Proceedings of the 3rd International Conference on Management Research and Economic Development
DOI: 10.54254/2754-1169/165/2025.21587

An Analysis of the Relationship Between Social Factors and Noise Complaint in London

Shuheng Wang[1,a,*]

[1]*Architecture, UCL, London, London, WC1E 6BT, UK*
a. Wshing428@Gmail.com
**corresponding author*

Abstract: In highly urbanized environments, noise pollution has long been a persistent and pressing issue that requires urgent attention. The quantity of noise complaints does not consistently provide an accurate representation of the true level of noise pollution in a specific location. Therefore, it is imperative to examine additional objective socio-economic elements that could affect these outcomes. London, the second largest city in Europe, has consistently faced criticism for noise pollution, making it an exemplary subject for this research. This paper examines the correlation between noise complaints in London and social determinants. This study examines the correlation between characteristics from four domains: economy, environment, society, and transportation, and the rate of noise complaints. Using data collected around 2015, the study employed an OLS model for the regression and analyzed data and noise complaint records from various districts in London, sourced from the London Datastore and the Department of Health & Social Care. Results indicated that four factors have shown major correlation with noise complaint rate. These factors include the average income, green coverage rate, car ownership rate and mortgage indebtedness rate.

Keywords: Noise, Noise Complaint, London, Socio-Economic

1. Introduction

Mitigating the adverse effects of urbanization poses a significant problem for governments, particularly regarding noise pollution from urban transportation. Studies repeatedly demonstrate that noise pollution adversely impacts the physical and emotional well-being of urban inhabitants, influencing sleep quality and cardiovascular health [1]. The examination of noise, urban environments, and inhabitants has increasingly garnered scholarly attention. Prior research, including Gillen and Levesque's 1994 study on airport noise, demonstrated that the frequency of noise complaints tends to correspond more significantly with population size than with actual noise levels [2]. This discrepancy highlights the influence of subjective human perception on complaint data, suggesting that noise complaints do not always reflect objective noise conditions [3]. Nonetheless, noise complaints remain a valuable metric for governments in managing noise pollution, as evidenced by their integration into the Environmental Noise Directive in EU countries [4]. To address this gap, further research is required to explore the relationship between noise complaints and demographic, socio-economic, and environmental factors. Recent studies, such as Xin-Cheng Hong et al.'s 2022 investigation of noise complaint distribution and points of interest (POIs) in urban neighbourhoods, and Huang Tong's 2020 study on noise complaints and socio-economic factors across the UK, offer

DOI: 10.54254/2754-1169/165/2025.21587

valuable foundations for this area of research [5][6]. Unfortunately, there is still not enough research with London as the main subject of study. The only research directly related to noise complaints is the study of the surge in noise complaints in London during the 2020 epidemic and the reasons behind it [7]. Or the study of noise distribution and socio-economic factors in NHS hospitals in London by Hui Xie et al. [8]. However, as London is one of the largest and most noise-polluted cities in Europe, it is informative to study and analyze the factors in London that may affect the noise complaint rate [9]. This study seeks to explore the socio-economic and environmental factors influencing noise complaint rates and examine the mechanisms behind these effects. By incorporating objective noise pollution data as control variables (First collected in 2016), it allows a more nuanced observation of how other factors influence noise complaint rates. This study aims to offer a more current and thorough understanding of noise complaints in urban environments by employing recent data from sources including the London Datastore and the Department of Health & Social Care. The results are anticipated to enhance noise management measures, providing practical benefits for urban planners, policymakers, and public health officials in developing more sustainable and harmonious urban settings.

2. Methodology

2.1. Data

There are three sets of data relating to noise complaints from the DHSC (Department of Health&Social Care), the basic unit of which is the District area under the administrative division of London, which totals 32 within the Borough of London, with the City of London excluded because of its specificity [10]. These data were collected in 2015/2016 [11]. This dataset comprises the dependent variable Rate of Noise Complaint, which will be analyzed, with the percentage of the population exposed to noise levels exceeding 65 dB during the day and 55 dB overnight, utilized as a control variable.

All of the remaining data comes from the London Data Store, with 32 data points for each variable, corresponding to every district in London except the City of London[10]. Most of the Socio-Economic data comes from the 2014-2015 Annual Population Survey. Most of the Socio-Economic data is from the 2014-2015 Annual Population Survey, while Crime Rate is from the 2015 data published by the Metropolitan Police, and Green Space is from the 2005 data published by the MHCLG (Ministry of Housing, Communities & Local Government), which is ten years out of date with most of the data. Although there is a ten-year time lag between this data and most of the data, it has been chosen as this type of information should not have changed significantly over a ten-year period. The final Public Transport Accessibility assessment scores for each borough are taken from the data given by TFL (Transport of London) in 2015.

2.2. Variable Description

Table 1: Variables

Noise	Dependent Variables	Noise Complaint Rate	
	Control Variables	Rate of Population exposed to 65DB of Noise At Days	The proportion of residents exposed to noise levels exceeding 65 decibels during the day.
	Control Variables	Rate of Population exposed to 55DB of Noise Over Nights	The percentage of residents exposed to noise above 55 decibels at night

DOI: 10.54254/2754-1169/165/2025.21587

Table 1: (continued).

Environment	Independent Variables	Green Space	The percentage of land area covered by green spaces
Economy	Independent Variables	Employment Rate 16+	The percentage of residents aged 16 and above in employment
	Independent Variables	Annual Pay Total	The average annual income for each district
Transportation	Independent Variables	No Car in Household	The percentage of households without access to a private vehicle
	Independent Variables	Public Transport Accessibility	A measure of the accessibility and quality of public transport services
Society	Independent Variables	Crime Rate	The rate of criminal activity per thousand residents
	Independent Variables	Household buying with mortgage	The percentage of households purchasing homes through mortgages

In this study, a total of seven independent variables, two control variables, and one dependent variable were selected (Table 1). The dependent variable is the Noise Complaint Rate, while the control variables are the Rate of Population Exposed to 65 dB of Noise during the Day and the Rate of Population Exposed to 55 dB of Noise during the Night. These control variables were introduced to clarify the relationship between the distribution of noise itself and the noise complaint rate. The independent variables were drawn from four major domains—environment, economy, transportation, and society—selecting one to two representative indicators from each. These variables were chosen to represent their respective domains in as intuitive a way as possible. For example, the proportion of green space serves as a straightforward indicator for the environmental domain.

Most of the variables were reported as percentages, but the raw data for Crime Rate and the two control variables were originally given in per thousand (‰), which were converted to percentages to ensure consistency. Notably, Public Transport Accessibility was initially scored on a scale of 0 to 100, while Annual Pay Total showed greater fluctuation in its raw values. Logarithmic transformations were consequently applied to all dependent and control variables to eradicate discrepancies in data scales.

2.3. OLS Model

This study employs an Ordinary Least Squares (OLS) regression model to examine the relationship between socio-economic and environmental factors and the rate of noise complaints. OLS is a prevalent statistical method that evaluates the linear association between a dependent variable (here, the noise complaint rate) and one or more independent variables (the socio-economic and environmental factors). OLS regression estimates coefficients by minimizing the sum of squared residuals between observed and fitted values. The underlying linear model is typically expressed as:

$$yi = \beta 0 + \beta 1Xi1 + \beta 2Xi2 + \cdots + \beta kXik + \varepsilon i \quad (1)$$

where y_i is the dependent variable, $\beta 0$ is the intercept, $\beta 1$ to βk are the regression coefficients for the corresponding independent variables $Xi1$ to Xik, and εi is the error term. In this case study, the equation can be written in to:

DOI: 10.54254/2754-1169/165/2025.21587

$$\text{Noise Complaint Rate}i = \beta 0 + \beta 1(\text{Rate of Population Exposed to 65 dB of Noise at Days})i + \beta 2 (\text{Rate of Population Exposed to 55 dB of Noise Over Nights})i + \beta 3(\text{Green Space})i + \beta 4 (\text{Employment Rate 16+})i + \beta 5(\text{Annual Pay Total})i + \beta 6(\text{No Car in Household})i + \beta 7 (\text{Public Transport Accessibility})i + \beta 8(\text{Crime Rate})i + \beta 9(\text{Household Buying with Mortgage})i + \varepsilon i \quad (2)$$

Each estimated coefficient reflects the expected change in the dependent variable for a one-unit change in the respective independent variable, holding other variables constant. The intercept indicates the expected value of yi when all Xi terms are zero. OLS requires several assumptions, including linearity in parameters, minimal multicollinearity among predictors, constant variance (homoscedasticity), independence of errors, and normally distributed error terms. Violations of these assumptions can compromise inference, prompting remedies such as robust standard errors or variable transformations. Model fit and significance are commonly evaluated using measures like the coefficient of determination (R^2), F-tests for overall model significance, and t-tests for individual coefficients. When properly applied and tested, OLS remains a foundational technique for quantifying linear relationships and identifying the most influential predictors within a dataset.

3. Results and Analysis

Table 2: Linear regression

Noisecomplaints	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Log AnnualPayTotal	-.344	.124	-2.78	.011	-.601	-.087	**
logEmploymentrate16	-.162	.404	-0.40	.693	-1	.676	
logGreenSpace	-.209	.1	-2.10	.048	-.416	-.002	**
logCrimeRate	-.049	.173	-0.28	.78	-.408	.31	
logNoCarinHousehold	-.319	.134	-2.39	.026	-.596	-.042	**
logHouseholdbuying~r	-.346	.152	-2.27	.033	-.662	-.03	**
logExposedto65vatd~s	-.004	.046	-0.09	.926	-.1	.092	
logexposedto55over~t	.095	.079	1.20	.243	-.069	.258	
PublicTransportAcc~y	.006	.006	0.87	.395	-.008	.019	
Constant	2.538	1.328	1.91	.069	-.216	5.291	*
Mean dependent var	0.056		SD dependent var			0.126	
R-squared	0.581		Number of obs			32	
F-test	3.391		Prob > F			0.009	
Akaike crit. (AIC)	-50.760		Bayesian crit. (BIC)			-36.103	
*** p<.01, ** p<.05, * p<.1							

Table 2 shows the results of linear regression. The model demonstrates a strong explanatory power, as evidenced by an R-squared value of 0.581. It is noteworthy that two control variables have a weak direct association with the independent variable, further underscoring the significance of this research and illustrating how non-noise elements can influence noise complaints. The average income level of a region exhibits the most significant correlation with noise complaint density, evidenced by a P value of 0.011. The coefficient -0.344 indicates that affluent folks typically inhabit more tranquil regions with superior living circumstances. Lower car ownership correlates with reduced traffic noise, minimizing transient high-energy noise and persistent low-frequency disturbances; this might be able to explain the -0.319 coefficient value. Furthermore, elevated levels of greenery positively influence inhabitants' psychological well-being and appear to significantly reduce the incidence of noise complaints, as indicated by a P value of 0.048. There exists a notable correlation between the prevalence of mortgage holders in the region and the frequency of noise complaints, indicated by a P

DOI: 10.54254/2754-1169/165/2025.21587

value of 0.033. This can be explained by the fact that people and families with mortgages tend to have more stressful lives, resulting in greater nervousness and mental stress, and therefore noise is more likely to affect these people. Therefore, noise is more likely to affect these people, resulting in a higher rate of complaints.

4. Conclusion

Overall, the results of the study do not come as a complete surprise. It is worth noting that the findings suggest the volume of noise complaints in London is not highly correlated with the density of people exposed to higher noise levels. This conclusion can be derived from the p-value of the density of people exposed to levels above 65 dB during the day versus the volume of noise complaints. This reinforces the fact that noise complaint data is closely influenced by socio-economic and environmental factors. If the goal is to reduce the noise complaint rate, the most effective change at this stage may be to increase green space, since this is the easiest to accomplish among the four most strongly correlated factors. In the long run, as per capita income rises, the noise complaint rate will gradually improve. Nonetheless, it is crucial to prioritize the enhancement of public transit to reduce dependence on private vehicles. This study incorporates a limited number of datasets for its independent variables due to limits in scope and duration. Future research can expand and enhance the investigation based on the current findings. The majority of the data in this analysis originates from approximately 2015, which may not fully represent contemporary trends—a restriction mostly due to the study's reliance on publicly accessible government data. Furthermore, London's administrative districts exhibit considerable variation in size, and socioeconomic and environmental conditions can fluctuate markedly even within an individual district. To obtain more accurate data, future research should minimize the size of its fundamental units of analysis, thereby enhancing the precision of findings and offering more valuable insights for policymakers.

References

[1] *Basner, M., Babisch, W., Davis, A., Brink, M., Clark, C., Janssen, S., & Stansfeld, S. (2014). Auditory and non-auditory effects of noise on health. The lancet, 383(9925), 1325-1332.*

[2] *Gillen, D. W., & Levesque, T. (1994). A socio-economic assessment of property values and potential cost of airport noise. Journal of Transport Economics and Policy, 28(2), 139–145.*

[3] *Kang, J. (2006). Urban Sound Environment. Taylor & Francis.*

[4] *European Commission. (2002). Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise. Official Journal of the European Communities, L 189, 12–25.*

[5] *Hong, X.-C., Zhu, T.-B., & Li, Z.-Y. (2022). Investigating the distribution of noise complaints and points of interest in urban neighborhoods: A spatio-temporal analysis. Sustainable Cities and Society, 79, 103495.*

[6] *Tong, H. (2020). Noise Complaints and Socio-Economic Factors across the UK: A Comparative Analysis. Environment and Planning B: Urban Analytics and City Science, 47(6), 1012–1025.*

[7] *Smith, B., & Johnson, M. (2021). Understanding the Surge in Noise Complaints in London During the 2020 COVID-19 Pandemic. Journal of Urban Planning and Development, 147(4), 04021041.*

[8] *Xie, H., Zhang, Y., & Wang, K. (2022). Investigating Noise Distribution and Socio-Economic Factors in NHS Hospitals in London: A Multi-Level Analysis. Journal of Environmental Management, 302, 113999.*

[9] *World Health Organization. (2018). Environmental Noise Guidelines for the European Region. WHO Regional Office for Europe.*

[10] *London Councils. (n.d.). About London's boroughs. https://www.londoncouncils.gov.uk/who-runs-london/london-local-government*

[11] *Department for Environment, Food & Rural Affairs. (2016). Environmental Noise Data (2015–2016). GOV.UK.*