Governance

The dividend of technology is not determined only at the level of the workplace, with patterns of benefit and disadvantage playing out in common ways across sectors, for different demographic groups and occupational grades. In terms of exposure to automation archetypes:

- Preliminary unequal experiences of automation between gender and age groups reduce once we account for different levels of exposure to varied technologies. Workers from Asian backgrounds are more likely to experience intensification and displacement than their counterparts.
- Workers identifying as Black, Caribbean or African consistently report higher levels of telepresence and matching compared to White workers, indicating greater exposure to monitoring and algorithmic management.
- The latter ethnic group also report higher levels of 'good' automation as high-discretion augmentation.
- Workers in higher occupational grades are more likely to experience 'good' automation outcomes, leading to more autonomy and wage-enhancing outcomes.
- Those in public administration are less likely to experience displacement, while workers in education and service sectors are less likely to experience telepresence.

These outcomes are detectable at the system level, demonstrating that technological adoption risks exacerbating inequalities, with current institutional structures not yet working to effectively mitigate this.

This suggests that intelligence about and intervention across all stages of th, development and deployment, and across the innovation ecosystem is needed to ensure greater equality of outcome.

Recommendations:

- The Government, via its AI and the Future of Work Unit, and forthcoming Institute of AI and the Economy, should monitor the full range of automation archetypes as these play out across the economy, demographic groups and occupational grades. Insights should feed back into the regulatory ecosystem and public investment to ensure better designed technologies are deployed in the UK workforce.
- Sandboxing can support (a) the evaluation of new frameworks designed to advance good work through adoption; (b) better understanding of how different legal regimes are interpreted, applied, traded off, and negotiated with business priorities in practice. Given the government's focus on upholding Employment Rights in the Growth Labs, Good Work Algorithmic Impact Assessment should be considered as an option.
- Investment bodies such as the UKRI and Innovate UK should consider how their investment portfolio shapes different automation archetypes.

Rights

The UK has among the lowest worker rights among OECD countries. While the Employment Rights Act is an important intervention, work supporting this report demonstrates significant 'gaps' in protection. In this work, we undertook an assessment of perceived rights.

This is a necessary but not sufficient basis for rights to be realised in practice. Perceived rights are also important to understand when thinking about institutional trust.

Our work finds inequalities in the perceived rights landscape before accounting for employment conditions such as pay, training, access to representation and type of HR policies.

- Men report higher perceived rights than women, reflecting pay and occupational grade-effects on perceived rights.
- Perceived rights also increase steadily with age, with workers aged 65 and above reporting the highest levels.
- Managers, directors, and senior officials consistently report the highest levels of perceived rights, followed by skilled trades occupations. The lowest levels of perceived rights are among workers in elementary occupations, process, plant and machine operatives, as well as those in caring, leisure and other services occupations.
- Among employees, employment and organisational characteristics – including pay, training, voice, and HR philosophy – substantially increase the explanatory power of the model beyond demographic and occupational characteristics alone.

Recommendations:

- The Economic and Social Research Council (ESRC) should actively sponsor research which monitors differences in perceived rights at work through technological transition, to understand perceived justice across different demographic groups. This could prove critical to social cohesion.
- The government should benchmark the UK's protections for workers against the risks of different automation archetypes, considering successful regulation under international precedent.
- The government should work to resolve issues relating to access to justice, which can entrench low trust in the enforcement of rights, and therefore perceived rights. This includes ensuring the tribunal system is functioning effectively, collective and representative claims are available, and that legal protections apply on the basis of exposure to automation rather than employment status.

Institutional Context for Rights and Voice

Augmentation can be high-discretion, increasing reliance on human skills with a benefit to job quality and wages, or low-discretion, where the human skill demand decreases, with wages and job quality.

We find that perceived rights are critical to securing 'good automation' outcomes.

- Strengthening perceived rights is important, as even when no worker voice mechanisms are present, higher perceived rights can insulate against harmful automation types, and strengthen good automation.
- In addition, access to unions is associated with stronger perceived rights. Moreover, unlike non-union voice, access to unions does not weaken the protective association between perceived rights and automation outcomes. In other words, unions and rights are a good combination to preserve that protection.

- At very low levels of rights, having access to non-union types of worker voice can make things worse for workers' autonomy. This highlights the importance of unions in shaping good automation outcomes.
- Employee-centred HR philosophy strengthens the positive association between perceived rights and high discretion augmentation. However, higher perceived rights, when combined with employee-centred HR policies, can exacerbate harmful automation outcomes, such as telepresence, matching, intensification, and displacement. This suggests that employees can fail to effectively negotiate better outcomes, or be more likely to concede higher risk outcomes, without the support of unions.

Recommendations:

- Consistent with the government's commitment to put power back into the workplace and into the hands of working people, trade unions should have a statutory right of access to workplaces where AI and monitoring technologies are deployed.
- There should be a statutory right to bargain collectively on the introduction and use of AI in the workplace, complementing the proposed duty to consult worker representative bodies and building on the government's extension of collective agreement-making through fair pay agreements.
- The importance of trade unions in improving understanding of rights and the role this can play in advancing good automation should be better recognised. Collective bargaining can provide a reflexive process to guide the design, development and deployment of workplace technology towards good automation.
- Improving mechanisms for worker voice through technology adoption, when supported by union membership and awareness of rights, is a 'no regrets' policy. HR-policies promoting voice should have due regard to union membership and perceived rights, which we find are correlated and underpin the efficacy of employee-centred practices.
- Alongside technology and operational teams, HR function should have a defined role in the procurement, implementation and ongoing review of workplace technologies, assessing its outcomes against 'Good Work' frameworks.
- Rather than simply paving the way for faster adoption through light engagement, employee-centred HR practices should translate into meaningful worker involvement in decisions about how technology changes autonomy, learning, workload and monitoring. HR should therefore monitor the effects of adoption and use established worker voice channels, including collective mechanisms where present, to identify and address harmful impacts.

1. Introduction

Context

Scholars have theorised that it is the strength of our institutions that determines a nation's success or failure.[1] This includes the role of law, which shapes individual rights and corporate duties that seek to protect individual wellbeing, and freedom. However, rights are not realised by default. Their realisation changes throughout history and is shaped by the institutions which see them invoked, enforced and realised. More recently, the role of worker voice, as a form of 'countervailing power', has been recognised as the condition for rights to be effective, and as a particularly important tool in the context of shaping good automation.[2]

Perceived rights, union membership and human resource management have each been shown to drive productivity and good work.[3] Ensuring our innovation ecosystems are inclusive is important to preventing the creation of 'outsiders'[4] at a time of ever declining trust in institutions.[5]

Research Questions

Our core objective in this work was to understand how different groups of workers experience automation, and whether workplace rights and worker voice mechanisms make a meaningful difference to those outcomes.

Throughout this report, we use workers as an umbrella term for people in paid work who participated in the survey, including employees and self-employed respondents. Where an analysis is restricted to respondents who self-identified as employees, we refer explicitly to the employee subsample.

Specifically, we addressed the following questions:

- How are different types of automation distributed across demographic groups, occupations, and industries?
- Do workers who perceive themselves as having more rights at work experience better automation outcomes?
- How do different voice mechanisms, such as unions and inclusive HR practices, each strengthen or weaken the role of perceived rights and ultimately the impacts on automation outcomes?

We look at who experiences different types of automation in the UK workforce. We explored this via the 'Automation Archetypes' set out in the Pissarides Review into the Future of Work and Wellbeing.[6] These represent different strategies for value creation through cognitive automation, each of which can have different consequences for not only access to work, but also terms and conditions, and quality. We used these types of automation outcomes to further explore how they relate to workers' own perceptions about their level of rights protection, and the role of institutions in buffering from harmful automation outcomes.

This study contributes to policy and academic debates in two relevant ways. First, by setting out the uneven benefits and risks associated with different automation archetypes, and exploring who experiences what kind of automation archetype. Second, by exploring how perceived rights are shaped by institutional context, such as unions, other types of voice, and human resource management philosophy. Further, how these interact to determine and shape automation outcomes for different groups in practice.

2. Automation: Uneven Benefits and Risks

The outcomes of automation are not predetermined. Instead, they emerge from choices made during the design,[7] development,[8] and deployment of technologies, which are themselves influenced by ideas, rules and resources - or the nature of our innovation ecosystems.[9]

This has important implications. If we are to craft a fairer future of work, it is essential for policymakers, firm leaders, unions, and other stakeholders to better understand the diverse ways automation affects work and how these impacts create different risks for different groups.

Drawing on evidence from the Pissarides Review into the Future of Work and Wellbeing,[10] IFOW developed a framework of different automation archetypes.[11] This approach recognises both the technical capabilities of technology, and the choices that shape these capabilities through real-world application. Rather than treating automation as a single, uniform process, the archetypes framework captures the different ways technology can assist firms in collecting or creating value and restructures work.

This report represents the first attempt to operationalise the automation archetypes framework using survey data collected by IFOW in the context of the Pissarides Review. The analysis draws on a weighted sample of over 5,000 UK working adults, weighted to align with the UK working population by age, gender, education level, employment type and geographic region. Each archetype is captured as a continuous index, enabling analysis of varying degrees of exposure rather than simple binary outcomes. As the survey was not originally designed to measure these archetypes, the indicators should be understood as proxies, and findings interpreted with appropriate caution. We note that this data was collected in 2023 and therefore mostly predates the Generative AI wave.

In this section, we explain what each of these archetypes can mean for work, how we sought to measure the extent to which workers were exposed to this in the labour market, and then go on to present which demographic groups see more or less of each of these kinds of change to work in practice.

2.1 Displacement

Displacement is the outcome of technology designed or deployed to conduct tasks previously conducted by people, in a way which reduces the demand for labour at the level of an entire job. **For example:**

- Natural language processing displaces transcription jobs
- Chatbots displace customer service operatives
- Driverless cars replace delivery workers
- Manufacturing workers are displaced by assembly line robots

Displacement of cognitive rather than manual work has been used to explain the hollowing out of middle-pay jobs, as linked to the theory of routine-biased technological change. However, increasingly with the advent of GenAI, professional work is seen as at risk.

Advances in pattern recognition through Machine Learning and GenAI have led to professions which require less standardised (or even creative) application of knowledge also being seen as displaceable.[12]

Displacement risk is unevenly distributed by gender,[13] ethnicity,[14] and place.[15] There are also political factors surrounding what work is seen as automatable – i.e. what should be displaced,[16] driving design, development and deployment of technology in those sectors, and/or communities of different races.[17] Further, the tendency not to recognise the value of work conducted by racialised groups can correlate with 'faux-automation', whereby a system is marketed as 'fully automated' but there is in fact a labour force delivering the activity – often without fair compensation.[18]

In this study, the displacement measure was constructed using two survey items capturing workers' perceptions of how technology affects job security and task automation. Specifically, we included:

- the reported change in the proportion of workload that is automated due to technology,

- the perceived change in the likelihood of job loss or unemployment in the next six months.

Responses were originally captured on a five-point Likert scale (from "decreased a lot" to "increased a lot") and rescaled to a 0–100 index, where higher values indicate greater displacement risk.

The displacement index showed a mean of 55.7 and a median of 50, indicating a moderate overall level of perceived displacement risk in the sample. The distribution is relatively concentrated, as reflected in the histogram, suggesting that most respondents cluster around mid-level values rather than at the extremes. This pattern indicates that while widespread displacement risk was not reported, a substantial share of workers perceived some degree of exposure to displacement.

2.2. Low and High Discretion Augmentation

'Low discretion' augmentation is the outcome of technology designed, developed and deployed to reduce the required discretion and skills composition of work, standardising and routinising tasks.

For example:

- Route instructions for taxi drivers on major platforms reduce the need for detailed place knowledge
- A factory worker is required to follow a single method for conducting their work, taking pictures to confirm compliance with a set method

'High discretion' augmentation is the outcome of technology designed and deployed to help workers to conduct work in ways which enhance their autonomy, learning and use of judgement to ultimately improve processes, their experience and, potentially, their productivity.

For example:

- An architect uses software to model different designs for a building
- A radiographer uses AI to support this analysis of the likelihood that a growth is cancerous
- An assembly worker wears a bionic suit to reduce strain on their body

Augmentation refers to how technology reshapes the content of work by altering the demand of – or ability to demonstrate – skills, judgement, and autonomy within jobs. Recent literature distinguishes between 'low discretion' and 'high discretion' augmentation as they are the result of different approaches to the design and deployment of technologies within workplaces.[19]

Low discretion augmentation arises where technology is designed or deployed to codify, standardise, and closely manage work processes. This aligns with theories of effort-biased automation, where value is derived from reducing the need for discretionary effort and human capital, allowing labour to be contracted at a cheaper rate.[20] In practice, this can involve routinisation,[21] real-time task guidance, and the extraction of tacit knowledge into systems, enabling less experienced workers to perform tasks previously requiring skill and judgement.[22]

Some technology developers today are explicit about their objective to reduce the discretion of workers, presenting this as value saving by reducing scope for errors, or by reducing the requirement for experience and tacit knowledge which has been extracted from skilled workers and integrated into their systems.

While such approaches may improve efficiency and reduce costs, they can also diminish job quality – limiting autonomy, reducing opportunities for skill use, and potentially generating wellbeing costs where workers are unable to fulfil their capabilities. This has been the case, for example, with GenAI and its potential to disrupt creative work, which has long been deemed inherently human and as having greater capacity to be intrinsically rewarding. While discretion has long been seen as being more difficult to replace in the case of physical tasks demanding sensor-motor capacity,[23] robotic technologies have developed at pace in the last decade, allowing humans to be positioned merely as the 'sensing appendage' of machines in some cases.[24]

Evidence of declining task discretion and increasing routinisation, including in higher-skilled occupations,[25] suggests this is a growing feature of technological change.[26] In some cases, this process functions as a form of "pre-automation", where roles are progressively simplified in advance of potential future displacement.[27] In practice, however, it is observed that core decision-making aspects of work are being substituted, without completely displacing the requirement for labour, leaving workers in their roles but with downgraded job quality.

High discretion augmentation, by contrast, aligns with theories of skills-biased technological change used to understand the early effects of computerisation on the labour market.[28] It occurs where technology complements human capabilities by enabling more complex, creative, or collaborative forms of work. This may involve the creation of new tasks requiring human expertise, the substitution of routine elements within roles, or enhanced coordination between workers.[29]

Such outcomes are associated with improvements in the conditions of work,[30] and across multiple dimensions of job quality, including learning,[31] and creativity and collaboration.[32] These in turn can promote dignity,[33] pay equality,[34] and autonomy,[35] as well as accelerate new forms of union activity.[36]

These outcomes are highly desirable and should be the focus of innovation. However, as highlighted in the introduction, they are not evenly distributed. Evidence suggests that high discretion augmentation is more prevalent in higher-skilled, higher-paid roles, contributing to an "autonomy premium" in technology-intensive work.[37] In addition, access to highly paid tech jobs is often racialised and gendered.[38] Since access to augmenting technologies is shaped by existing inequalities, both the design and deployment of new technologies can reinforce disparities between groups.[39]

These dynamics highlight how augmentation is not a uniform outcome of technological change, but reflects choices in how technologies are introduced and used. Both forms – low and high discretion augmentation – can coexist within and across jobs, and there is growing evidence of increasing routinisation alongside rising skill requirements.

While 'low' and 'high' discretion augmentation are theoretically distinct, our empirical approach treats them as part of a continuum, capturing the extent to which technology shifts work towards greater or lesser discretion.

The measure was constructed using three survey items capturing changes in:

- *influence over work-related decisions*
- *opportunities to learn new things, and*
- *opportunities to apply one's own ideas at work*

Responses were originally collected on a five-point Likert scale (from "decreased a lot" to "increased a lot") and rescaled to a 0–100 index, where higher values indicate greater high-discretion augmentation and lower values indicate movement towards low-discretion augmentation.

Descriptively, the index ranges from 0 to 100, with a mean of 60.8 and a median of 58.3, indicating that, on average, workers reported moderate to relatively high levels of discretion-enhancing effects from technology. The distribution is reasonably spread as reflected in the histogram, suggesting greater variation across workers compared to displacement. Overall, this pattern indicates that while many workers experience technology as enhancing autonomy and learning, there remains substantial heterogeneity, with some workers experiencing reductions in discretion.

2.3. Intensification

Intensification is the outcome of technology designed, developed or deployed to support increased density of tasks. This generates value by increasing the output and activity of humans.

For example:

- Workers seeing risk of losing their contracts or access to work if quantified performance thresholds are not met
- A consultant undertakes meetings via telepresence (see below) and, as a result, more meetings are possible throughout the day.

Intensification commonly refers to increases in the volume, pace, and timing of work, reflecting an imbalance between job demands and workers' control over how work is performed, ultimately impacting on workers' wellbeing.

It is closely linked to theories of effort-biased automation where productivity gains arise not only from technological capability but from requiring workers to exert greater effort within existing roles. This aligns with empirical measures capturing changes in task volume, work speed, and the frequency of work outside normal business hours.

Intensification can be the result of a conscious or unconscious overestimation of the true labour-saving benefits of new technologies. Where overestimation leads to a reduction in team size, work effort may be transferred to adjacent roles.[40] This has been observed across a range of occupations, such as checkout assistants who are required to staff tills and help

customers to manage self-service checkouts,[41] or public servants who are required to review the most complex cases of welfare allocation following automated processes.[42]

Digital monitoring/measuring leads to intensification because having more data points makes allows employers to set more precise targets across a wider range of metrics, both of which lead to intensification. Some algorithmic management technologies offer the reduction of workers' non-productive time as a function. Together, then, technologies developed in the service of intensification can support the conditions for 'matching' (see below).

Downtime reduction, increments in work pace, and extended work into unsociable hours are all known to affect autonomy[43] and harm physical and mental wellbeing.[44] Such dynamics are particularly observed in the gig economy[45] and in lower-power roles, where workers may have limited ability to contest demands or resist performance pressures, but it has also been linked to cases of role up-skilling.[46] There is also evidence that older workers may face a greater burden as technological acceleration changes requirements for work.[47]

We constructed a measure of intensification using three survey items capturing changes in:

- *the volume of tasks and duties,*
- *the usual pace of work,*
- *the frequency of working unsociable hours, such as nights and weekends.*

Responses were originally collected on a five-point Likert scale (from "decreased a lot" to "increased a lot") and rescaled to a 0–100 scale. The final index is calculated as the unweighted mean of the three normalized items, using complete cases only, where higher values indicate greater work intensification and lower values represent de-intensification.

Descriptively, the intensification index ranges from 0 to 100, with a mean of 57.1 and a median of 50, indicating moderate levels of perceived intensification across the sample. The distribution is relatively concentrated as reflected in the histogram, with most respondents clustered around mid-range values. This suggests that while widespread extreme intensification is not evident, a substantial share of workers report some increase in workload, pace, or unsociable working patterns associated with technology.

2.4. Telepresence

Telepresence is the outcome of technology designed and deployed to enable a user's perceptual, cognitive or psychomotor capabilities into a distant environment.[48]

For example:

- A civil servant conducts their work remotely, no longer required to live in central London.
- A technician in Vietnam controls a robot in a warehouse in America.
- A surgeon conducts surgery in an adjacent room via a remote-controlled robot.

Telepresence or telework refers to work performed at home or at a distance, enabled by rapid advances in digital infrastructure and broadband connections.[49] Telepresence has reshaped the geography of work, allowing tasks to be performed remotely across locations, sectors, and increasingly across national borders.

Telepresence can generate efficiencies for organisations by reducing travel time, lowering

overhead costs, and enabling access to labour markets in regions with lower pay expectations or regulatory requirements. The ability to offshore work, first observed with early computerisation, has been amplified by the rise of platform-based models.[50] In some cases, this has led to practices such as the aforementioned "faux-automation", where services appear fully automated but actually rely on hidden human labour or "ghost workers" contracted on low pay in lower-income countries to do piecework.[51]

At the same time, telepresence has expanded opportunities for remote and flexible working, which has allowed businesses to continue to operate during crisis events. However, evidence suggests that it is a very small select group of the workforce, particularly in managerial, professional and higher-skilled roles, who are afforded freedom over locality in such a way that they can selectively offshore themselves working as 'digital nomads'.[52] The opportunity to work remotely is also stratified by gender[53] and community of place.[54]

The productivity returns of telepresence or remote work continue to be mixed.[55] While this type of work can reduce costs, improve organisational commitment, safety, job satisfaction, and work–life balance for some, these benefits have been found to come at the expense of working longer hours, an inability to switch off,[56] and sometimes the entrenchment of gendered domestic labour.[57]

Telepresence is also increasingly used to extend managerial oversight in the form of 'surveillance'.[58] Technologies that enable remote work are often accompanied by tools that track performance, time use, communications, and behaviour. These systems can support coordination and safety,[59] but may also undermine dignity,[60] and affect industrial relations, undermining rights within the workplace, such as privacy and freedom of expression.[61]

In this study, the telepresence measure captures the extent to which technology enables remote or flexible work while simultaneously increasing monitoring and surveillance. It was constructed using two survey items capturing perceived changes in:

- *flexibility to choose work location (item #11),*
- *amount of surveillance over work (item #1),*

alongside four indicators of algorithmic monitoring capturing the use of digital devices to:

- *track the amount of spent working (item #am1),*
- *record content and quality of voice calls or emails (item #am2),*
- *record internet use (item #am3),*
- *and to track movement in the workplace (item #am4).*

The first two items were originally collected on a five-point Likert scale (from "decreased a lot" to "increased a lot"), and the algorithmic monitoring items were measured in a binary "yes"/ "no" format. All items were normalised to a 0–100 scale, and the index was calculated as the unweighted mean of all six items, with higher indicating higher exposure to telepresence-related control.

Descriptively, the telepresence index has a mean of 53.4 and a median of 54.2, indicating moderate levels of exposure overall. Despite this, the measure captures meaningful variation in experiences of monitoring, surveillance and telepresence.

2.5. Matching

Matching concerns the outcome of technologies designed or deployed to reduce frictions in processes of pairing workers to jobs or tasks, by harnessing its information processing capabilities.

For example:

- Hiring: AI is increasingly used in recruitment, to identify a good 'match' between applicants and jobs.

- Dynamic pricing: Self-employed workers can be given different rates for jobs where a matching algorithm exploits wage elasticities based on supply.

- Delivery: data analytics ensure rapid matching of labour demand and supply by matching drivers with riders for a platform-based taxi service.

Matching refers to the use of algorithmic systems to allocate tasks, evaluate performance, and match workers to work. These systems draw on predictive analytics to automate or support decisions that were previously made by humans, reshaping both job roles (e.g., displacing the taxi rank coordinator), and wider labour market structures.

Matching technologies underpin new business models, elsewhere known as 'gigification', commonly concentrated in platform-based sectors such as logistics and delivery, but growing across other sectors too.[62] By dynamically matching labour supply with demand, these technologies reduce geographic and organisational frictions and enable more flexible, on-demand forms of work, creating savings for firms by reducing outlay on labour. In some cases, these systems are also used to set 'dynamic wages', reflecting real-time supply and demand conditions.

In these models, firms claim to act as market intermediaries rather than employers, and argue that workers should therefore be classified as independent contractors rather than workers. It is hard to make generalisations about the employment status of platform workers, because of the heterogeneous nature of these systems. But in many, even most, cases platform workers have been found to be workers, rather than self-employed.

This result is very likely where the individual has to perform the work themselves, and the platform exercises a degree of control over their performance and conditions. So platform workers are often being misclassified when they are treated as self-employed by the platforms.

The leading example of platform workers being found to be self-employed in the UK is Deliveroo riders - and this decision turned on the riders having an unlimited right to sub-contract their work or send someone else in their place (i.e. no requirement of personal performance).

This reflects the shift of flexibility risks onto workers, contributing to the growth of more precarious arrangements and underemployment.[63]

Furthermore, matching can increase information asymmetries, reduce transparency and contestability in decision-making. These impacts also make it harder to exercise worker voice, including through collective bargaining. Algorithmic allocation and evaluation systems may limit workers' access to managers and make it more difficult to understand or challenge the fairness of decisions about scheduling, performance, or pay, with associated anxiety.[64] Some matching tools have also been deployed to predict propensity to unionise, impacting the potential for participation and reducing the power of labour to determine fair pay.[65]

There is also growing evidence that matching systems can reproduce or amplify existing inequalities, as predictions are based on historical data that may reflect biased patterns.[66] At the same time, these systems can contribute to skill mismatches, where workers perform tasks below their level of qualification, particularly in platform-based work.[67] Research demonstrates that skills mismatches and the wider nature of the gig economy are often driven by racial and ethnic labour market segmentation.[68]

Empirically, the matching measure used in this study captures the extent to which technology is used to allocate, monitor, and evaluate work, particularly in ways that may affect predictability and contestability. It was constructed using two survey items capturing perceived changes in:

- the predictability of working hours (item #14),

- the fairness and accuracy of performance evaluations (item #19),

alongside two indicators of algorithmic monitoring capturing the use of digital devices to:

- track the amount of spent working (item #am1),

- and to track movement in the workplace (item #am4).

The first two items were originally collected on a five-point Likert scale with both increases and decreases from the baseline ("no change") indicative of greater matching intensity, therefore we coded these symmetrically. The latter two algorithmic monitoring items were measured in a binary "yes"/ "no" format. All items were normalised to a 0–100 scale, and the final index calculated as the unweighted mean of the four components, with higher values indicating higher matching risk.

Descriptively, the matching index showed a mean of 39.3 and a median of 37.5, indicating relatively lower average matching outcomes compared to other archetypes. As with telepresence, the widespread distribution of the index captures substantial variation in how algorithmic systems shape work allocation, monitoring, and evaluation across the workforce.

2.6. Who experiences what kind of automation?

This section examines how different groups of workers are exposed to each automation archetype. We focus on whether there are systematic differences across demographic and occupational groups, using regression-adjusted mean scores (Figures 1–5), which account for other characteristics. Overall, the findings show that automation is unevenly distributed, but not always in expected ways. Differences are most pronounced for telepresence and matching, while variation in intensification and displacement is more limited.

Gender

Women report lower levels of telepresence and matching than men, suggesting reduced exposure to monitoring and algorithmic allocation of work. This may reflect differences in job

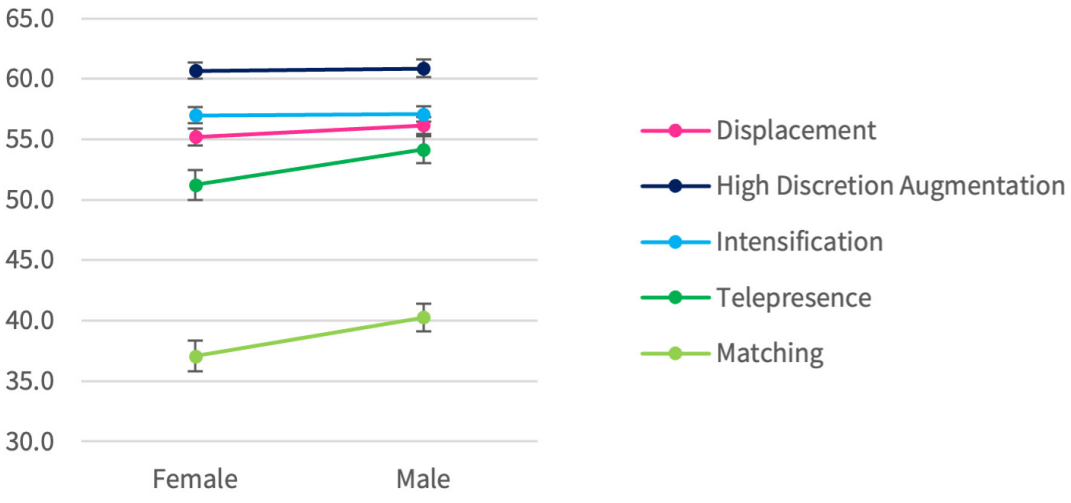


Figure 1. Adjusted mean scores by gender, with 95% confidence intervals.

roles and access to remote or digitally mediated work.

There are no meaningful gender differences in augmentation, intensification, or displacement. These patterns remain unchanged after accounting for other factors.

Age

Exposure to automation generally declines with age, with younger workers reporting higher scores across most measures. This gradient is particularly strong for telepresence and

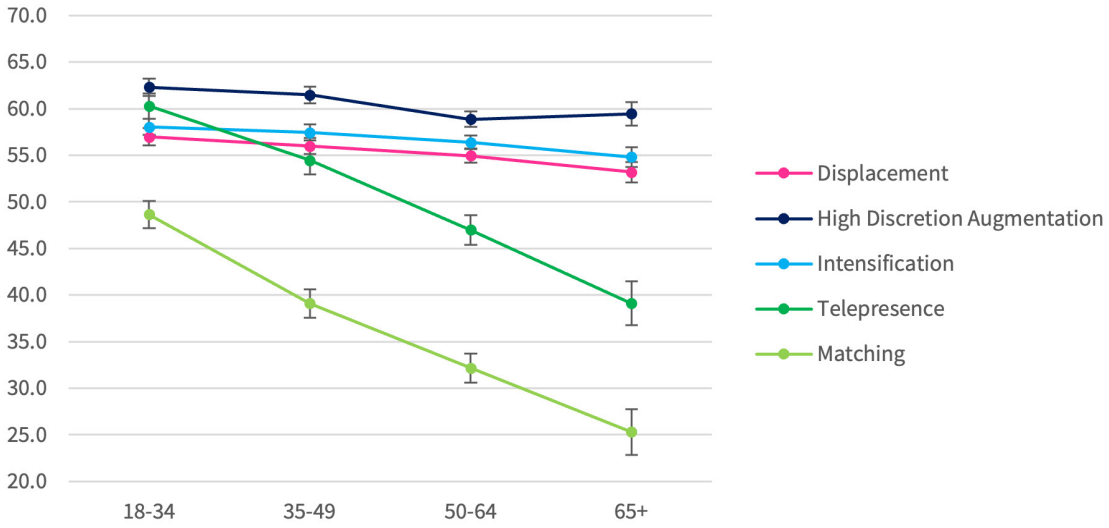


Figure 2. Adjusted mean scores by age group, with 95% confidence intervals.

matching, where older workers are significantly less exposed.

Differences in other forms of automation are more modest and tend to emerge mainly from mid-life onwards.

Ethnicity

Clear differences emerge across ethnic groups. Workers identifying as Black, Caribbean or African report higher levels of telepresence and matching compared to White workers,

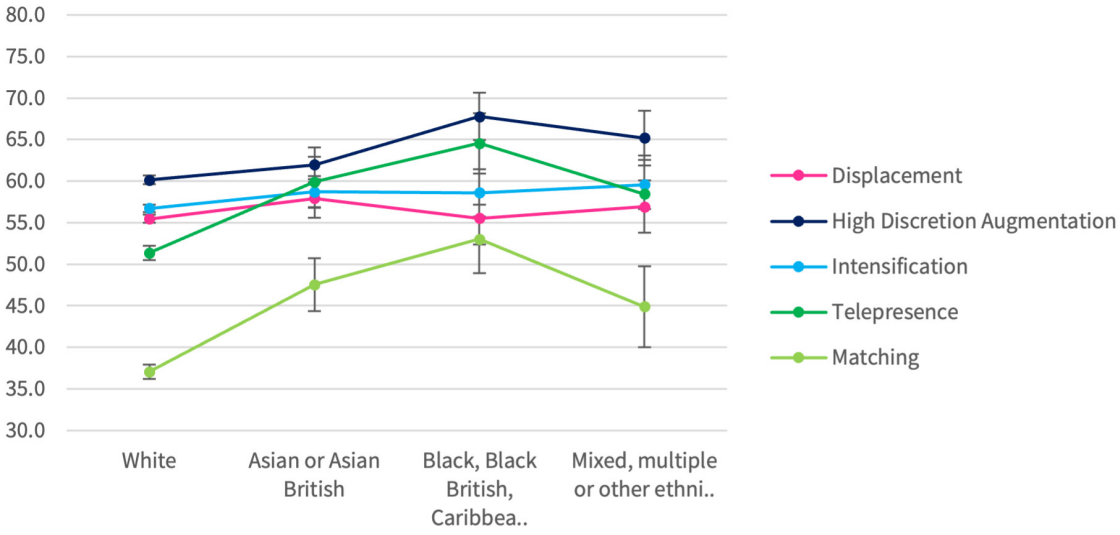


Figure 3. Adjusted mean scores by ethnic background, with 95% confidence intervals.

indicating greater exposure to monitoring and algorithmic management. This aligns with wider evidence that technologies of control are more often deployed in contexts involving racialised groups.[69]

This group also reports higher scores of 'high' discretion augmentation, suggesting a more complex and unexpected pattern where enhanced autonomy and increased monitoring can coexist.

Workers from Asian backgrounds report higher levels of intensification and displacement relative to White workers.

These findings should be interpreted with caution due to smaller sample sizes for some groups, which may affect precision.

Occupation

There is a clear occupational gradient in high discretion augmentation. Higher-skilled roles, such as managers and professionals, report the highest levels of autonomy-enhancing

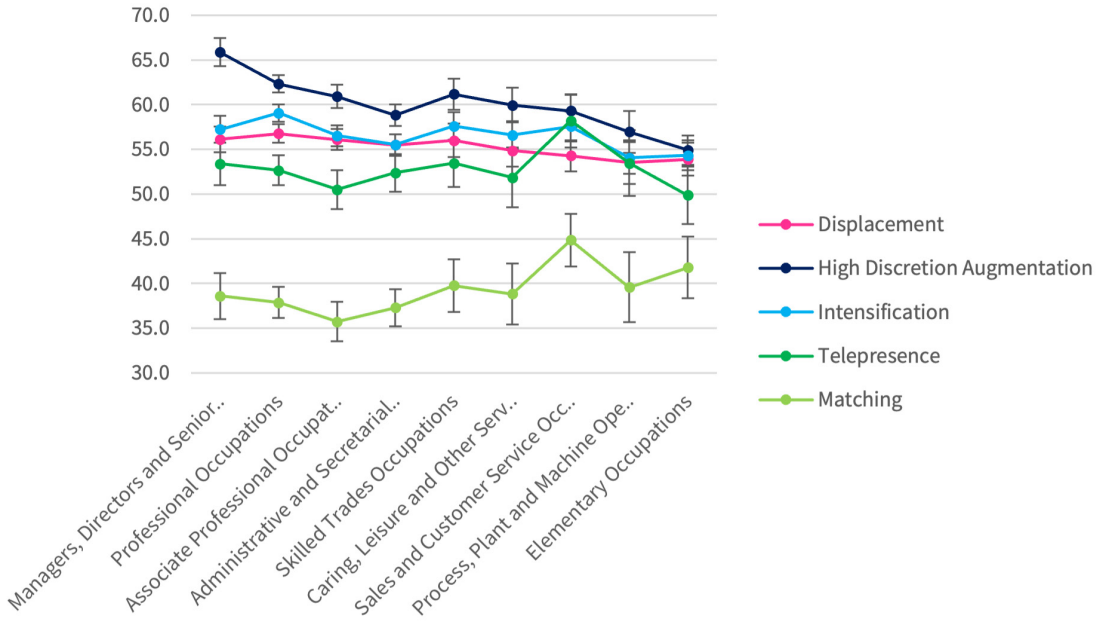


Figure 4. Adjusted mean scores by occupation, with 95% confidence intervals.

technological change, while workers in elementary occupations report the lowest.

In contrast, intensification and displacement show little variation across occupations, suggesting these experiences are more evenly distributed. Little differences refer to the lesser intensification of operative and elementary occupations compared to managerial, professional and customer service roles.

Differences are more pronounced for telepresence and matching. These are highest in sales and customer service roles, and relatively low in associate professional occupations. Telepresence is also low among elementary occupations involving less digitally mediated work.

Overall, occupational position remains a strong predictor of how technology shapes job quality rather than job quantity, particularly in relation to autonomy and control.

Industry

Workers in the Information and Communication sector report the highest exposure to all forms of automation, particularly telepresence and matching. This reflects the central role

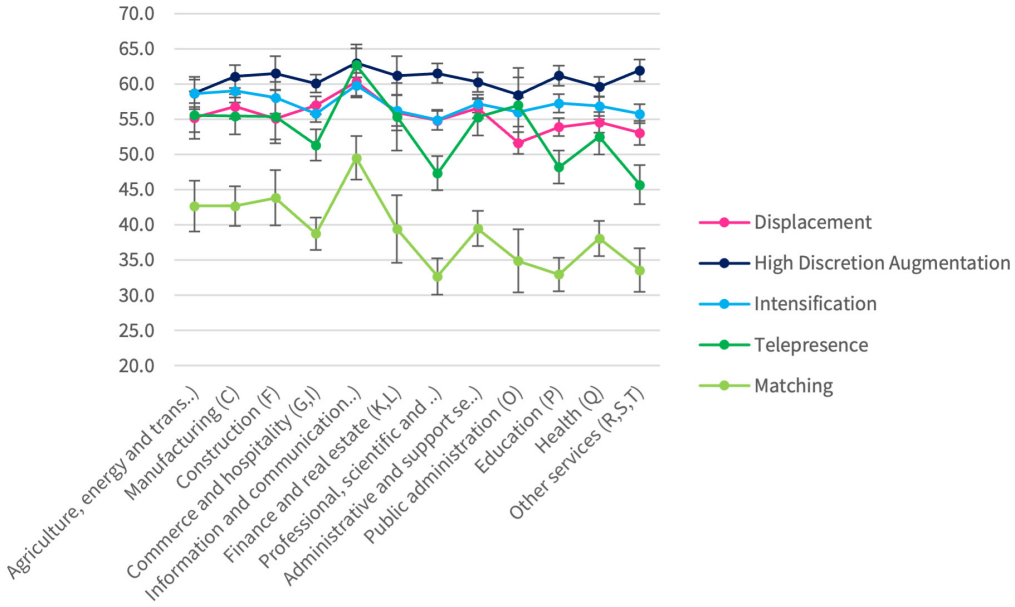


Figure 5. Adjusted mean scores by industry sector, with 95% confidence intervals.

of digital technologies in shaping work in this sector. These are also sectors probably most impacted by the emergence of GenAI, particularly in respect of displacement.

By contrast, sectors such as Education, Professional, Scientific and Technical activities, and Other Services report lower levels of telepresence and matching.

Some sector-specific patterns also emerge:

- Public administration is associated with lower perceived displacement, possibly reflecting superior contractual protections, perceived rights, and unionisation rates.

- Commerce and hospitality, professional and scientific sectors show lower levels of intensification.

Across all groups, telepresence and matching show the greatest variation, indicating that technologies related to monitoring, allocation, and remote work are unevenly distributed across the workforce. By contrast, intensification and displacement appear more evenly experienced, with fewer clear structural differences. High discretion augmentation sits between these patterns, showing variation primarily along occupational lines.

2.7. Do inequalities persist after accounting for workers' different technological exposure?

The previous section showed that experiences of automation vary across groups. A technological-determinist perspective would suggest that these differences are largely explained by who is exposed to which technologies. To test this, we extend the analysis by accounting for workers' exposure to key workplace technologies (digital ICTs, wearables, AI/ML, and robotics).

To measure technology exposure, participants were asked how often in the course of their job on a typical work week, they interact with the following technologies:

- *Digital information or communication technologies*
- *Wearable and remote sensing technologies*

- *Software technologies using artificial intelligence (AI) and machine learning (ML)*
- *Automated tools, equipment, machines and robotic technologies*

For each item participants responded using a 5-point scale from 'never' to 'always'.

Overall, adding measures of technology exposure improves the explanatory power of the models, indicating that technology matters in shaping automation experiences. However, the total variance explained remains modest, particularly for intensification and displacement, where only a small share of variation is accounted for. This suggests that technology alone provides only a partial explanation.

More importantly, many of the differences observed earlier persist even after accounting for exposure, pointing to the role of structural and organisational factors beyond the technologies themselves.

The role of different technologies

We found that different technologies are associated with different types of automation, but their effects are not uniform:

- Digital ICTs are most strongly linked to high-discretion augmentation, but are also associated with moderate increases in intensification and telepresence.
- Wearables are primarily associated with intensification, telepresence and matching, suggesting a stronger link to monitoring and coordination than to autonomy enhancement.
- AI and machine learning are associated with both positive and negative outcomes, increasing high-discretion augmentation but also intensification, matching and perceived displacement.
- Robotics show weaker and less consistent effects, though they are associated with higher levels of matching, telepresence, and displacement. Notably, they are not clearly linked to intensification.

These findings indicate that while the functionality of technologies shapes the type of automation experienced, this does not fully determine outcomes.

Do inequalities persist?

Accounting for technology exposure reduces some differences between groups, but does not eliminate them.

- Gender differences in telepresence and matching largely disappear once exposure is considered, suggesting these were driven by men's higher interaction with certain technologies.
- The age gradient also weakens, with older workers' lower exposure explaining much of their reduced experience of enhanced discretion, intensification, or perceived displacement, although differences in telepresence and matching remain.

However, other inequalities persist:

- Ethnic differences remain evident, albeit smaller. Workers from Asian, Black, Caribbean and African backgrounds continue to report higher levels of telepresence and matching, even after accounting for exposure.
- Occupational differences remain substantial. Higher-skilled roles continue

to experience more discretion-enhancing forms of automation, while lower-skilled roles are more exposed to matching and telepresence and the associated monitoring.

- Industry differences also persist. For example, lower displacement in public administration and lower telepresence in education and service sectors are not fully explained by technology exposure, pointing to institutional factors such as employment protections and organisational practices.

Taken together, these findings provide limited support for a technological-determinist explanation of automation outcomes. While differences in exposure to technology explain part of the variation, they do not fundamentally alter the pattern of inequalities.

Instead, the results suggest that how technologies are designed, deployed and governed within workplaces is at least as important as what technologies are used. In this sense, automation does not simply reflect the capabilities of technology, but the choices and structures that determine its use.

3. Workplace rights and automation outcomes

Technology does not operate in a vacuum. As shown in the previous sections, workers with similar exposure to technology can experience very different outcomes. This reflects not only what technologies do, but how change is negotiated, resisted or shaped within workplaces. Beyond 'objective' technological capabilities, whether workers feel able to question, influence, or contest decisions about how their work is redesigned shapes outcomes of automation in practice.

This points to the importance of institutions in protecting workers from market impacts. A central institutional tool of the state is individual rights. These may be designed for the workplace, or human rights as these apply and are interpreted at work. Relevant regimes are set out in IFOW's Good Work Charter.[70] Universal rights are grounded in the principle of human dignity, with equal and inalienable rights seen as fundamental to freedom, justice and social stability.[71] However, not all employment rights are universal. The landscape of protections, particularly as determined by contract, is highly varied.

Firm-level corporate duties may support individual rights freedoms and interests. These frameworks establish a baseline of protections intended to ensure that risks arising from workplace change - including technological change - are consulted on, anticipated, managed, and monitored.

However, as shown in a recent analysis by IFOW, there are important gaps in existing protections, particularly in the UK context.[72] Not only have we not developed protections which support anticipating, monitoring, mitigating and managing automation archetypes - the UK has among the lowest levels of employment rights in the OECD for 'translation' into the workplace.[73]

This is significant given the UK's enthusiasm for rapid AI adoption and the capacity of new technologies, as shown above, to accelerate inequalities and (as we have shown elsewhere) impact on quality of life for some groups.

3.1. Individual perception of rights

Evidence suggests that formal rights alone are not sufficient. What matters in practice is whether workers feel able to understand and exercise those rights.

Studies on legal consciousness show that knowledge of rights is limited, and unevenly distributed, with individuals frequently assuming that the law aligns with their own moral, ethical or social attitudes.[74] This bias has been exacerbated by the use of GenAI, which has a confirmation bias.[75] This use of GenAI to support workers identify legal regimes of relevance to their experience may be changing the historic tendency for citizens to have, and/or recognise, their limited knowledge of formal legal frameworks,[76] as suggested by the recent increase in employment tribunals.[77] Of course, in practice, owing to the confirmation bias in LLMs, some of these claims to rights may be misplaced, leading to further potential disenfranchisement subsequently.

Without accurate knowledge of legal protections that can be used, individuals will fail to assert their rights, take steps to protect themselves against real or potential infringements, and experience reduced success at self-representation. his In the academic community, there is also no consensus on how best to measure knowledge of rights. Self-reported measures can be affected by overconfidence or misunderstanding, while more objective approaches are difficult to implement at scale.

In this study, we measure workers' perceived rights using a single survey item capturing their overall sense of protection and agency at work:

- *On a scale of 1 to 10, where 1 means having no rights at all at work and 10 means having lots of rights at work, how would you rate your current job?*

This is an adapted version of Lokshin and Ravallion's standard "power ladder" measure.[78] It captures workers' subjective assessment of their ability to influence, contest, and navigate workplace conditions, rather than their formal legal entitlements.

As a result, survey-based research typically focuses on perceived rights, rather than attempting to capture precise legal knowledge.

We adopt this approach for several reasons. Rights at work span multiple domains (including rights under collective agreements, employment law and human rights), making it difficult to comprehensively capture different degrees of objective protection. Prior research shows that workers' perceptions of their rights and agency are more relevant to how they experience workplace change than their detailed legal knowledge. Also, the framing of the question captures workers perceived non-statutory 'rights' - such as those contained in employment contracts or company grievance policies, etc.

The measure allows respondents to interpret what "having rights" means in their own context, recognising that rights at work are multidimensional and may include autonomy, participation, access to protections, and their effective enforcement. In doing so, it provides a practical way to capture variation in perceived power across the workforce, which is central to understanding how automation is experienced.

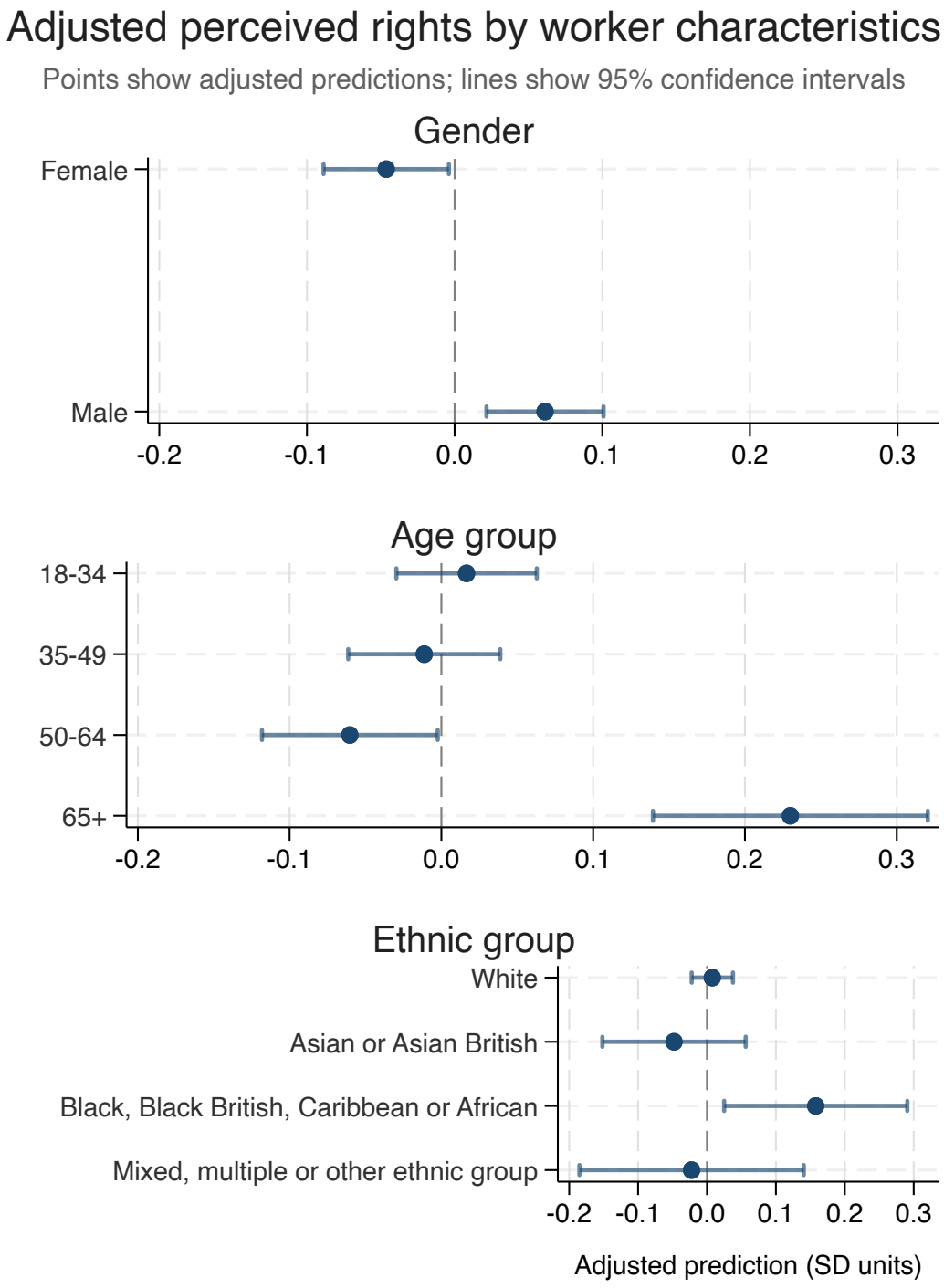
More broadly, this approach enables us to analyse automation outcomes along a continuum of job quality, rather than as a simple distinction between employment and unemployment, highlighting differences in security, control, and working conditions within employment itself.

3.2. Which groups perceive higher rights at work?

This section explores group differences in perceived rights across workforce characteristics such as gender, age, ethnicity, occupation and sector, providing an initial view of social patterns and inequalities. As shown in Figure 6, men report significantly higher perceived rights than women. Perceived rights also increase steadily with age, with workers aged 65 and above reporting the highest levels. Among ethnic groups, Black, Caribbean, and African workers display slightly higher perceived rights than White workers, while other ethnic groups do not differ significantly.

Perceived rights also vary substantially across occupational groups, displaying a clear gradient by job level. As shown in Figure 7, managers, directors and senior officials report the highest levels of perceived rights, followed by skilled trades occupations. At the opposite end of the occupational scale, we find the lowest levels of perceived rights among workers in elementary occupations, process, plant and machine operatives, as well as those in caring, leisure and other services occupations.

Sectoral patterns are somewhat more varied but unsurprising. Workers in finance and real estate, professional and technical services, and information and communication report significantly higher perceived rights. By contrast, workers in agriculture, energy and transport, education, health and hospitality sectors report lower perceived rights.



Outcome standardised to mean 0 and standard deviation 1.

Figure 6. Predicted perceived rights by gender, age and ethnicity

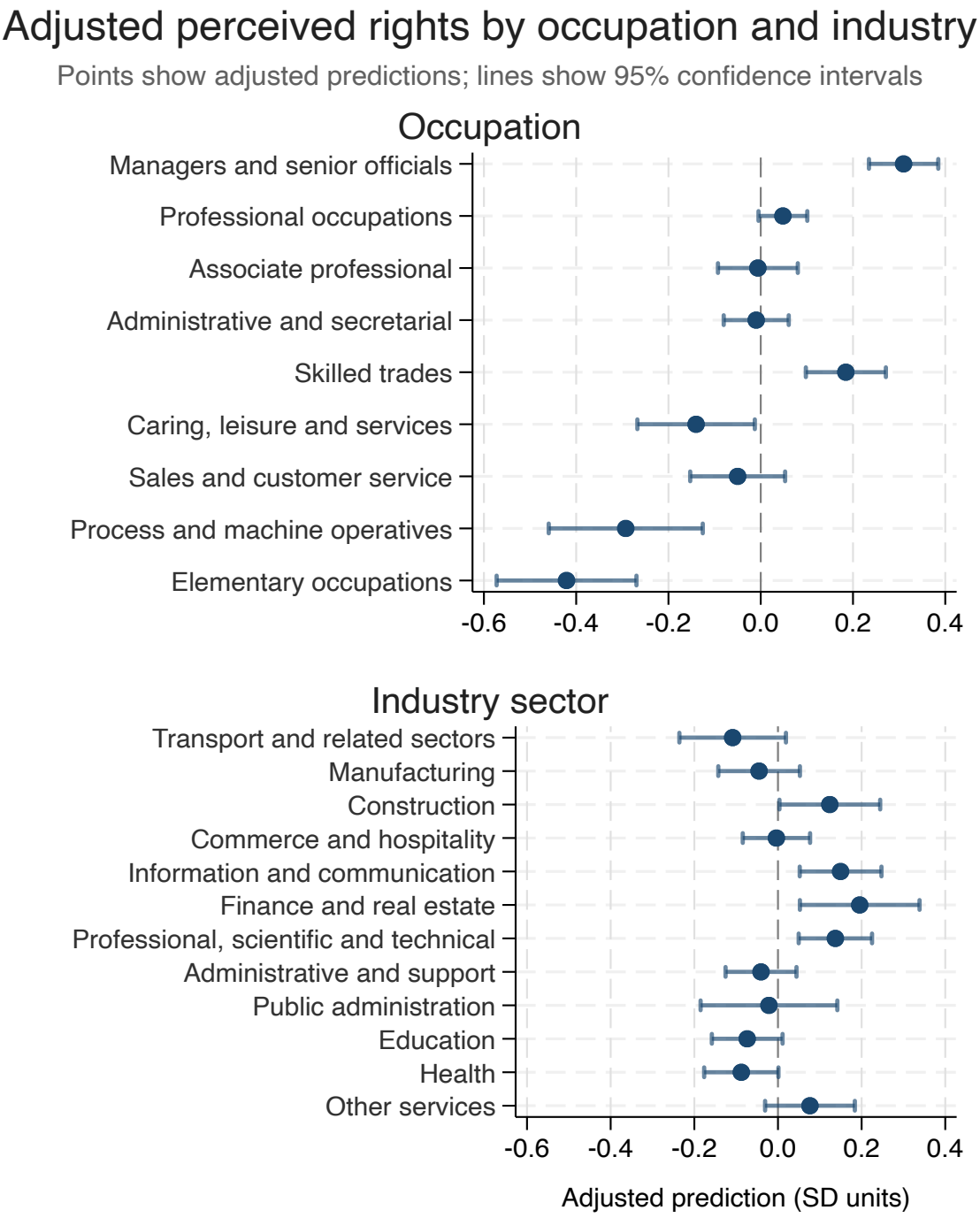


Figure 7. Perceived predicted rights by occupational grade and sector.

Perceived rights and institutional conditions

We further examine whether perceived rights are associated with objective employment and organisational conditions including pay, tenure, establishment size, access to training, access to different representation channels, and reported HR practices. Because the HR-philosophy questions were administered only to employees, this extended analysis is restricted to the employee subsample and results should not be generalised to self-employed workers.

Among employees, perceived rights at work are strongly associated with employment and organisational conditions. Within the employee subsample, the extended model

incorporating pay, training, access to representation, HR philosophy and other worker and job characteristics explains around 40% of the variation in perceived rights (R2 = 0.428), far more than demographic or occupational characteristics alone.

In particular, we find that employees with higher earnings report markedly stronger perceived rights, with rights scores increasing progressively across pay bands. Similarly, employees who have accessed formal employer-provided training opportunities and those exposed to a stronger employee-centred HR philosophy report much higher perceived rights. Having access to different types of voice at work is also associated with perceiving higher rights. Specifically, employees with combined access to unions and other types of voice like employee forums and consultative committees perceive significantly higher rights than those without any voice.

Taken together, these findings indicate that there is a notable overlap between '*perceived*' rights and '*actualised*' rights, especially in the form of HR practices, pay, and access to voice mechanisms.

Accounting for the additional influence of these employment factors on perceived rights changes the initial landscape, where we observed some demographic, occupational and sectoral differences. Most of those differences vanish once we account for employment characteristics such as pay, access to representation, and workplace HR practices. This suggests that the observed gaps in perceived rights between demographic groups may reflect differences in the employment and institutional contexts in which workers are located, including pay, access to representation and workplace HR practices. We can only hypothesise, for example, that older and male workers tend to occupy more secure or higher-paid roles where employment rights are better formalised, while Black workers are more concentrated in larger or unionised sectors where there is more awareness of formal rights frameworks. In this sense, the higher perceived rights reported by some groups reflect the institutional environments they work within, rather than distinct perceptions or attitudes towards rights themselves.

That said, gaps in perceived rights between the ends of the occupational grade (managers and elementary occupations) persist, and so does the relatively higher status of workers in Finance and Real Estate, Public Administration and Other Services. This pattern suggests that perceptions of rights are closely linked to occupational status and sector. The mechanisms can be varied, however. It is expected that higher occupational grades do not only enjoy a greater degree of discretion and autonomy, but also are more educated and literate around actual labour rights. Sectoral variations in perceived rights may reflect larger firm sizes where there is more often formalised and expert HR input.

3.3. Do perceived rights shape automation outcomes?

Our analysis (summarised in Table 1) shows a clear but selective relationship between perceived rights and how workers experience automation.

After accounting for differences in age, gender, ethnicity, occupation, industry and exposure to digital technologies, a one-point increase on the 1–10 perceived-rights scale is associated with a 1.87-point increase in the augmentation score (greater prevalence of high discretion augmentation), a 0.86-point reduction in telepresence and a 0.64-point reduction in matching. These associations are statistically significant. By contrast, perceived rights are not significantly associated with either intensification or displacement.

This means that workers who feel they have stronger rights at work are more likely to experience high-discretion augmentation, and less likely to report forms of automation associated with remote monitoring or algorithmic matching and allocation. The relationship is therefore relatively strong for augmentation and more modest, although still statistically

significant, for telepresence and matching. It does not extend consistently to every type of automation outcome.

However, this analysis cannot demonstrate that stronger perceived rights cause more positive automation outcomes. The models account for several important differences between workers and jobs, including occupation and industry, but they do not directly control for overall job quality or every aspect of a "good job", such as pay, security, management quality, existing autonomy or opportunities for worker voice. It therefore remains possible that stronger perceptions of rights and more positive experiences of automation both arise, at least partly, from working in generally better-quality jobs.

The relationship may also run in the opposite direction. For example, automation that increases autonomy and learning may strengthen workers' sense of agency and rights, while increased monitoring or algorithmic control may weaken it. These findings are therefore best interpreted as evidence of a robust association between perceived rights and specific forms of automation, than proof of a causal effect.

	(1) **Augmentation**		(2) **Intensification**		(3) **Telepresence**		(4) **Matching**		(5) **Displacement**	
Perceived rights at work	1.869***	(0.149)	0.015	(0.130)	-0.856***	(0.227)	-0.641**	(0.222)	-0.045	(0.129)
Constant	36.08***	(2.218)	48.97***	(2.072)	33.82***	(3.117)	20.11***	(3.193)	47.34***	(2.110)
Observations	5467		5554		4342		4822		5536	
r^2	0.147		0.0546		0.297		0.330		0.060	
p	0.000		0.000		0.000		0.000		0.000	

Table 1. Regression estimates of automation types on worker characteristics, technology exposure and perceived rights

*Note: Adjusted by gender, age, ethnicity, occupation, sector, and exposure to digital ICTs, wearables, AI/ML software, robotics. Robust standard errors in parentheses. * p < 0.05, ** p < 0.01, *** p < 0.001 Each coefficient shows the estimated change in the relevant automation-outcome score associated with a one-point increase in the perceived-rights scale, while holding the other characteristics constant.*

4. Institutional context for rights: unions and HR philosophy

Different workers do benefit from different rights. For example, even if they are working in the same building on the same project, full-time employees enjoy stronger protections than self-employed contractors. Those classed as 'limb-b workers' rather than employees also lack certain rights, such as protection from unfair dismissal. Sub-contracted workers, or agency workers, are other examples where people may be working alongside each other with very different perceived and actual protections.

However, the ability for each worker to realise their rights is also shaped by their perceived power, knowledge, and institutional conditions. Moreover, the institutions that make percieved rights tangible are crucial as this can shape whether workers are able to realise their rights. This could include, for example, certain regulators having resource constraints on being able to hold firms to account, or different unions being able to offer different levels of access to legal support.

Trade unions and worker voice

Union membership is a key means by which workers exercise their rights. Unions can support workers to know and understand their rights and also enable workers to actualise them by providing legal advice and support. But the mechanisms for this are not always in place and are at times restricted. Some work suggests the increased 'juridification' of the workplace expressed through a rise in individual-based employment rights has been associated with a decline in collective action.[79] Another lens is that juridification and the greater focus on individuals' rights has been the response to a decline in union strength, which was caused by legal restrictions on unions (not a shift towards individual rights, which came later). Rather than being seen as antagonistic, a strong labour movement and collective rights can, and should, co-exist with individual rights protections.The scale and breadth of this technological transformation has underpinned calls for a move away from individual rights to collective rights.

We wanted to tease out the different impact of unions from other kinds of worker voice in this work. To capture workers' access to voice, understood as the mechanisms through which employees can express collective views and influence workplace decision-making, we used the following survey item adapted from the 6th European Working Conditions Survey (EWCS).

Which of the following, if any, do you have access to in order to express your views about what is happening in your work or industry? Select all that apply.

- *Trade Unions*
- *Staff Associations*
- *Work Councils*
- *Joint Consultative Committees*
- *Employee forums*
- *None of these*
- *(Don't know)*
- *(Prefer not to say)*

For the analysis, response categories were collapsed to reflect theoretically meaningful differences in the forms of worker voice. This approach is grounded in expert consultation.[80]

The resulting categories differentiate levels and types of voice as follows:

1) No voice mechanisms available
2) Reported trade union mechanisms only
3) Reported consultative voice only
4) Reported both trade union and non-union consultative voice mechanisms

This categorisation enables analysis of how different institutional configurations of worker voice are associated with perceptions of rights and automation outcomes, without assuming equivalence across rigid categories of representation. We separate union and workplace consultative mechanisms to recognise and distinguish what can confidently and exclusively be identified as the result of union presence.

Human Resource Management (HRM) Philosophy

Perceived rights are also shaped by human resource philosophy, which is reflected in investment in employees and their work quality.[81] It also expresses itself in the context of rights, where HRM filters and interprets the law.[82] This can shape awareness, ideas and expectations of rights.

We measure HR Philosophy through an adapted 3-item scale measuring employees' perceptions about Human Resources management.[83] Participants were asked their level of agreement with three statements (alpha = 0.87):[84]

To what extent do you agree or disagree with the following statements? The organisation or firm where you work…

a) Takes care of their workforce, no matter what business challenges they face

b) Invests heavily in their employees because they know that we determine the success of their business

c) Maintains a long-term commitment to the growth and wellbeing of their employees

The average scale is a reversed score and ranges from 0 (representing maximum efficiency-centrality) to 4 (representing maximum employee-centrality).

4.1. On legal consciousness

The concept of 'legal consciousness' helps outline the combined effect between rights and the institutional context (such as types of voice) in which those rights are invoked or realised. Legal consciousness can be understood as the "participation in the production of legal meanings" through "what people do as well as say about law".[85] It is less concerned with the law in fact and more about how ideas of what the law should be shape outcomes in practice. In this sense, even misunderstandings or overestimations of the law can be seen to shape change in meaningful ways.

Legal consciousness is shaped by class, gender, race, and occupation; it mediates how workers respond to change (including technological change). Societal imaginaries – the set of values, institutions, laws, and symbols through which people link their individual selves to membership of institutions and societies - also shape legal consciousness in ways which might determine outcomes even without invoking legal action. The UK has seen a rise in employment laws protecting individual rights.[86] This has shaped legal consciousness, with

workers increasingly assuming the law will support them when they face issues at work.[87] The individualisation of rights has transferred the responsibility of being informed about one's rights to workers. The alternative being that unions educate workers about their rights – unionised workers have higher legal awareness than non-unionised workers.[88]

Unions and collective bargaining represent a flexible and efficient approach to negotiating technological impacts, with social partnership determining what is and is not fair or reasonable, through collective agreements. However, where union membership or collective mechanisms are not present, individual rights rely on enforcement mechanisms which are inadequate in responding to cumulative and collective impacts. For instance, tribunal claims against unfair dismissal or discrimination currently have a waiting time of one year or more, and employment tribunals temporarily introduced fees.[89] The absence of legal aid and complexity of bringing forward claims is also relevant, beyond the activity of unions. This in turn shapes legal consciousness through perceptions about the effectiveness of laws, and could erode 'perceived rights' regardless of changes in the law in practice.

4.2. Perceived rights, institutions and automation outcomes

The magnitude of the associations between perceived rights and automation outcomes change slightly when we consider voice and HR philosophy.

(Note that the analysis in this section includes HR philosophy and is therefore based on the employee subsample. Self-employed respondents are not represented in the following models).

Table 2 shows that, among employees, higher perceived rights remain positively associated with high-discretion augmentation, but part of this relationship is absorbed by the existence of voice mechanisms and a strong employee-centred HR philosophy. The observed association between perceived rights with telepresence and matching also changes once institutional conditions are added to the model. Specifically, the relative importance of perceived rights increases. Taken together, these hint at the idea that both perceived rights and institutional context (unions and HR philosophy) could have a combined impact on automation outcomes, as we proceed to analyse in the following section.

4.3. Perceived rights conditional on worker voice

The relationship between perceived rights and automation outcomes differs according to the type of worker voice available, but voice mechanisms do not have a uniformly protective effect.

As represented by the first row in Table 3 and the blue lines in Figure 8, among workers with no access to representative mechanisms, higher perceived rights are associated with more high-discretion augmentation and lower levels of intensification, telepresence, matching and displacement. This suggests that perceived rights are associated with better automation outcomes even in the absence of formal worker representation.

The existence of union-only voice does not change this, as indicated by the red-coloured lines in Figure 8 and the finding that none of the interactions between perceived rights and union-only voice is statistically significant (Table 3).

The pattern changes for workers with non-union-only voice mechanisms, such as employee forums (represented by the green lines in Figure 8). The positive effect of rights on discretion augmentation (good automation) is enhanced and is, in total, higher than for workers without representation once perceived rights meet a threshold. Specifically, when perceived rights are lower than 7.75, non-union voice does not

translate into protection from low-discretion augmentation relative to workers without access to any representation.

Notably, the combination of higher perceived rights and the of other representative forms like employee forums also exacerbates the higher risk automation types. These non-union voice mechanisms weaken or reverse the otherwise protective effect of perceived rights on intensification, telepresence, matching and displacement. Nevertheless, the detrimental relationship between non-union voice mechanisms and bad automation only happens at very high levels of perceived rights.

Hybrid union and non-union arrangements show a more limited pattern (yellow-coloured lines in Figure 8). They significantly change the relationship between perceived rights and telepresence and matching, but there is no statistically significant difference for augmentation, intensification or displacement.

	(1)		(2)		(3)		(4)		(5)	
	Augmentation		**Intensification**		**Telepresence**		**Matching**		**Displacement**	
Perceived rights at work	0.613***	(0.183)	-0.0481	(0.184)	-1.029***	(0.304)	-0.856**	(0.300)	-0.3	(0.190)
Access to voice (ref: no access)										
Union only	0.433	(0.709)	1.646*	(0.724)	7.985***	(1.228)	7.666***	(1.237)	1.184	(0.711)
Non-union only	-0.45	(0.644)	0.232	(0.644)	6.956***	(1.048)	9.307***	(1.069)	1.725*	(0.671)
Union + Non-union	2.032**	(0.764)	2.050*	(0.829)	10.89***	(1.299)	9.885***	(1.256)	2.032*	(0.808)
Employee-centred HR Philosophy	4.626***	(0.325)	0.255	(0.337)	0.328	(0.564)	0.361	(0.561)	0.599	(0.335)
Constant	36.50***	(2.219)	49.34***	(2.226)	35.17***	(3.325)	21.03***	(3.381)	48.10***	(2.280)
Observations	4823		4903		3791		4244		4888	
r^2	0.208		0.060		0.278		0.322		0.070	
p	0.000		0.000		0.000		0.000		0.000	

Table 2. Regression estimates of automation types on worker characteristics, technology exposure, perceived rights and institutions

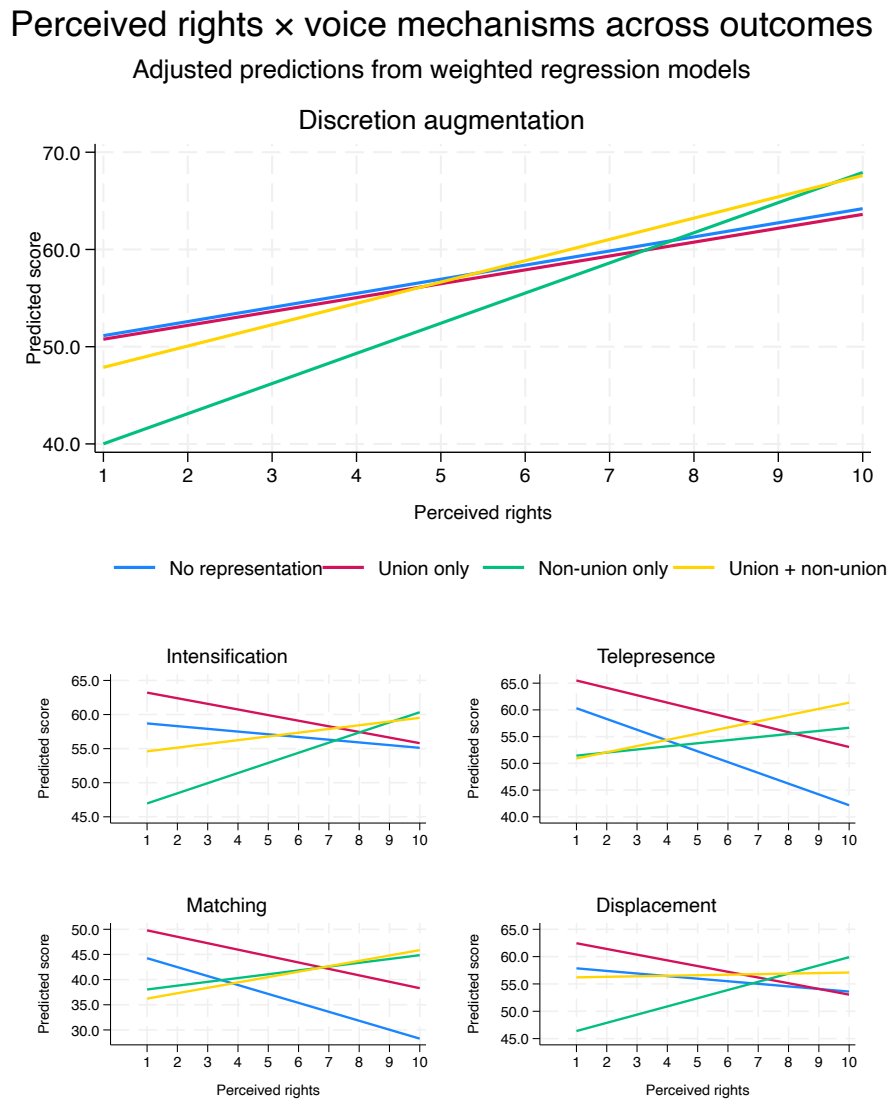
*Note: Adjusted by gender, age, ethnicity, occupation, sector, and exposure to digital ICTs, wearables, AI/ML software, robotics. Robust standard errors in parentheses. * p < 0.05, ** p < 0.01, *** p < 0.001*

These results do not show that workplace (non-union) representation causes either favourable or adverse automation outcomes. They may reflect differences between workplaces, the functions performed by different voice mechanisms or the possibility that workers' perceptions of their rights are themselves influenced by their experience of automation. One possible interpretation is that these non-union forms of voice are more conducive to the adoption of technologies that capture value and enhance productivity, whether through greater worker discretion or through greater monitoring and work intensity. However, the data do not directly test organisational motivations or the mechanisms behind these relationships, which require further investigation).

	(1)		(2)		(3)		(4)		(5)	
	Augmentation		**Intensification**		**Telepresence**		**Matching**		**Displacement**	
Perceived rights at work	1.451***	(0.188)	-0.398**	(0.152)	-2.017***	(0.304)	-1.776***	(0.296)	-0.472**	(0.150)
Access to voice (ref: no access)										
Union only	-0.345	(3.079)	4.95	(3.040)	4.552	(5.025)	5.03	(4.713)	5.162	(3.205)
Non-union only	-12.78***	(3.324)	-13.62***	(2.860)	-11.47**	(4.119)	-8.756*	(4.402)	-13.45***	(2.843)
Union + Non-union	-4.001	(4.344)	-5.035	(4.339)	-12.58	(6.663)	-10.88	(6.118)	-2.219	(3.889)
Voice x Rights (ref: no access x rights)										
Union only x Rights	-0.0243	(0.406)	-0.427	(0.408)	0.634	(0.655)	0.5	(0.623)	-0.572	(0.416)
Non-union only x Rights	1.650***	(0.413)	1.885***	(0.360)	2.596***	(0.513)	2.534***	(0.547)	1.974***	(0.364)
Union + non-union x Rights	0.741	(0.545)	0.944	(0.543)	3.177***	(0.804)	2.847***	(0.745)	0.57	(0.503)
Constant	39.80***	(2.370)	51.64***	(2.097)	40.96***	(3.458)	26.91***	(3.471)	50.13***	(2.085)
Observations	5413		5501		4313		4791		5483	
r^2	0.153		0.0662		0.332		0.363		0.0726	
p	0.000		0.000		0.000		0.000		0.000	

Table 3. Summary table: interaction between rights and voice mechanisms (Model 5)

*Note: Adjusted by gender, age, ethnicity, occupation, sector, and exposure to digital ICTs, wearables, AI/ML software, robotics. Robust standard errors in parentheses. * p < 0.05, ** p < 0.01, *** p < 0.001*



Perceived rights range from 1 to 10.

Figure 8. Interaction plots

4.4 Perceived rights conditional on HR philosophy

Does the organisation's HR philosophy (employee-centred vs efficiency-centred) change how perceived rights protect from bad automation types?

We found that an employee-centred HR philosophy strengthens the positive association between perceived rights and high-discretion augmentation (good automation) (Table 4 and Figure 9). However, higher perceived rights where employee-centred HR policies exist can also relate to higher risk automation, compared to a null effect of perceived rights when such policies are absent. Similarly, employee-centred HR philosophy, independently of perceived rights, is positively associated with high-discretion augmentation, but has no role in the high risk automation that employees report.

	(1) Augmentation		(2) Intensification		(3) Telepresence		(4) Matching		(5) Displacement	
Perceived rights at work	0.920***	(0.201)	0.317	(0.195)	-0.261	(0.312)	0.023	(0.314)	0.166	(0.205)
HR Philosophy (centred)	4.889***	(0.325)	0.458	(0.333)	0.904	(0.559)	0.971	(0.567)	0.924**	(0.332)
Perceived rights x HR Philosophy	0.612***	(0.138)	0.619***	(0.130)	1.089***	(0.204)	1.103***	(0.209)	0.743***	(0.127)
Constant	51.81***	(1.936)	49.22***	(1.877)	29.48***	(2.822)	16.78***	(2.970)	47.12***	(1.920)
Observations	4867		4947		3814		4269		4932	
r^2	0.211		0.064		0.263		0.307		0.075	
p	0.000		0.000		0.000		0.000		0.000	

Table 4. Summary of interaction between rights and HR philosophy (Model 6)

*Note: Adjusted by gender, age, ethnicity, occupation, sector, and exposure to digital ICTs, wearables, AI/ML software, robotics. Robust standard errors in parentheses. * p < 0.05, ** p < 0.01, *** p < 0.001*

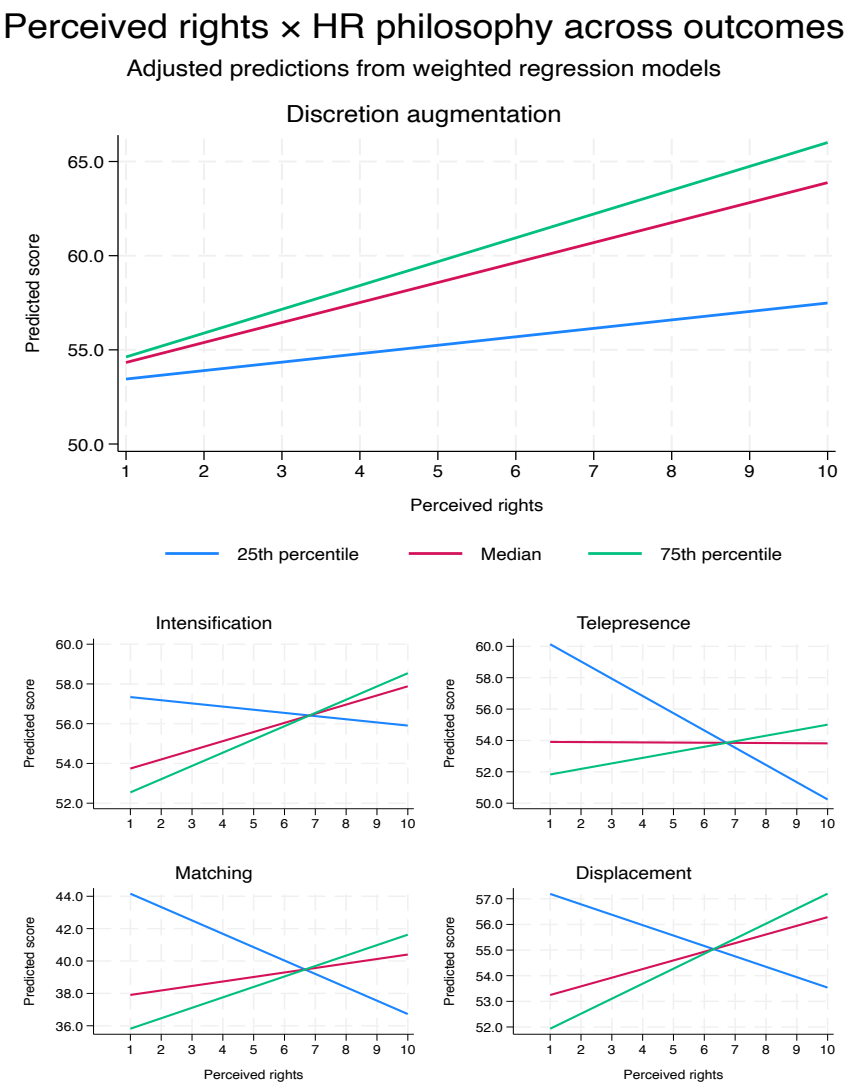


Figure 9. Interaction plots

5. Conclusion

This research set out to better understand the mechanisms by which technological change at work produces uneven outcomes, asking who benefits, who bears the risks, and how these dynamics can be shaped by institutions – through HR philosophies, workplace representation and worker voice.

This is an urgent question. With a labour market seeing reduced opportunities for young people, and major rounds of job losses blamed on automation, this is not just a technological issue, but a political one. Analysis by the UK Government highlights five critical uncertainties in how AI and automation technologies will impact society, with huge variations in possible societal impacts.[90] Our own work highlights that there are significant gaps in how current regulations and protections for workers are fit for purpose in tackling this new landscape.[91]

Results from this work demonstrate that automation is not being experienced uniformly, but varies significantly across workers and contexts, with particularly strong differences observed in forms of monitoring and algorithmic management such as telepresence and matching.

Importantly, the analysis shows that workers' perceived rights - and the institutional environments that support them - play a key role in shaping these outcomes. Higher perceived rights are associated with more autonomy-enhancing forms of automation and reduced exposure to surveillance-oriented practices, although they do not consistently protect against all negative outcomes. At the same time, these effects are mediated by factors such as employee voice and HR philosophy, highlighting that rights alone are insufficient without the institutional mechanisms that enable them to be realised.

Taken together, the findings reinforce the message that the impacts of technology at work are not predetermined, but - through policies, choices around HR philosophy, and how firms are organised to promote worker voices – are shaped by institutions.

If we are to shift the current uneven distribution of impacts away from risk and towards wider benefit for all, both formal protections and the practical conditions through which workers can understand, access, and exercise their rights need to be strengthened. If this can be done, an innovation ecosystem can be developed that ensures that technological change contributes to better work, rather than exacerbating existing inequalities.

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84. Of note, this scale is not measuring practices as intended by the organisation, but rather as perceived by individual employees. The gap between both reports is well established in the literature, and it is often explained by eligibility issues (i.e. not everyone in an organisation might access to wellbeing and development resources), by unintended variance in the application of organisational policies, or simply by biased perceptions of individuals vis a vis the intended practices (Jiang et al., 2017; Meijerink et al., 2016; Piening et al., 2014). However, the experience of HR practices as reported by employees is considered valid and a relevant dimension of the organizational context shaping workers' experiences of technological deployment and wellbeing.
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Institute for the Future of Work
Somerset House
Strand
London
WC2R 1LA
ifow.org / @ifow.org

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