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Commuting in Flux

The Roles of Place and Personal Circumstance in Shaping Behavioural Plasticity

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Motivation and Theoretical Background

A Personal Anecdote

- (Nearly) Two years ago, I moved to the Netherlands, prior to which, I had not ridden a bike in maybe 10-15 years. Now, I ride a bike every single day.

- What were the factors that prompted this sudden shift?
  - Built Environments?
  - A Major Life Event Disrupting Old (And Creating New) Habits?
  - “Because Everyone Else Is Doing It”

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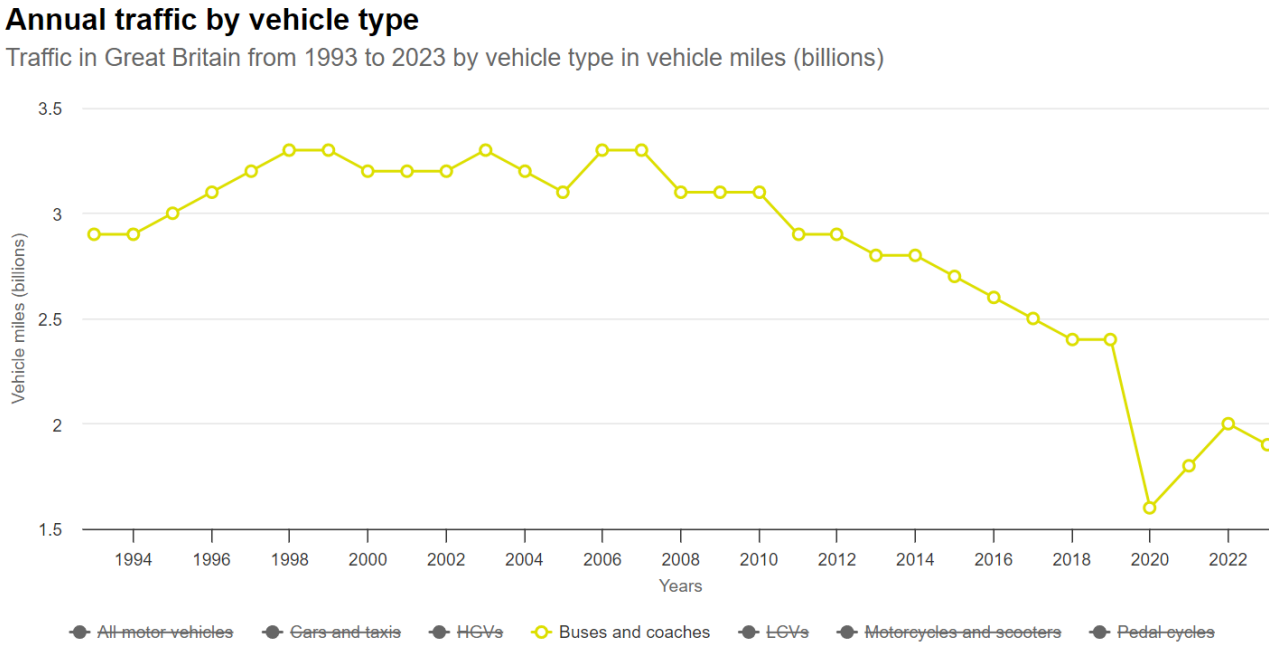
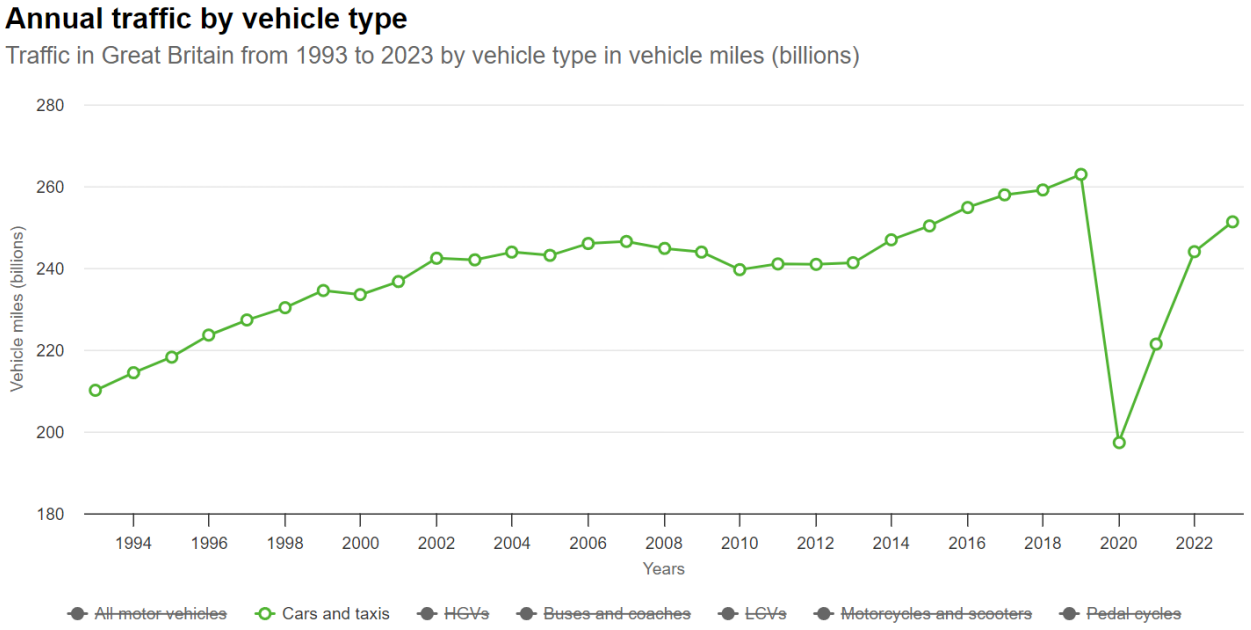
A Policy Interlude

- Understanding the determinants of travel behaviours is high on global policymaking agendas.
  - Transport accounted for 26% of all domestic emissions in 2021.





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Theoretical Background: Static Foundations

- Commute seen as a **constrained utility-maximizing** choice (time, money, convenience).
  - Costs dominate utility: **commuting as derived demand**, not intrinsically valued.
- **Explicit costs** (e.g., fares, fuel) and **implicit costs** (e.g., time, comfort, safety) vary across space and time.
- **Local spatial structure** shapes feasible and attractive modes; path dependence develops through sunk costs (e.g., housing, vehicles).
- **Habitual behaviours** emerge due to **bounded rationality**, satisficing, and status quo bias.
  - Result: commuting choices are stable, **not always actively optimized**.

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Theoretical Background: Dynamic Foundations

- Travel behaviours evolve via **learning, life events**, and **environmental change**.
- **Disruptions** (e.g., job changes, parenthood, relocations) create windows for **partial re-optimization**.
  - Behaviour is path-dependent but **plastic during transitions**.
- **Self-selection and sorting** complicate causal inference—people choose neighbourhoods aligned with preferences.
- Spatial and behavioural patterns shaped by **interplay of preferences, constraints**, and **attitudes**.
  - Empirical challenge: disentangling **endogenous sorting** from **exogenous impacts**.

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Where Are We Then?

- **My focus:**
  - How residential relocations affect **commute mode switching** in the UK.
  - Decompose the role of **local spatial structures vs. life-course dynamics** in shaping behaviour.
- **Core contribution:**
  - Move beyond cross-sectional and attitudinal models by using **longitudinal data** and a **causal identification strategy**.
- Address key gaps:
  - Distinguish **cause vs. selection**,
  - Account for **spatial and temporal nuance**,
  - Identify **when and for whom** change is most likely.

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Design, Data, and Definitions

The Strategy

- Relocations disrupt existing habits and routines, while also changing the characteristics of local built environments and activity spaces.
    - Windows of opportunity for behavioural reassessment.

- Control for selection and sorting mechanisms – the prominent sources of endogeneity underscoring the relationship linking who we are and where we live to how we travel.

- Isolate the direct effect of relocating on the probability of changing behaviour to infer the relative importance of changing local spatial structures and life circumstance.

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The Method

- Pre-treatment event-study regression design:
  - Y_{it}: The probability of switching commute mode.
  - βX_{it}: A vector of individual-specific, time-varying, covariates.
  - βZ_{lt}: A vector of LSOA-specific (l), time-varying covariates.
  - γ_i: individual-level fixed effects.
  - $\tau_p \delta_t$: region-year fixed effects.

$$Y_{it} = \sum_{k<0} \beta_k D_{it}^{(k)} + \beta_0 D_{it}^{(0)} + \beta X_{it} + \beta Z_{lt} + \gamma_i + \tau_p \delta_t + \epsilon_{it}$$

Endogeneity Is Everywhere

- Reasons for moving:
  - If travel-related preferences shape residential choices (i.e., self-selection), then conditioning on reasons for moving should mitigate any selection-induced omitted variable bias.

- The type of place people move to:
  - Macro-level heterogeneity (i.e., place-specific structures, policies, and contexts) might otherwise bias the estimated impact of relocation on commuting behaviour.

Justifying The Strategy and Method (Hopefully)

- Parallel trends upheld at multiple time periods.

- Although not *purely* random, the distribution of event timing across calendar years is reasonably even.

- Balance table confirms that there are no major differences between treatment and control groups.

UK Household Longitudinal Survey (2009-2020)

- *UKHLS* captures a range of social, economic and attitudinal information about the lives of (all) members of 40,000 households through an annual, computer-assisted, personal interview.

- Individual-level panel data (2009-2020) geocoded at the Lower Layer Super Output Area level.
  - 1,619 individuals (N = 6,476) tracked throughout the interval ranging from $-3 \leq t \leq 0$.
  - Treatment (i.e., relocation) occurs when t = 0.

Spatial Data

- *Torres and McArthur (2024)* compute spatial accessibility indicators at the LSOA level (i.e., distance to nearest city, share of employment opportunities accessible within 15 minutes).

- *Fleischmann and Arribas-Bel (2022)* compute spatial signatures (i.e., geographical characterisations of urban form) across the UK at LSOA level.
  - This dataset allows me to compute a measure of land-use mixing, but it also allows me to document the predominant land-use class in a given area.

- *Ballantyne and Beragen (2024)* count the number (and type) of points-of-interest across the UK at the LSOA level.

Spatial Data

- The LSE-REEF index is a micro-geographic mix-adjusted property price index. Its unique feature is that it reveals house price trends in about 35,000 lower-layer super output areas in England and Wales from 2010 to 2020.

- The **N**ational **P**ublic **T**ransport **A**ccess **N**odes (NaPTAM) dataset covers all UK public transport access points. I use bus and rail links in a cross-sectional structure.

- The OS Open Roads dataset offers a high-level view of the road network, from motorways to country lanes across the UK. I use this in a cross-sectional structure.

Results, Discussion, and Conclusion

The Big-Picture Results: Full Sample

- **Residential Relocations are Catalysts for Change**
  - Moving increases the probability of switching commute mode by **11 percentage points**. No evidence of pre-trends—**changes occur at the moment of moving**, not before.
- **Life Events Matter—But Differently**
  - **Acquiring a car**: +7.9 percentage points; **Changing job**: +2.4 percentage points; **Marriage and childbirth**: No significant effect (likely countervailing pressures).
- **Built Environment Effects Are Mixed**
  - **Land-use mixing**: Increases switching by **10.7 percentage points. Public transport access nodes**: Small, negative effect—suggests **provision alone is insufficient**.

Conditioning on Selection

- **Relocation motivations shape behavioural flexibility** but the effects differ sharply by **reason for moving**.
- **Strongest impact:**
  - Movers for **personal reasons** (e.g., lifestyle, household changes) (**+19.5 percentage points**).
  - Suggests meaningful **re-evaluation of routines** in response to internal change.
- **No significant effect** for:
  - **Work-related movers** – likely constrained by job demands and location.
  - **Area/housing-related movers** – limited evidence of travel preference alignment or residential dissonance adjustment.

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Conditioning on Where People Move To

- **Relocating to suburbs (+13 percentage points)** and **peripheral areas (+21 percentage points)**
  - Significantly increases likelihood of **commute mode switching.** Likely due to **larger shifts in transport environments and cost structures.**

- **No significant effect** when moving to **City centres** or **urban fringes.** Suggests **limited variation in transport context** or strong **habitual persistence.**
  - Spatial context of destination plays a **key moderating role** in post-relocation behavioural change
  - **Relocations to less connected areas disrupt routines more** and **expand or shift feasible choice sets**

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Bringing Everything Together

- **Commute behaviour is sticky, but not fixed.**
- **Life events matter, but unevenly.**
  - **Car acquisition** and **job change** prompt change. **Marriage/childbirth**: No effect.
- **Spatial context influences plasticity.**
  - **Land-use mixing** increases switching; **PT access nodes** show weak/negative effects.
  - Strongest changes occur **in moves to suburbs and peripheries**.
- **Relocation impacts are heterogenous.**
  - **Personal-motivated movers** show significant behavioural change.
  - **Work/housing movers** show none – reflecting **constraints and selection mechanisms**.

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Bringing Everything Together For Policy

- **Embed transport policy within housing and relocation planning.**
  - Align **planning permission**, **social housing allocation**, and **mobility services**.
- **Prioritize mixed-use development in suburban and rural destinations.**
  - Where **behavioural change is most likely**, and **infrastructure can shift transport hierarchies**.
- **Avoid one-size-fits-all strategies.**
  - Effectiveness of interventions varies by **reason for moving** and **destination context**.
- **Shift policy focus from static provision to dynamic timing.**
  - Maximise impact by targeting **moments of behavioural plasticity**, not just long-run preferences.

Thank you!

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Table 4: Reasons For Moving Value Distribution

Primary Reason For Moving	N	Percent
Did Not Move In A Given Year	4655	71.88
Moved For Primarily Employment Reasons	85	1.31
Moved For Primarily Housing/Area Reasons	885	13.67
Moved For Primarily Other/Multiple Reasons	451	6.96
Moved For Primarily Personal/Family Reasons	400	6.18
Total	**6476**	**100.00**

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Table 5: Move Destination Type Value Distribution

Move Destination Type	N	Percent
Did Not Move In A Given Year	4857	75.00
Moved To City Centre	135	2.08
Moved To Rural / Peripheral Area	327	5.05
Moved To Suburb / Independent Town	974	15.04
Moved To Urban Fringe	183	2.83
Total	**6476**	**100.00**

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Figure 1: Pre-Treatment Trends Across Multiple Time Windows

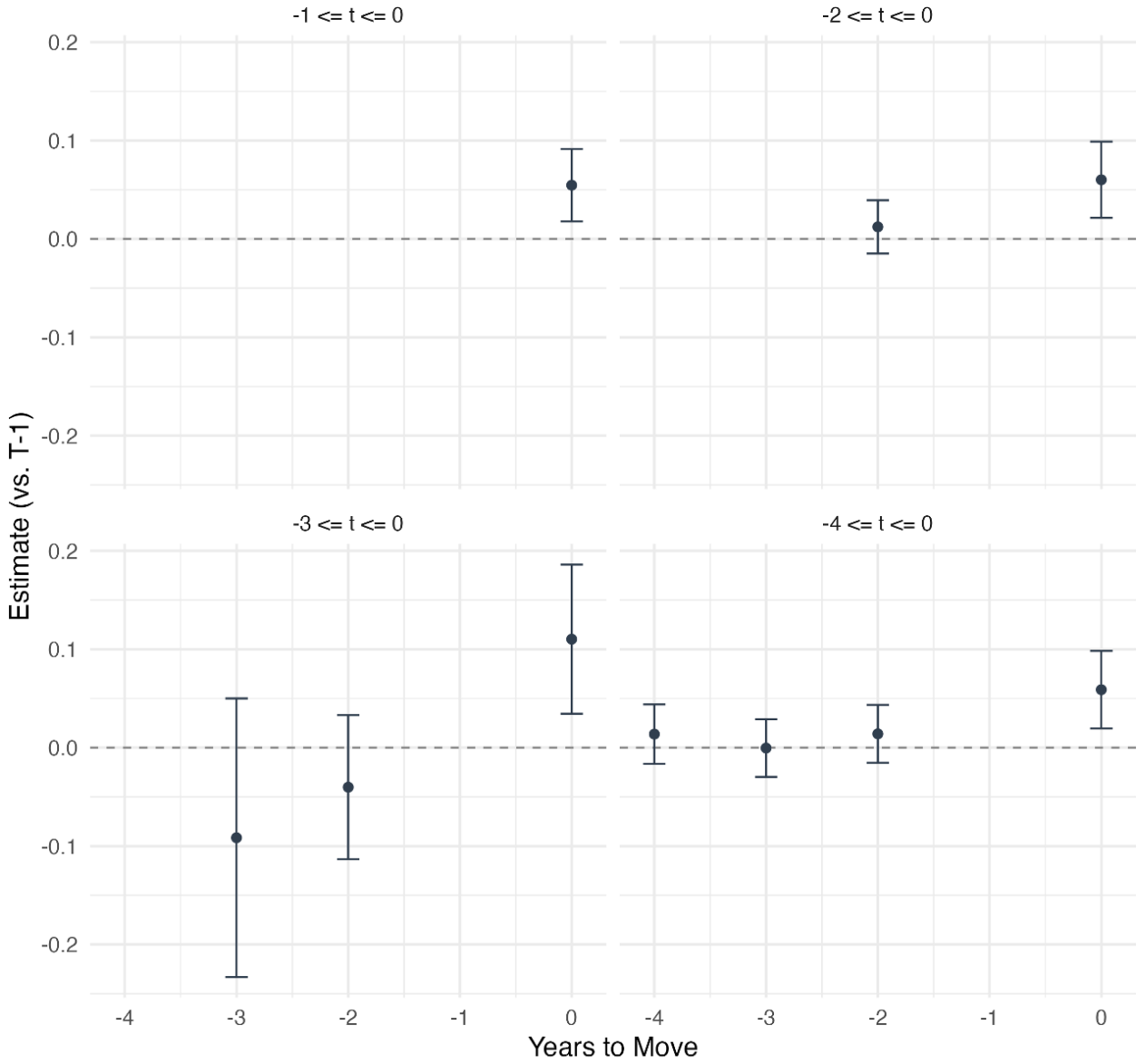

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Table 2: Treatment Distribution Across Calendar Years

Year	Total Observations	Number Moved	Percent Moved
2009	110	0	0.0
2010	439	0	0.0
2011	794	0	0.0
2012	1027	108	10.5
2013	1140	328	28.8
2014	978	327	33.4
2015	787	269	34.2
2016	595	236	39.7
2017	340	146	42.9
2018	201	143	71.1
2019	63	60	95.2
2020	2	2	100.0

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Table 3: Balance Table For Treated and Control Groups

Variable	Did Not Move (N = 4857)		Moved (N = 1619)		Diff. in Means	Std. Error
	Mean	Std. Dev.	Mean	Std. Dev.		
Age	38.5	10.6	40.6	10.5	2.0***	0.3
[Marital Status 1] Married or Couple (1 = Yes)	0.7	0.5	0.8	0.4	0.1***	0.0
[Marital Status 2] Widowed, Divorced/Seperated, or Other (1 = Yes)	0.1	0.3	0.1	0.3	0.0+	0.0
[Marital Status 3] Never Married (1 = Yes)	0.2	0.4	0.1	0.3	−0.1***	0.0
[Highest Qualification 1] Higher Education (1 = Yes)	0.5	0.5	0.5	0.5	0.0	0.0
[Highest Qualification 2] A-level or Equivalent (1 = Yes)	0.2	0.4	0.2	0.4	−0.0	0.0
[Highest Qualification 3] GCSE or Equivalent (1 = Yes)	0.2	0.4	0.2	0.4	−0.0	0.0
[Highest Qualification 4] Other (1 = Yes)	0.1	0.3	0.1	0.3	−0.0	0.0
[Main Work Location 1] At Home (1 = Yes)	0.1	0.2	0.1	0.2	0.0	0.0
[Main Work Location 2] At Employers Workplace (1 = Yes)	0.8	0.4	0.8	0.4	−0.0	0.0
[Main Work Location 3] Multiple Locations/Mobile Worker (1 = Yes)	0.2	0.4	0.2	0.4	0.0	0.0
[Occupation Class 1] Management and Higher Professional (1 = Yes)	0.5	0.5	0.5	0.5	0.0	0.0
[Occupation Class 2] Intermediate Professional (1 = Yes)	0.1	0.3	0.1	0.3	−0.0	0.0
[Occupation Class 3] Small Employers and Self-Employed (1 = Yes)	0.1	0.3	0.1	0.3	0.0	0.0
[Occupation Class 4] Lower Supervisory and Technical (1 = Yes)	0.1	0.3	0.1	0.3	−0.0	0.0
[Occupation Class 5] Semi-Routine and Routine (1 = Yes)	0.2	0.4	0.2	0.4	0.0	0.0
Minutes Spent Travelling To Work	24.0	22.8	25.6	25.1	1.7*	0.7
Access To Private Car (1 = Yes)	0.8	0.4	0.9	0.3	0.1***	0.0
Net Monthly Individual Income derived from Labour	1668.2	1050.3	1794.2	1109.9	126.0***	31.4
Relocated to a new address Since Previous Year (1 = Yes)	0.1	0.2	0.2	0.4	0.1***	0.0
Changed Marital Status Since Previous Year (1 = Yes)	0.0	0.2	0.1	0.2	0.0*	0.0
Had Kids Since Previous Year (1 = Yes)	0.3	0.4	0.2	0.4	−0.1***	0.0
[Commute Mode 1] Cars	0.7	0.5	0.7	0.4	0.0	0.0
[Commute Mode 2] Bus	0.0	0.2	0.0	0.2	−0.0	0.0
[Commute Mode 3] Rail	0.1	0.3	0.1	0.3	−0.0	0.0
[Commute Mode 4] Cycle	0.0	0.2	0.0	0.2	−0.0	0.0
[Commute Mode 5] Walk	0.1	0.3	0.1	0.3	0.0	0.0

Note: +p<0.1; *p<0.05; **p<0.01; ***p<0.001.

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Table 6: Results of Linear Probability Models Using A Full Sample

	Dependent Variable: Probability of Changing Commute Mode since the previous survey wave				
	(1)	(2)	(3)	(4)	(5)
Time To Move [T-3]	-0.027**	-0.078	-0.076	-0.071	-0.092
	(0.011)	(0.080)	(0.080)	(0.081)	(0.090)
Time To Move [T-2]	0.011	-0.026	-0.032	-0.029	-0.040
	(0.010)	(0.041)	(0.041)	(0.041)	(0.045)
Time To Move [T0]	0.058***	0.106**	0.104**	0.101**	0.111**
	(0.011)	(0.042)	(0.042)	(0.043)	(0.048)
[1]Got Married (1 = Yes)			-0.001	-0.002	0.002
			(0.016)	(0.016)	(0.017)
[1]Had Kids (1 = Yes)			0.016	0.016	0.019
			(0.022)	(0.022)	(0.023)
[1]Changed Employer (1 = Yes)			0.025**	0.025**	0.024**
			(0.012)	(0.012)	(0.012)
[1]Purchased/Leased A Car (1 = Yes)			0.055***	0.055***	0.079***
			(0.019)	(0.019)	(0.024)
LSOA-level Travel Time To Nearest City By Car				0.002	0.002
				(0.002)	(0.002)
LSOA Population Density				-0.0003	-0.0003
				(0.0003)	(0.0003)
LSOA Relative Entropy (Land-Use Mixing)				0.107*	0.107*
				(0.064)	(0.064)
LSOA Average House Price				0.00001	0.00001
				(0.00002)	(0.00002)
LSOA Share of Employment Opportunities Accessible Within 30 Minutes By Car				-0.009	-0.008
				(0.010)	(0.010)
LSOA Total Amenities				0.0001	0.0001
				(0.0001)	(0.0001)
LSOA Bus Stop Count				-0.002*	-0.003*
				(0.001)	(0.001)
LSOA Road Length				-0.00000	-0.00000
				(0.00000)	(0.00000)
Robust Standard Errors	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	No	Yes	Yes	Yes	Yes
Region Fixed Effects	No	Yes	Yes	Yes	Yes
Year-Region Fixed Effects	No	Yes	Yes	Yes	Yes
Individual Controls	No	No	No	No	Yes
Observations	6,476	6,476	6,476	6,476	6,476
R^2	0.012	0.004	0.051	0.054	0.067
F Statistic	19.997*** (df = 3; 4854)	2.085*** (df = 114; 4743)	2.182*** (df = 118; 4739)	2.158*** (df = 126; 4731)	2.425*** (df = 141; 4716)

Note: *p<0.1; **p<0.05; ***p<0.01. Panel-Corrected, heteroskedasticity-consistent standard errors are included in parentheses.

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Table 7: Results of Linear Probability Models Stratified By Primary Reasons For Moving

	Dependent Variable: Probability of Changing Commute Mode since the previous survey wave			
	Moved Primarily For Personal Reasons (1)	Moved Primarily For Work-Related Reasons (2)	Moved Primarily For Area/Housing Reasons (3)	Moved Primarily For Other/Multiple Reasons (4)
Time To Move [T-3]	-0.263	-0.532	0.060	0.0003
	(0.187)	(0.830)	(0.147)	(0.184)
Time To Move [T-2]	-0.134	-0.355	0.042	0.030
	(0.094)	(0.400)	(0.073)	(0.094)
Time To Move [T0]	0.195**	0.549	-0.012	0.086
	(0.098)	(0.429)	(0.076)	(0.100)
Observations	1,532	328	3,332	1,356
R^2	0.148	0.471	0.068	0.163
F Statistic	1.464*** (df = 122; 1027)	1.364** (df = 97; 149)	1.411*** (df = 124; 2375)	1.480*** (df = 119; 898)

Note: *p<0.1; **p<0.05; ***p<0.01. Panel-Corrected, heteroskedasticity-consistent standard errors are included in parentheses.

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Table 8: Results of Linear Probability Models Stratified By Move Location

	Dependent Variable: Probability of Changing Commute Mode since the previous survey wave			
	Moved To City Centre	Moved To Urban Fringe	Moved To Suburban Area	Moved To Rural/Peripheral Area
	(1)	(2)	(3)	(4)
Time To Move [T-3]	0.748	0.309	-0.167*	-0.153
	(0.457)	(0.375)	(0.098)	(0.122)
Time To Move [T-2]	0.376	0.173	-0.073	-0.082
	(0.237)	(0.195)	(0.049)	(0.063)
Time To Move [T0]	-0.325	-0.196	0.133**	0.213***
	(0.249)	(0.198)	(0.052)	(0.063)
Observations	540	732	3,896	1,308
R^2	0.205	0.242	0.065	0.215
F Statistic	0.842 (df = 95; 310)	1.291** (df = 109; 440)	1.580*** (df = 125; 2797)	2.010*** (df = 118; 863)

Note: *p<0.1; **p<0.05; ***p<0.01. Panel-Corrected, heteroskedasticity-consistent standard errors are included in parentheses.

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