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Green transport measures at the ballot box: The role of Low Traffic Neighbourhoods in the 2022 London local elections

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ABSTRACT

Like many green transport policies that restrict car use, England's Low Traffic Neighbourhoods (LTNs) have been controversial, with some schemes removed amidst local backlash and fervent online debate. Although overt policymaker support may facilitate LTN implementation, evidence on any electoral consequences remains limited. This paper combines electoral data with Twitter data on councillors' tweets and stances on LTNs, based on sentiment analysis. It uses these two datasets to examine how tweeting about and/or publicly supporting LTNs affected the probability of incumbent Labour councillors being re-elected and the change in their relative vote shares at the 2022 London local elections. Using regression analysis, we find that neither tweeting at all about LTNs nor tweeting positively about LTNs reduced London Labour councillors' relative vote shares, nor their chances of being re-elected. Rather, we found tentative evidence of a positive, albeit weak, electoral impact of tweeting positively about LTNs. Despite controversy and local exceptions, engaging positively on Twitter about LTNs seems not to have been politically damaging for incumbent Labour councillors. This is an important finding given the ongoing likely use of social media to build support for contentious but effective environmental policies.

1. Introduction

1.1. Low Traffic Neighbourhoods in London

Greenhouse gas emissions from transport across the EU are increasing, with road transport accounting for 76 % of all emissions (European Environment Agency, 2023). In the UK, 91 % of domestic transport emissions comes from road transport (Department for Transport, 2023a). There is a clear need to reduce car-dependency and increase walking and cycling, yet little progress has been made in the UK, where 86 % of passenger kilometres in 2022 were made by cars, vans or taxis – even higher than the 83 % 10 years earlier (Department for Transport, 2023b). Hence, cities in the EU and the UK have developed localised transport interventions aiming to improve neighbourhood-level walkability/cyclability and create low-car or car-free spaces (Marchigiani and Bonfantini, 2022). Such interventions include Superblocks in Barcelona, Low Traffic Neighbourhoods (LTNs) in the UK, Kiezblocks in Germany, and School Streets across many cities, notably Paris and London.

LTNs refer to neighbourhood-level schemes that, through the use of modal filters (e.g. bollards, planters, or cameras), prohibit through motor traffic within a contiguous set of usually residential streets. They permit passage for people walking, cycling, or wheeling[i], plus in some cases exempted motor vehicles (e.g. disabled residents), buses, and/or emergency vehicles. They are a 'carrot and stick' policy that aim to encourage mode shift by creating more pleasant neighbourhoods for walking and cycling ('carrot') that are less permeable for driving ('stick'). While implemented as 'Village schemes' within the London borough of Waltham Forest between 2015 and 2019, they proliferated across Greater London between 2020 and 2023, such that within 6 months of the UK's first anti-pandemic measures, some 300,000 Londoners – 4 % of the city's population – lived in new LTNs (Aldred et al., 2021)[ii]. This was the result of funding made available by the national government (the 'Active Travel Fund'), although the entire implementation process takes place at local authority level – typically individual councillors on the Cabinet of local authorities vote on implementation. In short, LTN implementation is always a political decision and councillors play a key role.

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[i] Wheeling refers to the use of powered or manual wheelchairs and similar devices.

[ii] Between March 2020 and May 2022, when the local elections took place, 80 LTNs were implemented across Greater London by local authorities.

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Academic research has found largely positive impacts, including reduced motor traffic (Yang et al., 2022; Thomas and Aldred, 2023), more walking and cycling (Aldred and Goodman, 2021), lower street crime (Goodman et al., 2021), fewer road traffic injuries (Goodman et al., 2021), reduced car ownership (Goodman et al., 2020) and less air pollution (Yang et al., 2022). However, qualitative research (e.g. Pritchett et al., 2024) has revealed strong opposition from some residents, with LTNs sparking more controversy than many other green transport policies. As of July 2024, a quarter (27) of Greater London's 103 post-2020 LTN schemes had been removed, many following public backlash. While recent evidence suggests schemes generally achieve net positive ratings amongst residents (Department for Transport, 2024; Redfield and Wilton Strategies, 2024), discontent remains, as evidenced by public protests against LTNs and 15-minute cities and social media fuelled online resistance to green transport policies (Gössling et al., 2024). LTNs have faced political criticism, with some Conservative MPs framing them as part of a "war on motorists" (Slow, 2023). While Boris Johnson's government encouraged driving restrictions during the pandemic, the subsequent Conservative-led Sunak administration shifted its stance, promoting a more driver-friendly approach in the 2023 'Plan for Drivers' (Department for Transport, 2023c).

Such intense politicisation is highlighted by the widespread interpretation of the Conservatives' victory in the 2023 Outer London Uxbridge and South Ruislip by-election as a referendum on Sadiq Khan's expansion of the London Ultra Low Emission Zone – an expansion that, nonetheless, proceeded as planned (Mabbett, 2023). This followed warnings before the 2022 English local elections of negative impacts for councillors implementing 'anti-driver' policies such as LTNs (Walker, 2022; McIntyre, 2022). Yet there is a lack of evidence regarding both the public acceptability of LTNs and electoral consequences of supporting or implementing them. Perhaps LTNs reflect a 'transport taboo' (Gössling and Cohen, 2014) – implementing or showing support for them in a car-dominated society could reflect a violation of social norms and thus be electorally damaging for councillors. Or perhaps, just as some city mayors – including Anne Hidalgo and Sadiq Khan – have won re-election on platforms characterised as 'anti-car' (Volk, 2020), councillors that publicly support LTNs may benefit or at least not lose out electorally. This is the first study to explore this question, examining the evidence on electoral consequences by linking electoral data from the 2018 and 2022 local elections in London with councillors' tweets on LTNs.

1.2. The public and political acceptability of green transport policies

Political implementation of LTNs, like other green transport policies that aim to reduce car use, has been beset by public dissent and backlash. Many areas of the UK, following the rapid proliferation in LTN implementation during the Covid-19 pandemic, saw 'a sweeping resistance to the measures, accompanied by vandalism, protests, and even death threats to locally elected leaders' (Campbell, 2023, p.119). In Barcelona, comparable Superblock schemes have been delayed by local opposition and changing political structures (Nieuwenhuijsen et al., 2024; Zografos et al., 2020), while there has been significant international 'bikelash' against cycling infrastructure (Wild et al., 2017), and a wave of more recent protests resisting 15-minute cities (Marquet et al., 2024b).

By making travelling by motor vehicle harder, road space reallocation policies like LTNs reflect a shift in transport planning goals, from 'efficient' car travel to accessing key destinations by walking and cycling. Policies that are perceived as 'sticks' (such as charging for or restricting car parking) tend to be less popular than those perceived as 'carrots' (such as cheaper buses), yet including 'stick' elements may be much more effective in achieving behaviour change (Xiao et al., 2022). For LTNs, the 'stick' element is likely to be more obvious (Transport for All, 2021), despite evidence suggesting that they also improve perceptions of the local environment (Aldred and Goodman, 2021). This fits with public discontent around other 'carrot and stick' policies, such as congestion charging (Sherriff, 2015; Börjesson et al., 2012) and pedestrianisation (Hickman and Huaylla Sallo, 2022; Nello-Deakin, 2023).

Beyond the wider problem of public acceptability of 'anti-car' measures in a 'motonormative' society (Walker et al., 2023), LTNs face further obstacles due to the marginalisation of cycling in the UK. While they may have a larger impact on walking than cycling, LTNs are often interpreted as primarily benefiting cycling (Aldred and Goodman, 2021). Hence, schemes may be vulnerable to the 'bikelash' (Field et al., 2018) that frequently affects cycling policies in contexts where cycling is a minority activity. In such environments, there is well reported prejudice against people who cycle (Aldred, 2013), which can feed into political conflict and opposition to transport schemes (Castillo-Manzano and Sánchez-Braza, 2013).

Authors differ on the importance of public acceptability in the implementation of such schemes. Selmoune et al. (2020), for instance, identify it as often the single most significant barrier to introducing congestion pricing. In some London boroughs, public opposition – or the anticipation of it – has led to LTNs being abandoned before implementation or being swiftly removed. Yet political actors may underestimate support for pro-climate policies (Mildenberger and Tingley, 2019). Walker (2011) has argued that fears of voter backlash have hindered road pricing schemes, even though transport professionals agree on their necessity. Goodwin (2006) describes a 'gestation process' whereby initial public support increases with issue recognition, but falls off sharply as detail is revealed. With time, Goodwin argues, support will typically recover, but often not before a political panic.

If a politician perceives a green transport policy to have low public acceptability, they may view their own overt support for it as politically risky, fearing it could cost votes or even their seat. In this sense, politicians may have a barrier to implementing or publicly supporting LTNs because of interlinked 'transport taboos' (Gössling and Cohen, 2014, p.204). In a 'motonormative' society where the driving of motor vehicles receives more favourable treatment than other societal harms, even an ecologically-minded politician may see themselves in a bind, trying to balance overcoming a societal pro-driving bias with the potential political consequences of doing so (Walker et al., 2023). By violating societal norms in publicly supporting LTNs, the politician may 'become marginalized' and "die' politically' as a result (van Diepen, 2023, p.202).

Debates over public and political acceptability continue partly because of a lack of evidence. Most existing research on the electoral acceptability of green transport measures has tended to focus on single-issue referenda (e.g. Sherriff, 2015; Hansla et al., 2017; Gaunt et al., 2007; Boggio and Beria, 2019). For instance, Fang and Thigpen's (2017) study of 148 local transport policy–related ballot measures in California from 1995 to 2015 found that most passed, with pro-alternative or anti-car policies passing at a slightly higher rate than pro-car or anti-alternative measures. However, they highlight the problematic nature of such referenda and the potential undermining of representative democracy, such as elections in which voters can choose between different transport policy platforms (among other issues).

Very few studies have used electoral data from local or national elections to analyse the political impacts of climate or green policy implementation. Research in Canada (Stokes, 2016) found that wind turbine installation led to nearby electoral losses for the incumbent government, and in Madrid, that voters living near to a new metro station rewarded the government post-implementation (De La Calle and Orriols, 2010). In Barcelona, Marquet et al. (2024a) found that Superblock implementation, at the district level, resulted in increased support for the Barcelona en Comú party responsible for their implementation. The authors are not aware of any other research to date that has explored, using elections data, the impact of implementing or supporting green built environment-based travel policies.

This paper combines data from Twitter (now X) with local election results to examine the impact of Labour councillors' stances on LTNs on changes in their electoral support between the 2018 and 2022 elections

in Greater London. It is a novel individual-level approach (rather than aggregating to council-level) reflecting the fact that: a) the most pronounced impacts of LTNs are likely to be felt at a more localised scale; b) electors vote for individual councillors in their wards; c) councillors within the same party may differ in their public association with LTNs; d) the small number of local authorities makes robust analysis at the local authority level difficult. We choose to analyse tweets because, unlike official voting records, they are more publicly visible and were at the time a key means through which many councillors chose to communicate their stance to the public. By focusing on the public stances of individual councillors rather than on implementation, this article improves understanding of the individual-level political costs or benefits of supporting the LTN interventions.

The analysis therefore exploits an unusual opportunity to study how far a controversial intervention played a role at a range of local ballot boxes. There are two research questions:

1) To what extent was tweeting about LTNs in the 2022 local elections in Greater London associated with (a) the probability of incumbent Labour councillors holding their seat and (b) changes in their relative vote share compared to 2018?
2) To what extent was the sentiment (i.e., the positivity or negativity) of Labour councillors' tweets about LTNs associated with (a) the probability of holding their seat and (b) changes in their relative vote share compared to 2018?

2. Methods

2.1. Study approach

Through this study we sought to better understand the impact of Labour councillors publicly supporting a controversial green transport measure on their personal vote results. Hence, we needed to decide how to measure councillors' attitudes and/or communications around LTNs. All potential methods had limitations. For instance, we considered a survey of current or former councillors but expected a very low response rate. Similarly, a survey of local advocacy groups could introduce district-level bias due to varying levels of advocacy activity and differing relationships with local borough leaderships.

Instead, we decided to analyse councillors' LTN-related tweets (including their stance on LTNs and their frequency of such tweets) using the Twitter API,[iii] which was freely available for academic use at the time. Our approach had benefits and limitations. Positively, Twitter was then widely used by councillors to discuss schemes and most incumbent Labour councillors had an account, meaning it was a key platform for publicly communicating LTN positions. Additionally, research has shown links between tweeting and other official expressions of political views, particularly on environmental issues (e.g., Greenwell and Johnson, 2022). However, there are limitations: tweets are only one way of publicly expressing an opinion towards LTNs and classifying the sentiment of tweets inevitably carries some inaccuracy.

2.2. Data sources

Table 1 outlines the key datasets used in this study.

Table 1
A summary of datasets used in study.

Dataset	Source	Description
Low Traffic Neighbourhoods in Greater London	Researchers' own dataset	Shapefile of all LTNs implemented in Greater London between March 2020 and May 2022
Candidates and results data	Democracy Club (2023)	Data of candidates, their party and number of votes received for 2010, 2014, 2018 and 2022 local elections
Councillors' tweets between January 2020 and May 2022	Twitter (now X) API	All tweets from councillors – reduced to tweets relating to LTNs, on which a sentiment analysis was conducted
Wards – 2018 local elections	Office for National Statistics (2019)	Shapefile of all wards in Greater London
Wards – 2022 local elections	Office for National Statistics (2022)	Shapefile of all wards in Greater London
2021 ward-level census data	Office for National Statistics (2023)	Ward-level demographic and socioeconomic characteristics

2.3. Study methods

2.3.1. Identifying councillors to include in analysis

Firstly, we included only councillors for wards in local authority districts where LTNs were either implemented and still in place or were planned at the time of the 2022 local elections, as we did not anticipate effects of LTN stance in areas without LTNs. The analysis was further restricted to incumbent councillors (elected in 2018 and standing for re-election in 2022) who stood for the same party and ward at both elections. This allowed us to focus on the change in vote share between elections. Since most incumbents in these areas were Labour, and only Labour councils implemented LTNs in London, the analysis was limited to Labour councillors.

2.3.2. Measuring councillor vote changes

We acquired election results data for the 2018 and 2022 local elections in Greater London from Democracy Club (2023), matching candidates by name, ward, and party across the two elections. We then created two outcome variables: 1) holding the seat; 2) change in relative vote share. The second measure involved calculating, for each incumbent in both 2018 and 2022, the percentage difference between the votes they received and the mean votes per candidate in the same ward. This relative measure was used in place of absolute changes in vote share, which in local elections varies significantly by the number of candidates standing – which itself can change greatly between elections. To address potential distortions in relative support due to fluctuations in the number of candidates, the change in the number of candidates standing between the two elections was always included as a control variable in the statistical models outlined in 2.2.6 below.

The percentage difference between a councillor's votes (A) and the mean number of votes per candidate (B) in the same ward was calculated as follows:

$$\%difference = 100^{*}\frac{|A-B|}{(A+B)/2}$$

If the percentage difference was positive, the councillor received more votes than the mean; a negative value indicates the opposite. Once the percentage difference was calculated in 2018 and in 2022, the *change* in relative votes was calculated by subtracting the 2018 value from the 2022 value. A positive change in relative votes indicates that the councillor increased their votes relative to the average; a negative change indicates a relative decrease.

2.3.3. Identifying and accounting for boundary changes

Of 511 Labour councillors included in this study, 313 had significant boundary changes to their ward between the 2018 and 2022 local elections. A boundary change was deemed significant if the area of the 2022 boundaries intersecting with the 2018 boundaries was less than 90 %. Such boundary changes present a problem since any change in votes

[iii] Throughout this paper, we refer to Twitter, the platform's name at the time the councillors were tweeting. Given the significant changes since its rebranding as X, we do not assume that our findings would necessarily apply to the platform in its current form.

in these seats could be the result of changes in ward composition.

For councillors with significant boundary changes, we adjusted their relative vote share for the 2018 local elections using linear regression modelling. This model used 2021 ward-level sociodemographic census data combined with 2014 and 2010 election results (Democracy Club, 2023) to estimate the relative number of votes in 2018 for each candidate. We then used the model to predict the notional 2018 relative votes for councillors as if the election was contested at their 2022 ward boundaries. The model's accuracy was validated against the actual 2018 results. The R-squared value of 0.79 for Labour councillors indicates that the model explained 79 % of the variance in the relative Labour votes. These predicted 2018 relative votes (at 2022 boundaries) were subsequently used in place of actual 2018 relative votes, to calculate the change in relative votes between 2018 and 2022.

2.3.4. *Identifying incumbent councillors in relation to LTNs*

We used our own dataset on LTN implementations, locations, and extents (Fig. 1) to identify incumbent councillors in London boroughs in which:

1) Prior to the 2022 local elections, one or more LTNs had been implemented and not subsequently removed, and/or
2) One or more LTNs was planned at the time of the 2022 local elections.

Incumbent councillors were only included in the study if they met these criteria. We included councillors in 18 of the 32 local authority boroughs in Greater London[iv]. Most included local authorities are in inner London, and all were controlled by the Labour Party prior to the 2022 local elections (see Fig. 2).

2.3.5. *Analysing the sentiment of councillors' tweets*

To identify the level of positivity or negativity within the councillors' stances towards LTNs, we conducted a sentiment analysis of their tweets. This had several stages:

1) Identifying councillors' Twitter accounts and their tweets relating to LTNs
2) Conducting a sentiment analysis on the LTN tweets
3) Creating an overall LTN sentiment score for each councillor based on all their LTN tweets

1. Identifying councillors' Twitter accounts

We used a systematic method utilising consistent search terms (a combination of their full name, political party, local authority name and "Twitter account") to identify each councillor's associated Twitter account(s). This included both 'professional' and 'personal' accounts,[v] all of which were reviewed to ensure that they were accurately identified and still active at the time of the 2022 local elections.

Of the 511 incumbent Labour councillors included in this study, 380 (74.4 %) had at least one active Twitter account. Fig. 3 shows the number of councillors (with Twitter accounts) included in the study broken down by each Local Authority borough. The boroughs with the largest number of councillors included were Lambeth (30, 97 %), Southwark (28, 85 %), Ealing (26, 74 %) and Hackney (26, 81 %).

2. Identifying LTN tweets and conducting a sentiment analysis

Public tweets from each councillor's Twitter handle between 1st January 2020 and 5th May 2022 were programmatically retrieved using the Twitter V2 API[vi]. This period incorporates the post-Covid-19 implementation of LTNs across Greater London up to the 2022 local elections. We employed a set of keywords—such as the names of individual LTNs and related terms like "healthy neighbourhoods"—to identify tweets about LTNs. Without manually inspecting each tweet, it was considered too complex to separate out tweets about specific LTNs (i.e. to identify tweets related to an LTN in a councillors' ward or a different LTN).

We included only original tweets and not retweets or replies. As data downloaded from the Twitter API service was delivered in a raw text format, contextual information such as tweet threads and other users' original retweeted tweets were not returned. We conducted a sentiment analysis to categorise the polarity of opinions, emotions, and views in the tweets about LTNs (see Zhang and Liu, 2016). A supervised learning approach using a Naïve Bayesian classifier was employed to account for discrepancies between the surface-level tone of an opinion (i.e. sentiment) and underlying attitudes (i.e. stance) (see Mourad et al., 2018; Fitri et al., 2019; Pang et al., 2002; Jurafsky and Martin, 2023 for more details).

The Naïve Bayes classifier uses statistical assumptions to 'predict' the probability that the sentiment of each tweet is positive, negative, or neutral. We trained this model on a random sample of LTN tweets that were manually coded by the authors. To predict the category, the model included information on the text of the tweet (e.g. words, hashtags and mentions), the emotional tone of the tweet, and additional contextual features (e.g. borough, political party and whether that party was in power at the borough-level). The emotion types and process of identification were based on an existing emotion lexicon in wide usage (Mohammad and Turney, 2010, 2013; Vishnubhotla and Mohammad, 2022). The final model achieved an overall accuracy score of 82 % against the manually-coded training data, closely aligning with the agreement between two manual coders, indicating the model's effectiveness in classifying tweets as accurately as a well-informed human.

3. Generating an overall sentiment score for each councillor

The Naïve Bayesian classifier assigned a sentiment category label to each analysed tweet based on the probabilities of being positive, negative, or neutral. Two composite sentiment scores were then created for each councillor based on their tweets.

The first score – hereafter referred to as the 'LTN sentiment score' – was derived from the counts of positive, neutral, and negative tweets per councillor. This calculation included a denominator to moderate the score when tweet counts were low, reflecting a higher level of uncertainty compared to councillors with more tweets about LTNs. The score ranges from −1 (most negative) to + 1 (most positive), with 0 indicating neutrality.

The second score – hereafter referred to as the 'alternative LTN sentiment score' was only used in a sensitivity analysis. This score applied the same calculation as the LTN sentiment score but used the classifier's probabilities for each sentiment type instead of the counts.

2.3.6. *Statistical modelling*

There are two explanatory variables of interest: a binary variable denoting if the councillor had tweeted about LTNs and a continuous LTN sentiment score. The two dependent variables are a binary seat retention variable (indicating if the incumbent councillor held their seat) and a continuous variable measuring the change in relative vote share.

To estimate the impacts of the two explanatory variables on seat retention, we employed binomial logistic regression models:

[iv] City of London, the 33rd district in Greater London, is not a borough and does not have standard democratic elections in the same way.

[v] Tweets were combined across all active accounts associated with councillors, as often the distinction between 'professional' and 'personal' was unclear.

[vi] https://developer.x.com/en/products/twitter-api. Access to the service was authorised with academic research credentials and ethics approval for this data collection was obtained from the University of [REDACTED] ethics Committee in November 2022.

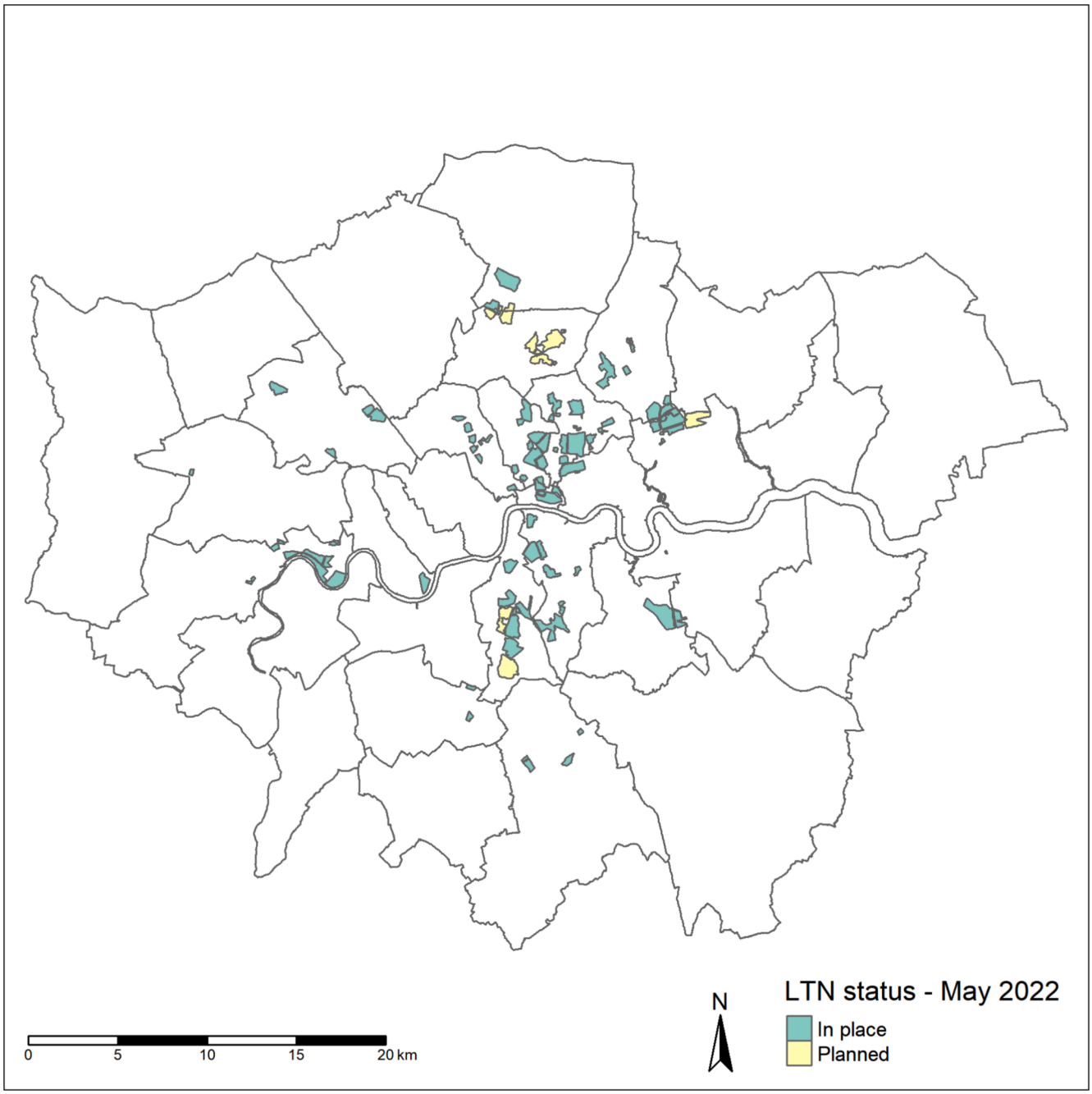

Fig. 1. A map of existing and planned LTNs at the time of the May 2022 local elections.

- **Model 1** tests the association between tweeting about LTNs and seat retention.
- **Model 2** tests the association between the LTN sentiment score and seat retention.

Both models were estimated with only five explanatory variables and using Firth's penalised logistic regression to mitigate overfitting, biased coefficients and unreliable p-values due to the small sample size and rare outcome of not retaining a seat (N = 37) (see: Firth 1993; Suhas et al., 2016).

To assess the impact of tweeting/LTN sentiment on the change in relative vote share between 2018 and 2022, we created linear regression models:

- **Model 3** tests the association between tweeting about LTNs and change in relative vote share.
- **Model 4** tests the association between the LTN sentiment score and change in relative vote share.

Model 3 has been calculated with heteroscedasticity robust standard errors as the residuals in the model were initially non-normally distributed. In all models, where possible, a range of political, socio-demographic, and geographical explanatory variables are included alongside the explanatory variables of interest. To account for the potential bias of councillors tweeting more confidently about LTNs if they believe they will retain their seats, all models included the relative vote share from the 2018 local elections as a measure of seat 'safety'.

The specification of each model varies based on sample size, comparisons of model performance and the need to remove colinear

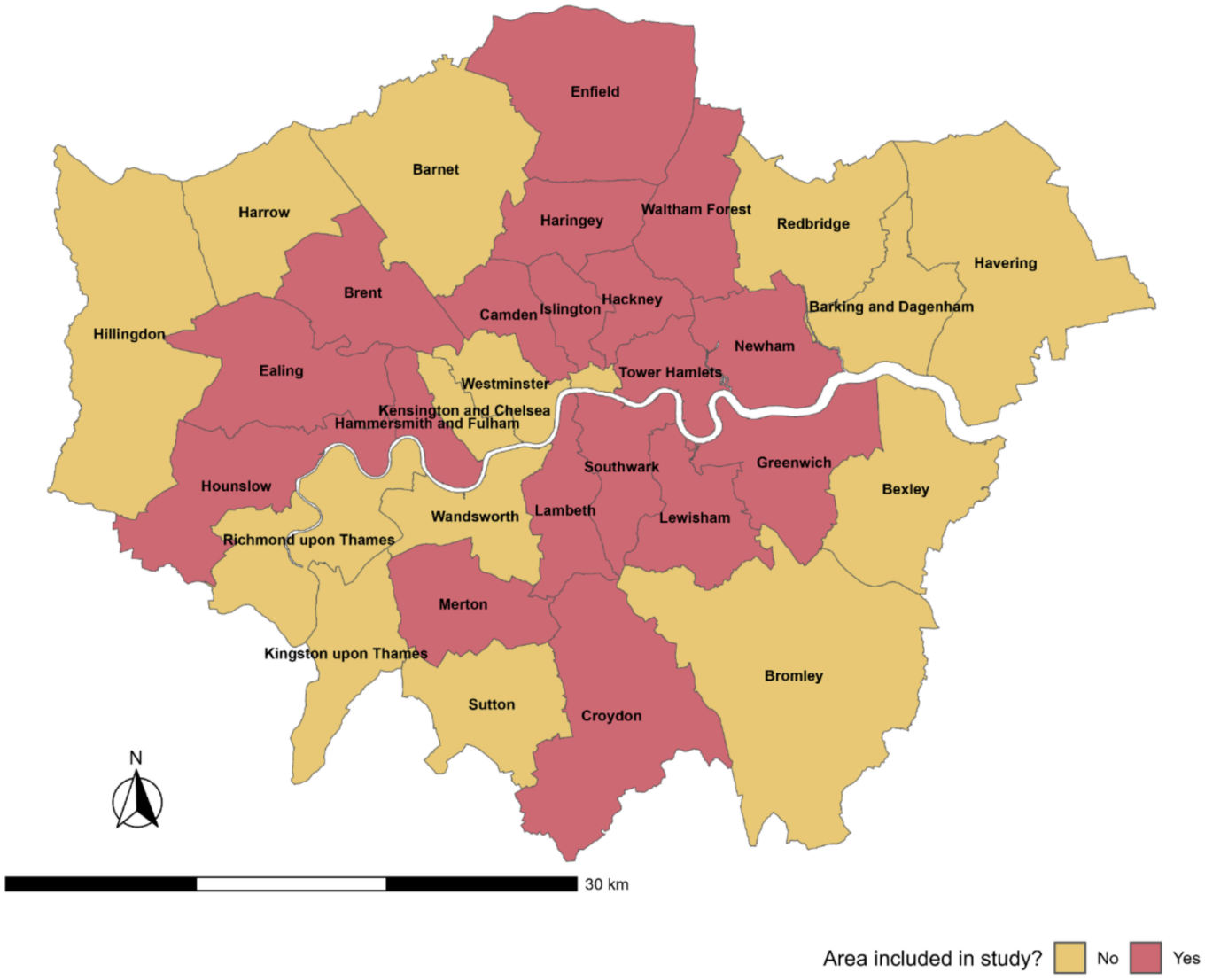

Fig. 2. A map showing the local authorities that are included and excluded from this study.

variables. A summary can be found in Table 2. Variables coded as 'No' for all models were tested but were excluded from all models as they did not enhance model power.

Due to the potential undue influence of councillors who tweeted extensively about LTNs, each model was tested after removing those who tweeted more than 100 times (N = 1) or more than 40 times (N = 3). Additionally, as a sensitivity analysis, Models 3 and 4 were estimated using the alternative LTN sentiment score, and Model 4 was repeated with 'No. of LTN tweets' and 'No. of all tweets' included as explanatory variables. Further details are available in the Appendix.

3. Results

3.1. Descriptive overview

Of the 511 Labour councillors in this study, 95 (18.6 %) had tweeted about LTNs during the specified period. This was considerably lower than the proportion (but not the absolute number) of Conservative (28 councillors or 31.5 %) and Liberal Democrat (10 councillors or 35.7 %) councillors who had tweeted about LTNs. The difference may reflect reluctance amongst Labour councillors to publicly express their positions, genuine neutrality regarding LTNs, or Conservative councillors being more comfortable tweeting in opposition to controversial policies than Labour councillors are in support.

Fig. 4 illustrates the distribution of tweets about LTNs amongst the 95 Labour councillors. The median number of tweets per councillor was only 2, with most (77 or 81.1 %) tweeting fewer than 10 times, and only one councillor tweeting more than 50 times about LTNs.

Fig. 5 shows the distribution of Labour councillors' LTN sentiment scores, ranging from −1 (most negative) to + 1 (most positive). Notably, no Labour councillors received a negative LTN sentiment score – perhaps not surprising given all London LTNs have been implemented by Labour councils. The median sentiment score for Labour councillors was 0.29, with 25 % of councillors scoring 0.57 or higher (see Fig. 5 details). Of the 705 tweets from Labour councillors, 574 were coded as positive[vii] (81.4 %) with 130 tweets (18.4 %) neutral and just 1 tweet (0.1 %) negative. A statistically significant positive correlation was found between the number of LTNs implemented (in the local authority) and sentiment score ($r = 0.24$, $p = 0.018$), indicating that where more LTNs were implemented, councillors' sentiments were more positive when tweeting about them.

[vii] A tweet is considered 'positive' when the probability of it being 'positive' from the classification model is higher than the probability of it being 'negative' or 'neutral'.

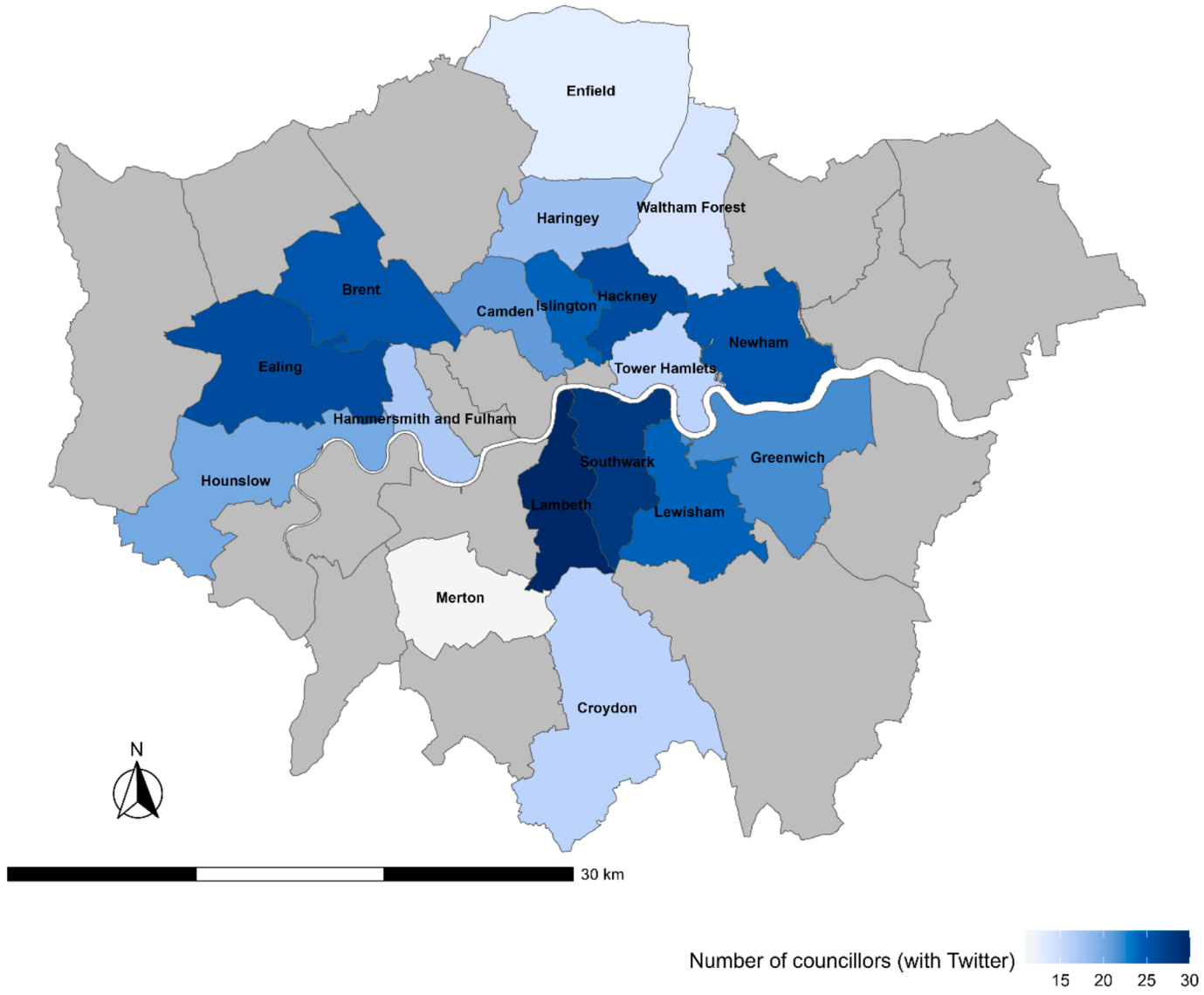

Fig. 3. A map showing the number of incumbent councillors with Twitter accounts in each local authority area included in this study.

Table 2 presents the number of LTNs and incumbent Labour councillors for each local authority, detailing how many have tweeted about LTNs and the sentiment of those tweets. There was a moderate (though not statistically significant) positive correlation between the number of LTNs in a local authority and the number of councillors who had tweeted about LTNs ($r = 0.41$, $p = 0.088$), indicating that areas with more LTNs tended to have Labour councillors tweeting more frequently. Some 37.6 % of all tweets were from councillors in Lambeth, with 135 of the 265 tweets in the local authority coming from one councillor. In all areas except Tower Hamlets and Ealing, there were more positive than neutral tweets.

The two key outcome variables in this analysis were winning the seat and change in relative vote share. Of 511 incumbent Labour councillors, 474 (92.8 %) retained their seat, while 37 (7.2 %) lost their positions. This retention rate was higher than that of Conservative (73 %, or 65 of 89) and Liberal Democrat (75 %, or 21 of 28) incumbents across the same local authorities. Regarding changes in relative vote shares, Labour councillors had a median change of −7.8 and a mean change of −10.9, indicating a slight decrease in votes relative to the ward average (see Fig. 6 for distribution).

3.2. *Retaining seats*

Overall, there was no clear relationship between Labour councillors tweeting about LTNs and their seat retention (Table 3). Among those who tweeted, 92.6 % held their seat, compared to 92.8 % among those who did not tweet. Logistic regression results indicate that tweeting about LTNs had no statistically significant effect on the probability of retaining a seat (OR = 1.61, $p = 0.332$). Of the other political characteristics included in the model, ward turnout was significantly negatively associated with seat retention, while relative vote share in 2018 had a significant positive association.

There was also little evidence of any relationship between the sentiment of LTN tweets and seat retention. Amongst councillors with a neutral sentiment score, 84.6 % held their seat compared to 93.8 % and 94.1 % amongst those that were ‘somewhat positive’ and ‘very positive’ respectively (see Table 4). A logistic regression model (see Fig. 7) tested the relationship between a councillor’s LTN sentiment score and seat retention, finding no significant relationship (OR = 0.50, $p = 0.689$). This lack of significance was consistent in a sensitivity analysis using the alternative LTN sentiment score (see Appendix, Table A.5.). Thus, tweeting about LTNs or adopting a more (or less) positive stance on them was not associated with the likelihood of a Labour councillor being

Table 2
Explanatory variables used in each statistical model.

Category	Variable	Geography	Model 1	Model 2	Model 3	Model 4	Source
Dependent variable			Held seat (2018) (Y, N)	Held seat (2018) (Y, N)	Relative vote share change (2018–2022	Relative vote share change (2018–2022)	
Explanatory variable of interest			Has tweeted (Y, N)	LTN sentiment score	Has tweeted (Y, N)	LTN sentiment score	
Political characteristics	Change in number of candidates standing (2018–2022)	Ward	No	No	Yes	Yes	Democracy Club (2023)
	Turnout (%) (2018)	Ward	Yes	Yes	Yes	Yes	
	Vote share (%) of councillor's party (2018)	Local authority	No	No	Yes	No	
	Relative vote share of councillor (2018)	Ward	Yes	Yes	Yes	Yes	
	Party in control of council (2018, 2014, 2010)	Local authority	No	No	No	No	
	Substantial boundary changes (2018–2022)	Ward	No	No	No	No	Office for National Statistics (2022, 2019)
LTN characteristics	No. of LTNs implemented by local authority	Local authority	No	No	Yes	Yes	Own dataset
Twitter characteristics	No. of all tweets	Individual	No	No	Yes	No	Twitter API
	No. of LTN tweets	Individual	No	No	No	No	Twitter API
Demographic characteristics [only includes those included in at least one model]	Ethnicity: White British (%)	Ward	No	No	Yes	No	
	Occupations: NS-SEC 7 (Intermediate occupations) (%)	Ward	No	No	Yes	No	
	Occupations: NS-SEC 8 (Employers in small organisations) and 9 (Own account workers) (%)	Ward	No	No	Yes	Yes	Office for National Statistics (2023)
	Occupations: NS-SEC 15 (Full-time students) (%)	Ward	No	No	Yes	No	
	Tenure: private renters (%)	Ward	No	No	Yes	No	
	Travel to work: walk (%)	Ward	No	No	Yes	No	
	Travel to work: train (%)	Ward	No	No	Yes	Yes	
	Travel to work: underground/ tram (%)	Ward	No	No	Yes	No	
	Distance to work: 2–5 km (%)	Ward	No	No	Yes	Yes	
	Distance to work: 5–10 km (%)	Ward	No	No	Yes	No	
	Distance to work: 30–40 km (%)	Ward	No	No	No	No	
	Household deprivation: 4 dimensions (%)	Ward	No	No	Yes	No	
	Household deprivation: 2 dimensions (%)	Ward	Yes	Yes	No	No	
	Age 20–24 (%)	Ward	Yes	Yes	No	No	
	Age 50–64 (%)	Ward	No	No	No	No	
	Age ratio (age 65+ / age 20–34) (%)	Ward	No	No	Yes	No	

re-elected.

3.3. Change in relative vote share

The second part of the analysis explores the relationships between tweeting at all/tweet sentiments and changes in relative vote share. Table 5 indicates that Labour councillors who tweeted had slightly higher mean (−6.8) and median (−4.1) changes in vote share compared to those who did not tweet (−11.8 and −8.8). However, Model 3 showed no statistically significant association between tweeting at all about LTNs and relative vote share change ($\beta = 3.057$, $p = 0.051$ – see Fig. 9), after controlling for other ward-level characteristics (outlined in Table A.3). Some other political factors were negatively associated with mean relative vote share change, including 2018 ward turnout, the relative vote share of the candidate in 2018 and the change in the number of candidates standing.

The relationship between the sentiment of LTN tweets and the relative vote share change of Labour councillors is, without accounting for other factors, weakly to moderately positive ($r = 0.28$, $p = 0.006$) – see Fig. 8).

This relationship was found to be statistically significant in Model 4, in which a one point increase in the LTN sentiment score was associated with a mean 11.92 point increase in the relative vote share of the incumbent councillor ($\beta = 11.92$, $P < 0.05$). The LTN sentiment score remained statistically significant in the sensitivity analysis models with outliers removed and with the total number of LTN and all tweets included. However, in the sensitivity analysis using the alternative LTN sentiment score, the association is non-significant. While the analysis therefore provides clear evidence against a negative association, the evidence supporting a positive association is less robust. It is also worth noting that in all variants of Model 4, the number of LTNs implemented by the local authority was statistically significantly negatively associated with the relative vote share change ($\beta = -0.999$, $p < 0.05$). For every additional LTN implemented, there was a mean change of −0.999 in the relative vote share of incumbent Labour councillors (see Table 6).

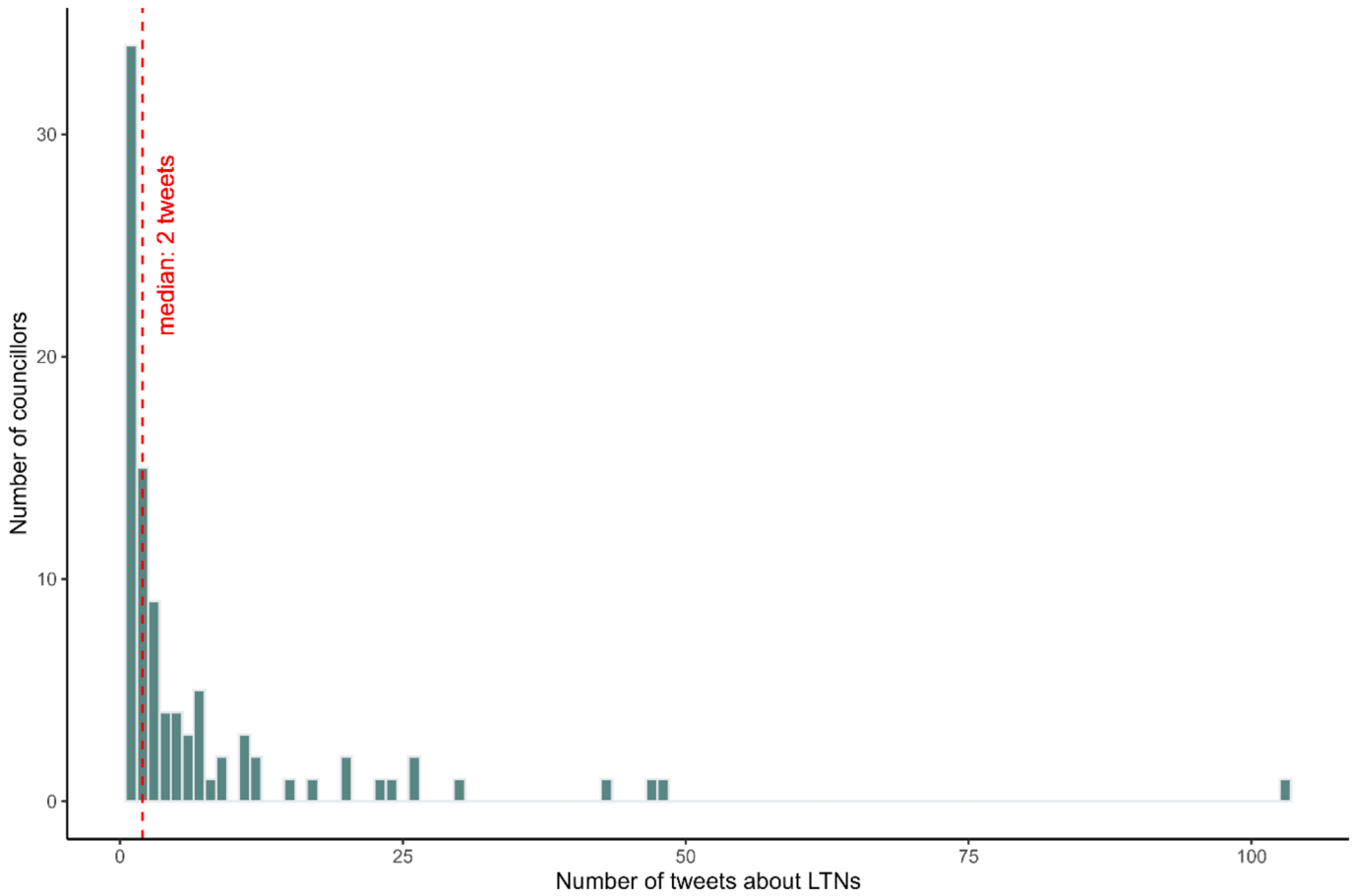

Fig. 4. Distribution of tweets about LTNs amongst the 94 Labour councillors who had tweeted at all about LTNs.

4. Discussion and conclusions

4.1. Summary of results

The first research question examined the association between incumbent Labour councillors tweeting at all about LTNs and a) seat retention b) their relative vote share change between 2018 and 2022. The analysis revealed no statistically significant evidence of any association between tweeting about LTNs and electoral outcomes for Labour councillors. Interestingly, many incumbent Labour councillors, even in areas where LTNs had been widely implemented or planned, chose not to tweet about LTNs in the run-up to the 2022 local elections. This may reflect a lack of interest or, for some, a fear of engaging with a contentious policy, especially given reports of councillors experiencing harassment and abuse (Firth, 2023; Pal, 2023). Some councillors may simply be concerned that taking *any* public position on LTNs could diminish their chances of re-election.

Councillors may be particularly fearful of expressing positive sentiments about LTNs amidst possible public backlash. Yet, in answering the second research question, we found no evidence of any negative association between the sentiment of LTN tweets and electoral outcomes. On the contrary, there was weak evidence suggesting that councillors who tweeted more positively about LTNs experienced more favourable changes in their relative vote shares between 2018 and 2022. While LTN implementation itself may generate some degree of political backlash – we found weak evidence of a negative association between the number of LTNs implemented and relative vote share change – our findings suggest that active and positive engagement by councillors online around local LTN implementation may help to mitigate this risk.

4.2. Interpretation of results

The political backlash against road space reallocation and reducing car usage is not unique to LTNs, with similar schemes identified as politically risky elsewhere (Field et al., 2018; Lambe et al., 2017; Timmons et al., 2023). As Marquet Sardà (2024) notes in the Barcelona context, 'loud opposition movements might be concealing substantial silent support'. Despite the perceived risk of supporting LTNs, Labour councillors may even benefit—or at least not suffer—from taking a positive public stance, even though implementing more LTNs may have had a minor negative electoral impact. This suggests a complex relationship between policy implementation, political messaging, and voter response, with vocal support on social media possibly mitigating negative effects.

Perhaps it is not surprising that councillor (lack of) communication about LTNs seems to have had minor, negligible, or unclear impacts on voting outcomes. For many voters, LTNs may not be as important as issues like the economy, healthcare, or housing (Redfield and Wilton Strategies, 2024). As suggested by a recent Department for Transport (2024) report, many people may be unaware of such measures, perhaps especially in London where travel is frequently disrupted by building projects, major schemes, and utility works (Thomas and Aldred, 2023). In cities, LTNs are only one policy of many that impact upon a constantly evolving urban environment.

London councillors have still faced substantial challenges implementing LTNs (Aldred et al., 2023). Even where public transport provision is comparatively good and levels of car ownership and dependency are relatively low, policies that challenge car-centric road space allocation are unlikely to achieve universal support. What is striking about the London context, however, is that despite a highly

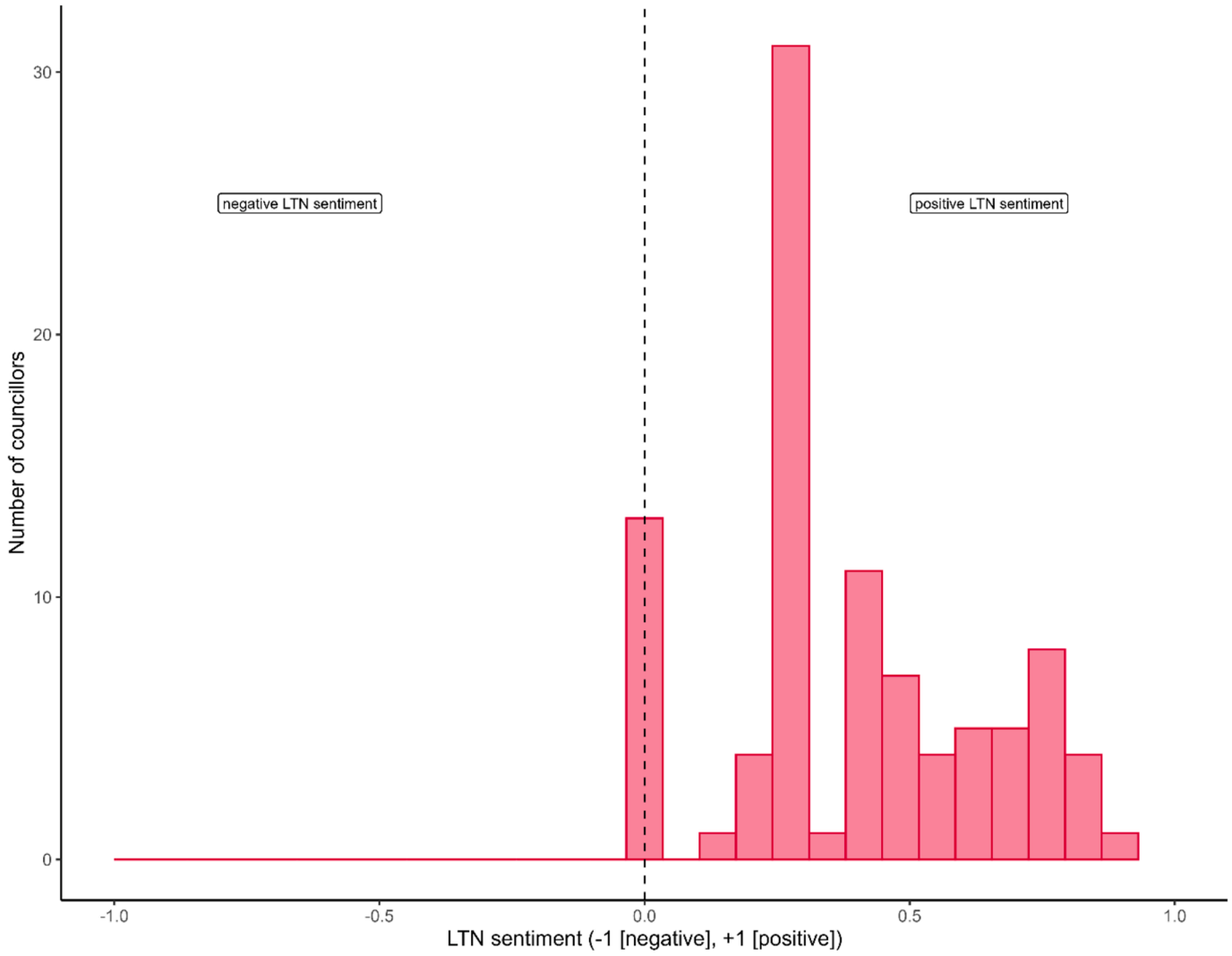

Fig. 5. Distribution of Labour councillors' LTN sentiment scores.

charged political atmosphere, local authorities have succeeded in implementing so many LTNs – largely without adverse political consequences.

In contrast, elsewhere in the UK, including in other major cities, LTNs have often been removed or have failed to progress beyond the planning stage, with notable exceptions like Oxford. Hence, our finding of little political risk associated with publicly supporting LTNs may be, in the UK context, unique to London, and perhaps more specifically, to inner London, where most of the city's LTNs have been implemented. We evaluate three possible explanations, which each reflect characteristics of inner London or London more widely: 1) the dominance of the Labour Party; 2) low car ownership and good quality public transport; 3) greater resources for engagement with residents than elsewhere in England.

Our first proposition is that a high degree of political stability may permit more risk-taking on the part of policymakers and councillors (Burchell et al., 2014). Labour's stronghold on many London councils is now long-standing, and Sadiq Khan, Labour's candidate, won his third London mayoral term in 2024. However, this factor alone does not appear sufficient to explain the scale of LTN implementation in the capital. While LTNs have only been implemented in Labour-held councils – despite initial support from Conservative Prime Minister Boris Johnson – we found no evidence of any relationship between relative vote share in 2018 (a proxy for seat 'safety') and the number of LTN tweets by Labour councillors with LTNs implemented in their local authority.

If political stability were the primary driver of councillors publicly supporting or implementing LTNs, we might expect similar trends in other Labour-dominated English cities, such as Manchester, Liverpool, Bradford, or Leeds. Yet just as London is the only major city with a congestion charge, it also remains unusual in the scale of LTN implementation relative to city size. Elsewhere, except for Oxford where cross-party collaboration has been unusually strong, LTNs have often been removed mid-trial, quietly abandoned, or never progressed beyond the planning stage. We therefore conclude that while the political context is an important enabling condition, it alone cannot account for London's distinctiveness in implementing LTNs at scale.

A second proposition relates to inner London's unique transport context. As car ownership and usage is lower and public transport more comprehensive than elsewhere in England, a lower proportion of residents would be personally affected by the 'stick' element of LTNs restricting motor vehicles. Existing research has shown that people are less willing to accept environmental policies if they perceive themselves to be unfairly negatively affected (e.g. car owners and perceptions of road pricing – see Fujii et al., 2004). While overall LTNs may hold majority support (Department for Transport, 2024), there is higher opposition to LTNs amongst car owners (Redfield and Wilton Strategies, 2021). In inner London, where only 41 % of households own a car (compared to 67 % in outer London and 78 % in the rest of England and Wales), implementing a policy that restricts car use might be perceived

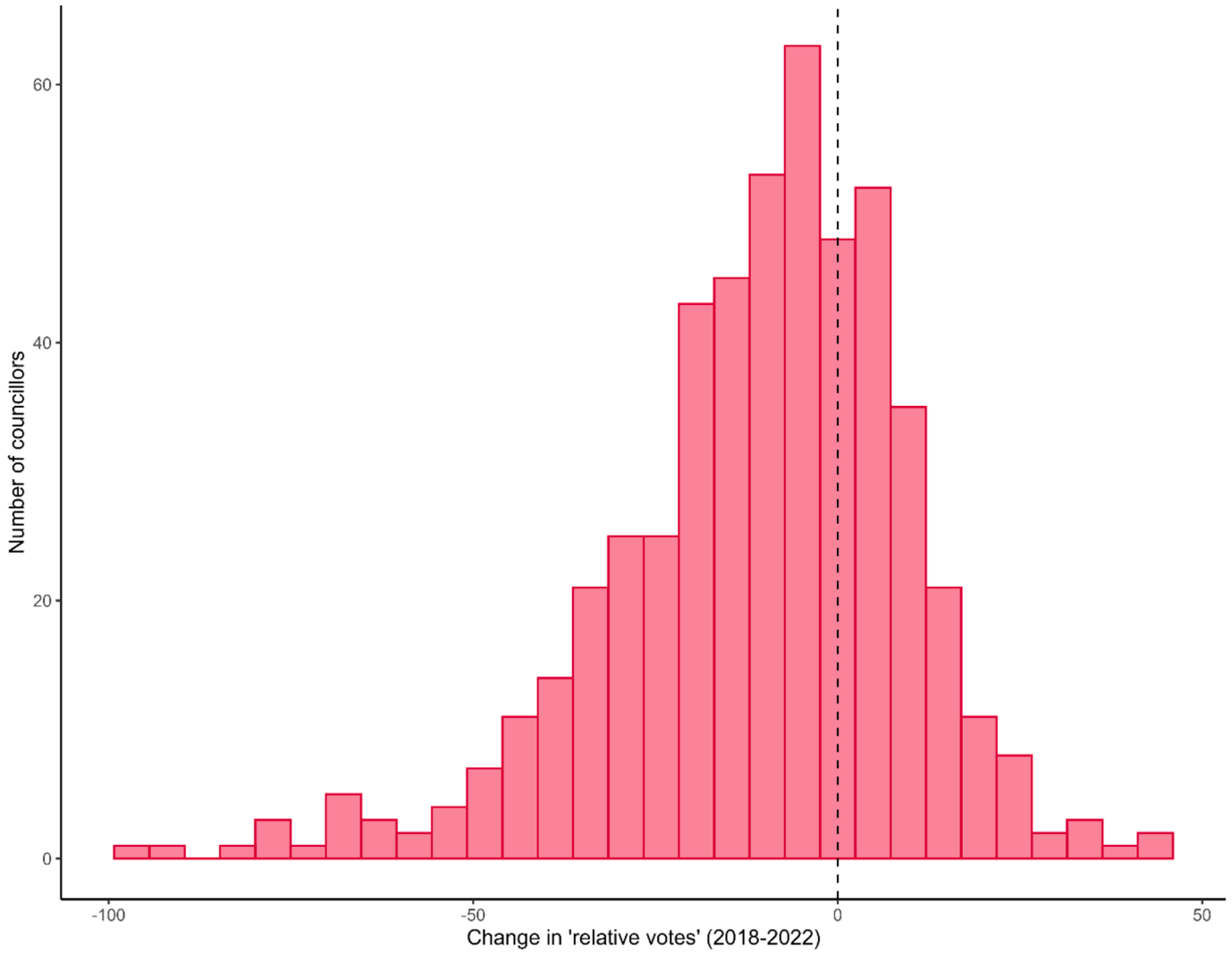

Fig. 6. Distribution of changes in relative vote shares, 2018–22.

Table 3
LTNs, councillors, and tweets by local authority district.

	LTNs	Councillors				Tweets			
Local authority	**Number of LTNs (planned and/or implemented and in place), Jan 2020-May 2022**	**Incumbent councillors (2022)**	**Incumbent winners**	**With Twitter accounts**	**Have tweeted about LTNs**	**All (N)**	**Negative**	**Positive**	**Neutral**
Brent	4	31	27	25	7	20	0	15	5
Camden	9	24	24	23	3	14	0	13	1
Croydon	2	16	16	16	5	15	0	14	1
Ealing	2	35	35	27	8	52	0	25	27
Enfield	2	25	20	13	2	2	0	2	0
Greenwich	1	23	23	22	5	14	0	9	5
Hackney	13	32	30	27	8	43	0	37	6
Hammersmith and Fulham	1	24	20	17	1	2	0	2	0
Haringey	3	28	28	18	3	25	0	19	6
Hounslow	6	32	30	20	3	8	0	7	1
Islington	7	32	31	24	13	72	0	69	3
Lambeth	7	31	29	30	12	265	1	215	49
Lewisham	1	29	29	24	5	30	0	26	4
Merton	2	21	18	11	1	6	0	5	1
Newham	4	38	37	25	6	89	0	81	8
Southwark	6	33	32	28	5	22	0	18	4
Tower Hamlets	2	23	12	16	7	15	0	6	9
Waltham Forest	5	30	29	14	1	11	0	11	0

Table 4
Seat retention by whether a councillor tweeted about LTNs.

Category	Held seat?	Count	Percent	Lower confidence interval (95 %)	Upper confidence interval (95 %)
Has tweeted	No	7	7.4	3.3	15.7
	Yes	88	92.6	84.3	96.7
Has not tweeted	No	30	7.2	4.9	10.6
	Yes	386	92.8	89.4	95.1

as a lower political risk.

A third proposition is that councillors in local authorities in London are more likely to have access to greater resources for public engagement, given the longstanding relative priority given nationally to the capital's transport networks. Recent research in Leeds suggested that a lack of consultation during Covid-19 negatively affected local views on emergency transport schemes introduced during that period (Campbell, 2023). While most LTNs in London were also introduced under Covid-19 emergency powers, research has shown that London authorities felt more able to engage residents effectively than did authorities in the rest of England (Aldred et al., 2023). Communication that was perceived to be more open may have improved acceptance of schemes due to greater perceived procedural fairness (Besley, 2010; Huber et al., 2020, Liu et al., 2020). Now LTNs and related schemes are once again required to be implemented under standard planning processes (rather than using Experimental Traffic Orders), local authorities will be able to – and likely need to – conduct more meaningful engagement with residents than they did during the Covid-19 pandemic. This, however, is likely to continue to prove challenging with English local authorities declaring or on the verge of bankruptcy after many years of austerity.

The discussion above has some tentative implications for policy and further research. Adequate resourcing is key for successful implementation of controversial policies, including being able to engage meaningfully with residents beyond the short life of an individual project (Verlinghieri et al., 2023). Without sufficient resources, local authorities may be set up to fail. In contexts like London (and to a lesser extent in English metropolitan regions) where resources are somewhat greater, more political boldness may be possible. Similarly, local authorities in diverse contexts may be able to take advantage of demographic shifts (e.g. the reduction in car ownership among young people) to propose policies that perhaps would have been seen as too challenging in the past.

Table 5
Seat retention by Tweet sentiment.

LTN sentiment councillor classification	Held seat?	Count	Percent	Lower confidence interval (95 %)	Upper confidence interval (95 %)
Neutral (sentiment score = 0)	No	2	13	15.4	3.7
	Yes	11	13	84.6	53.6
Somewhat positive (0 < sentiment score ≤ 0.5)	No	3	48	6.2	1.9
	Yes	45	48	93.8	81.1
Very positive (sentiment score > 0.5)	No	2	34	5.9	1.4
	Yes	32	34	94.1	78.3

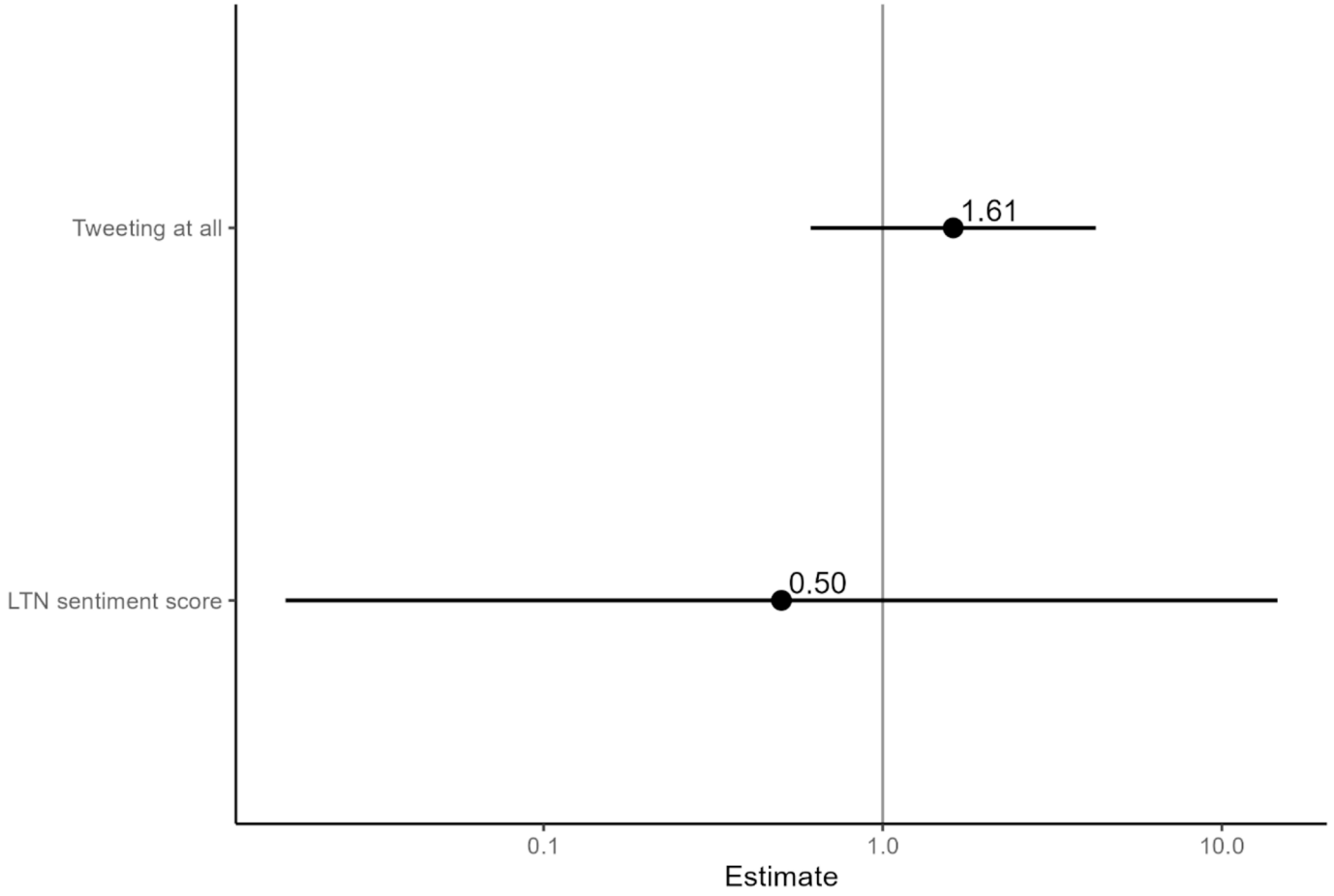

Fig. 7. Odds of holding seat associated with LTN sentiment score and tweeting about LTNs.

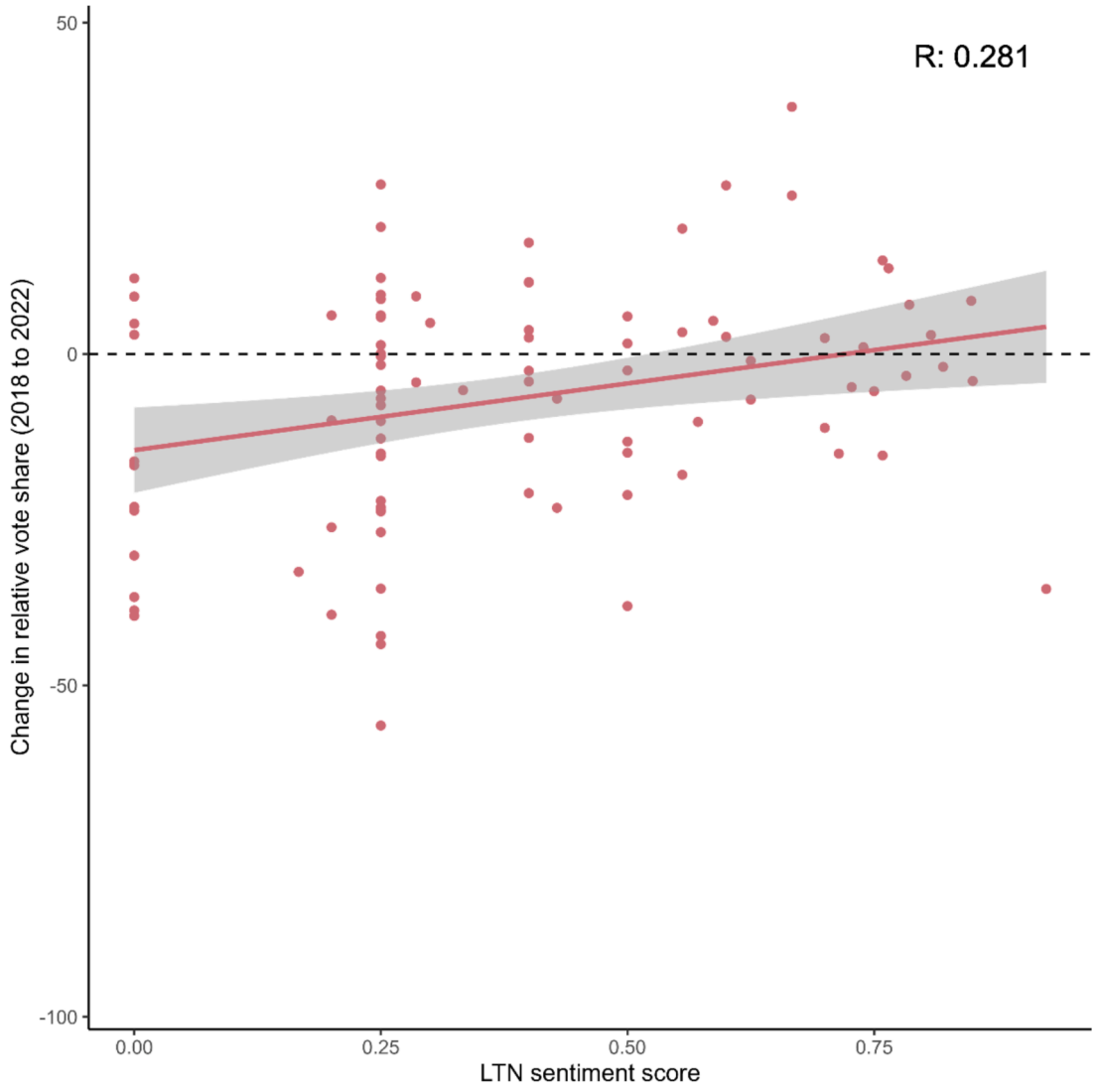

Fig. 8. Change in vote associated with LTN sentiment score.

4.3. Strengths and limitations

This research is the first to analyse, for individual elected representatives, the possible electoral consequences of taking a public stance on controversial active travel infrastructure in London. It employed an innovative approach to estimate notional election results in wards with boundary changes and used a Naïve-Bayesian model to predict the sentiment of LTN-related tweets. By conducting analysis at the councillor- rather than ward level, we could capture the nuances of individual councillors' positions on contentious local policies. This analysis is significant, as X (previously Twitter) remains an important tool for councillors to communicate with residents, shape public perceptions of policies, and contend with online backlash against LTNs.

In terms of limitations, no statistical model can account for all factors that determine the re-election of an incumbent councillor. Due to limited resources, it was not possible to find Twitter accounts of opposition candidates. As a result, this analysis focused only on incumbent Labour councillors, as the sample sizes of incumbents for other parties were too small to meaningfully make like-for-like comparisons. Furthermore, causality here may run in both directions; some councillors may tweet about LTNs because they are confident the schemes have local support or that their re-election is secure. To mitigate this potential endogeneity, we controlled for the 'safety' of seats in the 2022 elections by including the relative vote share from 2018 in the regression models.

A further weakness is, of course, the limited generalisability to other UK or international cities – as discussed, even with the UK, London has a unique political and transport environment. Conducting a similar study in other parts of England would not be easy, precisely because policymakers have not introduced many LTNs and many others have been swiftly removed, perhaps due partly to a fear of political consequences. Would these consequences, in rather different transport environments, have transpired or would (as in London) they be absent? We cannot know, but the results do suggest that at least where there is a combination of low car ownership, high public transport usage and significant political stability then politicians can afford a certain level of boldness in supporting LTNs. This finding may be transferable to other contexts and other controversial transport policies, where more research on related lines would build knowledge of these complicated relationships between political stability, demographic and transportation contexts, and resourcing.

CRediT authorship contribution statement

Jamie Furlong: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Resources, Project administration, Methodology, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Athena Brook:** Writing – review & editing, Validation, Software, Methodology, Investigation, Formal analysis, Data

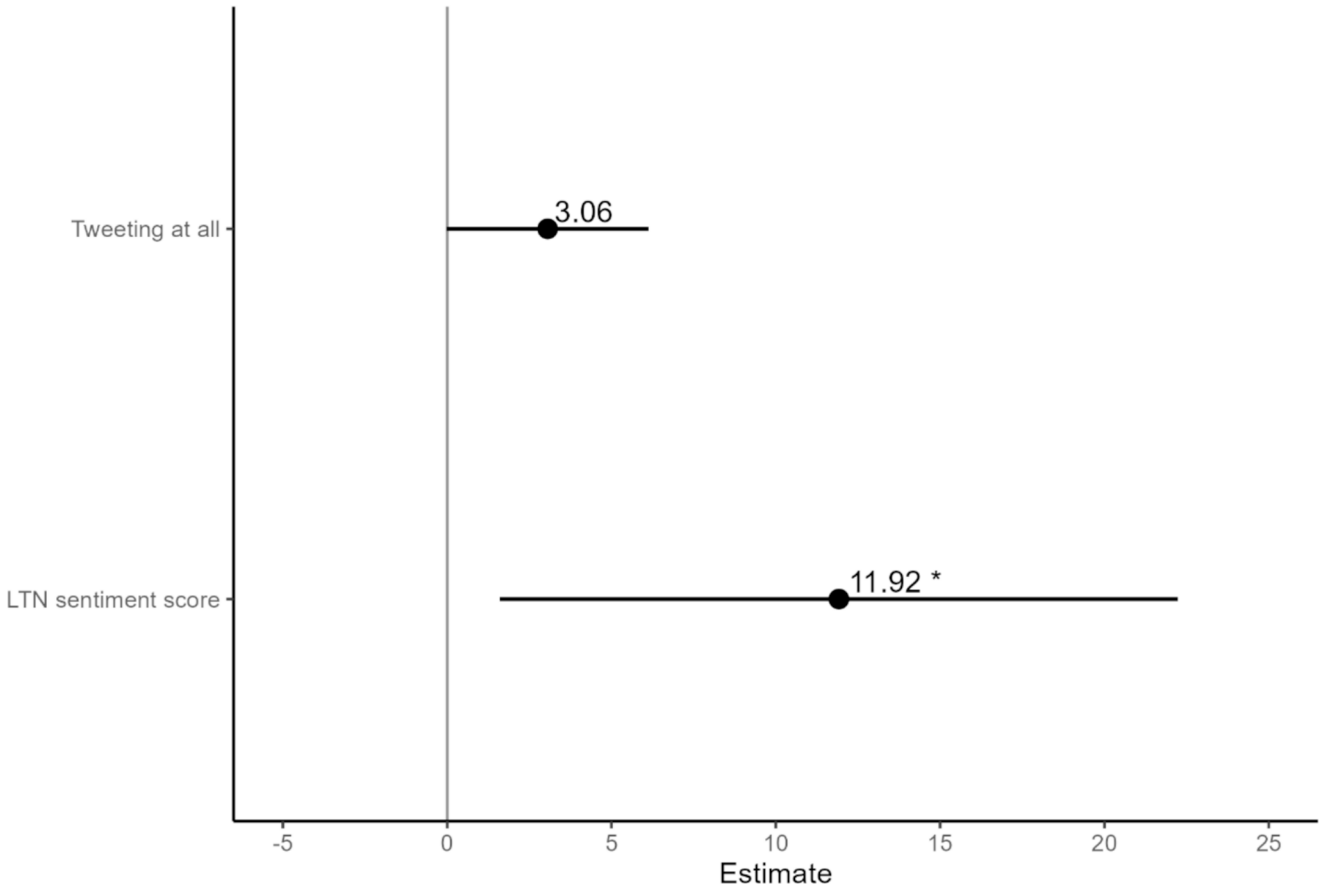

Fig. 9. Change in vote associated with LTN sentiment score and tweeting about LTNs.

Table 6
Distribution of the change in relative vote shares for Labour councillors who had or had not tweeted about LTNs.

LTN tweet?	Minimum	Lower quartile	Median	Mean	Upper quartile	Maximum	Standard deviation
No	−94.8	−21.6	−8.8	−11.8	2.1	45.6	21.1
Yes	−56.0	−17.5	−4.1	−6.8	5.3	37.3	17.8

curation. **Rachel Aldred:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Funding acquisition, Conceptualization. **Charlie Hicks:** Writing – review & editing, Writing – original draft, Conceptualization.

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Data availability

Anonymised data will be made available on request.

Declaration of competing interest

The authors declare no financial or personal relationships that unduly influenced the work reported in this paper. Charlie Hicks is a Labour Party councillor for Oxfordshire County Council, which has implemented Low Traffic Neighbourhoods in Oxford. Charlie's participation in this article was in a personal capacity - all data collection, analysis and interpretation were conducted independently of the Council, and no Council funds or staff time were used in this research.

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Appendix

Table A1
Regression output from model 1 predicting probability of a councillor holding their seat.

Variable	Estimate	Std. Error	z value	p value
Has tweeted LTNs (ref = no)	0.479	0.494	0.970	0.332
2018 ward turnout	−0.270	0.078	−3.440	0.001
Age 20 to 24	−0.001	0.000	−2.556	0.011
Households deprived: two dimensions	0.248	0.060	4.142	0.000
Relative vote share 2018	0.023	0.010	2.376	0.018
Intercept	8.256	3.099	2.664	0.008

Observations: 511.
AIC: 225.25.

Table A2
Regression output from model 2 predicting probability of a councillor holding their seat.

Variable	Estimate	Std. Error	z value	P value
LTN sentiment score	−0.687	1.718	−0.400	0.689
2018 ward turnout	−0.204	0.180	−1.136	0.256
Age 20 to 24	−0.002	0.001	−2.292	0.022
Households deprived: two dimensions	0.389	0.152	2.561	0.010
Relative vote share 2018	−0.010	0.021	−0.476	0.634
Intercept	8.054	7.325	1.100	0.272

Observations: 95.
AIC: 44.623.

Table A3
Regression output from model 3 predicting change in relative vote share (2018–2022).

Variable	Estimate	Std. Error	t value	p value
Has tweeted LTNs (ref = no)	3.057	1.564	1.955	0.051
Change in no. ward candidates (18–22)	3.420	0.377	9.068	0.000
2018 ward turnout	−1.168	0.506	−2.307	0.021
Party council-level vote share (2018)	−0.069	0.074	−0.939	0.348
White British ethnicity	−0.007	0.103	−0.065	0.948
NSSEC 7	−2.362	0.874	−2.704	0.007
NSSEC 8 and 9	1.317	0.564	2.335	0.020
NSSEC 15	0.476	0.243	1.959	0.051
Private renters	−0.570	0.129	−4.407	0.000
Travel to work: underground/tram	−0.107	0.200	−0.533	0.594
Travel to work: train	0.111	0.417	0.267	0.789
Travel to work: walk	−0.089	0.428	−0.209	0.835
Distance to work: 2–5 km	0.064	0.323	0.199	0.842
Distance to work: 5–10 km	0.736	0.304	2.424	0.016
Household deprivation: 4 dimensions	6.883	3.998	1.721	0.086
Ratio of older to younger people	−26.277	9.774	−2.688	0.007
No. all tweets	0.002	0.001	2.032	0.043
Relative vote share 2018	−0.426	0.055	−7.749	0.000
No of LTNs by council	−0.261	0.361	−0.722	0.470
Intercept	95.129	23.584	4.034	0.000

Observations 511.
R^2 0.425.
Adjusted R^2 0.402.

Table A4
Regression output from model 4 predicting change in relative vote share (2018–2022).

	Dependent variable:
	Change in relative vote share (2018–2022)
LTN sentiment score	11.920**
	(5.189)
Change in no. ward candidates (18–22)	2.658***
	(0.592)
2018 ward turnout	−2.450***
	(0.621)
NSSEC 8 and 9	1.260**
	(0.551)
Travel to work: train	−1.742***

(*continued on next page*)

Table A4 (*continued*)

	Dependent variable:
	(0.589)
Distance to work: 2–5 km	0.773**
	(0.373)
Relative vote share 2018	−0.366***
	(0.067)
No of LTNs by council	−0.999**
	(0.442)
Intercept	103.903***
	(26.099)
Observations	95
R^2	0.621
Adjusted R^2	0.586
Residual Std. Error	11.429 (df = 86)
F Statistic	17.618*** (df = 8; 86)
Note:	*p < 0.1**p < 0.05***p < 0.01

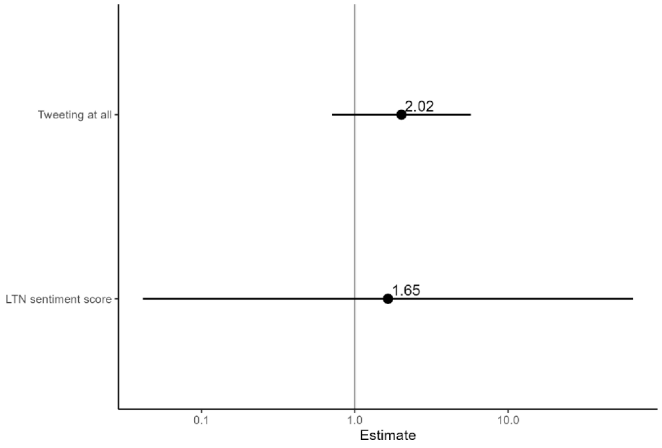

Fig. A1. Odds of holding seat associated with LTN sentiment score and tweeting about LTNs − councillor with 100 + tweets removed

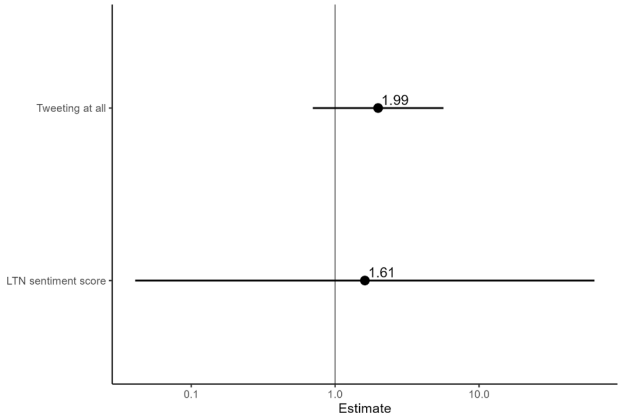

Fig. A2. Odds of holding seat associated with LTN sentiment score and tweeting about LTNs − councillors with 40 + tweets removed

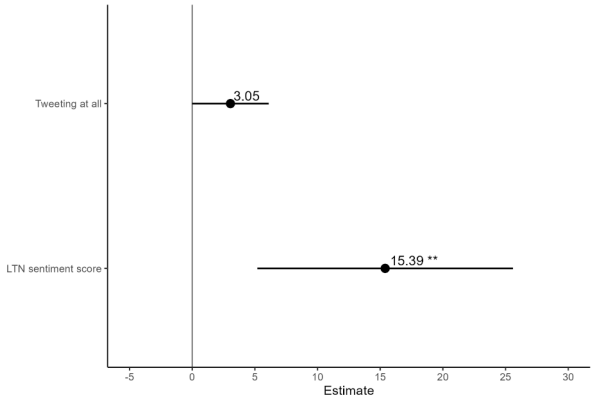

Fig. A3. Change in vote associated with LTN sentiment score and tweeting about LTNs − councillor with 100 + tweets removed

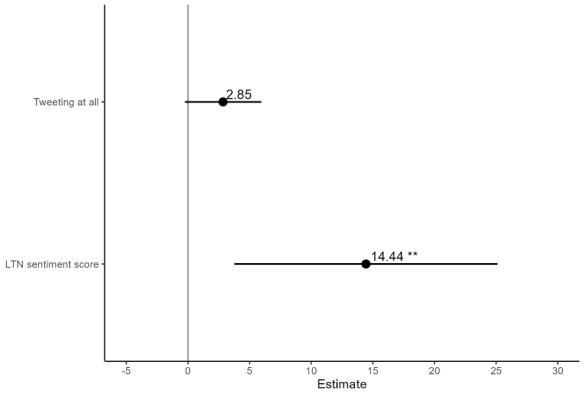

Fig. A4. Change in vote associated with LTN sentiment score and tweeting about LTNs − councillors with 40 + tweets removed

Table A5
Regression output from model (sensitivity analysis) using the alternative LTN sentiment score to predict the probability of a councillor holding their seat.

Variable	Estimate	Std. Error	z value	p value
Alternative LTN sentiment score	−0.271	1.366	−0.199	0.843
2018 ward turnout	−0.201	0.193	−1.044	0.296
Age 20 to 24	−0.002	0.001	−2.259	0.024
Households deprived: two dimensions	0.395	0.155	2.551	0.011
Relative vote share 2018	−0.010	0.021	−0.479	0.632
Intercept	7.755	7.793	0.995	0.320

Observations: 95.
AIC: 44.712.

Table A6
Regression output from model (sensitivity analysis) using the alternative LTN sentiment score to predict relative vote share change.

	Dependent variable:
	Change in relative vote share (2018–2022)
Alternative LTN sentiment score	2.133
	(3.892)
Change in no. ward candidates (18–22)	2.908***
	(0.599)
2018 ward turnout	−2.656***
	(0.636)
NSSEC 8 and 9	1.303**

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Table A6 (*continued*)

	Dependent variable:
	(0.566)
Travel to work: train	−1.690***
	(0.608)
Distance to work: 2–5 km	0.654*
	(0.385)
Relative vote share 2018	−0.367***
	(0.069)
No. of LTNs by council	−0.843*
	(0.454)
Intercept	114.867***
	(26.732)
Observations	95
R^2	0.599
Adjusted R^2	0.562
Residual Std. Error	11.754 (df = 86)
F Statistic	16.071*** (df = 8; 86)
Note:	*p < 0.1**p < 0.05***p < 0.01

Table A7
Regression output from model 4 (sensitivity analysis) that includes all LTN tweets and all tweets as explanatory variables.

	Dependent variable:
	Change in relative vote share (2018–2022)
LTN sentiment score	16.211**
	(6.615)
Change in no. ward candidates (18–22)	2.535***
	(0.602)
2018 ward turnout	−2.528***
	(0.628)
NSSEC 8 and 9	1.248**
	(0.553)
Travel to work: train	−1.791***
	(0.597)
Distance to work: 2–5 km	0.708*
	(0.379)
Relative vote share 2018	−0.369***
	(0.068)
No of LTNs by council	−1.045**
	(0.450)
No. of tweets	0.001
	(0.002)
No. of LTN tweets	−0.149
	(0.121)
Intercept	107.407***
	(26.432)
Observations	95
R^2	0.628
Adjusted R^2	0.584
Residual Std. Error	11.461 (df = 84)
F Statistic	14.170*** (df = 10; 84)
Note:	*p < 0.1**p < 0.05***p < 0.01

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