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Building supply chain resilience through transport worker retention

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ABSTRACT

Ensuring an adequate truck driver workforce is a key policy concern for governments seeking resilient supply chains. In recent years, workforce contraction has intensified this challenge. In the aftermath of the COVID19 pandemic, many national governments introduced recruitment-focused measures, however worker retention received comparatively less attention. Drawing on a 2023 survey designed and administered to UK truck drivers (N = 1756), Structural Equation Modelling (SEM) is used to examine how job satisfaction, health and wellbeing, flexible work arrangements and workplace discrimination are associated with intention to quit or remain working as a truck driver. Drivers reporting higher job satisfaction and wellbeing were less likely to intend to leave the occupation (inter-occupational turnover). The availability and uptake of diverse work arrangements was associated with better retention outcomes through higher satisfaction and wellbeing, whereas experiencing discrimination was associated with lower retention. Company size and worker age also had direct associations with quitting intentions and retention, while contract type and caring responsibilities operated mainly through their relationships with satisfaction, wellbeing and discrimination. The findings indicate how truck driver retention is shaped by the interaction between working conditions, health and the fit between paid work and life outside work. These findings support a shift from recruitment-led responses towards retention-oriented transport policy, including stronger health and wellbeing provision, more predictable working hours and flexible working arrangements, and effective protection against discrimination. These measures will require support through employment regulation, freight procurement standards and buyer-supplier contracting practices, rather than relying on individual firms alone.

1. Introduction

Supply chain resilience is a key policy objective for national governments (Chatterjee and Chaudhuri, 2022; Dorantes and Allen, 2024). Transport policy plays an important role in this through, for example, continued investment in transport infrastructure, specifically ports, railways, roads and inland logistics hubs, encouraging distributed logistics networks to avoid overreliance on single nodes, designing transport systems that can withstand increasingly extreme and variable weather, *and* ensuring there is sufficient labour to keep goods moving (see, Feo-Valero et al., 2024; International Road Transport Union, 2024). In this paper, we focus on the policy problem of skills shortages (Kalaitzi and Tsolakis, 2023; Chandiran et al., 2023). Our specific case is road haulage, a critical component of many national logistics networks. In the Republic of Ireland, for example, over 99% of inland freight (by tonne-kilometre) is moved by road (Allied Irish Banks [AIB], 2024). In the UK, 81% of freight is moved by road (Department for Transport [DfT], 2024). Elsewhere, 65% of freight in Brazil is moved by road (ITF, 2023), 76% in Kenya (United Nations Conference on Trade and Development [UNCTAD], 2022) and 70% in India (Kumar Dadsena et al., 2023).

National dependence on road freight creates challenges for supply chains, where a reduction in the availability of key resources can contribute to knock-on effects across economies, due to multi-scalar system inter-dependencies (Churchill et al., 2025). Road haulage's continued dependence on internal combustion engine vehicles, for example, means that firms are reliant on fossil fuels. Oil price volatility and supply side shocks thus have severe consequences for day-to-day

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operations in what is a low profit margins industry, with implications for the workforce upon whom cost savings are displaced. At the same time, sufficient (and readily available) capital goods (trucks, containers, trailers, pallets) and workers (drivers) are all critical to meeting supply chain needs, and to realising the timely movement of freight.

This paper focuses on the importance of workers to supply chain resilience in the road haulage industry. Threats to that resilience have been brought to the fore by what has become known globally as the 'truck driver shortage'. The International Road Transport Union (IRU 2025a) reported that 3.6 million truck driver positions remained unfilled across 36 countries in 2024. This reflects not only the depth of the challenge but also its global nature, manifesting in Australia, China, Uzbekistan, Argentina, the EU and the UK, amongst other countries (ibid). Freight-specific dynamics (e.g. hazardous chemicals, tankers, logging) can extend or reduce national vulnerabilities to truck driver shortages, however the policy response to truck driver shortages has been consistently at the national level, and focused on an aggregated i.e., whole-industry, approach. It has also been supply-side oriented. Thus, the policy response to driver shortages in many countries has been to implement *driver recruitment* strategies, including enhanced pay (UK), changes to driver training schemes, through the development of apprenticeship routes (e.g., China, European Union, UK and US), government training subsidies (UK), cross border licensing agreements (European Union) and enabling fast-track immigration pathways (Canada, and temporarily in the UK) (see, Streeter, 2024).

While the unique conditions of the COVID19 pandemic made truck driver shortages visible in many countries (Sperry et al., 2022), these shortages did not come as a surprise to those in the industry or in transport policy. For at least two decades, scholars have been reporting that fewer people were entering truck driving work than leaving the occupation (see, LeMay, 1989; Min and Lambert, 2002). Yet for many countries, calculating the required number of truck drivers to maintain operational supply chains is complicated by high worker turnover, or 'churn' (Levy, 2023), within road haulage, with drivers either moving between employers as they seek alternative routes, contracts and pay (intra-occupational turnover, e.g., Prockl et al., 2017; Chandiran et al., 2023), moving into non-driving roles in logistics, or leaving the industry for opportunities elsewhere (inter-occupational turnover).

In this paper we focus on inter-occupational turnover with specific reference to UK truck drivers, examining this as a sectoral rather than firm-level challenge. For more than ten years, the UK government has been deliberating on the best ways to attract more people and a greater socio-demographic diversity of people, into truck driving work (UK Parliament, 2016). Yet, UK policy efforts to *retain* truck drivers have been limited. There is, however, growing acknowledgement on the part of transport policymakers of the occupation's unique challenges, including the need for higher-quality rest areas, improved work-life balance, more opportunities for career development, and greater appreciation of the work truck drivers do. Whilst strongly affirming the importance of these issues, we argue that policy development in this sphere would also benefit from a better understanding of how the work itself is experienced by drivers, and a more granular understanding of the relation of that experience to workers' 'intention to quit'. To that end, the paper presents a quantitative analysis of a large-scale survey of UK truck drivers.

2. Literature review and conceptual model

Recognition of the key role truck drivers play in maintaining supply chain resilience, but also the poor conditions within which they work in many countries, has stimulated a growing body of research. Scholarship at the intersection of transport policy and truck driving work focuses on: health and safety of both drivers and other road users (Spinney et al., 2015), experiences of infrastructural changes and congestion (Cherry and Adelakun, 2012; Caspersen et al., 2023), routing (Tsirimpa et al., 2019) and, increasingly, decarbonisation technologies and practices (Paddeu and Denby, 2022; Jones, 2024). Truck drivers' intentions to quit have received some attention in this literature, seeking to explain higher and lower propensities to quit, and the dynamics that contribute to this. A significant feature of this scholarship is its dependence on qualitative methods (Sousa and Ramos, 2018; Fournier et al., 2012; Aryal et al., 2023; Schmidbauer et al., 2025), or small sample surveys (n = 154, Nadler and Kros, 2014; n = 110, Mumford, 2019).

We next review the literature that seeks to explain why workers leave a particular occupation (inter-occupational turnover, turnover hereafter), before focusing on the specific dimensions that have been suggested to hold importance in the context of road haulage, and presenting our hypotheses.

2.1. Why do truck drivers quit?

There are numerous explanations for high rates of turnover in truck driving which reflect specific sectoral circumstances, skills and geographical contingencies. Some theories focus on work alone, and the capacity of a particular job to meet the individual's goals (e.g., psychological goal system theory of employee turnover, Zhang and Yang, 2024). Sociological scholarship has shown how fit of work with life outside of work (work-life balance), including caring responsibilities, holds an important position in employment decision-making (Rode et al., 2007). In this paper, we take a sociological approach, conceptualising work-related decision making as closely entangled with wider life dynamics. This, we argue, is particularly the case for truck drivers, who are a quintessential example of mobile workers (Gregson, 2023). Not only is their work done on the move, but it also often involves driving considerable distances as a condition of employment, and not always between the same places. As a result, many truck drivers work unpredictable hours and spend long durations of time at a distance from where they live, away from home, family and friends.

Job *dis*satisfaction has long been theorised as a key factor contributing to workers' intentions to quit their job (Lee, 1996; Aguiar do Monte, 2012). Across organisational, work and employment scholarship more widely, it is claimed that workers who report lower levels of job satisfaction are more likely to quit (e.g., Freeman, 1978; Green, 2010). Moreover, scholars have suggested that job dissatisfaction is associated with increased rates of absenteeism and decreased job performance (Mohr and Zoghi, 2008), along with heightened worker anxiety and depression (e.g., Faragher et al., 2005).

Job satisfaction is shaped by extrinsic and intrinsic factors. For truck drivers, extrinsic factors include pay, pressure to meet delivery windows, relationships with management, and time away from home, while intrinsic factors include recognition and a sense of achievement (Mumford, 2019). For this reason, multi-dimensional job satisfaction scales (e.g., pay, job security, amount of work etc.) have been posited as particularly useful for eliciting intrinsic and extrinsic satisfaction compared to single factor scales. Despite this, the road haulage industry continues to measure workers' satisfaction through single item survey questions, e.g., 'Overall, how satisfied are you with your job?' (IRU, 2024a). Satisfaction with financial renumeration has been singled out as a particularly important factor for the retention of truck drivers, with scholarship long reporting low pay as a significant factor contributing to occupational change, particularly for younger drivers (Backman and Jarvinen, 1983; LeMay and Keller, 2019) who are underrepresented in the job (IRU, 2024b).

Scholarship has suggested that truck drivers' relationships with transport managers and routers strongly influences their intention to quit their job (Keller, 2002), and that satisfaction with one's employer has a statistically significant relationship with job satisfaction (Prockl et al., 2017). However, more recent research has argued that this relationship has changed with the introduction of a range of surveillance and work allocation technologies (Radio Frequency Identification technologies, front and driver-facing cameras, app-mediated job allocations and real-time driver monitoring, see Levy, 2023). Truck driving

is no longer an autonomous occupation. Correspondingly, interpersonal relationships have changed, reshaping the impact the relationship between drivers and transport managers has on a driver's desire to quit (LeMay et al., 2013). The technologies themselves are reported as having a mixed relationship with drivers' reported job satisfaction (Gruchmann and Jazairy, 2025).

Schmidbauer et al. (2025)use the concept of job embeddedness (see Mitchell et al., 2001) to describe organisational and community connections that contribute to a worker's desire to remain in a job, even where the job quality and conditions are poor. These arguments can help to explain why high levels of satisfaction are reported for jobs that are objectively framed as low quality. While embeddedness can reduce truck drivers' intentions to quit their job and/or leave the industry, it can also more problematically lead to them being 'stuck' in poor working conditions. Although satisfaction alone is unable to explain actual quitting behaviour, decades of scholarship has established that satisfaction is sufficiently important to understanding quitting behaviours to hypothesize *that reported job satisfaction is negatively associated with intention to quit truck driving (H^1)*; that is, higher job satisfaction is associated with a lower intention to quit working as a truck driver.

As noted above, the degree to which a worker feels satisfied with their job can relate to their health and wellbeing. This relationship is complex, wherein sedentary work can result in elevated levels of diabetes and heart disease (Bailey, 2021), repetitive tasks can impact upon joint health, and solitary work contexts can increase loneliness (Bryan et al., 2023). Loneliness at work has been shown to result in reduced job satisfaction, declining relationships with managers, and increased risk of burnout (ibid.). Bartoll and Ramos (2020) show the importance of employee control over working hours, with greater control associated with mental well-being. They suggest that flexible work arrangements can, in some contexts, improve workers' mental health.

Scholarship has indicated that overwork can have a negative impact on workers' mental and physical health (Bannai et al., 2015). De Croon et al. (2004) suggest that work-related stress, or the strain and fatigue associated with truck driving work contribute to intentions to quit. This is particularly the case, they report, for drivers leaving the industry, rather than those moving within the industry (i.e. to work for a different employer), for whom dissatisfaction with pay or conditions were highlighted. Work in logistics and particularly in road haulage is characterised by long (Belzer and Sedo, 2017), and often variable working hours dictated not only by the allocation of jobs, but also road conditions including traffic congestion. Aryal et al. (2023) note how these unique demands of truck driving can contribute to mental ill-health. Nevertheless, job embeddedness (Schmidbauer et al., 2025) can help to partially explain why workers do not always quit jobs that are high stress or that result in poor health outcomes. Drawing on this literature, we hypothesize that *reported job satisfaction is positively associated with positive impacts of the job on the driver's mental and physical health (H^2) and negative reported impact of truck driving work on health and wellbeing is positively related to intentions to quit truck driving work (H^3)*.

One factor that can contribute to mental ill-health in the workforce is workplace discrimination. Deery et al. (2011a,b) discuss the relationship between harassment and turnover intentions for nursing staff and report that the effects of harassment on intention to leave a job are higher when the harassment is from someone inside their company (e.g., a colleague) rather than outside (e.g., a patient's family). For mobile occupations like truck driving, where drivers come into contact with a variety of different groups of people, from staff in the home depot, to the public enroute, to customers' premises and beyond, there is potential for a variety of different sources of discrimination. We therefore hypothesize that *experiences of discrimination at work are associated with reported mental and physical ill-health (H^4) and experiences of discrimination at work are negatively associated with job satisfaction (H^5)*.

Many forms of truck driving work entail long working days, with routine early starts and late finishes, night working and working away for days, or even weeks, on end all being commonplace working patterns. For this reason, it can be difficult to combine truck driving work with child and elder care responsibilities, creating a tension between paid work and home life. This is one reason why the industry has struggled to diversify the socio-demographic profile of its workforce (Hopkins and Akyelken, 2022; Scott and Davis-Sramek, 2023; IRU, 2025a), with research suggesting that such factors can contribute to truckers' job dis/satisfaction (Jiang et al., 2017). While flexible work arrangements and family-friendly shifts have emerged as policies to address work-life balance in other occupational settings, including office-based logistics, the principles are less easy to adopt in truck driving work, where delivery demands control the work schedule, and are themselves mediated by road traffic conditions.

Trucking has scarce uptake of provisions including part time hours (Just 4.7 percent of UK truck drivers work part time hours, Office for National Statistics [ONS], 2023), school hour shifts, and job sharing, and there is limited research exploring the provision and uptake of these arrangements. Nevertheless, the absence of a work-life balance may contribute to intentions to quit, in order to move to occupations that are more closely aligned with life outside of work. We hypothesize that *the availability and uptake of diverse work arrangements is positively related to truck drivers' satisfaction with the job they do (H^6) and the availability and uptake of diverse work arrangements is positively related to truck drivers' mental and physical health (H^7)*.

2.2. Conceptual model

Our review of the literature, provided above, suggests that multiple factors, in combination, contribute to intentions to quit truck driving work (e.g., Aryal et al., 2023). Fig. 1 presents the conceptual model informing the analysis. Investigating intention to quit truck driving, rather than focusing solely on those who have already exited the profession, offers several advantages for understanding and addressing workforce challenges, particularly in the context of worker retention and policy intervention. Quitting is understood in this paper as a process rather than a single moment, often beginning with dissatisfaction, moving through contemplation, and eventually resulting in action (Mobley, 1977). Studying *intention* allows us to capture drivers at various stages of this continuum, offering a more dynamic and predictive view of turnover risk. This forward-looking approach aligns with behavioural theories, such as the Theory of Planned Behaviour (Ajzen, 1991), which emphasise intention as a critical predictor of actual behaviour. When analysed alongside latent variables on work arrangements, health and well-being, and job satisfaction, intention data provides a valuable lens for designing targeted, preventative policy interventions.

3. Material and method

3.1. Survey design and data

The empirical contribution of this paper comes from a survey of UK truck drivers, conducted in 2023. The survey was designed by the research team, drawing on the team's previous qualitative research with UK truck drivers, as well as from established labour force surveys including the Cardiff Skills and Employment Survey (Cardiff University, 2017). To ensure that the language and response categories were appropriate, the survey was developed in collaboration with industry partners, piloted with 11 truck drivers, and revised in response to their feedback. The full survey instrument is available (Trucking Lives, 2024). The aim with the survey instrument was to attract a diverse sample of the UK's 300,000 truck driving population. The sampling frame sought a broad spectrum of socio-demographic and work and employment characteristics, as well as representation from across the 4 nations (England, Scotland, Wales & Northern Ireland). For these reasons, a response rate for the survey cannot be calculated. In March 2023, the survey was launched and promoted using a variety of online and offline

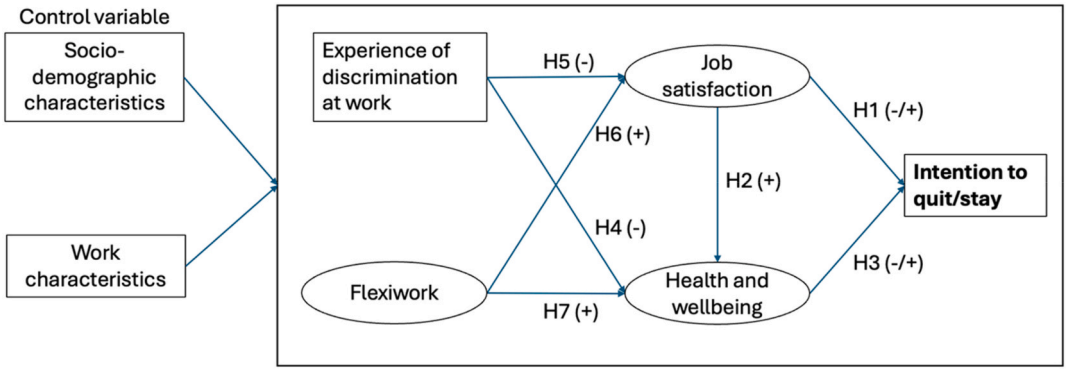


Fig. 1. Conceptual Model. Source: Authors. Note: Ellipses denote latent constructs and rectangles denote observed variables. Quit/Stay are modelled separately (see section 3.3).

tactics. To avoid undue bias toward certain (very large) firms, geographies and types of truck driving work, advertisements were published in trade magazines, social media pages, online fora, and surveys were disseminated through the research project's partner organisations including trade unions. The survey was open for 8 weeks. The final sample size of active truck drivers was n = 1756.

3.2. Variables

The survey was structured into seven sections: 1. Entry into truck (Heavy Goods Vehicle [HGV]) driving work, 2. Current work and employment conditions, 3. Combining trucking work with caring responsibilities, 4. Health and wellbeing in trucking, 5. Quitting HGV driving, 6. Actions by the government and industry to improve workers' lives, and 7. Demographic information. The survey questions used for the analysis presented in this paper are listed in Table 1, ordered by their connection to the three latent variables itemised in Fig. 1: 1. Availability and uptake of diverse ('flexi')work arrangements, 2. Health and wellbeing, and 3. Job satisfaction.

Fig. 2 presents the distribution of responses for the items used to construct the three latent variables: 'Diversity of Work Arrangements', 'Job Satisfaction', and 'Health and Wellbeing'. Reported uptake of diverse work arrangements was low across all eight items, while most respondents indicated that arrangements were either unavailable or that they did not know whether they were available. Responses to the job satisfaction items were more widely distributed across the scale, showing variation across different aspects of working conditions, and employment relationship and supporting the use of a multidimensional measure of satisfaction. Responses to the health and wellbeing items were concentrated around the middle categories. Missing responses were most evident for relationships with children and partners, reflecting the fact that these items were not applicable to all respondents. The similarity of the distributions before and after imputation suggests that the imputation procedure did not substantially alter the underlying response patterns.

To address 'I don't know' responses, we applied variable-specific strategies. The most appropriate approach was selected through a sensitivity analysis (see Table 2). We compared alternatives in terms of internal consistency (using Cronbach's alpha, preferring values above 0.8), factor uniqueness (preferring values below 0.6), and consistency in the direction of estimated effects (as reversed signs may indicate incorrect response ordering). Based on these criteria, we adopted an ordinal coding in which 'I don't know' was positioned between 'Not available' and 'Available but not used', with the full scale: 'Not available', 'I don't know', 'Available but not used', and 'Yes'.

Missing data posed a particular challenge for the 'Health and Wellbeing' variable, as only 1143 respondents answered all relevant items. To maximise sample retention, we used Multiple Imputation by Latent Class Analysis (MILCA), following Sulis and Porcu (2017). This approach is appropriate for survey data with ordinal response categories, including the five Likert-scale items assessed here: Mental Health (MH), Physical Health (PH), Relations with Children (RC), Parents (RP), and the Wider Social Circle (RS). The robustness of the imputation approach is supported by the consistency of findings across the structural equation models (see, Table 3). Further details are provided in Note[2].

3.3. Structural Equation Modelling

SEM is a theory-oriented approach for testing hypothesised patterns of association among latent and observed variables and has been used extensively in transport policy focused research (e.g., Azmoodeh et al., 2023; Sheykhfard et al., 2025). While SEM is often described as modelling 'causal' pathways, the directionality of paths here reflects our theoretical model rather than evidencing causation. A SEM was estimated using maximum likelihood estimation, with Model 1 focusing on intention to quit and Model 2 on driver retention. Models 1 and 2 differ only in their outcome variables ('intention to quit' or 'intention to remain'). They capture the same underlying concept from slightly different perspectives, serving as a form of cross-validation to check the consistency of results. Both models included direct and indirect effects, with standardised coefficients reported. The SEM framework allowed for the simultaneous estimation of relationships between latent and observed variables, providing a comprehensive analysis of the factors influencing truck driver turnover.

Women were purposively oversampled because they constitute only 2% of the UK's truck driver population. A strictly representative sample would have yielded too few responses from women to enable statistically robust analysis or meaningful subgroup comparisons. Weights were adjusted to the sample to reflect the gender distribution of the UK truck driver population. Standardised coefficients were reported, and model fit was assessed using equation-level goodness-of-fit and total effects. The use of survey weights and robust imputation procedures strengthens the reliability of the findings.

4. Results

We now present the results of our analysis of inter-occupational turnover, first from the exploratory factor analysis (EFA), and then the structural equation model (SEM).

4.1. Exploratory factor analysis

To quantify the three latent variables from Fig. 1, we conducted an EFA using an iterative approach. This involved removing indicators with cross-loadings and assessing model fit at each step (see, Table 4). The

Table 1
Descriptive statistics of dependent and independent variables.

Attribute	Statement/questions	Code	Mean/ Proportion (S. D)
Dependent variable			
Intention to quit	In the past 12 months, have you considered quitting HGV driving?	1: Yes; 0: No	0.538
Retention	How likely are you to still be working as an HGV driver in 12 months' time?	5-Likert Scale	4.163 (1.056)
Latent variables			
Flexiwork	Are any of the following working arrangements and/or childcare support made available by your current employer, and if so, have you used it?	1: It was not available to me; 2: I don't know; 3: It was available to me, but I didn't use it; 4: I used this arrangement	See also Fig. 2 for visualization
	W1: Work part-time		1.791 (0.810)
	W2: Work only during school term-time		1.575 (0.664)
	W3: Job-share		1.537 (0.649)
	W4: Work flexitime		1.707 (0.852)
	W5: Work reduced hours for a limited period		1.874 (0.894)
	W6: Work a compressed working week		1.645 (0.745)
	W7: Work annualised hours		1.661 (0.741)
	W8: Employer assistance with childcare		1.592 (0.657)
Health & well-being [see Note[1]]	To what extent does your work as an HGV driver positively or negatively affect:	5: Positively; 4: Somewhat positively; 3: Neither positively; 2: Somewhat negatively; 1: Negatively; 0: Not applicable	See also Fig. 2 for visualization
	Your mental health		2.972 (1.135)
	Your physical health		2.536 (1.203)
	Your relationships with your children		2.893 (1.142)
	Your relationships with your partner		2.919 (1.151)
	Your wider social relationships		2.519 (1.145)
Job satisfaction	How satisfied or dissatisfied are you with this particular aspect of your current job:	7: Completely satisfied; 6: Very satisfied, 5: Fairly satisfied; 4: Neither satisfied nor dissatisfied; 3: Fairly dissatisfied; 2: Very dissatisfied; 1: Completely dissatisfied	See also Fig. 2 for visualization
	JS1: Your promotion prospects		4.579 (1.563)
	JS2: Your pay		4.756 (1.451)
	JS3: Relations with your supervisor or manager		5.125 (1.611)
	JS4: Your job security		5.317 (1.429)
	JS5: The opportunity to use your abilities		5.202 (1.475)
	JS6: Being able to use your own initiative		5.401 (1.464)
	JS7: The ability and efficiency of the management		4.497 (1.764)
	JS8: The hours you work		4.663 (1.618)
	JS9: The work itself		5.453 (1.236)
	JS10: The amount of work		5.058 (1.462)
	JS11: The variety in the work		5.084 (1.371)
	JS12: The training provided		4.878 (1.673)
	JS13: The friendliness of the people you work with (other HGV drivers)		5.421 (1.334)
	JS14: The friendliness of the people you worked with (people working at depots)		4.904 (1.466)
Independent variables			
Work characteristics			
PermContract	What kind of contract do you currently hold?	1: Permanent; 0: Temporary/Temp to Perm/Zero hours	0.876
NightAFH	How many nights in a row are you typically away from home (tramping) in your current job?	Number	2.187 (3.723)
Agency	Are you...	1: Contracted through an agency to single/multiple companies; 0: Other	0.0797
PartTime	What kind of hours do you currently work?	1: Part time; 0: Full time	0.0581
VehicleType (Artic)	What class of HGV do you drive all or most of the time?	1: full articulated or a draw bar; 0: Ref- Rigid/7.5 tonner	0.817
CompanySize	What is the size of the company you currently work for? Note: If you are employed through an agency, please put the size of the company you drive for.	5: Extra-Large (251+ vehicles); 4: Large (101-250 vehicles); 3: Medium (31-100 vehicles); 2: Small (2-30 vehicles); 1: Owner operator (1 vehicle)	3.493 (1.225)
HGVexp	How many years of experience do you have as an HGV driver? Note: if you have taken breaks from HGV driving please exclude this time from your total, and round to the closest year.	Number	16.315 (12.859)
Experience of discrimination at work	As an HGV driver, have you been discriminated at work?	1: Yes; 0: No	0.316
Socio-demographics			
Gender	Are you …	1: Yes; 0: No	
Female			0.130
Other			0.006
Male (ref)			0.864

(*continued on next page*)

Table 1 (*continued*)

Attribute	Statement/questions	Code	Mean/ Proportion (S. D)
Age	What is your age?	Number	
18-29 (ref)			0.116
30-49			0.431
50+			0.454
OtherThanWhite	To which of these groups do you consider yourself to belong?	0: White; 1: Other than white	0.028
Care	Do you have any caring responsibilities for a child/children and/ or another adult/s?	1: Yes; 0: No	0.349

process resulted in a clear single-factor structure. Internal consistency and construct reliability were found to be satisfactory for all three constructs: 'Diversity of Work Arrangements', 'Job Satisfaction', and 'Health and Wellbeing', with Cronbach's alpha values of 0.86, 0.90, and 0.88, respectively.

4.2. Structural equation model

The SEM models explain a moderate proportion of variance in the outcome variables intention to quit truck driving ($R^2 = 0.237$, Model 1) and retention ($R^2 = 0.213$, Model 2). Within these models, the mediating variables themselves are well-explained by their predictors: job satisfaction ($R^2 = 0.228$ in both models) and wellbeing ($R^2 = 0.407$ in Model 1; $R^2 = 0.495$ in Model 2). Table 5 presents the standardised coefficients from the two SEMs. The structural model summarises the relationships among latent constructs, job characteristics, and socio-demographic factors, while the measurement model shows how well each observed item represents its underlying construct. Asterisks indicate significance levels ($p < 0.05$, $p < 0.01$, $p < 0.001$), and R^2 values at the bottom indicate the proportion of variance explained in each outcome.

The models presented in Table 5 and Fig. 3 show that drivers' wellbeing is directly associated with lower intention to quit truck driving (−0.318, $p < 0.001$) and enhances retention (0.161, $p < 0.01$), with no indirect associations (see Note[2]), supporting H[3]. This emphasises the pivotal role that wellbeing plays in worker retention, consistent with research on workplace stress and loneliness (Bryan et al., 2023). The results support H[1]: Job satisfaction exerts a strong association with lower intention to quit (−0.231, $p < 0.01$) and higher retention (0.354, $p < 0.001$), amplified by indirect association through well-being (−0.174 for quit, 0.088 for retention), mediated by its direct

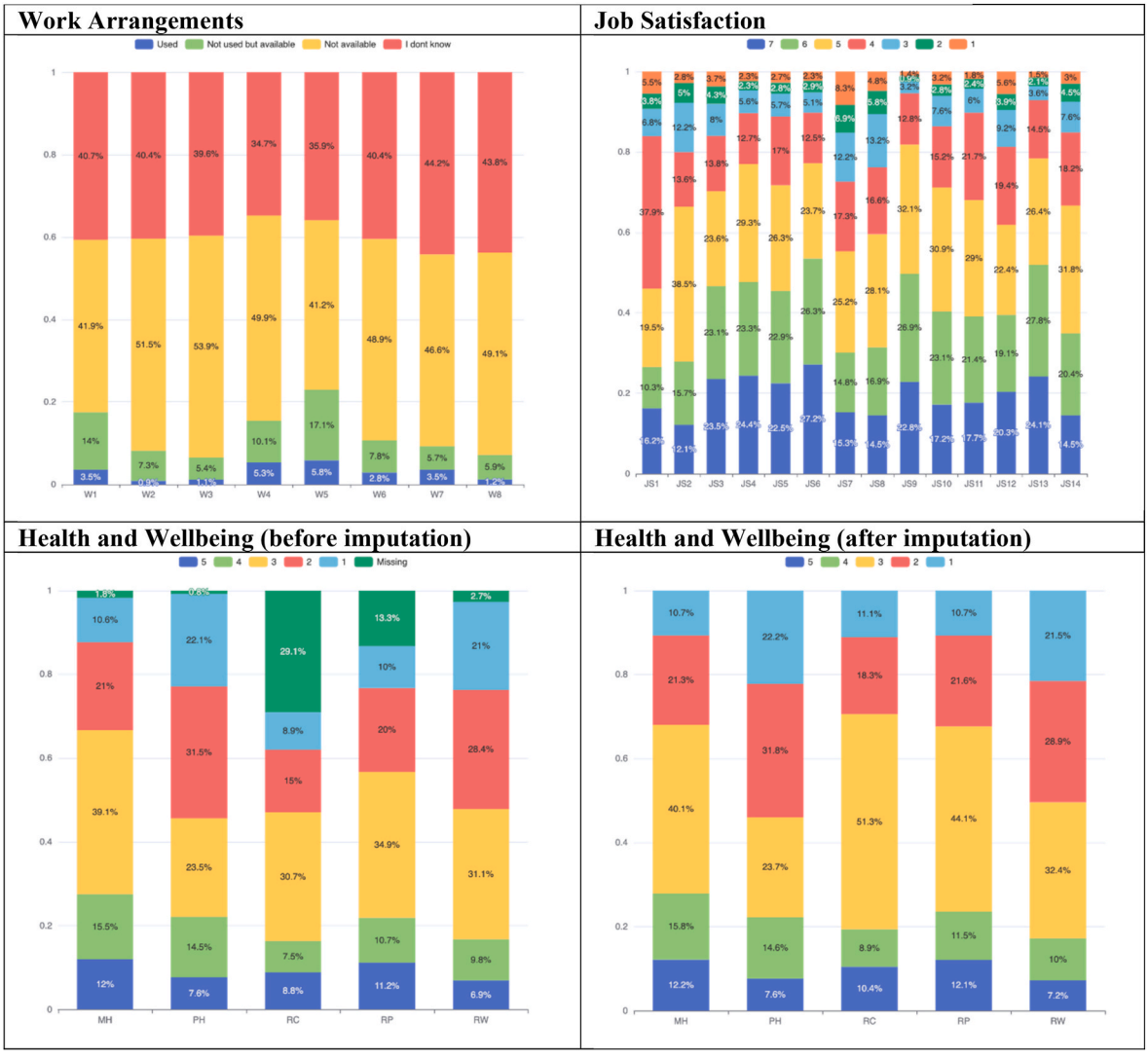


Fig. 2. Distribution of responses of items in latent variables.

Table 2
SEM with five imputed dataset for latent variable 'Wellbeing' (following Sulis and Porcu (2017)).

Structural Path Coefficients	Original	Imputation 1	Imputation 2	Imputation 3	Imputation 4	Imputation 5
DISCRIM - > Satisfaction	−0.295***	−0.258***	−0.258***	−0.258***	−0.258***	−0.258***
DISCRIM - > Wellbeing	−0.120***	−0.110***	−0.111***	−0.110***	−0.109***	−0.111***
Flexiwork - > Satisfaction	0.245***	0.267***	0.267***	0.267***	0.267***	0.267***
Flexiwork - > Wellbeing	0.159***	0.141***	0.137***	0.138***	0.139***	0.136***
Satisfaction - > Wellbeing	0.489***	0.536***	0.537***	0.539***	0.534***	0.538***
Satisfaction - > Quit	−0.298***	−0.216***	−0.217***	−0.219***	−0.223***	−0.216***
Wellbeing - > Quit	−0.243***	−0.322***	−0.322***	−0.316***	−0.313***	−0.323***
Model Fit Statistics						
Sample Size	1143	1752	1752	1752	1752	1752
χ^2 (df = 371)	2474.20***	3501.98***	3511.00***	3517.87***	3529.89***	3500.83***
CFI	0.884	0.880	0.880	0.880	0.880	0.881
TLI	0.874	0.869	0.869	0.868	0.868	0.869
AIC	84227.613	129721.655	129646.854	129671.501	129570.776	129595.656
BIC	84686.381	130219.290	130144.488	130169.136	130068.411	130093.291
SRMR	0.049	0.046	0.046	0.046	0.046	0.046
CD (R^2 Overall)	0.896	0.894	0.894	0.894	0.894	0.894

Note: ***p < 0.01.

Table 3
SEM for different construct of latent variable *flexiwork* with key decision indicators bold.

Path	ordinal_dontknow_b/w	ordinal_dontknow_least	binary	dontknow_asmissing
DISCRIM - > Satisfaction	−0.258***	−0.286***	−0.286***	−0.320***
DISCRIM - > Wellbeing	−0.111***	−0.113***	−0.117***	−0.075*
flexiwork - > Satisfaction	**0.267*** **	**0.007 (p=0.787)**	**0.107*** **	**0.214*** **
flexiwork - > Wellbeing	**0.136*** **	**−0.031 (p=0.175)**	**0.053***	**0.165*** **
Satisfaction - > Wellbeing	0.538***	0.577***	0.570***	0.548***
Satisfaction - > Quit	−0.216***	−0.216***	−0.217***	−0.222***
Wellbeing - > Quit	−0.323***	−0.322***	−0.320***	−0.313***
Cov(DISCRIM, flexwork)	−0.107***	0.054*	−0.002 (p = 0.938)	−0.123***
Sample Size	**1752**	**1752**	**1752**	**634**
χ^2 (df = 371)	3500.83***	3490.89***	3346.25***	1663.54***
RMSEA (90% CI)	0.069 (0.067–0.072)	0.069 (0.067–0.071)	0.068 (0.066–0.070)	0.074 (0.071–0.078)
CFI	0.881	0.882	0.866	0.865
TLI	0.869	0.871	0.854	0.852
AIC	129595.656	128573.228	89043.411	42667.156
BIC	130093.291	129070.862	89541.046	43072.293
SRMR	0.046	0.047	0.046	0.050
CD (R^2 Overall)	**0.894**	**0.902**	**0.765**	**0.898**

Note: ***p < 0.01.

association with well-being (0.547, p < 0.001), supporting H^2.

Flexible work arrangements (Flexiwork) show an indirect association with lower intention to quit truck driving (−0.144) and higher retention (0.134) via their positive associations with well-being (0.121, p < 0.001) and job satisfaction (0.259, p < 0.001), partially supporting H^6 and H^7. Reported availability of flexible work arrangements, elaborated in Fig. 4, differs by gender and presence of caring responsibilities, wherein women reported higher availability of flexible working arrangements than men across all eight arrangements. This may reflect greater need for the arrangements. Part-time working was perceived as the most available option, particularly among women with caring responsibilities (M = 2.21), whereas job-sharing, term-time working, and employer childcare assistance received the lowest availability ratings across all groups. Despite group differences, all mean scores were below the midpoint of the scale, suggesting that respondents generally perceived flexible working arrangements as only low to moderately available to them.

The models show that discrimination (DISCRIM) is indirectly associated with higher intention to quit truck driving (0.150) and lower retention (−0.142) through its negative direct associations with job satisfaction (−0.281, p < 0.001) and well-being (−0.111, p < 0.001), with additional indirect associations with well-being (−0.154), partially supporting H^4 and H^5.

Job characteristics show varied impacts. Permanent contracts and larger company sizes (CompanySize) shapes outcomes indirectly through job satisfaction and well-being. CompanySize is directly associated with lower intention to quit (−0.060, p < 0.001) and higher retention (0.111, p < 0.001), with indirect associations via well-being (0.057 for quit, −0.075 for retention) and satisfaction (−0.193, p < 0.001), reflecting greater job security. Being hired through an agency is indirectly associated with intention to quit (0.044) and reduces retention (−0.049) through its negative association with job satisfaction (−0.110, p < 0.001). Night shifts away from home (Night-AFHDay) were not directly associated with turnover outcomes. However, they exhibited small indirect effects, reducing intention to quit (−0.020) and increasing retention (0.038). These indirect associations appear to be mediated primarily through higher job satisfaction (0.117, p < 0.001), despite a concurrent negative association with well-being (−0.087, p < 0.01). This pattern suggests that while working night shifts away from home may enhance aspects of the job, such as financial rewards or perceived autonomy, these benefits may be offset by adverse effects on employee well-being.

Socio-demographic factors also show nuanced effects. Being an older driver (AGE50) has a direct association with higher intention to quit (0.092, p < 0.001) and lower retention (−0.093, p < 0.001), with indirect associations via well-being (0.102, p < 0.01) and satisfaction (−0.045, p < 0.01), possibly due to retirement considerations or health challenges. Compared to early-career drivers (ages 18-29, reference group), being a mid-career driver (AGE3049) shows a small direct association with intention to quit (0.016, p < 0.05) and retention (−0.045, p < 0.01), with indirect associations through satisfaction (−0.041, p < 0.05) and well-being (−0.038). Non-white ethnicity

Table 4
Factor loadings of latent variables.

Variable/ Item	Item text	Uniqueness[a]	Cronbach's alpha/Factor loading
Availability and uptake of diverse work arrangements ('Flexiwork')			**0.8643**
W1	Work part-time	0.6093[b]	-
W2	Work only during school term-time	0.5032	0.6865
W3	Job-share	0.4935	0.7040
W4	Work flexitime	0.4699	0.7318
W5	Work reduced hours for a limited period	0.5714	0.6464
W6	Work a compressed working week	0.4131	0.7793
W7	Work annualised hours	0.5740	0.6610
W8	Employer assistance with childcare	0.5636	0.6676
Job satisfaction			**0.9099**
JS1	Your promotion prospects	0.4529	0.7356
JS2	Your pay	0.6258[b]	-
JS3	Relations with your supervisor or manager	0.4012	0.7821
JS4	Your job security	0.4856	0.7154
JS5	The opportunity to use your abilities	0.3436	0.8162
JS6	Being able to use your own initiative	0.4257	0.7671
JS7	The ability and efficiency of the management	0.4049	0.7856
JS8	The hours you work	0.4395	0.7394
JS9	The work itself	0.4505	0.7332
JS10	The amount of work	0.4068	0.7634
JS11	The variety in the work	0.4761	0.7252
JS12	The training provided	0.5108	0.6936
JS13	The friendliness of the people you work with (other HGV drivers)	0.7210[b]	-
JS14	The friendliness of the people you worked with (people working at depots)	0.7136[b]	-
Health & well-being			**0.8753**
MH	Your mental health	0.5812	0.6471
PH	Your physical health	0.5281	0.6870
RC	Your relationships with your children	0.2542	0.8636
RP	Your relationships with your partner	0.2232	0.8813
RW	Your wider social relationships	0.3880	0.7823

[a] Uniqueness = 1 - Communality.
[b] Items with high uniqueness (>0.60) that were excluded. 'Unique' items are less likely to co-occur with other reasons and therefore do not form a coherent latent construct. Including them individually in the model (as single Likert-scale items) could introduce measurement error and model instability, thereby reducing the overall reliability and validity of the model.

(OtherThanWhite) is indirectly associated with lower intention to quit (−0.024) and higher retention (0.013) via well-being (0.075, $p < 0.01$) and discrimination (0.064, $p < 0.01$), reinforcing diversity-focused policies. Care responsibilities (CARE) is indirectly associated with higher intention to quit (0.036) and lower retention (−0.034) through negative associations with well-being (−0.176, $p < 0.01$) and discrimination (0.070, $p < 0.01$).

5. Discussion and policy implications

Drawing on a survey of 1765 truck drivers working in the UK, this paper has examined the factors shaping their intentions to quit or continue working in this occupation. The analysis extends current research on truck driver retention by showing how working conditions are associated with intention to quit and retention through job satisfaction and wellbeing. Rather than identifying a single cause of turnover, such as low pay, our models show how workplace and wider life experiences combine to shape drivers' employment decisions. The models therefore support a sociological understanding of employment decision making, in which paid work is closely connected to health, caring responsibilities and life outside work (Rode et al., 2007). These relationships are particularly important for truck drivers, since the nature of their mobile work is such that it often entails long and unpredictable hours as well as extended periods away from home, family and friends (Gregson, 2018, 2023).

At a general level, the findings endorse existing research that has identified job dissatisfaction as an important factor contributing to intention to quit (Freeman, 1978; Lee, 1996; Aguiar do Monte, 2012; Green, 2010). In our analysis, job satisfaction was directly associated with lower intention to quit and higher retention and indirectly associated with both outcomes through its positive association with well-being. The analysis nonetheless extends previous truck driving research by measuring satisfaction as a multidimensional construct, including management, job security, autonomy, working hours, workload, training and the work itself. This provides a more nuanced account of job satisfaction than the single-item measures often used in road haulage surveys, showing that retention is not simply a matter of pay, but of several inter-connected aspects of the employment relationship.

The analysis also shows that driver wellbeing is directly associated with lower intention to quit truck driving. This is consistent with De Croon et al. (2004), who associate the strain and fatigue of truck driving with intentions to leave, and with research documenting the effects of long hours, variable schedules, sedentary work and loneliness on drivers' health (Bannai et al., 2015; Belzer and Sedo, 2017; Aryal et al., 2023; Bryan et al., 2023). A more expansive reading of well-being, which brings mental health, physical health and relationships with partners, children and wider social networks into view, is instructive here insofar as it shows that retention is influenced not only by occupational wellbeing, but also by the effects of truck-driving work on drivers' lives and relationships outside work.

The findings indicate the clear need for a greater diversity of work arrangements in road haulage, not least because this supports the retention of drivers within the industry. The Flexiwork variable was indirectly associated with lower intention to quit and higher retention through its positive associations with satisfaction and wellbeing. This supports Bartoll and Ramos's (2020) finding that control over working hours can improve mental wellbeing and extends this argument to truck driving, where delivery schedules, traffic conditions and time away from home restrict workers' control over when and where they work. It reflects the need for further examination of work-life balance in the context of road haulage, and specifically truck driving (Rode et al., 2007), recognising the difficulties mobile work creates for sustaining social connections, particularly for those drivers with caring responsibilities (Gregson, 2018; Arora and Hopkins, 2026). The analysis suggests that flexible work can support driver retention because it improves drivers' experience of work and its fit with their life outside employment.

Yet the analysis shows that *reported* availability of diverse arrangements for truck drivers remains below the midpoint of the scale across all groups. Women reported greater availability than men, while men with caring responsibilities generally reported less availability than men without caring responsibilities. These findings could reflect the necessity to seek out arrangements when the need arises (i.e., for those with caring responsibilities), and how successful these experiences were in locating suitable arrangements. This contributes to research linking inflexible working patterns with the industry's limited workforce diversity (Hopkins and Akyelken, 2022; Scott and Davis-Sramek, 2023), while also showing that the tensions between paid work and care work are not only experienced by women. In a predominantly male occupation, the flexibility needs of male carers may be less visible, despite their association with wellbeing and retention. This may also hinder recruitment efforts, where those with, or pre-empting (i.e., those intending to

Table 5
Modelling results of SEM (standardised coefficients).

From	To									
	Model 1 (Intention to quit)					Model 2 (Retention)				
	Quit	Wellbeing	Satisfaction	Flexi-work	Discrimination	Retain	Wellbeing	Satisfaction	Flexi-work	Discrimination
Wellbeing	−0.318***					0.161**				
Satisfaction	−0.231**	0.547***				0.354***	0.547***			
Flexiwork		0.122***	0.260***				0.121***	0.259***		
Discrimination		−0.115**	−0.282***				−0.111***	−0.281***		
PermContract				−0.043**	−0.047**				−0.043**	−0.047**
Artic		−0.104***			0.068***		−0.102***			0.068***
CompanySize	−0.060***	0.067**	−0.194***			0.111***	0.065**	−0.193***		
NightAFH		−0.085**	0.116**				−0.087**	0.117***		
Agency			−0.109**					−0.110***		
PartTime				0.092**					0.092**	
HGVexp	0.133***	−0.053***		0.021*	0.043**	−0.063***	−0.053***		0.021*	0.043**
Age30-49	0.0164**		−0.041*	−0.061*		−0.045**		−0.041*	−0.061*	
Age50+	0.092***	0.101**	−0.045***	−0.092**		−0.093***	0.102**	−0.045**	−0.092**	
OtherThanWhite		0.074**		0.073***	0.064**		0.075**		0.074***	0.064**
Female		0.072**	0.101***	0.102***	0.167***		0.069**	0.101***	0.102***	0.167***
Other			−0.035***	0.018**	0.057**			−0.034***	0.0183***	0.057**
Care				−0.176**	0.070**				−0.176**	0.070**
MH		0.704***					0.699***			
PH		0.698***					0.696***			
RC		0.668***					0.672***			
RP		0.776***					0.779***			
RS		0.776***					0.778***			
JS1			0.748***					0.748***		
JS3			0.778***					0.777***		
JS4			0.719***					0.720***		
JS5			0.810***					0.811***		
JS6			0.762***					0.762***		
JS7			0.781***					0.780***		
JS8			0.740***					0.740***		
JS9			0.731***					0.732***		
JS10			0.765***					0.765***		
JS11			0.723***					0.723***		
JS12			0.691***					0.691***		
W2				0.688***					0.688***	
W3				0.717***					0.717***	
W4				0.727***					0.727***	
W5				0.647***					0.647***	
W6				0.778***					0.778***	
W7				0.652***					0.652***	
W8				0.676***					0.676***	
R^2	0.237	0.407	0.228	0.057	0.025	0.213	0.495	0.228	0.057	0.025

Note: the columns reflect the variables presented in the conceptual model in Fig. 1. Four of the variables (excluding 'Quit' and 'Retain') are abbreviated to wellbeing ('impact of job on health and wellbeing'), satisfaction ('job satisfaction'), flexiwork ('availability and uptake of diverse work arrangements') and discrimination ('experience of discrimination of work').
***p < 0.01; **p < 0.05, *p < 0.1.

become parents, or with ageing family members), caring responsibilities self-select out of truck driving work. Going further than pre-existing models of flexible work arrangements is a key policy priority.

Experiences of workplace discrimination were indirectly associated with higher intention to quit and lower retention through its negative associations with satisfaction and wellbeing, as reported by Deery et al. (2011a,b) in healthcare professions. Again, the mobile nature of truck driving work increases the complexity of this experience, wherein drivers interact with colleagues, managers, depot staff, customers and members of the public, creating several potential sources and sites of discrimination. The findings show that discrimination may influence turnover by progressively reducing job satisfaction and wellbeing, rather than through a direct association with the decision to leave. Anti-discrimination protections are therefore important for workforce retention as part of wider commitments to equity and inclusion.

The findings on night shifts away from home (a practice called 'tramping' in the industry) show a more complex relationship. Night work was positively associated with satisfaction but negatively associated with wellbeing, partly offsetting indirect associations with turnover outcomes. This is consistent with Schmidbauer et al.'s (2025) use of job embeddedness to explain why drivers may remain in work despite poor or demanding conditions. Drivers may value some features of night or away-from-home work (e.g., the prestige of tramp driving work relative to other types of truck driving work) while also experiencing health and social costs. However, further research is required to explain the positive association with satisfaction.

As we go on to show, these findings have implications for transport policy targeting labour retention in the UK truck driving industry, but they also need to be considered in relation to the structure and context of the industry. Specifically, the findings suggest that, in circumstances where working conditions continue to reduce satisfaction, wellbeing and compatibility with life outside work, recruitment and licensing measures alone are unlikely to resolve driver shortages. Transport policy therefore needs to be integrated more strongly with employment regulation, by promoting support for predictable and flexible scheduling, physical and mental health, caring responsibilities and protection from discrimination. At the same time, many of these areas of intervention require implementation at the level of the firm, which presents a significant policy challenge in what is a fragmented and highly competitive industry. The UK road freight industry comprises more than 54,000 businesses and is characterised by relatively low barriers to entry, widespread subcontracting and limited market concentration

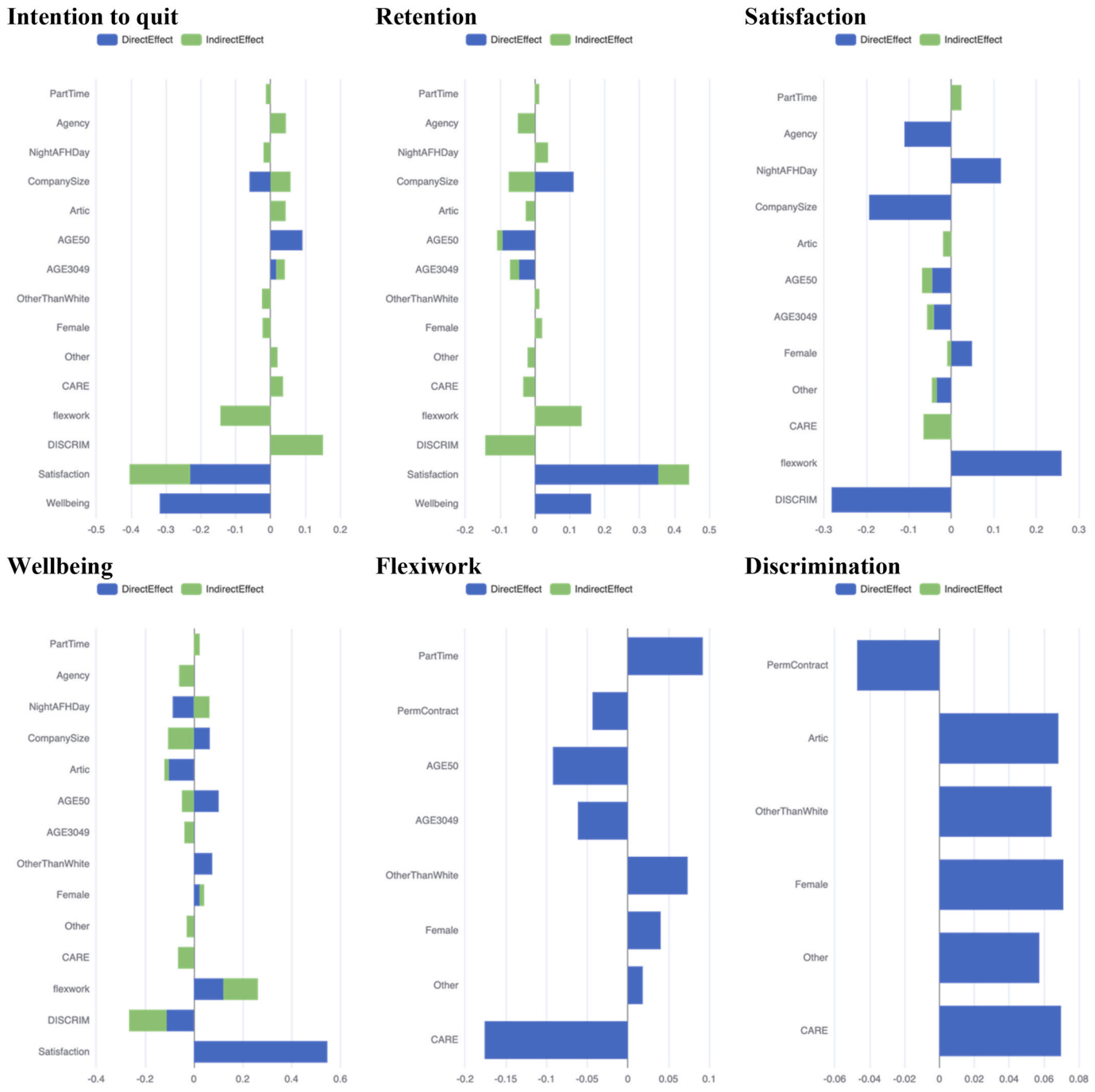


Fig. 3. Direct and indirect standardised effects on selected variables.

(Department for Transport, 2024), while small and medium-sized operators face financial, administrative and operational constraints that limit their capacity to invest in improved practices (Allen et al., 2023). This suggests that regulation directed solely at individual hauliers is likely to be insufficient. Measures targeting the whole supply chain therefore are more likely to be effective. The purchasing and contracting practices of shippers, retailers and logistics intermediaries shape the resources available to haulage operators. There is capacity here to improve employment conditions, with Kim et al. (2022) showing how power imbalances between purchasers of trucking services and owner-operators can undermine welfare and safety ambitions.

Alongside regulation, there may therefore be scope for a sector-specific certification scheme through which purchasers of transport services could identify operators providing fair employment conditions (International Labour Organization, 2020). The Swedish Fair Transport scheme provides an existing example, linking working conditions, road safety and environmental performance to standards intended to inform purchasing decisions. However, research on private labour governance cautions that certification should complement rather than replace regulation. Such schemes are most credible where standards are transparent, monitoring is independent, workers are represented and non-compliance carries meaningful consequences (e.g., O'Rourke, 2003). An ethical carriage standard would therefore require independent oversight and driver participation and would need to be linked to procurement requirements or commercial incentives, rather than relying only on voluntary employer commitments.

The multifaceted nature of truck drivers' intentions to exit the occupation suggests three sites of potential UK policy intervention. First,

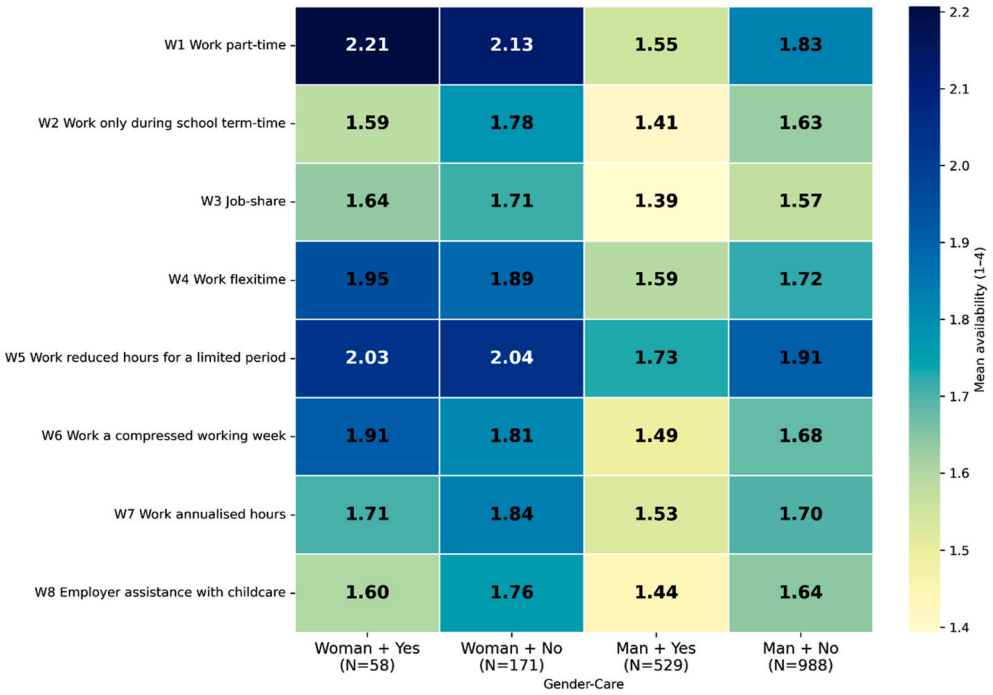


Fig. 4. Reported availability of Flexiwork (W1-W8) by gender and caring responsibility.

drawing on the Swedish template, there is a clear case for introducing sector-wide minimum employment standards for UK road haulage. This would include – and uphold - rights to predictable scheduling, access to flexible working, health and wellbeing support, anti-discrimination procedures and transparent employment conditions *for all truck drivers*. It could potentially be governed by an independently audited certification scheme. Second, targeted support is required for the micro- and SME operators within UK road haulage, reflecting their low margins and limited administrative capacities. Third, and finally, cross-supply chain thinking is necessary. The commercial pressures that contribute to uncertain and variable working schedules (amongst other concerns) in UK road haulage are themselves connected to freight contracting practices, and to freight purchasers. Concerted pressure to improve the working conditions of transport workers can only reap dividends when it is accompanied by buy-in from powerful freight buyers. These measures would not be seeking to remove all turnover, but rather to address the employment conditions most closely associated with drivers' intentions to remain in, or leave, the occupation.

6. Conclusions and limitations

With many countries depending on road haulage, truck drivers remain a critical part of the logistical system and essential to supply chain resilience. There are moral, social, economic and political motivations to enact policies to retain the existing truck driver workforce, rather than continuing to plug the retention gap through policy measures that target recruitment. Such policies would require engaging both public and private sector actors across spatial scales, from the international to the local, since truck driving work crosses borders as well as operating on national strategic road networks and local roads. With limited large sample datasets of truck driver experiences, the findings presented in this paper offer unique insights regarding inter-occupational turnover amongst UK truck drivers. It provides entry points to examine the policy levers that might be used in relation to driver retention.

There are, nonetheless, limitations to this research. First, while we were able to oversample women, we were less successful at recruiting truck drivers of colour for the survey, unable to reach the proportion in the total population (5%) and therefore the survey results overrepresent the experiences of white truckers. Second, the analysis relies on self-reported survey data, which may be affected by recall bias, subjective interpretation of questions, and social desirability effects, particularly in relation to mental and physical health. To mitigate these concerns, the survey wording was kept as clear and consistent as possible, although such biases cannot be fully eliminated. Third, the cross-sectional design limits causal inference. While the findings identify associations between working conditions, job satisfaction, wellbeing, and retention-related outcomes, they cannot establish the direction or timing of these relationships. Longitudinal research would therefore be valuable in examining how these factors shape driver retention over time. Fourth, our analysis is UK-specific and at the aggregate level of the road haulage industry. The nature of road haulage in any one national economy is a function of the relative balance between imports and exports, as well as the goods traded. Correspondingly, different economies will exhibit varying degrees of dependence on different types of trucking work (e.g. the significance of timber/logging truck driving in the US [Knight et al., 2024] and Austria [Kogler et al., 2025] compared with the UK), whilst freight-specific differences between countries will influence the types of truck driving work available in any one country.

CRediT authorship contribution statement

Debbie Hopkins: Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization. **Nicky Gregson:** Writing – original draft, Methodology, Investigation, Funding acquisition. **Ho-Yin Chan:** Writing – original draft, Visualization, Validation, Formal analysis, Conceptualization. **Kaveri Medappa:** Writing – review & editing, Project administration, Methodology, Investigation. **A.C. Davidson:** Writing – review & editing, Methodology, Investigation, Funding acquisition. **Al James:** Writing – review & editing, Methodology, Investigation, Funding acquisition.

Endnotes

Note[1] To explore the relationship between job satisfaction and

wellbeing, we tested three models within our SEM framework: two unidirectional models and one bidirectional model. In the first unidirectional model (1a), where Satisfaction > Wellbeing, the path was positive and statistically significant ($p < 0.01$), indicating that higher job satisfaction is strongly associated with better health and wellbeing. In the second unidirectional model (1b), Wellbeing > Satisfaction also produced a positive, significant result ($p < 0.01$), suggesting that wellbeing may enhance job satisfaction. However, in the bidirectional model, only the Satisfaction > Wellbeing path remained significant ($p < 0.01$), while the reverse path did not reach statistical significance. This suggests that the influence of satisfaction on wellbeing is stronger and more robust in our data. Based on these findings, we retained only the Satisfaction > Wellbeing path in the final model reported here. Nonetheless, model specification in SEM should be guided by theoretical frameworks. Researchers focusing on the reverse relationship may still justify using model 1b, depending on their hypotheses and supporting literature. Determining true directionality would benefit from longitudinal data or dynamic modelling techniques, which were beyond the scope of the current study.

Note[2] MILCA models patterns in the data to estimate missing values, generating multiple imputed datasets to reflect uncertainty. We fitted a 3-class model using the poLCA package in R (Linzer and Lewis, 2011), identifying distinct response profiles across participants. Model quality was assessed using standard fit indices and entropy to ensure reliable classification. Based on each respondent's likelihood of belonging to a specific class, missing responses were imputed using class-specific probabilities. For sparse cases, especially those with little or no observed data, imputation was limited or highlighted as less reliable. In total, five imputed datasets were created, balancing accuracy and efficiency. The results from all five datasets showed consistent findings in the structural equation models (Table 3), supporting the robustness of the imputation approach.

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Data availability

Data will be made available on request.

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