

where the difference between (1) and (2) is that the former is spatially invariant whereas, in (2), $\beta_k(u_i, v_i)$ is a realisation of the continuous function $\beta_k(u, v_i)$ at point i (Fotheringham, Brunsdon & Charlton 2002).

In other words, GWR assumes the nature of the relationship between Y and the X s to vary continuously across space, an assumption which is the opposite of a standard regression methodology that takes the relationship to be everywhere the same. This, the global model, for the data is:

$$Y = 0.09 + 1.60X_1 + 0.46X_2 - 0.32X_3 + 0.38X_4 - 0.07X_5 + \epsilon$$

Each of the predictor variables is significant at a greater than 99% confidence but this is hardly surprising and not especially instructive: it a consequence of the size of n (it being large). What we are interested in and what the GWR data tell us is how the regression coefficients vary across England. The data reveal geographical variation in the correlates of car non-ownership.

SUMMARY OF THE DATA

The data confirm that the correlates of car non-ownership vary across England. For example, whereas the global model predicted a 10% increase in the proportion of lone parent households would be associated with an average decrease in car non-ownership of 3.2%, the GWR model suggests the decrease could typically be from 9.6% to 1.5%, depending upon the location. Because of the double negative, it is easier to interpret the results as showing that as rates of lone parenthood increase so too do rates of car ownership, but that the effect is greater in some places more than others.

The GWR methodology fits weighted regression models at each of 165 665 locations separately. The regression coefficients obtained at each of those locations are contained in the data set. A summary of their variation is given in Table 1. Note that there were 6 168 locations where no model could be fitted.

	Minimum	1st Quartile	Median	Mean	3rd Quartile	Maximum	NAs
Intercept	-50.48	0.05	0.21	0.2392	0.39	37.45	6168
X1	-28.97	0.16	0.56	0.5729	1.01	35.41	6168
X2	-4.1	0.46	0.53	0.5211	0.59	4.67	6168
X3	-136.1	-1	-0.58	-0.5587	-0.13	97.61	6168
X4	-3.59	0.13	0.28	0.2692	0.42	12.62	6168
X5	-37.02	-0.33	-0.15	-0.1773	0	50.73	6168

Table 1. Comparing the coefficients of a GWR model predicting car non-ownership for $n = 165,665$ census output areas in England and Wales.

FORMAT OF THE DATA

The data are saved as comma separated variables with the following headers and meaning:

Easting	The National Grid Reference of a centroid within the Output Area
Northing	The National Grid Reference of a centroid within the Output Area
Intercept	The intercept for the weighted regression model at the centroid location
beta1	The regression coefficient for X1 at the location
beta2	The regression coefficient for X2 at the location
beta3	The regression coefficient for X3 at the location
beta4	The regression coefficient for X4 at the location
beta5	The regression coefficient for X5 at the location

Note: the GWR model was fitted with a fixed bandwidth of 2643.3 metres.

SUGGESTED APPLICATIONS OF THE DATA

For teaching, to suggest how standard regression techniques may conceal geographical differences.

Example

Figures 1 and 2 show some of the spatial variation in the coefficient for the lone parent variable. Figure 1 is for London, and Figure 2 is for Birmingham and Coventry. Both are cartograms. Cartograms are produced by warping a Euclidean view of geographic space to permit the size of each circle to be proportional to the population density at the location that circle represents (Dorling 1996). Consequently, the positions of the motorways are indicative, included only to aid interpretation of the maps.

The interesting areas are those shaded yellow or red, as these are the places where an increase in lone parenthood is least associated with increased car ownership. In Birmingham and Coventry these places are near to the city centres; in London they are more dispersed but prevalent to the East of the city. If there is an advantage in the job market to be had by owning a car, then the results might suggest rather different experiences (or meanings) of lone parenthood across geographical space.

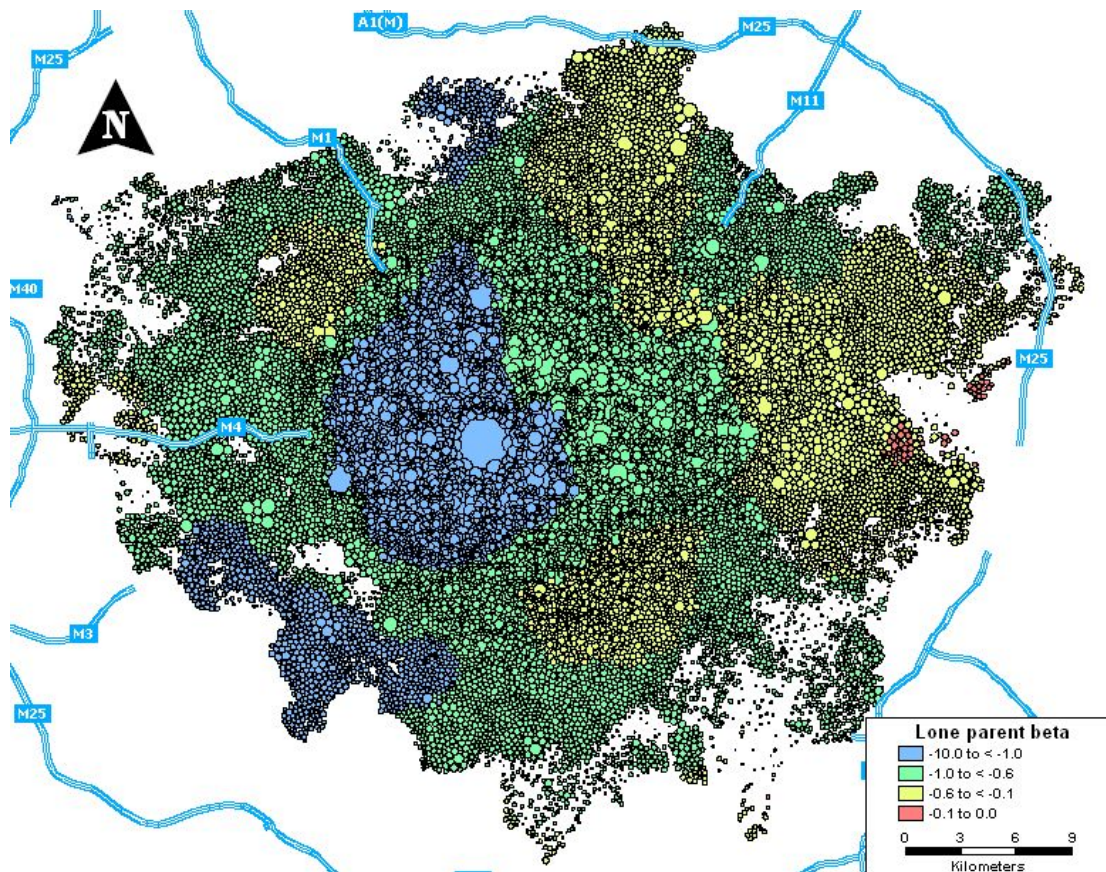


Figure 1. A cartogram showing the spatial variation in the lone parent coefficient across London.

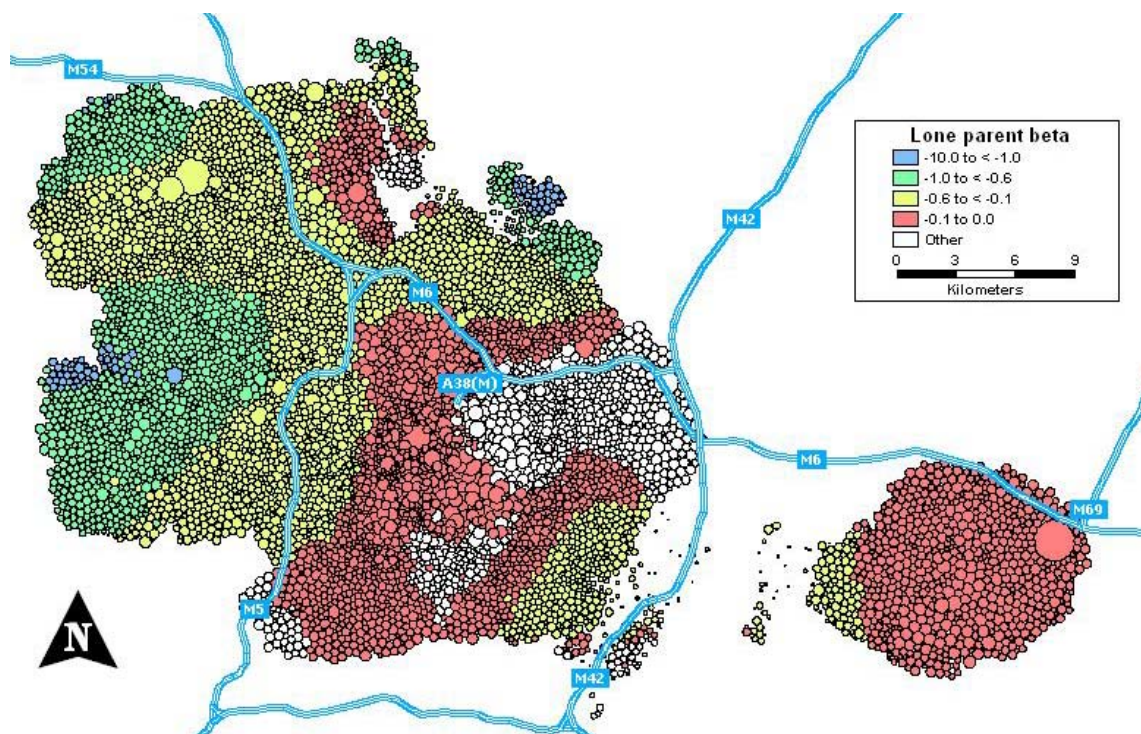


Figure 2. A cartogram showing the spatial variation in the lone parent coefficient across Birmingham and Coventry.

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