

Determinants of Car Use Frequency in England: Evidence from Workplace Parking, Economic Conditions and Commuting Constraints

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Abstract

This dissertation examines the extent to which workplace parking, remote working, economic conditions and commuting constraints influence car use frequency in England. Using nationally representative data from Wave 12 of the Understanding Society survey, ordered logit models were estimated to identify the factors associated with variations in car use behaviour. The results indicate that workplace parking availability and perceived need for car access are the strongest predictors of frequent car use. Higher household income and greater area deprivation are also positively associated with car use frequency, while urban residents are less likely to report frequent car use. In contrast, remote working exhibits only a modest relationship with car use frequency. Overall, the findings suggest that car use is shaped primarily by workplace conditions, transport accessibility and economic circumstances. The results highlight the importance of combining parking policies with improvements in transport accessibility to reduce car dependence.

AI Statement

I acknowledge the use of generative AI in *drafting and code development* in this paper. However, the work reported remains my own.

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Introduction

Private vehicle travel remains the dominant mode of commuting in England, with 68% of workers travelling to work primarily by car in 2022 (Department for Transport, 2023). While the car provides flexibility and accessibility, high levels of car dependence contribute to congestion, environmental pressures and transport-related inequalities. Consequently, understanding the factors associated with car use has become increasingly important for both researchers and policymakers.

Previous research identifies workplace parking availability, income, transport accessibility and socio-demographic characteristics as important influences on travel behaviour. More recently, the growth of remote working has generated renewed interest in how changing work arrangements affect travel demand. However, much of the literature focuses on car ownership, mode choice or specific transport policies rather than the frequency of car use itself.

Accordingly, this dissertation examines the determinants of car use frequency in England, with particular attention to workplace parking, remote working, economic conditions and commuting constraints. The study addresses the following research question:

‘To what extent do workplace parking, remote working, economic conditions and commuting constraints affect car use frequency in England?’

Using nationally representative data from Wave 12 of the Understanding Society survey, the analysis employs ordered logit models to assess the relative importance of these factors in

explaining individual car use frequency. The following sections review the literature, outline the methodology, present the results and discuss the findings.

Literature Review

Context and Theoretical Framework

Private vehicle travel remains the dominant mode of commuting in England, with 68% of workers travelling to work primarily by car in 2022 (Department for Transport, 2023). This continued reliance on the car has led transport researchers and policymakers to examine the factors that influence commuting behaviour and the effectiveness of interventions designed to reduce car dependence. From a social practice perspective, commuting behaviour is shaped not only by individual preferences but also by habitual routines, social norms and the practical constraints of everyday life (Guell et al., 2012). In addition, Douglas et al. (2011) argue that patterns of car use are influenced by transport systems and built environments that reinforce car dependency, highlighting the importance of structural factors in shaping travel behaviour. Accordingly, understanding the factors associated with car use frequency is important for explaining travel behaviour and informing policies aimed at reducing reliance on private vehicle travel.

Workplace Parking and Commuting Policy

The ONS reported that approximately 68% of individuals in England used a car as their main mode of transport to work in 2022 (Department for Transport, 2023), highlighting the continued importance of private vehicle travel for commuting. Given the dominance of the car in work-related travel, workplace parking has attracted considerable attention within the transport literature as a determinant of commuting behaviour. Commuting generates substantial parking demand, making workplace parking an important element of parking policy (Bates and Leibling, 2012). Existing studies suggest that parking policy can meaningfully influence travel choices, with restrictions on parking availability and increases in parking costs associated with reductions in car use (Rye et al., 2023).

The literature generally argues that workplace parking affects commuting decisions by altering the relative cost and convenience of driving. Less convenient parking arrangements, including increased walking distances between parking facilities and workplaces or the introduction of parking charges, can discourage car use and encourage shifts towards alternative transport modes. Knott et al. (2019) found that introducing workplace parking was associated with an 11.4% increase in motor vehicle commuting and reductions in active and public transport use, highlighting the influence of parking availability on travel mode choice. Evidence from the Nottingham Workplace Parking Levy suggests that charging employers for workplace parking spaces can contribute to reduced congestion and support modal shift away from private vehicle use. Dale et al. (2017) found that a 1% reduction in employer-provided workplace parking in Nottingham was associated with a 0.55% reduction in traffic delay, providing empirical evidence that workplace parking levies can function as an effective transport demand management measure.

Russo, van Ommeren and Dimitropoulos (2019) argue that subsidised workplace parking encourages car ownership and car use by causing commuters to underestimate the true costs of driving. Consequently, workplace parking is not simply a neutral element of transport infrastructure but a factor that can influence travel behaviour and reinforce demand for car use.

However, the effectiveness of workplace parking policies may vary across locations. Rye et al. (2023) note that evidence supporting parking interventions is generally stronger in urban areas, where alternative transport options are more readily available. In contrast, the

effectiveness of such policies appears more limited in rural areas, where lower population density and reduced public transport accessibility may constrain individuals' ability to switch away from car travel.

Economic Determinants of Car Use

Car availability is strongly associated with household income, with only 44% of households in the lowest income quintile having access to two or more cars compared with substantially higher rates among higher-income households (Department for Transport, 2024). Evidence from Great Britain further suggests that income is an important determinant of travel demand, with higher-income individuals generally travelling greater distances and exhibiting higher levels of mobility (Dargay and Clark, 2012).

At the same time, lower-income households experience higher levels of non-car ownership, while limited transport options can restrict access to employment, education and essential services, thereby reinforcing transport inequalities (Lucas et al., 2019). Consequently, economic conditions influence not only the ability to own and operate a vehicle but also access to wider economic opportunities.

Overall, higher household incomes are generally associated with greater levels of car ownership and more frequent car use (Dargay, 2007). However, car ownership is not always a reflection of economic advantage. Mattioli et al. (2015) argues that some lower-income households experience 'forced car ownership', whereby inadequate public transport makes private vehicle use a necessity despite the associated financial burden. This suggests that

deprivation and transport disadvantage can also shape patterns of car use, particularly where alternatives to the car are limited (Lucas et al., 2019).

Transport Infrastructure and Commuting Constraints

London exhibits the lowest levels of car commuting in England, reflecting greater public transport accessibility and higher population density (Department for Transport, 2023). Consistent with this, van Kampen et al. (2022) suggest that residents of urban areas are generally less dependent on private vehicles because higher-density environments provide greater access to alternative transport modes and services.

Hiscock et al. (2002) argue that car ownership and use are often shaped by the need to access employment and essential services, particularly where public transport provision is limited, highlighting the importance of transport constraints in influencing travel decisions. Similarly, Panter et al. (2011) found that mode choice is determined by both individual characteristics and the wider transport environment, with factors such as access to a car, distance to work and the perceived convenience of alternative modes playing an important role. Despite policy efforts to encourage modal shift, dependence on the car for commuting remains substantial, with 40% of drivers reporting that they have no feasible alternative to driving to work (RAC, 2025). This suggests that structural constraints continue to limit the extent to which many individuals can substitute away from private vehicle travel.

Furthermore, the growth of remote working has also altered travel patterns by reducing the need for regular commuting. During the COVID-19 pandemic, working from home became an increasingly important determinant of travel demand and transport choices (Crowley et al.,

2020). More recent evidence suggests that higher levels of remote working have contributed to lower travel demand and reduced transport-related emissions, reflecting a broader shift in commuting practices following the pandemic (Shen et al., 2025).

Socio-Demographic Determinants

Socio-demographic characteristics have been widely identified as important determinants of travel behaviour, with factors such as age, household composition and life-course transitions influencing transport choices and levels of car use (Scheiner and Holz-Rau, 2014). Age has been found to shape mobility patterns through life-cycle effects, with changes in employment, family circumstances and residential location often altering commuting behaviour and reliance on the car (Dargay and Hanly, 2007). Evidence also suggests that transport patterns differ across age groups and between genders, with generational changes and evolving mobility preferences contributing to variations in private vehicle use (Cubells et al., 2020). Furthermore, gender differences in travel behaviour are closely linked to household structure and caring responsibilities, suggesting that household composition can influence both transport decisions and overall travel demand (Nobis and Lenz, 2005).

Gap in the Literature

Although previous research has identified workplace parking, economic conditions, transport accessibility and socio-demographic characteristics as important influences on travel behaviour, much of the literature focuses on car ownership, mode choice or specific policy interventions rather than the frequency of car use itself. Moreover, these factors are often examined in isolation, despite the likelihood that workplace conditions, economic circumstances and commuting constraints jointly shape patterns of car use. While studies of

interventions such as the Nottingham Workplace Parking Levy provide valuable insights into parking policy, there remains limited empirical research assessing the relative importance of workplace parking, remote working, economic factors and commuting constraints in explaining individual-level car use frequency in England. This study addresses this gap using nationally representative data from the Understanding Society survey.

Data & Methodology

Data Source and Sample Selection

This study uses data from Wave 12 of the Understanding Society survey (Institute for Social and Economic Research (ISER), University of Essex, n.d.) a large-scale, nationally representative longitudinal household dataset that provides a comprehensive picture of social and economic conditions across the UK. The dataset is well suited to this analysis because it contains detailed travel behaviour data alongside a range of socio-economic and demographic characteristics.

Wave 12 was selected because it captures travel behaviour during the post-pandemic period, when remote working became more prevalent. These variables were selected because work is a key determinant of travel demand, with commuting creating a derived demand that makes the workplace a primary destination (Ramos, Bergstad and Nässén, 2020). The data were cleaned in Stata through recoding, observation removal and variable standardisation. The final analytical dataset contained 7,906 observations. Subsequently, R was used for data preparation, descriptive analysis, estimation of the ordered logit models and robustness checks. Figures and visualisations presented throughout the dissertation were produced using both R and Microsoft Excel.

Variable Definition and Construction

Table 1: Definition and Expected Effects of Variables Used in the Analysis

Variable	Description	Measurement / Coding	Expected Effect
CarFrequency	Frequency of car use	Ordered scale: 0 = low, 1 = medium, 2 = high	Dependent Variable
WorkPark	Workplace parking availability	1 = parking available, 0 = otherwise	Positive
RemoteWorking	Frequency of remote working	Ordered scale: 0 = never, 1 = sometimes, 2 = always	Negative / Ambiguous
LnIncome	Logged household income	Natural logarithm of household income	Positive
Needcar	Perceived need for car access	Ordered scale: 0 = disagree, 1 = neutral, 2 = agree	Positive
DeprivationIndex	Area deprivation measure	Continuous deprivation index	Negative
Age	Respondent age	Age in years	Positive
HouseholdSize	Household size	Number of individuals in household	Ambiguous
Male	Gender dummy variable	1 = male, 0 = female	Ambiguous
UrbanArea	Urban residence dummy	1 = urban area, 0 = rural area	Negative

Source: Understanding Society Wave 12 dataset; author's calculations.

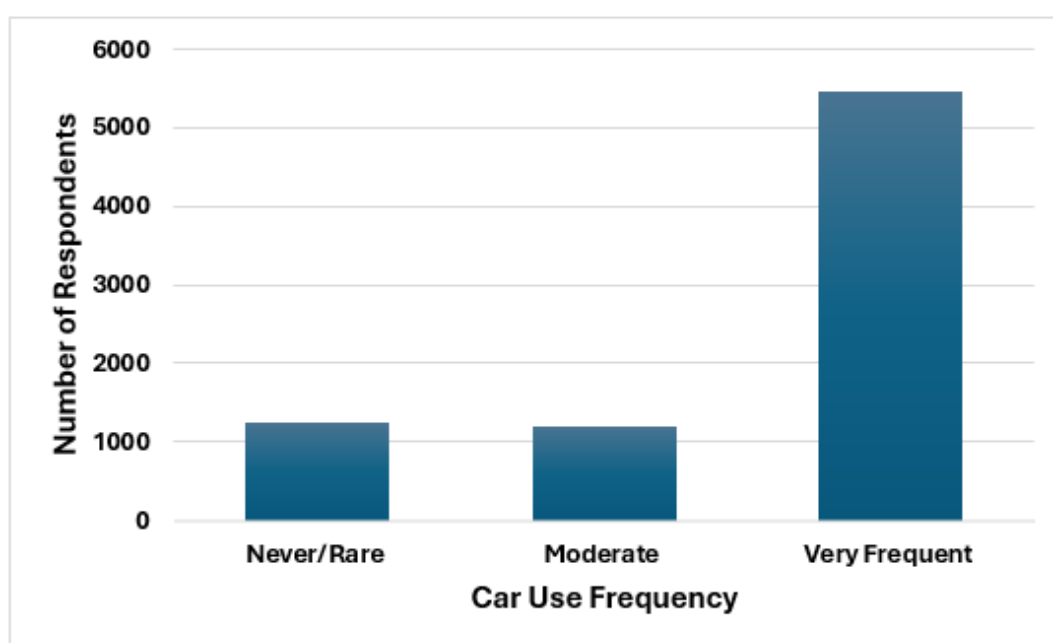
Table 1 outlines the variables used in this study and the way they are constructed.

CarFrequency serves as the dependent variable, while the explanatory variables capture workplace conditions, socioeconomic factors, transport-related needs, deprivation indicators and demographic characteristics.

Firstly, the main dependent variable, CarFrequency, was recoded into three categories to simplify the survey responses and create a more manageable structure for the regression analysis. The original variable was measured using an ordinal frequency response scale, consisting of categories ranging from 'Every day' to 'Never or almost never'. Hence, the variable was treated as ordinal because the response categories follow a clear ranking from

more frequent to less frequent car use, although the intervals between categories cannot be assumed to be equal. The scale also included non-substantive response options such as ‘Don’t know’, ‘Refusal’ and ‘Proxy response’. Recoding improved interpretability while preserving underlying frequency patterns. In Figure 1, the distribution of the recoded variable is concentrated in the ‘Very Frequent’ category, indicating that regular car use remains the dominant travel behaviour among respondents.

Figure 1: Distribution of Car Use Frequency

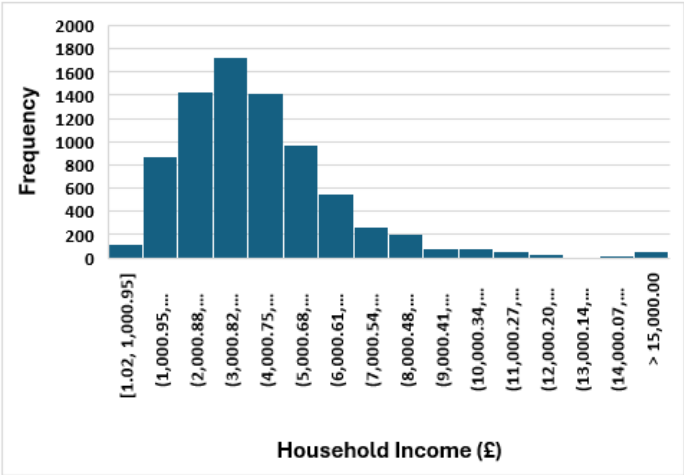


Source: Understanding Society Wave 12 dataset; author’s calculations.

Additionally, the main explanatory variables, WorkPark and RemoteWorking, were recoded to make the original categorical responses more suitable for regression analysis. WorkPark was converted into a dummy variable, while RemoteWorking was recategorised into three categories, enabling a clearer assessment of their relationship with CarFrequency and improving the interpretability of the regression results.

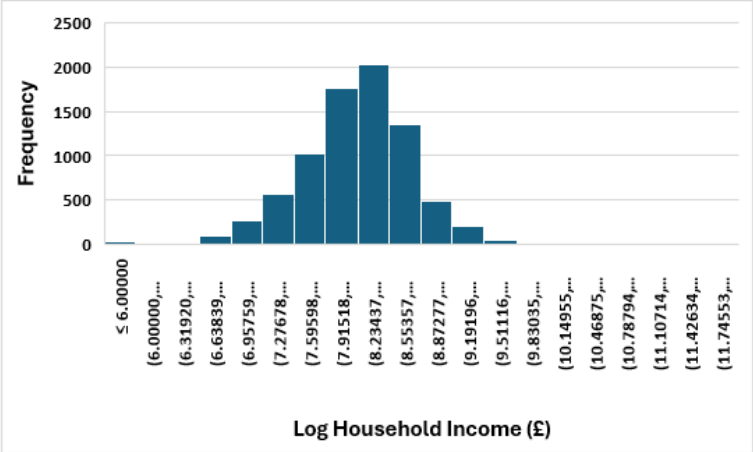
Furthermore, for the economic variables, the DeprivationIndex was retained as a continuous measure, although observations with invalid responses were removed from the dataset. The variable was restricted to its original quintile scale (1–5), representing areas from the least deprived to the most deprived 20% in England. In contrast, LnIncome was created by applying a logarithmic transformation to total household net income, as the original income distribution was highly skewed due to extreme outliers. Figures 2.1 and 2.2 show the log-transformed income variable exhibits a more balanced distribution. Although the mean and median appear low, this may reflect sample composition and income measurement, while also improving the suitability of LnIncome for regression analysis.

Figure 2.1: Distribution of Household Income



Source: Understanding Society Wave 12 dataset; author’s calculations.

Figure 2.2: Distribution of Log Household Income



Source: Understanding Society Wave 12 dataset; author’s calculations.

Finally, a range of socio-demographic and transport-related control variables were included to account for individual and household characteristics that may influence car use frequency. NeedCar was retained as an ordered variable measured on a three-point scale ranging from disagreement to agreement, capturing respondents' perceived necessity of having access to a car. Age was included as a continuous variable measured in years; however, the sample was restricted to respondents aged 17 and above, reflecting the legal driving age in England and

ensuring that the analysis focused on individuals with the potential to drive. HouseholdSize was measured as the total number of individuals residing within the household. Male was converted into a dummy variable, where 1 indicates a male respondent and 0 indicates a female respondent. Lastly, UrbanArea was included as a binary indicator of residential location, distinguishing between urban and rural areas. Retaining these variables in their original or appropriately recoded forms allowed the analysis to control for key demographic and contextual factors that may be associated with variations in CarFrequency.

Descriptive Statistics

Table 2: Summary Statistics

Variable	Min	Q1	Median	Mean	Q3	Max
Age	17.00	33.00	45.00	43.89	55.00	85.00
Income (£)	1.02	2727.94	3883.99	4363.06	5302.86	173638.00
LnIncome	0.0198	7.9113	8.2646	8.2236	8.5760	12.0647
Household Size	1.00	2.00	3.00	3.09	4.00	12.00
Deprivation Index	1.00	2.00	3.00	3.09	4.00	5.00
Male	0.00	0.00	0.00	0.46	1.00	1.00
Urban Area	0.00	1.00	1.00	0.80	1.00	1.00
Need Car	0.00	2.00	2.00	1.61	2.00	2.00
Remote Working	0.00	0.00	0.00	0.43	1.00	2.00
WorkPark	0.00	1.00	1.00	0.90	1.00	1.00
Car Frequency	0.00	1.00	2.00	1.53	2.00	2.00

Source: Understanding Society Wave 12 dataset; author's calculations.

Table 2 presents descriptive statistics for the analytical sample. Respondents had an average age of 43.9 years and lived in households comprising approximately 3.1 individuals. Mean logged household income was 8.22, while the average deprivation score was 3.09. Male

respondents accounted for 46% of the sample and approximately 80% resided in urban areas.

The travel-related variables suggest relatively high levels of car dependence. Workplace parking was available to around 90% of respondents, while the average perceived need for car access was 1.61 on a three-point scale. Remote working was less common, with a mean value of 0.43, indicating that most respondents worked primarily on-site. The mean value of CarFrequency was 1.53, suggesting that moderate to frequent car use was common among respondents.

Econometric Model Specification

The primary objective of this study is to examine the factors associated with variations in car use frequency in England. Since the dependent variable, CarFrequency, is measured as an ordered categorical variable consisting of three categories (low, moderate and high car use), an ordered logit model was employed. While the categories of car use frequency follow a clear ranking, the difference between adjacent categories is not directly observable. Consequently, an ordered logit model provides a more appropriate framework for analysing variations in car use frequency (Wooldridge, 2020).

The baseline model estimates the likelihood that an individual falls into a higher category of car use frequency as a function of workplace conditions, socioeconomic characteristics and demographic controls. The specification is given by the ordered logit model:

$$\text{CarFrequency}_i = \beta_0 + \beta_1 \text{WorkPark}_i + \beta_2 \text{RemoteWorking}_i + \beta_3 \text{LnIncome}_i + \beta_4 \text{NeedCar}_i + \beta_5 \text{DeprivationIndex}_i + \beta_6 \text{Age}_i + \beta_7 \text{HouseholdSize}_i + \beta_8 \text{Male}_i + \beta_9 \text{UrbanArea}_i + \varepsilon_i$$

where CarFrequency_i represents the observed level of car use frequency for individual i . The explanatory variables capture workplace parking availability, remote working status, household income, perceived need for car access, deprivation, age, household size, gender and urban or rural residential location. These variables were included based on the key determinants of car use identified in the Literature Review. In addition, the error term, ε_i , captures omitted factors affecting car use frequency that are not captured by the explanatory variables included in the model.

Accordingly, the estimated coefficients indicate the direction of the relationship between each explanatory variable and car use frequency. Positive coefficients imply a greater likelihood of belonging to a higher car use category, while negative coefficients imply a lower likelihood. Statistical significance is assessed using robust standard errors and conventional significance levels of 1%, 5% and 10%.

Pairwise correlations among the explanatory variables are presented in Appendix Figure A1. The generally low correlation coefficients suggest that multicollinearity is unlikely to pose a significant concern for the estimated models.

Robustness Checks

To assess the robustness of the baseline ordered logit estimates, two additional model specifications were estimated. The first introduced a centred age term and its square to

account for the possibility of a non-linear relationship between age and car use frequency. However, age was centred prior to squaring to reduce multicollinearity between the linear and quadratic terms and improve coefficient estimation. Travel behaviour is likely to vary across different stages of the life cycle, with car use potentially increasing throughout the working age before declining at older ages as retirement reduces the need for regular commuting. Therefore, a quadratic specification allows the effect of age on car use frequency to vary across the age distribution rather than assuming a constant relationship. Furthermore, the second robustness check incorporated interaction terms between workplace parking availability and deprivation categories to examine whether the relationship between workplace parking and car use frequency differs across socio-economic groups. This specification allows the effect of workplace parking to vary according to levels of deprivation rather than assuming a uniform relationship across all respondents. Together, these additional specifications provide a means of evaluating whether the main findings are sensitive to alternative model assumptions and variable relationships.

Results

Descriptive Patterns in Car Use Frequency

As reported in Table 2, the sample is characterised by relatively high levels of car dependence, with a mean car use frequency of 1.53 and workplace parking available to approximately 90% of respondents. Building on these summary statistics, Figures 3 and 4 provide a descriptive overview of how car use frequency varies across workplace parking and remote working categories.

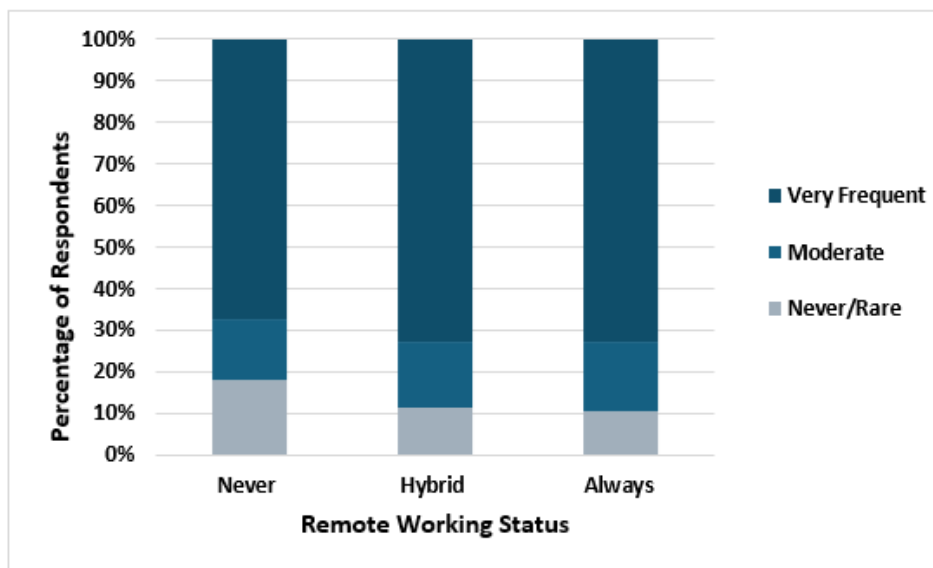
Figure 3: Average Car Use Frequency by Workplace Parking Availability



Source: Understanding Society Wave 12 dataset; author's calculations.

Figure 3 presents average car use frequency by workplace parking availability. Respondents with access to workplace parking reported substantially higher levels of car use than those without parking facilities. The average car use frequency among individuals with workplace parking was approximately 1.56, compared with around 1.25 for those without. This difference suggests that access to workplace parking is associated with more frequent car use and may encourage greater reliance on private vehicle travel. While Figure 3 cannot establish causality, it provides an initial indication that workplace parking availability may play an important role in shaping travel behaviour.

Figure 4: Car Use Frequency by Remote Working Status



Source: Understanding Society Wave 12 dataset; author's calculations.

Figure 4 illustrates the distribution of car use frequency across remote working categories. Across all groups, the majority of respondents were classified as very frequent car users, highlighting the overall prevalence of car use within the sample. Some variation is nevertheless evident between categories. Individuals who reported always working remotely exhibited a slightly lower proportion of infrequent car users and a marginally higher proportion of frequent car users than those who never worked remotely. However, the differences between groups remain relatively small, suggesting that the relationship between remote working and car use frequency is less prominent than that observed for workplace parking availability.

Taken together, these findings provide preliminary evidence of differences in car use behaviour across workplace parking and remote working categories. The extent to which these relationships persist after controlling for other socioeconomic and demographic characteristics is examined in the multivariate regression analysis that follows.

Baseline Ordered Logit Results

Table 3 presents the baseline ordered logit estimates examining the factors associated with car use frequency.

Table 3: Ordered Logit Regression Estimates of Car Use Frequency

<i>Variable</i>	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-value</i>
<i>WorkPark</i>	0.5146	0.0762	6.7552
<i>RemoteWorking</i>	0.0718	0.0388	1.8479
<i>LnIncome</i>	0.1949	0.0486	4.0103
<i>Needcar</i>	0.8808	0.0317	27.7614
<i>DeprivationIndex</i>	0.1287	0.0193	6.6660
<i>Age</i>	0.0220	0.0019	11.4550
<i>HouseholdSize</i>	-0.0710	0.0208	-3.4158
<i>Male</i>	0.0415	0.0515	0.8059
<i>UrbanArea</i>	-0.2073	0.0727	-2.8519

Threshold Parameters

<i>Threshold</i>	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-value</i>
<i>0/1</i>	2.5411	0.3952	6.4301
<i>1/2</i>	3.5672	0.3962	9.0030

Model Statistics

<i>Statistic</i>	<i>Value</i>
<i>Residual Deviance</i>	11771.47
<i>AIC</i>	11793.47
<i>Observations</i>	7,906

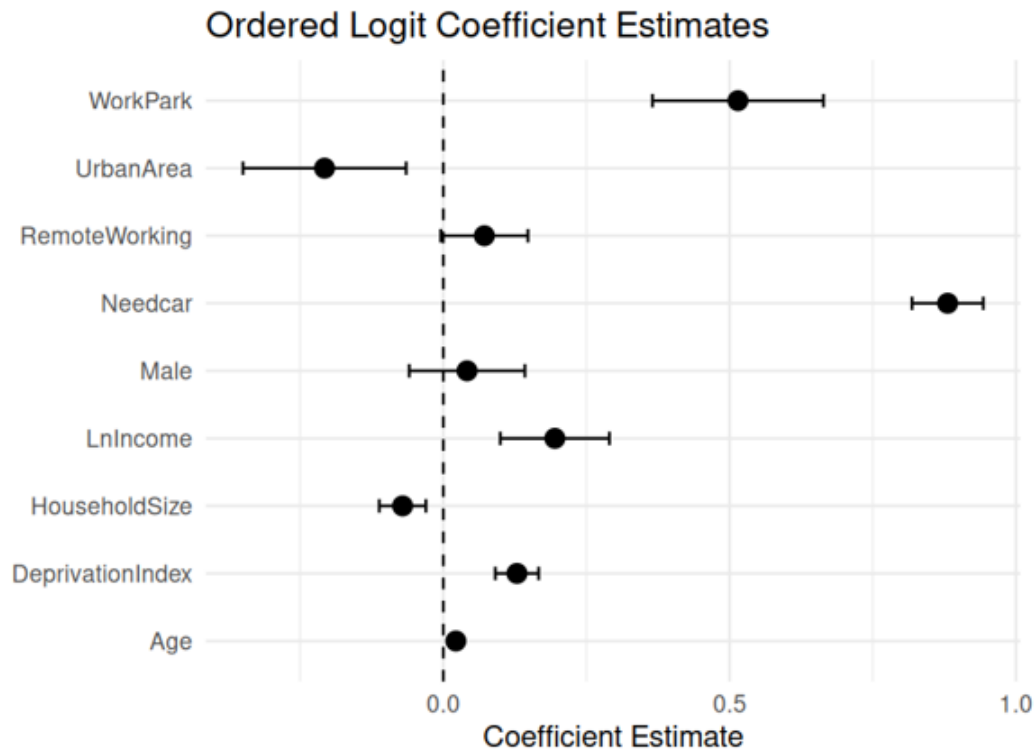
Source: Understanding Society Wave 12 dataset; author's calculations.

Among the explanatory variables, NeedCar exhibits the strongest relationship with car use frequency ($\beta = 0.881$). Respondents who perceive access to a car as necessary are substantially more likely to belong to higher car use categories, highlighting the importance of perceived transport dependence in shaping travel behaviour. WorkPark also displays a large positive coefficient ($\beta = 0.515$), indicating that access to workplace parking is associated with more frequent car use. Hence, this finding is consistent with the descriptive patterns presented in Figure 3 and suggests that workplace parking remains an important factor influencing travel choices.

Moreover, the economic variables are likewise significant. LnIncome is positively associated with car use frequency ($\beta = 0.195$), suggesting that individuals in higher-income households are more likely to be frequent car users. Similarly, DeprivationIndex remains positive ($\beta = 0.129$), indicating higher levels of car use among respondents living in more deprived areas. While both variables are statistically significant, their effects are considerably smaller than those observed for NeedCar and WorkPark.

Several demographic and contextual characteristics also contribute to explaining differences in car use frequency. Age is positively associated with car use, whereas HouseholdSize exhibits a negative relationship. UrbanArea likewise displays a negative coefficient ($\beta = -0.207$), suggesting that respondents residing in urban areas are less likely to belong to higher car use categories than those living in rural locations. By contrast, Male remains statistically insignificant, providing little evidence of systematic gender differences in car use behaviour. RemoteWorking is significant only at the 10% level and its effect remains relatively small.

Figure 5: Determinants of Car Use Frequency: Ordered Logit Coefficient Estimates



*Note: Points represent ordered logit coefficient estimates; horizontal lines indicate 95% confidence intervals.
Source: Understanding Society Wave 12 dataset; author's calculations.*

Figure 5 shows the estimated coefficients and confidence intervals. NeedCar and WorkPark exhibit the strongest positive associations with car use frequency, while UrbanArea exhibits the strongest negative association.

Robustness Checks

To evaluate the robustness of the baseline findings, a quadratic age specification, a parking–deprivation interaction model and a likelihood ratio test were estimated.

Quadratic Age Specification

Table 3.1: Ordered Logit Regression Results and Quadratic Age Robustness Check

<i>Variables</i>	<i>Main Model (1)</i>	<i>Quadratic Age Specification (2)</i>
Workplace Parking	0.515*** (0.076)	0.514*** (0.076)
Remote Working	0.072* (0.039)	0.063 (0.039)
Log Income	0.195*** (0.049)	0.199*** (0.049)
Need Car	0.881*** (0.032)	0.875*** (0.032)
Deprivation Index	0.129*** (0.019)	0.129*** (0.019)
Age	0.022*** (0.002)	
Age (centred)		0.021*** (0.002)
Age²		-0.0002* (0.0001)
Household Size	-0.071*** (0.021)	-0.075*** (0.021)
Male	0.042 (0.052)	0.041 (0.052)
Urban Area	-0.207*** (0.073)	-0.212*** (0.073)
Observations	7,906	7,906

*Notes: Column (2) includes a centred age term and its square to account for potential non-linear age effects while reducing multicollinearity. Standard errors are reported in parentheses. Significance levels: * $p < 0.1$, * $p < 0.05$, *** $p < 0.01$. **

Source: Understanding Society Wave 12 dataset; author's calculations.

Table 3.1 compares the baseline model with the centred quadratic age specification. The results are largely unchanged. WorkPark remains positive and highly significant, with the coefficient changing only marginally from 0.515 to 0.514. Likewise, NeedCar continues to exhibit the largest positive coefficient ($\beta = 0.875$), while LnIncome and DeprivationIndex remain positively associated with car use frequency. HouseholdSize and UrbanArea also retain their negative and significant effects.

The centred age term remains positive, while Age^2 is negative and significant at the 10% level, providing some evidence of a non-linear relationship between age and car use frequency. However, the effect is small and has little influence on the remaining coefficients. One notable difference is that RemoteWorking loses statistical significance once the quadratic age terms are introduced, suggesting that its relationship with car use frequency is less robust than that observed for the other explanatory variables. Overall, the principal findings remain unchanged.

Parking–Deprivation Interaction Specification

Table 3.2: Ordered Logit Regression Results and Parking–Deprivation Interaction Robustness Check

<i>Variable</i>	<i>Baseline Model (1)</i>	<i>Parking–Deprivation Interaction (2)</i>
WorkPark	0.515*** (0.076)	0.418** (0.177)
DeprivationIndex2		-0.168 (0.220)
DeprivationIndex3		0.067 (0.225)
DeprivationIndex4		0.386 (0.235)
DeprivationIndex5		0.284 (0.227)
RemoteWorking	0.072* (0.039)	0.073* (0.039)
LnIncome	0.195*** (0.049)	0.198*** (0.049)
Needcar	0.881*** (0.032)	0.880*** (0.032)
DeprivationIndex	0.129*** (0.019)	
Age	0.022*** (0.002)	0.022*** (0.002)
HouseholdSize	-0.071*** (0.021)	-0.071*** (0.021)
Male	0.042 (0.052)	0.043 (0.052)
UrbanArea	-0.207*** (0.073)	-0.206*** (0.073)
WorkPark:DeprivationIndex2		0.152 (0.235)
WorkPark:DeprivationIndex3		0.103 (0.240)
WorkPark:DeprivationIndex4		0.037 (0.251)
WorkPark:DeprivationIndex5		0.146 (0.243)
Observations	7,906	7,906

*Notes: Column (2) includes interaction terms between work parking availability and deprivation categories to examine heterogeneous socioeconomic effects. Standard errors are reported in parentheses. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.*

Source: Understanding Society Wave 12 dataset; author's calculations.

Table 3.2 reports the interaction model examining whether the relationship between WorkPark and car use frequency varies across deprivation categories. The baseline estimates

remain broadly stable. NeedCar continues to exhibit the largest positive coefficient, while LnIncome, Age and DeprivationIndex remain positively associated with car use frequency. HouseholdSize and UrbanArea also retain their negative relationships.

Although the coefficient on WorkPark falls from 0.515 to 0.418, it remains statistically significant. None of the interaction terms are statistically significant, suggesting that the association between workplace parking availability and car use frequency does not vary substantially across deprivation groups. Consequently, there is little evidence that deprivation moderates the effect of workplace parking on car use frequency.

Likelihood Ratio Test

Table 3.3: Likelihood Ratio Test for Ordered Logit Models

<i>Model</i>	<i>Residual df</i>	<i>Residual Deviance</i>	<i>LR Test</i>	<i>df</i>	<i>LR Statistic</i>	<i>p-value</i>
<i>Model 1: Reduced Model</i>	7897	11817.49				
<i>Model 2: Full Model</i>	7895	11771.47	1 vs 2	2	46.02	1.02×10^{-10}

Notes: Model 1 excludes workplace parking and remote working variables. Model 2 includes all explanatory variables. The likelihood ratio test compares the fit of the two ordered logit models.

Source: Understanding Society Wave 12 dataset; author's calculations.

Table 3.3 presents the likelihood ratio test comparing the full model with a restricted specification excluding WorkPark and RemoteWorking. Residual deviance falls from 11,817.49 to 11,771.47, while the likelihood ratio statistic of 46.02 is statistically significant. The null hypothesis that WorkPark and RemoteWorking jointly have no explanatory power is therefore rejected, indicating that the inclusion of both variables significantly improves model

fit. Full coefficient estimates for the robustness specifications are reported in Appendix Tables A1 and A2.

Taken together, the robustness checks provide additional support for the baseline findings.

Across all specifications, the direction, magnitude and statistical significance of the principal coefficients remain broadly unchanged. NeedCar and WorkPark consistently emerge as the strongest predictors of car use frequency, suggesting that the main conclusions are not driven by alternative modelling assumptions.

Discussion

Interpretation of Findings

This study examined the determinants of car use frequency in England. The findings indicate that workplace parking availability and perceived need for car access are the strongest predictors of frequent car use, while remote working exhibits a comparatively weaker relationship.

The positive relationship between workplace parking availability and car use frequency supports previous research suggesting that parking influences travel behaviour by altering the relative cost and convenience of driving. Consistent with Rye et al. (2023), Knott et al. (2019) and Dale et al. (2017), respondents with access to workplace parking were more likely to report frequent car use. This finding reinforces the argument that employer-provided parking can function as an implicit subsidy for driving by reducing the perceived costs of commuting (Russo, van Ommeren and Dimitropoulos, 2019). However, the relationship should be interpreted cautiously. Workplace parking may also proxy wider workplace-related characteristics, such as job location and accessibility, rather than reflecting the effect of parking provision alone. Furthermore, evidence suggests that parking restrictions are less effective where public transport alternatives are limited, implying that parking policy may be most influential when accompanied by accessibility-enhancing transport improvements (Titheridge and Hall, 2006).

NeedCar emerged as the strongest predictor of car use frequency, highlighting the importance of transport constraints in shaping travel behaviour. This finding is consistent

with Hiscock et al. (2002) and Panter et al. (2011), who argue that car dependence is often driven by the need to access employment and essential services where alternative transport options are insufficient. Nevertheless, NeedCar captures a subjective perception rather than an objective measure of accessibility. Consequently, the large coefficient may partly reflect attitudes towards car dependence as well as genuine transport constraints, suggesting that behavioural and structural factors jointly shape travel decisions.

The positive effects of income and deprivation demonstrate the continued importance of economic conditions in explaining travel behaviour. Consistent with Dargay (2007) and Dargay and Clark (2012), higher-income individuals were more likely to engage in frequent car use, reflecting the greater affordability of vehicle ownership and travel. However, the positive relationship between deprivation and car use appears less intuitive. Rather than indicating greater transport advantage, this finding may reflect forms of transport disadvantage identified by Mattioli et al. (2015) and Lucas et al. (2019), whereby individuals remain dependent on private vehicles because alternative transport options are limited. This interpretation suggests that car use may, in some cases, reflect necessity rather than preference.

Contrary to expectations, remote working exhibited only a modest relationship with car use frequency and became statistically insignificant in one robustness specification. This contrasts with studies highlighting remote working as an important contributor to reduced travel demand and transport emissions (Crowley et al., 2020; Shen et al., 2025). One explanation is that while remote working reduces commuting journeys, it does not

necessarily reduce overall car travel, as commuting trips may be replaced by shopping, leisure or household-related journeys. The findings therefore suggest that the long-term effect of remote working on car dependence may be weaker than early post-pandemic expectations implied.

Finally, respondents living in urban areas were less likely to report frequent car use, supporting evidence that higher-density environments provide greater access to public transport and alternative travel options (van Kampen et al., 2022). This finding is consistent with research showing that urban transport systems and workplace locations can reduce dependence on private vehicles by improving accessibility and providing viable alternatives to driving (Douglas et al., 2011; Næss, Tønnesen and Wolday, 2019). However, UrbanArea may capture differences in transport accessibility rather than location itself, suggesting that access to alternative transport is the primary mechanism underlying lower levels of car use.

Policy & Practical Implications

The findings suggest that workplace parking availability remains an important policy lever for influencing travel behaviour. The strong positive association between workplace parking and car use frequency supports the argument that employer-provided parking functions as an implicit subsidy to driving by reducing the perceived cost of commuting (Russo, van Ommeren and Dimitropoulos, 2019). Consequently, policies such as workplace parking levies, parking charges and restrictions on employer-provided parking may help reduce car dependence and congestion. Evidence from the Nottingham Workplace Parking Levy demonstrates that parking interventions can encourage shifts towards alternative modes and

contribute to wider transport objectives (Dale et al., 2017). However, their effectiveness is likely to depend on local transport conditions. Where public transport alternatives are limited, parking restrictions may impose greater costs on commuters without substantially reducing car use.

Accordingly, policies designed to discourage driving are likely to be most effective when accompanied by improvements in public transport accessibility, reliability and connectivity. This is consistent with Hiscock et al. (2002) and Panter et al. (2011), who emphasise the role of accessibility constraints in shaping travel behaviour. Similarly, Lucas et al. (2019) argues that inadequate transport alternatives can reinforce transport disadvantage and limit behavioural responses to policy interventions.

The findings also highlight potential tensions between environmental and equity objectives. Reducing car use may contribute to lower congestion, emissions and progress towards wider sustainability goals (Douglas et al., 2011). However, the positive relationship between deprivation and car use suggests that some households remain dependent on private vehicles despite financial constraints, reflecting broader concerns regarding transport disadvantage (Mattioli et al., 2015; Lucas et al., 2019). Policies that increase the cost of driving without improving transport alternatives may therefore disproportionately affect already disadvantaged groups.

Finally, the weak effect of RemoteWorking suggests that it should not be viewed as a standalone solution to reducing car dependence. Although remote working may reduce

commuting journeys, these may be replaced by discretionary and household-related travel, meaning that lower commuting does not necessarily reduce overall vehicle use (Speroni and Taylor, 2023; Crowley et al., 2020). This may explain why RemoteWorking exhibited only a modest effect within the model, suggesting that remote working is most effective when combined with broader transport and land-use policies.

Limitations & Future Research

Several limitations should be acknowledged when interpreting the findings. First, the analysis is based on cross-sectional survey data, which limits the ability to make causal inferences. While significant associations are identified, the results do not demonstrate that the explanatory variables directly cause changes in car use frequency.

Second, the study relies on self-reported measures of travel behaviour. Consequently, responses may be affected by recall bias or reporting inaccuracies. In addition, workplace parking availability may capture broader workplace characteristics that are not fully observed within the dataset, raising the possibility of omitted variable bias.

Third, although the analysis incorporates measures of transport dependence and residential location, it does not include detailed indicators of transport accessibility, service quality or commuting distance. As a result, some aspects of commuting constraints may not be fully captured.

Future research could address these limitations by using longitudinal data to examine how changes in workplace parking availability, remote working and economic circumstances influence car use over time. The longitudinal structure of Understanding Society may support future panel-based analyses that strengthen causal inference. Incorporating more detailed measures of transport accessibility, commuting distance and local transport provision could also help identify the mechanisms underlying car dependence and provide a more comprehensive understanding of car use behaviour in England. Future studies may further examine the environmental consequences of frequent car use, particularly in relation to transport emissions and sustainable mobility transitions.

Conclusion

This dissertation set out to examine the extent to which workplace parking, remote working, economic conditions and commuting constraints influence car use frequency in England.

Using nationally representative data from Wave 12 of the Understanding Society survey and an ordered logit modelling framework, the findings demonstrate that workplace parking availability and perceived need for car access are the strongest determinants of frequent car use. Income, deprivation and residential location also play a significant role, while the effect of remote working appears considerably weaker than initially expected.

The results suggest that patterns of car use are shaped by a combination of economic incentives, transport accessibility and structural constraints rather than individual preferences alone. In particular, the strong association between workplace parking and frequent car use supports the view that employer-provided parking lowers the effective cost of driving and can encourage greater reliance on private vehicles. Similarly, the importance of NeedCar indicates that many individuals continue to depend on cars because alternative transport options do not adequately meet their daily mobility requirements. These findings reinforce the argument that car dependence is often embedded within wider transport systems and commuting structures.

From a policy perspective, the results suggest that measures aimed at reducing car use are unlikely to be successful if they focus solely on discouraging driving. While workplace parking policies may help reduce car dependence, they are likely to be most effective when combined with improvements in public transport accessibility and connectivity. The findings also highlight the need to balance environmental objectives with concerns regarding transport

disadvantage, particularly for individuals living in areas where viable alternatives to the car remain limited.

Several limitations should be acknowledged. The cross-sectional nature of the data prevents causal inference, while self-reported measures of travel behaviour may be subject to reporting bias. Furthermore, the analysis cannot fully capture factors such as commuting distance, local transport provision or workplace-specific characteristics. Future research could address these limitations through longitudinal analysis and more detailed measures of transport accessibility and travel behaviour.

Overall, this study provides evidence that workplace incentives, economic circumstances and commuting constraints remain central to understanding car use frequency in England. Despite growing interest in remote working and changing travel practices following the COVID-19 pandemic, the findings suggest that transport accessibility and workplace conditions continue to play a more influential role in shaping everyday car use behaviour.

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Appendix A

Appendix Table A1: Ordered Logit Model with Centred Quadratic Age Specification

<i>Variable</i>	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-value</i>
<i>Workplace Parking</i>	0.5142	0.0762	6.7476
<i>Remote Working</i>	0.0633	0.0391	1.6170
<i>Log Income</i>	0.1989	0.0486	4.0910
<i>Need Car</i>	0.8754	0.0319	27.4575
<i>Deprivation Index</i>	0.1291	0.0193	6.6824
<i>Age (centred)</i>	0.0211	0.0020	10.5806
<i>Age²</i>	-0.000227	0.000136	-1.6708
<i>Household Size</i>	-0.0753	0.0210	-3.5914
<i>Male</i>	0.0411	0.0516	0.7974
<i>Urban Area</i>	-0.2122	0.0728	-2.9162

Threshold Parameters

<i>Threshold</i>	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-value</i>
<i>0/1</i>	1.5375	0.3855	3.9883
<i>1/2</i>	2.5641	0.3862	6.6389

Model Statistics

<i>Statistic</i>	<i>Value</i>
<i>Residual Deviance</i>	11768.69
<i>AIC</i>	11792.69

Notes: The model includes a centred age term and its square to account for potential non-linear age effects while reducing multicollinearity. Standard errors are reported in parentheses.

Source: Understanding Society Wave 12 dataset; author's calculations.

Appendix Table A2: Ordered Logit Model with WorkPark–Deprivation Interaction Specification

<i>Variable</i>	<i>Value</i>	<i>Std. Error</i>	<i>t value</i>
<i>WorkPark</i>	0.41779	0.177353	2.3557
<i>DeprivationIndex2</i>	-0.16841	0.219840	-0.7660
<i>DeprivationIndex3</i>	0.06747	0.224536	0.3005
<i>DeprivationIndex4</i>	0.38624	0.235002	1.6436
<i>DeprivationIndex5</i>	0.28353	0.226786	1.2502
<i>RemoteWorking</i>	0.07291	0.038849	1.8768
<i>LnIncome</i>	0.19788	0.048701	4.0632
<i>Needcar</i>	0.87966	0.031760	27.6976
<i>Age</i>	0.02215	0.001926	11.4978
<i>HouseholdSize</i>	-0.07112	0.020831	-3.4139
<i>Male</i>	0.04336	0.051566	0.8408
<i>UrbanArea</i>	-0.20598	0.073199	-2.8140
<i>WorkPark:DeprivationIndex2</i>	0.15194	0.235189	0.6460
<i>WorkPark:DeprivationIndex3</i>	0.10267	0.239942	0.4279
<i>WorkPark:DeprivationIndex4</i>	0.03680	0.250706	0.1468
<i>WorkPark:DeprivationIndex5</i>	0.14578	0.242761	0.6005

Intercepts

<i>Intercept</i>	<i>Value</i>	<i>Std. Error</i>	<i>t value</i>
<i>0/1</i>	2.2868	0.4211	5.4310
<i>1/2</i>	3.3138	0.4220	7.8531

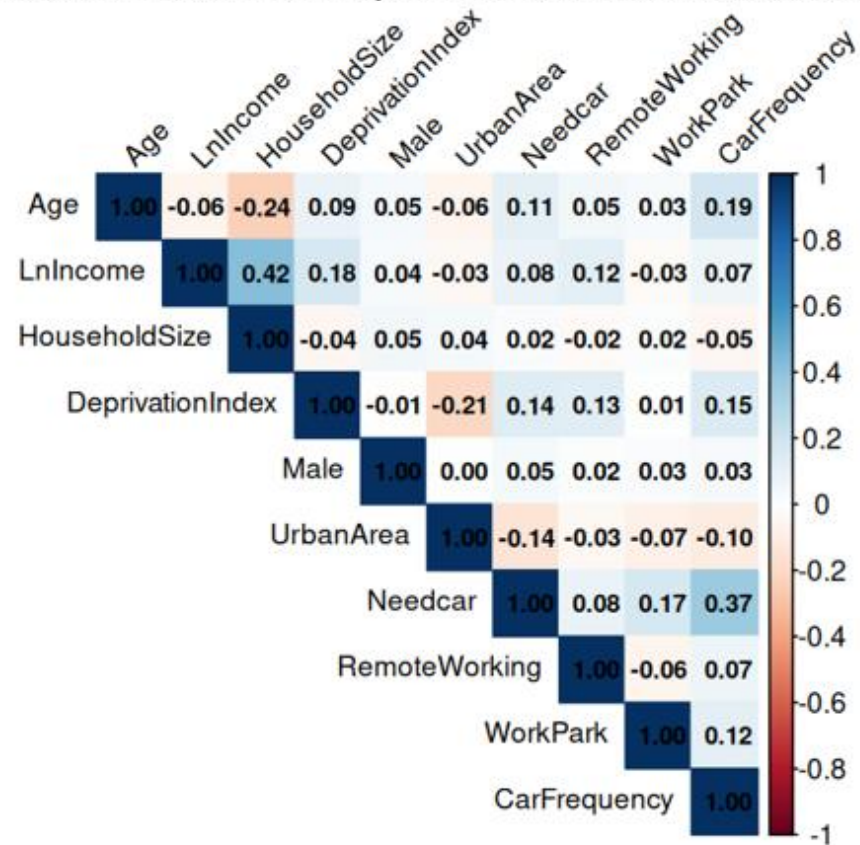
Model Fit Statistics

<i>Statistic</i>	<i>Value</i>
<i>Residual Deviance</i>	11762.62
<i>AIC</i>	11798.62

Notes: Ordered logit estimates reported with standard errors in parentheses. DeprivationIndex1 is the omitted reference category. Interaction terms capture the joint effect of work parking availability and deprivation status. Lower AIC values indicate improved model fit.

Source: Understanding Society Wave 12 dataset; author's calculations.

Appendix Figure A1: Correlation Heatmap of Variables Used in the Ordered Logit Model



Note: Values represent Pearson correlation coefficients.

Source: Understanding Society Wave 12 dataset; author's calculations.