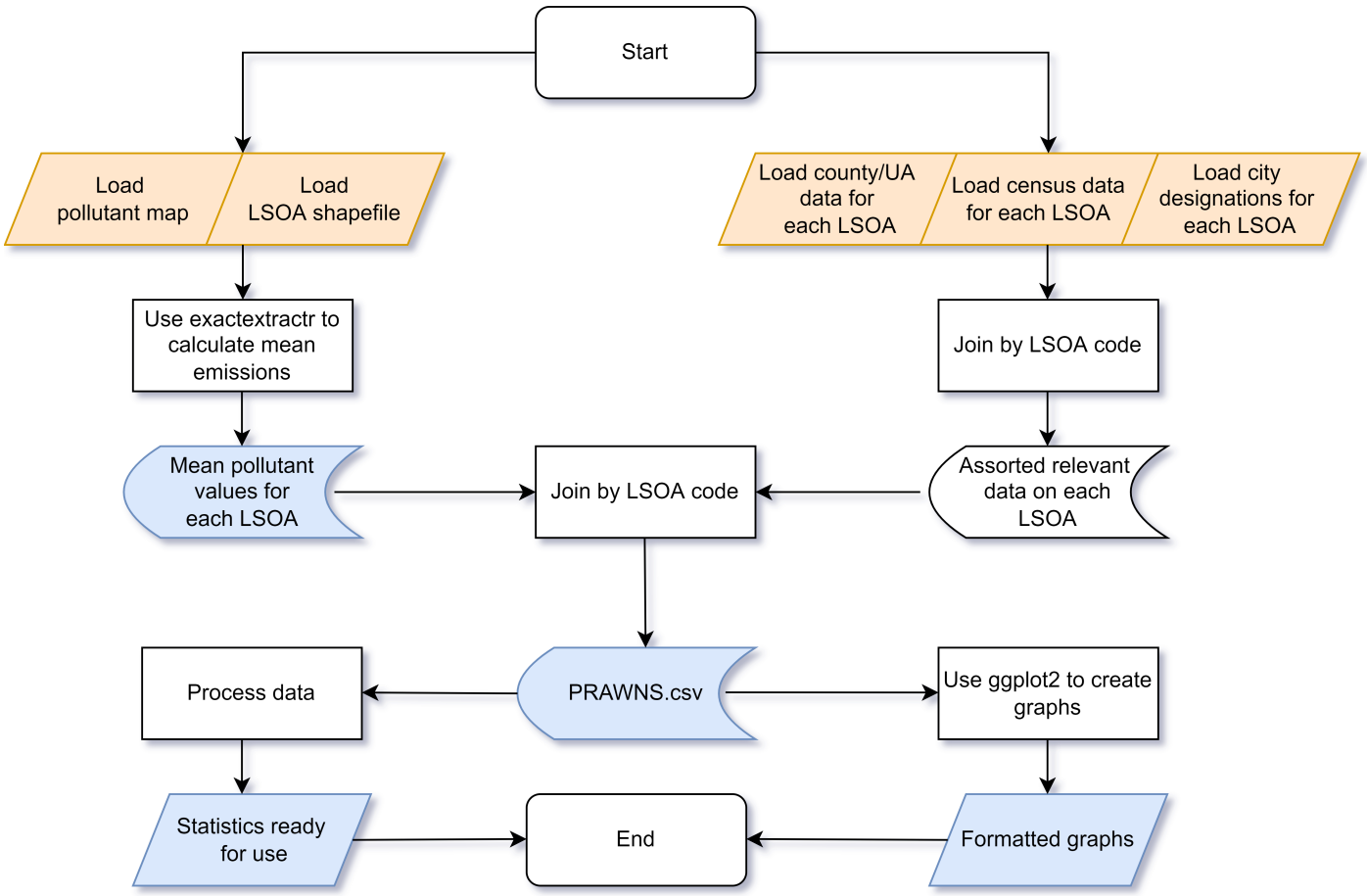
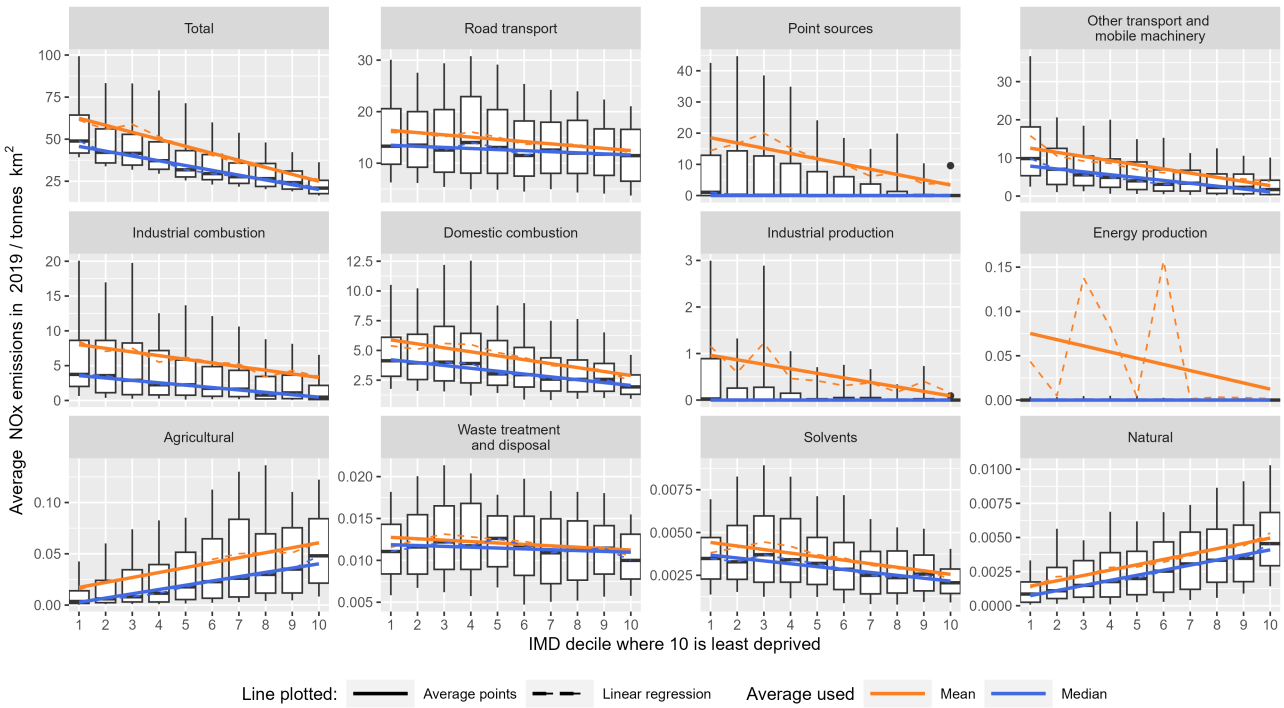
# Electronic Supplementary Information (ESI) for Deprivation based inequality in $NO_x$ emissions in England

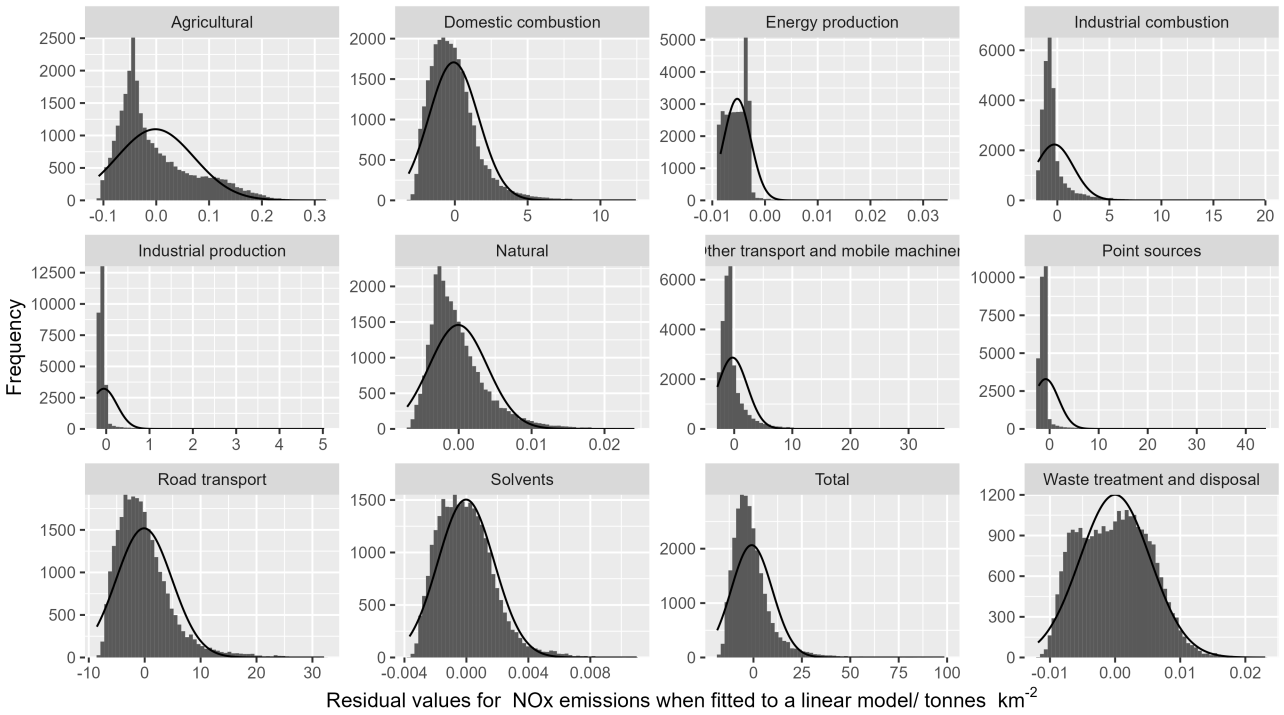
List of Figures



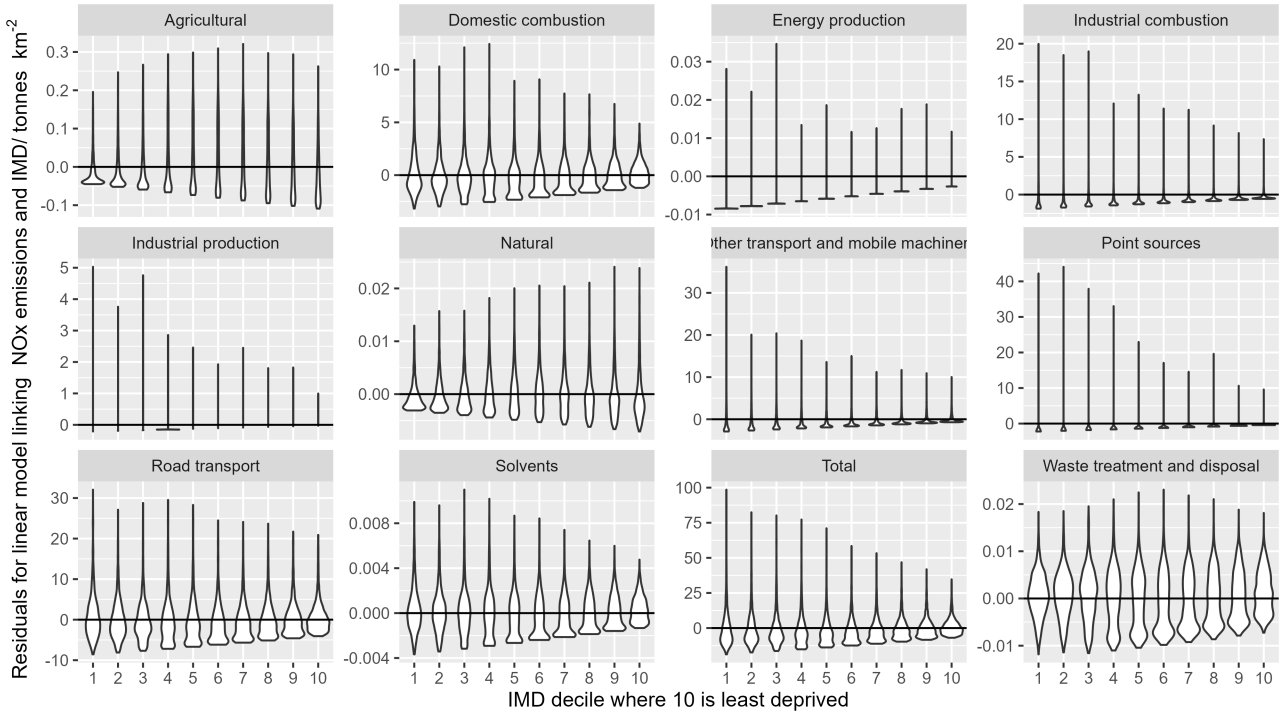

ESI:fig. 1 Workflow illustrating the process used to link individual data sources of NAEI $NO_x$emissions, geographic LSOA polygons and IMD census data within the PRAWNS R package, the software used to process data and create the graphs used in this paper.



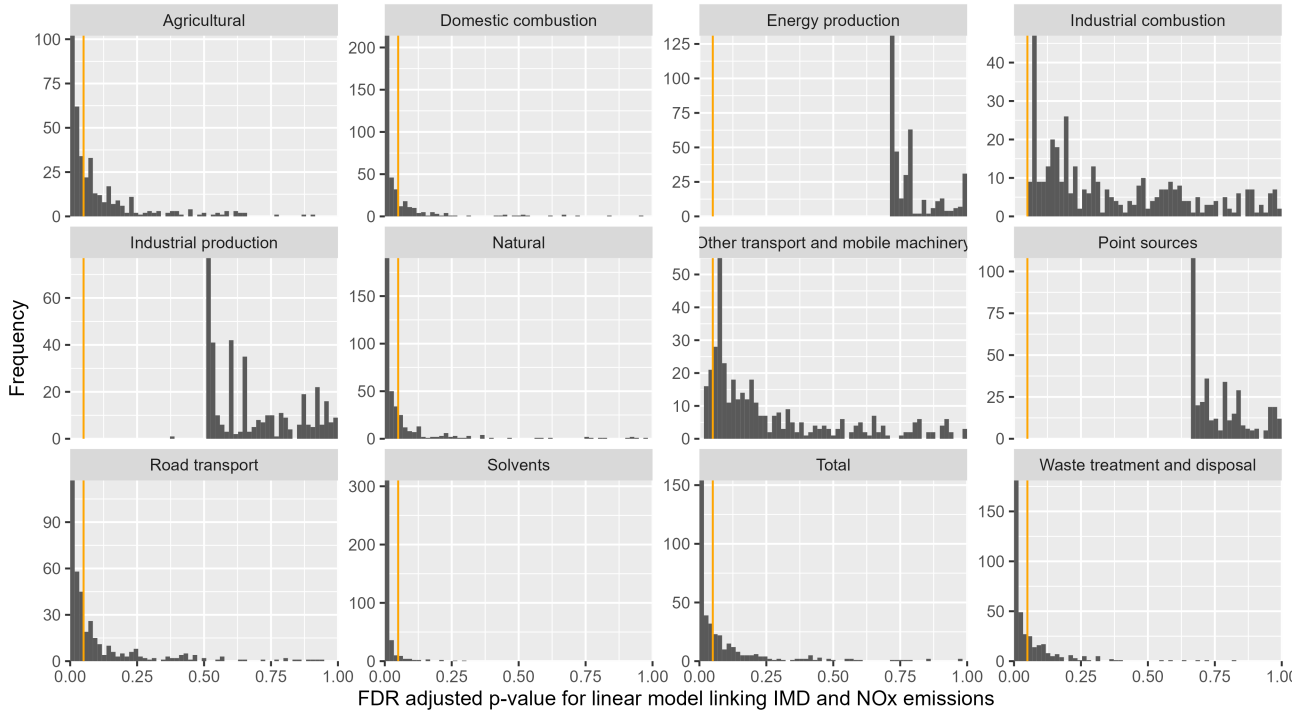

ESI:fig. 2 $NO_x$ emissions for the highest 10% emitting LSOAs in each deprivation decile



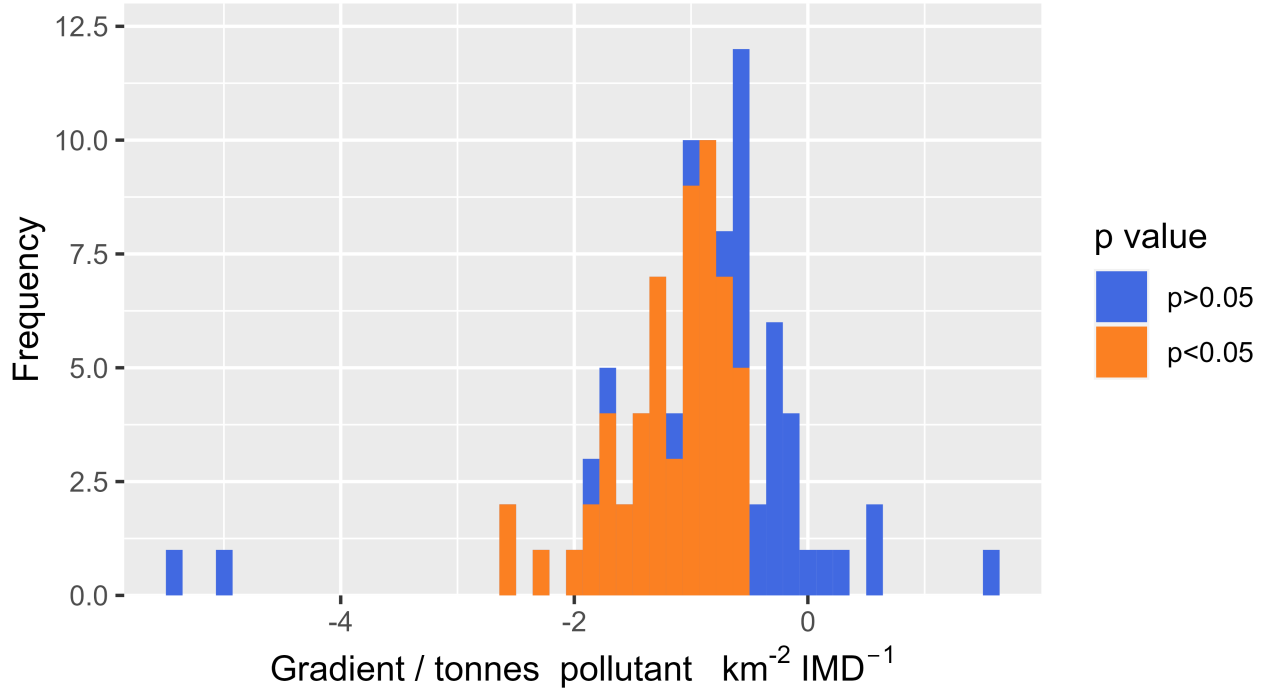

ESI:fig. 3 Residuals of the linear fit applied to each emissions sector for all LSOAs in England in 2019 with those associated with London removed. Plotted as a histogram to determine if they follow a Gaussian distribution, indicating randomly distributed error. A line approximating the gaussian they'd be expected to follow if the data was not skewed is also plotted.



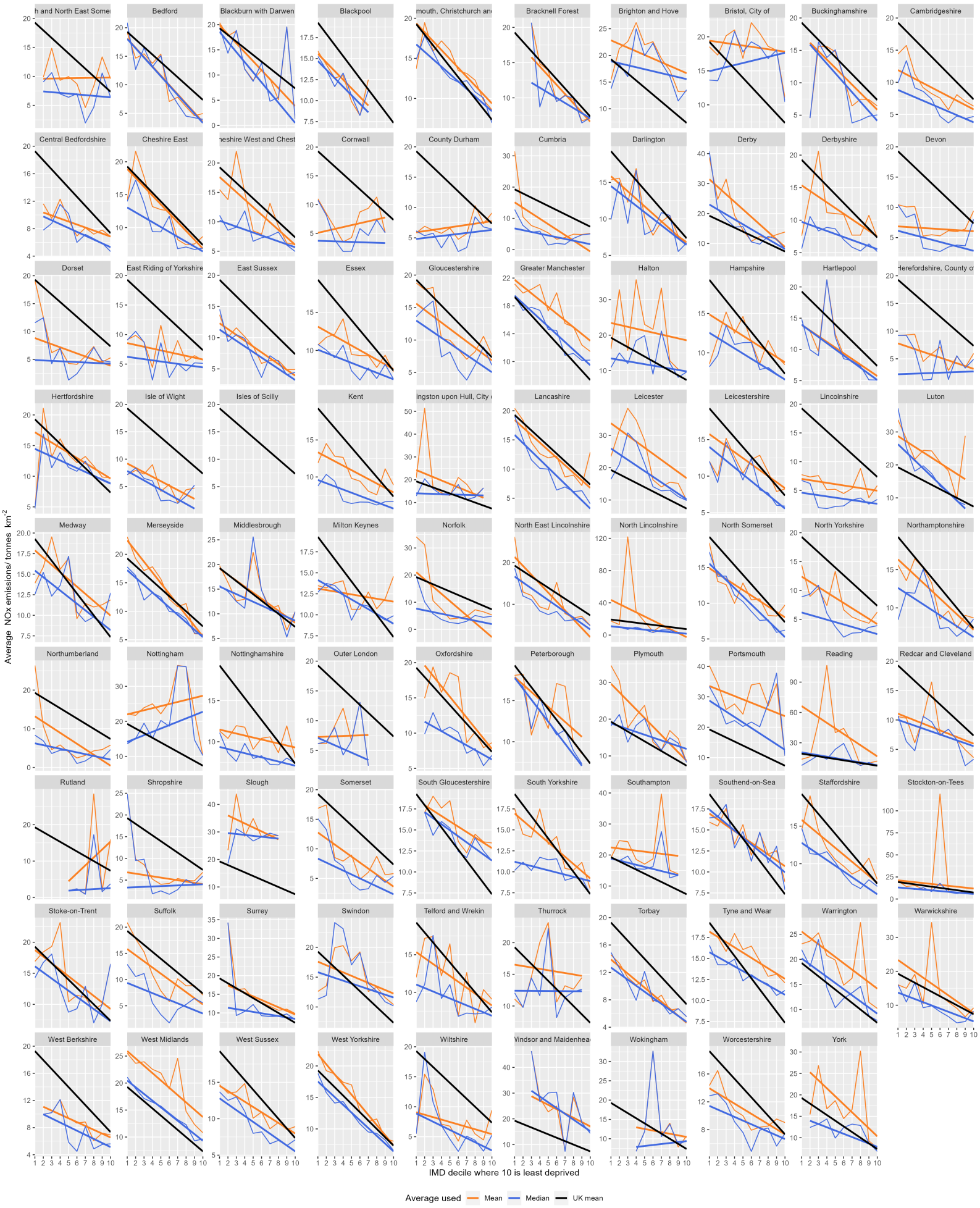

ESI:fig. 4 Violin plot showing the frequency distribution of the residuals of the linear fit applied to each emissions sector for all LSOAs in England with those associated with London removed. The highest 1% of residuals have been removed to enable a reasonable scale.



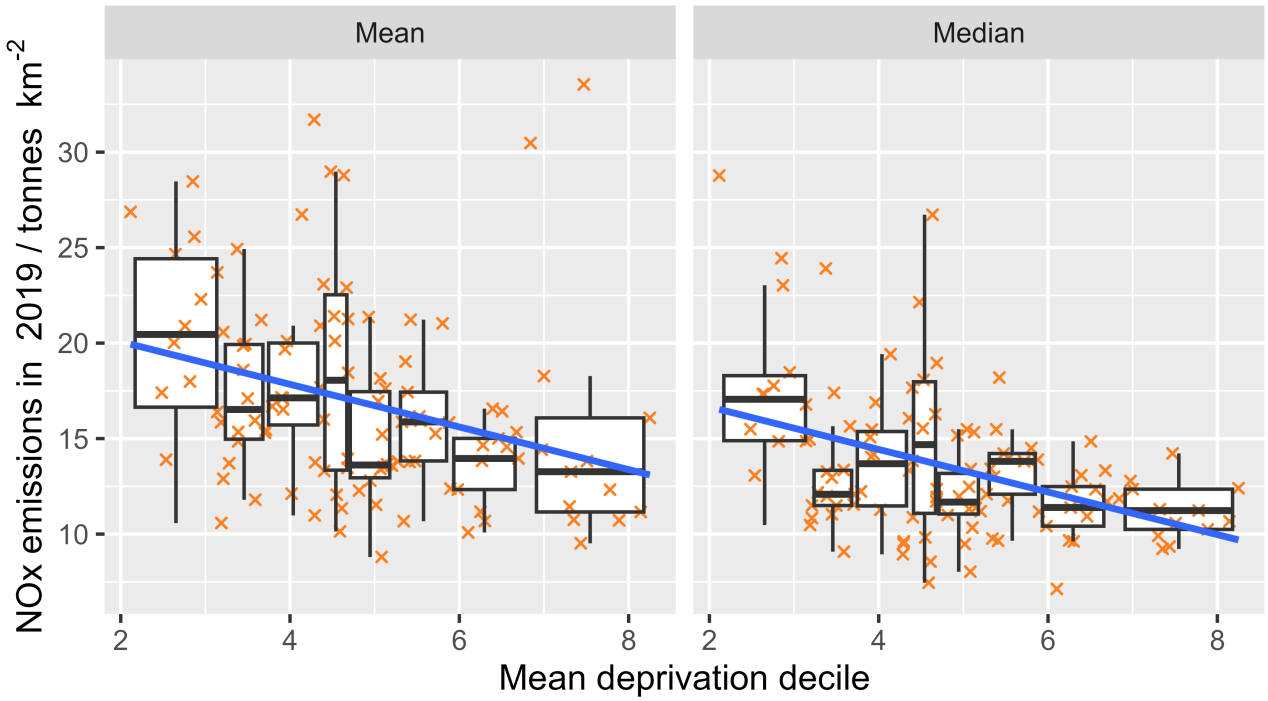

ESI:fig. 5 P values for each emissions sector when randomly broken into 384 chunks each containing 74 LSOAs. Patterns were consistent across 10 seeds used for the random splitting of data



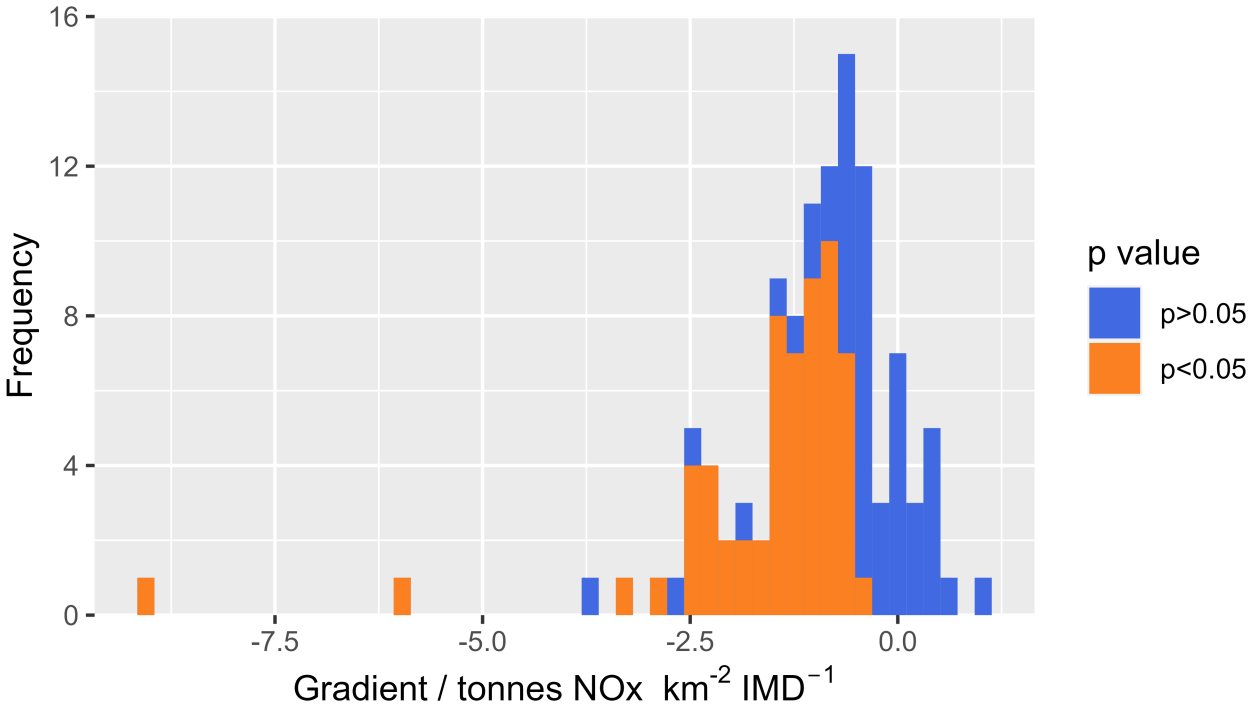

ESI:fig. 6 The calculated gradient of a linear model linking IMD decile and UK 2019 $NO_x$ emissions for every county/unitary authority in England with London excluded.




ESI:fig. 7 Total $NO_x$ emissions for counties and unitary authorities in England in 2019

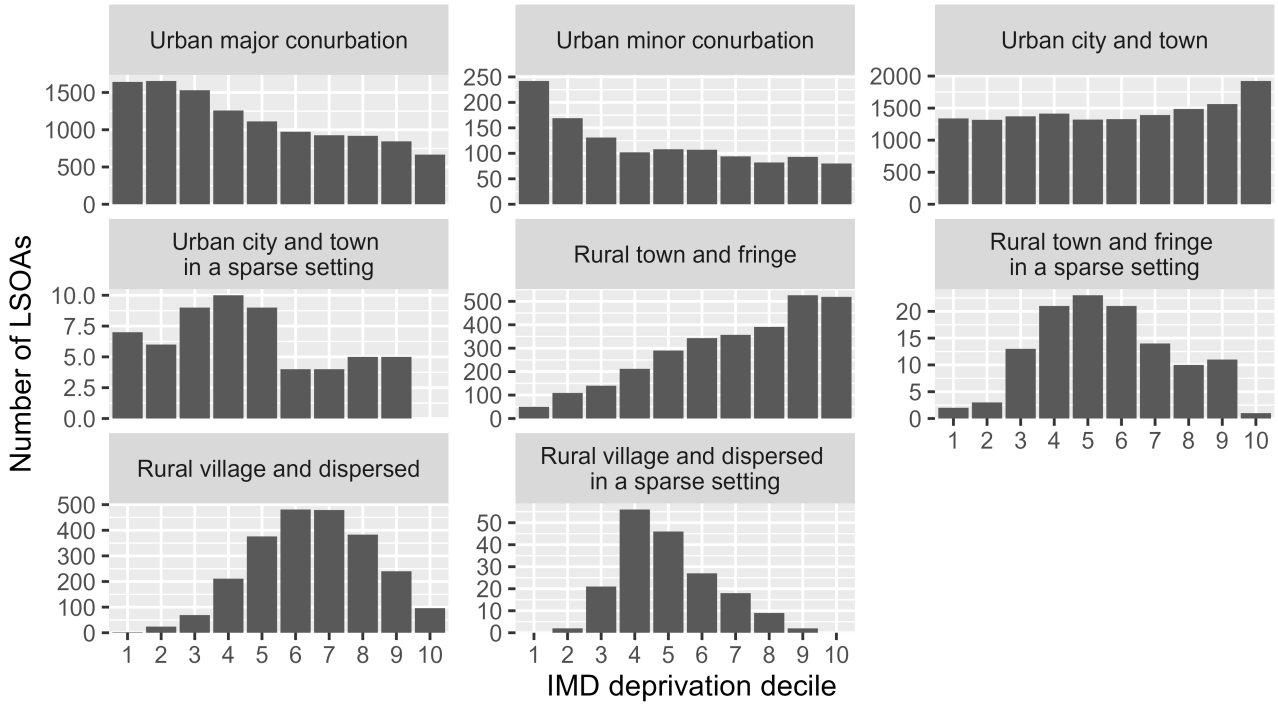



ESI:fig. 8 Scatter plot linking the average NOx emission and mean IMD decile for all cities in England with London removed. Each orange cross represents a single county or unitary authority. The blue line is a linear regression line plotted through all points. The boxplot is split into 8 bins containing equal numbers of counties/unitary authorities and uses standard procedures for plotting the whiskers

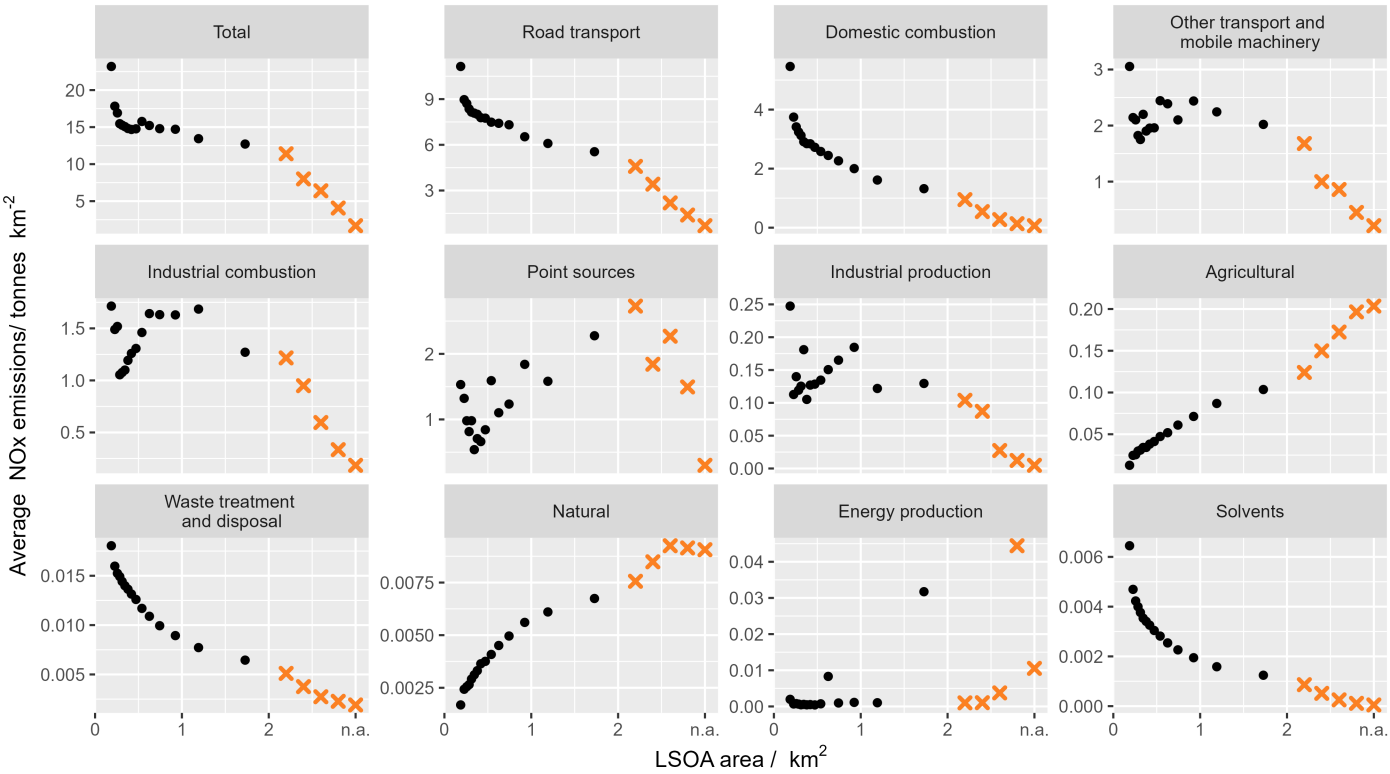



ESI:fig. 9 The calculated gradient of a linear model linking IMD decile and UK 2019 NOx emissions for every city in England with London excluded.

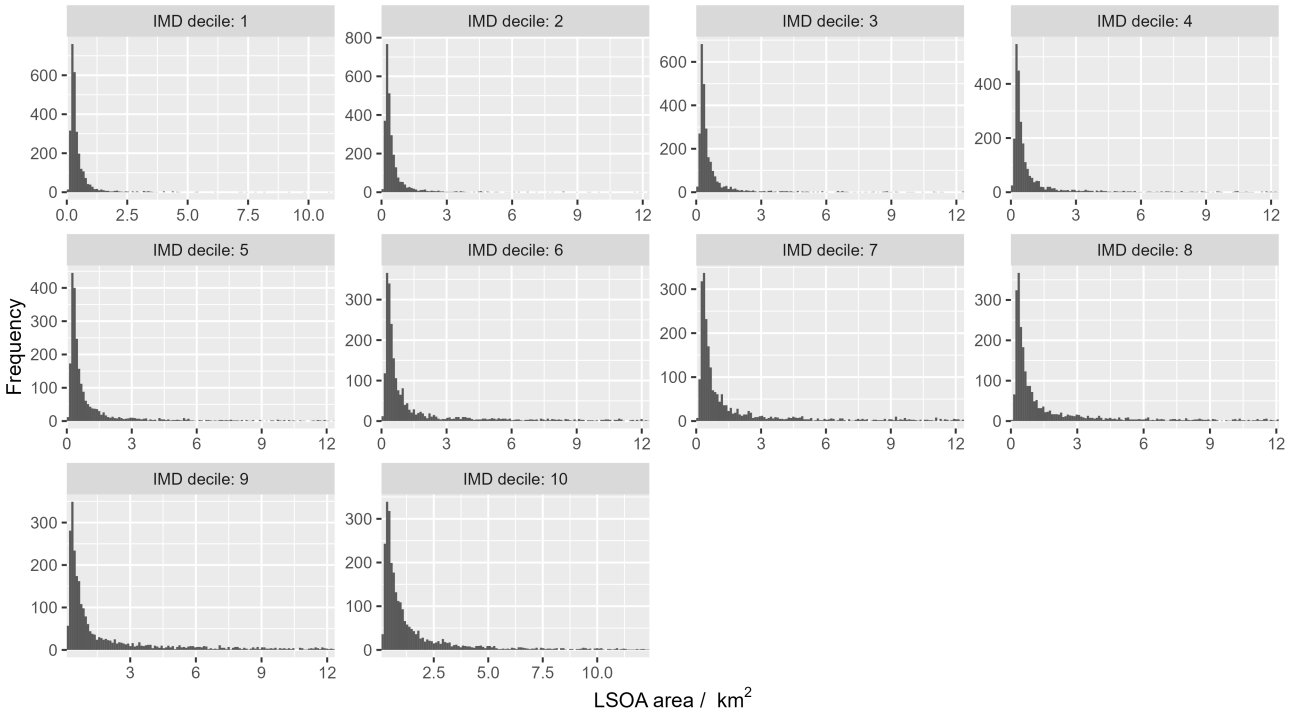

ESI:fig. 10 Total $NO_x$ emissions for cities in England in 2019



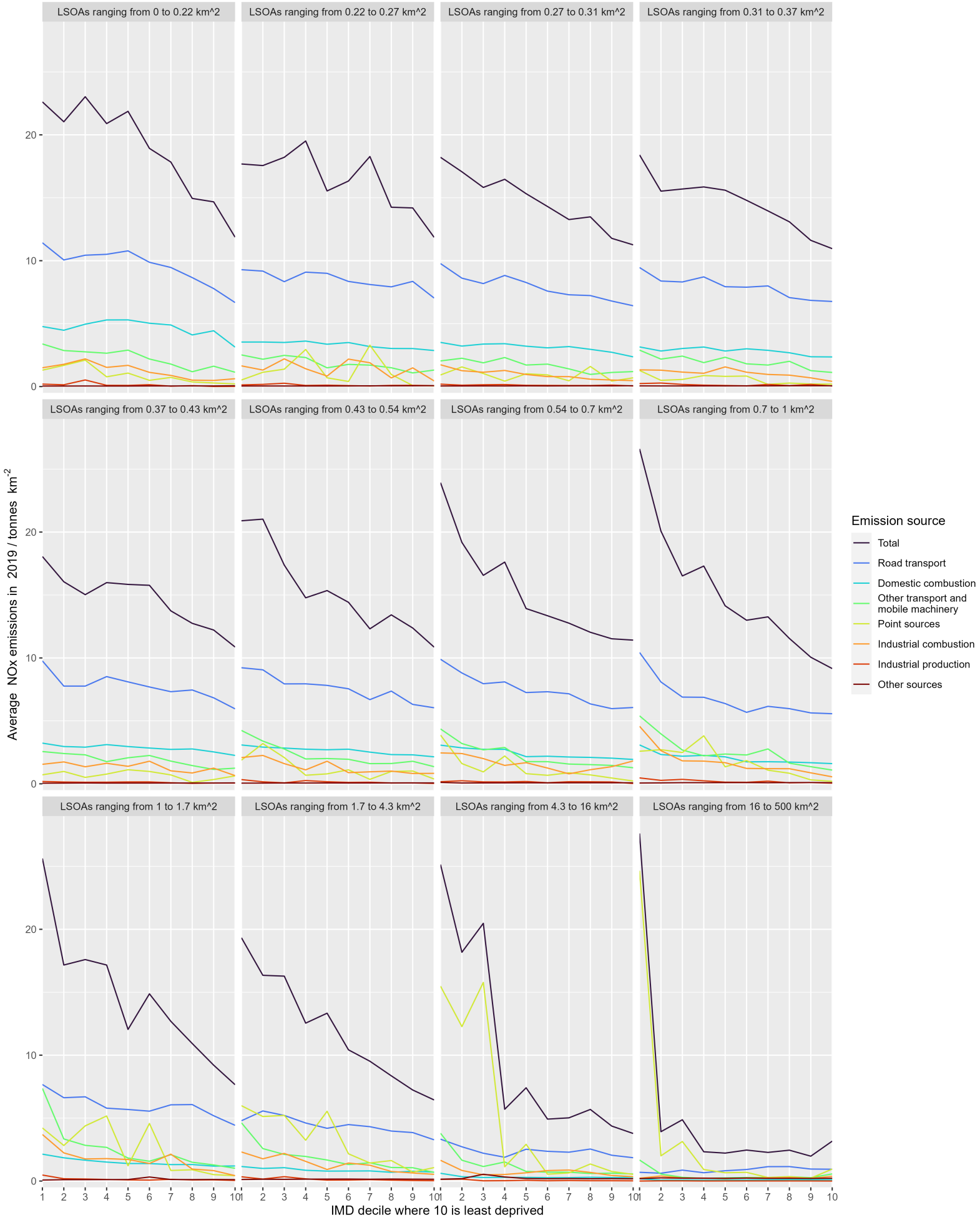

ESI:fig. 11 The difference in population deprivation profiles and population for each rural urban classification




ESI:fig. 12 The relationship between annual $NO_x$ emissions and LSOA size for each emission sector. Each point represents an equal number of LSOAs. Points marked as crosses are in sequence, but do not correspond with the numerical x axis, their positions are 2.9,5.4,12.3,25 and 680 $km^2$




ESI:fig. 13 The areas of the smallest 90% of LSOAs in each IMD decile. Data cropped to improve axis visibility




ESI:fig. 14 $NO_x$ emissions for LSOAs in 2019 for each source sector, faceted into 12 sections by LSOA size where 1 is the smallest 12th of LSOAs and 12 is the largest 12th of LSOAs in geographical area. The mean value at each IMD decile is plotted. LSOAs within London have been removed.