



# Spatial influences on domains of life satisfaction in the UK

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# Spatial influences on domains of life satisfaction in the UK

## **Abstract**

Multiple studies have identified an urban penalty on and regional differences in life satisfaction, but few studies compare the effects of both. This study applies a generalized ordered logit to data on residential location, region of the UK and two different life satisfaction measures. Overall, the regional effect outweighs the rural effect. A stable rural premium for life satisfaction is found; for satisfaction with leisure though, the effect differs across levels of satisfaction (a rural location increases the likelihood of being both highly satisfied and highly dissatisfied). Regional effects are also found to differ across levels of life satisfaction.

## **Keywords**

Life satisfaction, urban / rural divide, regions, ordinal regression

## **JEL Codes**

C25, I31, R10.

## **Introduction**

Influences on life satisfaction, happiness and subjective well-being have increasingly gained attention from psychologists, economists and other social scientists (e.g. Diener, 2000; Frey and Stutzer, 2002; Di Tella and MacCulloch, 2006, Weiman, Knabe and Schöb, 2015) as has the impact of life satisfaction research on public policy (e.g. Dorling and Ward, 2003; Layard, 2007). Research effort has gone into exploring how individual differences in psychological variables, economic situation (such as income and employment status) and personal situation (such as marital status) relate to happiness (see e.g. Diener and Seligman, 2004 and Dolan, Peasgood and White, 2008, for reviews). In both the Geography and Social Economics literature, the effect of residential location in terms of city size, urban versus rural location, capital city versus other locations and of change of location on life satisfaction have also been investigated (see e.g. Ballas, 2013 or Okulicz-Kozaryn, 2015). For example, Sørensen (2014) found a city-dwelling penalty on life satisfaction compared to rural living; a finding which echoes some but not all earlier studies. Nowak, van Ham, Findlay and Gayle (2013) found that migration is preceded by a decline in happiness, and that happiness is restored after moving to a new location. Rather surprisingly, the distance migrated seemed not to influence happiness levels. Differences in life satisfaction have also been found between regions (e.g. Grazia Pittau, Zelli and Gelman 2010; Oswald and Wu, 2011). Furthermore, these regional variations mirror variations in observable indicators of life satisfaction. Such regional differences may reflect differences in local (as opposed to national) policies and economic conditions, but may also potentially reflect differences in strength of local identity.

However, Binder and Coad's (2011) findings suggest that the dominant method used to investigate the link between residential location and life satisfaction may not reveal the full nature of the relationship. Their quantile regression results suggest that income, health and social factors decrease in importance as predictors at higher quantiles of happiness. This has implications for the robustness of prior findings regarding both the effects of urban versus rural location and region on life satisfaction. The aim of this paper is to test how far previous findings regarding the effects of urban versus rural location and of region on life satisfaction hold when a modelling approach which does not require relationships between dependent and independent variables to remain constant is employed.

The effect of urban versus rural environment on life satisfaction is gathering increasing importance for national and local policy (e.g. Lenzi and Perucca, 2018). In the UK, the National Well-Being Programme was launched in 2010 with the aim of measuring wellbeing as a measure of progress to complement Gross Domestic Product. Urbanization is a recent phenomenon – as Okulicz-Kozaryn (2015) notes, the US was 5 per cent urban in 1790; by 2010 the figure stood at 80 percent. The UK shows a similar degree of urbanization. In the UK, at mid-year 2014, 45.0 million people or 83.0 per cent of the population lived in urban areas, with 9.3 million (17.0 per cent) living in rural areas (Department for Environment, Food and Rural Affairs, 2018). As Champion (2014) reports, between 2001 and 2011, the population of major cities in the UK grew by approximately 1.4 million people, accounting for a 34% of the growth in the UK population. At the other end of the scale, the population of small towns and rural areas also grew over the period 2001-2011, by approximately 1.1 million (accounting for 27.9% of national population growth). Looking further back, the proportion of the population living in major cities in the UK declined through the 1980s, recovered in the 1990s and grew faster than other areas of the UK in the 2000s. Such a concentration of the population into urban areas highlights the importance of

understanding how urban living can influence life satisfaction and well-being, especially if it imposes a penalty on them. Of equal importance though are the issues inherent in rural living, where population densities are much lower. This raises issues of access to health and other services; in their review of rural living in England, the Local Government Association and Public Health England (2017) note that whilst approximately 10 million people live in rural areas, those areas account for 85 per cent of the land. As rural communities become increasingly older, this raises a number of issues relating to health and well-being.

The paper is organised as follows. The next section provides an overview of the literature on spatial influences (both urban versus rural location and the differences between regions) on life satisfaction. The following section describes the data employed, whilst the estimation methods used are discussed in the section after that. Results are presented in the penultimate section and conclusions are drawn in the final section.

## **Spatial influences on life satisfaction<sup>1</sup>**

### *Urban versus rural location*

A difference in urban versus rural location in terms of life satisfaction may arise from two possible sources. As Sørensen (2014) notes, urban living may be associated with higher quality of life when measured using objective measures such as income, employment and access to public services, stores and leisure facilities. However, urban living may also negatively affect quality of life through for example increased exposure to noise and air pollution and through the effects of higher density living. Conversely, rural locations are associated with lower incomes, less accessible public services, but also with greater social interaction and stronger community feeling. Such distinctions between urban and rural life

date back to Tönnies' (1887/1957) distinction between *gemeinschaft* (community) and *gesellschaft* (association) and to Wirth's (1938) 'urbanism as a way of life'.

A number of studies have explored the effect of urban versus rural location on reported well-being. For example, Gerdtham and Johannesson (2001) in a study of Swedish respondents found a small but significant negative effect on life satisfaction of residing in a large city (Stockholm, Gothenburg or Malmö), but no effect of living in a city of over 30,000 inhabitants when compared to the base category of living in the countryside or in smaller cities. Similar findings have been reported for China (e.g. Knight and Gunatilaka, 2010) and the USA (e.g. Berry and Okulicz-Kozaryn, 2011). Peiró (2006) presents somewhat more mixed evidence; in a study of 15 countries using data from the World Values Survey, town size is found to have an effect on happiness only for one country, Venezuela. A negative effect on life satisfaction was found in three countries: Nigeria, the USA and Venezuela; a positive effect in three: Dominican Republic, Taiwan and Peru and no effect in seven (with town size data not being available for two countries). A similarly mixed set of results were obtained for financial satisfaction. Shucksmith, Cameron, Merridew and Pichler (2009) found a significant effect of urban versus rural location on subjective quality of life, but the effect disappeared when other sociodemographic controls were introduced into their multi-level models. Sørensen (2014) using data from the European Values Survey, found a significant penalty on well-being among city dwellers, compared to town dwellers and rural dwellers. Furthermore, this finding holds for the whole EU sample and for subsamples of high, intermediate and low GDP countries and after other influences on well-being are controlled for.

There is also evidence that the type of city can also have an effect on well-being. Piper (2015) presents evidence of a happiness penalty on those who live in a country's capital city. Based on data from the European Social Survey covering 2002 to 2008 and 17 EU

states, Piper demonstrates that residing in a European capital city is, with the exception of Bulgaria, Denmark, France, Great Britain, Spain, Sweden and Ukraine is associated with a significant reduction in happiness. Differences in life satisfaction have also been identified between cities and metropolitan areas (as opposed to between cities / urban areas and rural areas). For example, Florida, Mellander and Rentfrow (2013) examine data from 184 US metropolitan areas and find that human capital, proxied by the proportion of the labour force with a bachelor's degree or higher, has a positive significant effect on happiness, whilst the median age has a significant negative effect. Glaeser, Gottlieb and Ziv (2016) also find significant differences in wellbeing across metropolitan areas in the US after controlling for State effects. Reporting results from New Zealand data, Morrison (2011) finds a positive effect on happiness and satisfaction with life from living in smaller urban settlements than in the largest: Auckland. No consistent effect is found for quality of life. However, economic growth (and consequent increases in population density) is found to reduce subjective wellbeing amongst city residents.

### *Regions and Life Satisfaction*

Alongside interest in the relative effect of urban and rural environments, research interest has also focussed on regional differences in life satisfaction and happiness. Whilst the effect of national level economic indicators on individual life satisfaction have been explored (e.g. Di Tella, MacCulloch and Oswald, 2003), it is arguably local, rather than national, macro level variables which would be more influential (Grazia Pittau, Zelli and Gelman, 2010), as life satisfaction and happiness are influenced by local comparisons. Oswald and Wu (2011) explore life satisfaction across States of the United States of America and find significant differences which remain when other influences on life satisfaction such as marital status, employment status, age, gender, education, ethnic origin and household size



are controlled for. Grazia Pittau, Zelli and Gelman (2010) draw a similar conclusion based on EU data – regional differences in life satisfaction persist after individual characteristics are controlled for. Aslam and Corrado (2012) adopt a different approach, capturing the influence of regions on well-being via regional measures of trust, religiosity, income and health. They also find evidence for regional variation in well-being as well as significant differences between European nations.

Regions may influence life satisfaction in two potential ways: by providing different reference groups and through different levels of sense of identity. The way in which unemployment or income level for example affect life satisfaction depends on the reference group individuals compare themselves to. Where unemployment is higher, for example, being unemployed has a less detrimental effect on life satisfaction (e.g. Clark, 2003; Powdthavee, 2007). Similarly, there is increasing evidence that the relationship between happiness and income depends on relative income more than absolute income (e.g. Caporale, Georgellis, Tsitsianis and Yin, 2009). When the reference group was defined as people living in the same region with similar education levels and at similar ages, Ferrer-I-Carbonell (2005) found that income of a reference group was as important as own income for individuals' happiness.

A second influence is through regional identity. The concept of regional identity has attracted increasing attention (e.g. Paasi, 2002). Keating (1998) suggests that regional identity has three fundamental elements. First, regional identity has a cognitive basis; people must be aware of a region and its limits. The second is affective, relating to people's feelings towards a region and how far it creates a basis for a common identity. The third is instrumental, relating to how far the region can be a basis for collective action. A sense of shared identity has also been shown to influence life satisfaction. For example, Delhey and Dragolov (2016) compared national level data across Europe and found that within societies which are more

affluent, togetherness and solidarity significantly enhances happiness. Lim and Putnam (2010) found a similar effect. They found that the positive effect of social networks formed via attendance at religious services on life satisfaction was contingent on a strong shared identity.

Lenzi and Perucca (2018) investigate the joint effect of rural location and degree of urbanisation in regions on life satisfaction. They find a rural location has a positive influence on life satisfaction whilst living in highly urbanized regions significantly reduces it. However, when the interaction between degree of urbanization and rural location is introduced to their regression model, the effect of rural location becomes negative, whilst the interaction has a positive coefficient, suggesting that rural dwellers are happier only if they live in more urbanized regions. This, they argue, results from positive externality effect, where the benefits of urbanization filter down to rural resident or urbanized regions. Conversely, in more urbanized regions, rural living would offer a greater contrast which might create a greater sense of satisfaction.

#### *Sources of variation in findings*

As Sørensen (2014) notes, the variability in findings could arise from differences in how the city size or rural-urban variables were operationalized and from how the dependent variable was measured. There is a further possibility related to the methods used to estimate the relationships. The studies discussed above have tended to employ ordinal regression or linear regression; table 1 lists the estimation methods and definitions of urban / rural location and region used in the studies discussed above.

(Table 1 here)

Such models make the implicit assumption that the effect of a change in an independent variable is fixed over the range of the dependent variable. There is however, no *a priori* reason for this assumption (to hold when considering influences on life satisfaction. Indeed, there is increasing evidence that it does not. Hohl (2009) explores the relationship between income and happiness and introduces Quantile Regression as a method of assessing if the relationship is constant across levels of happiness (in other words if an increase in income has the same effect on someone at the lower end of the happiness scale and someone higher up the happiness scale). The results suggest that the nature of the relationship varies and hence OLS results might be misleading. Rather than identify average effects (as OLS does), quantile regression can describe the entire conditional distribution of a dependent variable (for a discussion of quantile regression see e.g. Cade and Noon, 2003). Hohl (2009) also raises the point that methods such as OLS tell us about the average relationship, but it is also of benefit to look at the upper and lower ends of the distribution of the dependent variable. This is especially the case for policy research, where it would be more useful to focus on people who would benefit most from a policy change (e.g. those at the lower end of the happiness variable), rather than the average.

Binder and Coad (2011) developed Hohl's approach further, exploring a wider range of predictors of life satisfaction. Their quantile regression results suggest the effects of income, health and social factors on life satisfaction differs across the range of values of life satisfaction. Subsequent research has applied similar approaches to exploring the relationships between unemployment and subjective well-being (Binder and Coad, 2015), subjective well-being and social quality (Yuan and Gopelwar, 2013), health, income, social relations and subjective well-being (Lamu and Olsen, 2016) and happiness and arts attendance (Hand, 2018).

Overall, there is consistent evidence for a rural benefit in terms of life satisfaction and for the existence of regional differences in life satisfaction. However, there is also the risk that such conclusions may not fully capture the nature of these influences. The methods used focus on the average relationship between dependent and independent variables or assume that the relationship is constant across the range of the dependent variable. These both risk over- or under-estimating effects, or even not to identify an effect at all (e.g. Cade and Noon, 2003). Whilst significant effects of both urban versus rural location and region on life satisfaction have been identified, few studies explicitly account for both. It could be argued that the mechanisms by which urban versus rural location and region influence life satisfaction differ. An urban location may have a negative effect on life satisfaction if the advantages of urban living, such as access to amenities, are outweighed by the disadvantages of greater population density and exposure to noise, light and atmospheric pollution. The effect of region on life satisfaction could arise from the effect of regional economic and social policy and also from a sense of shared identity. Equally though, a region variable would also capture differences in degree of urbanisation, which could also have an effect on life satisfaction. People residing in rural areas in a more urbanised region would tend to be closer to a built up area (and hence have more access to amenities) than those in a less urbanised region. Hence, the primary aim of this paper is to re-investigate the effects of both the urban-rural difference in, and of region on, life satisfaction in the UK. To do this, a modelling framework which allows for the nature of the relationship between life satisfaction and its predictors to vary across levels of life satisfaction is used. The second aim is to contrast the effects of urban versus rural location and of region on life satisfaction.

## **Data**

The data used here are from the sixth wave of *Understanding Society*, the UK Household Longitudinal Survey (University of Essex. Institute for Social and Economic Research, NatCen Social Research and Kantar Public, 2016). The full sample contains responses from 37,805 members of households from across the UK, however not all respondents were asked or answered all of the questions – missing values reduces the sample to 34,557. Details of the survey are given by Knies (2016).

Life satisfaction is measured in the survey via four self-completed questions regarding satisfaction with life overall, satisfaction with leisure, satisfaction with income and satisfaction with health. Each of these was assessed on a single item seven point scale ranging from completely dissatisfied to completely satisfied. Whilst there is debate over the most appropriate way to measure life satisfaction and about the appropriateness of single item measures in general, there is evidence that such measures are both reliable and valid (e.g. Abdel-Khalek, 2006)

The respondents' residential locations were classified in the survey into urban and rural categories. Following the UK Office for National Statistics' classification, settlements with a population of 10,000 or more are classified as urban (with the remainder being classified as rural. Additionally, respondents' location in the UK was recorded as one of 12 regions: North East, North West, Yorkshire and Humberside, East Midlands, West Midlands, East of England, London, South East, South West, Wales, Scotland and Northern Ireland (i.e. at NUTS 1 level). As Ballas and Dorling (2013) note, studies of happiness at local level are comparatively rare due to a lack of relevant data. There are two reasons for using a comparatively high level of definition of regions. The first is that it is the regional level at which data is routinely made publicly available in the Understanding Society survey and other national surveys (and so is the level used in previous studies e.g. Aslam and Corrado, 2012). Secondly, NUTS1 regions coincide with the former Government Office Regions and

are typically the level at which Government regional statistics are published. Hence, policy decisions are likely to be based on NUTS1 level data. The regions consist of a number of counties, historical local administration areas in the UK. Arguably counties and regions (entities in their own right and as collections of counties) display Keating's (1998) foundations supporting a regional identity. Consequently, a positive relationship is expected between rural location and life satisfaction and with satisfaction with leisure. With regard to the effect of regions, a positive effect on life satisfaction of being located outside London is expected, but not expectations are put forward regarding the effects of other regions.

Other socioeconomic variables included in the survey and which have been identified as having an effect on life satisfaction are used as controls. The variables included are age, sex, economic status, marital status, household income, state of health, whether a University level qualification was held, number of close friends and number of children the respondent has responsibility for. Age is expected to show a significant non-linear relationship with life satisfaction (following Blanchflower and Oswald, 2004), as is sex, women tend to report higher happiness (Alesina, Di Tella, and MacCulloch, 2004). Being employed is expected to significantly increase life satisfaction (e.g. Clark and Oswald, 1994), as is being in good health (Gerdtham and Johannesson, 2001) and being married or in a relationship (e.g. Stutzer and Frey, 2006). Following Blanchflower and Oswald (2004) a positive effect of education on life satisfaction is expected. Finally, the number of close friends is expected to affect life satisfaction positively (e.g. Lelkes, 2006). The evidence regarding the effect of having children on life satisfaction is mixed, hence no a priori expectation is put forward.

Descriptive statistics for these variables are given in table 1 below.

[Table 2 near here]

## Estimation issues and methods

There is some debate over whether happiness or well-being data can be regarded as cardinal or ordinal and hence whether linear regression or ordinal regression should be used. Psychological studies have tended to employ OLS whilst economic studies have tended to use ordinal regression models (ordered logit or ordered probit); table 1 suggests that studies of or urban and regional effects on happiness also tend to employ ordinal regression. Studies which report both show few differences in the identified relationships (e.g. Ferrer-i-Carbonell and Frijters, 2004). However, linear regression may not fully capture the relationship between life satisfaction and its predictors (as e.g. Binder and Coad's, 2011 results show). The same concern applies to ordinal regression models – they too may also mask the nature of the relationship. Ordinal regression models are based on an assumption variously known as the parallel lines assumption or proportional odds assumption. This suggests that if the predicted conditional probabilities for each category of the outcome variable were drawn out, the lines would be parallel. In other words, the intercept will differ, but not the slope coefficients (see e.g. Long, 1997). Few studies of well-being which employ ordinal regression directly test the parallel lines assumption or employ methods which allow for it to be relaxed (Chongvilaivan and Powdthavee's, 2014, study of job satisfaction is an exception).

The ordered logit model, introduced by McKelvey and Zavoina (1975), is used to estimate the relationship between a set of independent variables and a dependent variable containing discrete ordered categories. The ordered logit model can be written as:

$$P(Y_i > j) = g(X\beta) = \frac{\exp(\alpha_j + X_i\beta)}{1 + [\exp(\alpha_j + X_i\beta)]}$$

Where  $j = 2, \dots, M-1$  and  $M$  is the number of categories in the ordinal dependent variable,  $X$  is a matrix of explanatory variables,  $\beta$  is a vector of slope coefficients and  $\alpha_j$  is a constant for the  $j$ th category of the dependent variable. Hence, whilst different constants are estimated for categories of the dependent variable, the slope coefficients do not vary across the categories of the dependent variable.

The generalized ordered logit model has been known about since the 1980s (e.g. McCullagh and Nelder, 1989; Peterson and Harrell, 1990) as Williams (2016) notes but it has only recently become more widely used. The model allows the parallel lines assumption to be relaxed for individual sets of coefficients and hence produces a more parsimonious model than say a multinomial logit. A generalized ordered logit produces estimates for a series of models similar to a binary logit. If we have four categories in the dependent variable ( $Y$ ) labelled  $a, b, c$  and  $d$ , and where the value of  $Y$  increases from  $a$  to  $d$ , the generalized ordered produces estimates for a model of  $a$  versus  $b, c$  and  $d$ ;  $a$  and  $b$  versus  $c$  and  $d$ , and finally  $a, b$  and  $c$  versus  $d$ . Where the parallel lines assumption holds, the slope coefficients will be the same in each of the four models. Where the assumption is relaxed, different coefficients are estimated for each model. The coefficients in these models are interpreted in a similar way to a binary logit; a positive coefficient suggests that a higher value of the explanatory variable increases the likelihood that the respondent will be in the higher category of  $Y$ , so in a model comparing  $a$  and  $b$  with  $c$  and  $d$  a positive coefficient shows that an increase in the independent variable increases the probability of belonging to the  $c$  or  $d$  categories of  $Y$ . Conversely, a negative coefficient decreases that likelihood. Using Williams' (2006) notation, the generalized ordered logit can be written as:

$$P(Y_i > j) = g(X\beta_j) = \frac{\exp(\alpha_j + X_i\beta_j)}{1 + [\exp(\alpha_j + X_i\beta_j)]}$$



where  $j = 2, \dots, M-1$  and  $M$  is the number of categories in the ordinal dependent variable. It is distinct from the ordered logit where the  $\beta$ 's are the same for all values of  $j$ ; here the  $\beta$ 's can be estimated for all  $j$  categories of the dependent variable. For overviews of the generalized ordered logit, see e.g. Williams (2006, 2016) or Long and Freese (2014).

## Results

### *Ordered logistic regression*

First, an ordered logistic regression model was run on the life satisfaction measure included in the survey. The Understanding Society survey also includes questions about satisfaction with leisure. The results for the first two of these are given in table 2 below. As *Understanding Society* is a household survey, multiple members of the same household are interviewed. In order to accommodate this, standard errors clustered by household are used to calculate test statistics.

[Table 3 near here]

The results shown in table 3 suggest that there is a significant rural effect on satisfaction with life overall ( $b = 0.051$ ,  $p = 0.047$ ); however, that effect is small in comparison with other significant variables. A coefficient of 0.051 implies that the odds of reporting higher life satisfaction are 1.05 times higher than compared to an urban location (the change in the odds ratio is given by the exponent of the estimated coefficient – in this case  $e^{0.051}$  which gives 1.05). A far bigger effect of regions (compared to London) is seen – with coefficients

ranging from 0.107 (West Midlands) to 0.297 (Northern Ireland), implying that in the West Midlands the odds of reporting higher life satisfaction are 1.11 times higher than in London, whilst in Northern Ireland the odds are 1.35 times higher.

Regional effects also outweigh the effect of rural location in the satisfaction with leisure model. The rural coefficient would be significant only at the 10% level in the satisfaction with leisure model ( $b=0.044$ ,  $p=0.081$ ). Given that rural location is significant in the life satisfaction model, it is surprising to see it is non-significant in the satisfaction with leisure model. The effect of region seems, again, to be greater, with increases in odds ratios ranging from 1.10 (West Midlands) to 1.26 for Scotland and 1.4 for Northern Ireland. As such, the results support Piper's (2015) conclusion of a capital city happiness penalty – London being the base category employed here.

The remaining results show some interesting patterns. For example, being responsible for children appears to have no significant effect on life satisfaction, but it does significantly reduce satisfaction with the amount of leisure, with greater reductions being associated with greater numbers of children. Being married increases satisfaction with life overall (being married is the base category and all of the estimated coefficients are negative). Single people are however (slightly) happier with their leisure time – the odds of reporting higher satisfaction with leisure are 1.08 times higher for single people than people who are married. Overall, health has the greatest impact on life satisfaction – a unit increase in the health variable increases the odds of reporting greater life satisfaction by 1.81 times. For satisfaction with leisure, the greatest impact comes (perhaps unsurprisingly) from being retired; compared to those in employment, being retired increases the odds of reporting greater satisfaction with leisure by 4 times.

These findings are broadly in line with prior literature – a positive effect of rural location on life satisfaction and significant regional effects in the form of a penalty to life

satisfaction of residing in or near the capita. However, the interpretations above are based on the assumption that the values of the slope coefficients are constant across values of the dependent variables. As was discussed above, there is evidence that it does not for a number of predictors of life satisfaction. This assumption can be tested via the Brant test of parallel lines (Brant, 1990). Table 4 below shows the results of a Brant test for the variables of focal interest here: the rural and regional dummy variables. A non-significant result is evidence that the parallel lines assumption holds.

[Table 4 near here]

The results in tables 3 and 4 above suggest that whilst the rural effect is smaller, it is also less variable across the values of the life satisfaction scores. The Brant test suggests that the parallel lines assumption holds for the rural variable in the life satisfaction model, but does not hold in the satisfaction with leisure model. This suggests that, as far as life satisfaction is concerned effect of rural location is not influenced by the choice of ordered logit or other single equation models. However, the same cannot be said for the second life satisfaction measure, satisfaction with leisure. The significant Brant test result offers a hint that the non-significant finding in the ordered logit model does not fully capture the underlying relationship.

The effect of region of the UK on the other hand has a bigger effect but also shows more variation across the range of the satisfaction variables. Table 2 shows a mix of results for the regional variables; for some the Brant test is non-significant whilst for others it is significant in one model or the other, or in both. In order to accommodate these violations of the parallel lines assumption, our models are re-estimated using a generalized ordered logit

model. As discussed above, this allows the parallel lines assumption to be relaxed for those variables with a significant Brant test result.

#### *Generalized ordered logistic regression*

The generalized ordered logit results are reported for the rural and regional variables; however, the same demographic controls are included as in the ordered logit models. Table 5 presents the results for life satisfaction whilst table 6 presents the results for satisfaction with leisure. and demonstrate the extent to which the slope coefficients vary across the ranges of the dependent variables. Where the Brant test indicates that a single coefficient can describe the relationship between life satisfaction and the independent variable, a single coefficient is reported in tables 5 and 6 in the first column, labelled PL (Parallel Lines) coefficient. Where the Brant test indicated that a single coefficient was not appropriate, coefficients are reported for a series of comparisons between categories of life satisfaction (between the lowest point on the scale, 1, and all other values; points 1 and 2 against points 3 to 7; points 1,2 and 3 against points 4,5,6 and 7 and so on). Similar approaches to reporting generalized ordered logit coefficients are adopted by e.g. Williams (2016) and Craemer, 2009).

[Table 5 near here]

Only one coefficient for the rural variable is calculated, based on the results of the Brant test and the coefficient is of similar magnitude to that obtained from the ordered logit. However, as table 5 shows, different regions appear to have different effects on life satisfaction. Being in Yorkshire and Humberside, the West Midlands and the South West, has a significant positive effect on life satisfaction, but only at the upper end of the life

satisfaction scale. When comparing lower levels of life satisfaction (e.g. 1 against all other values) residing in these regions provides no benefit over residing in London. In the case of the West Midlands, a significant effect is seen only when comparing the top two values in the life satisfaction variable with the five lower categories and the top category against the other six. The South East seems to show the opposite pattern; being in the South East compared to London reduces the likelihood of being at the lowest life satisfaction category. Residing in the South East increases the odds of being in the top six life satisfaction categories by 1.7 times (i.e. exponent 0.531), compared to being a Londoner. However, this South East life satisfaction premium begins to decline across the columns of table 4; the coefficients decline in size and in the final column it is no longer statistically significant. Although all of the regional variables in the ordered logit (table 3) were significant, the generalized ordered logit results suggest that, for some, the ordered logit results mask the true nature of the relationship.

Table 6 shows results for the satisfaction with leisure model.

[Table 6 near here]

In the satisfaction with leisure ordered logit model (table 3), the rural variable was significant only at the 10% level. The generalized ordered logit model results in table 6 provide a potential explanation for this. A rural location seems to have different effects at different ends of the leisure satisfaction scale. The results suggest that being in a rural location increases the likelihood of being in the lower extreme for leisure satisfaction compared to the other categories the coefficient in the 1 vs 2-7 column is significant and negative (-0.141), implying that residing in a rural location increases the likelihood of being in the lowest satisfaction with leisure category by 1.15 times. However, a rural location also increases the likelihood

of being more satisfied with leisure. The coefficient in the final column of table 6 is 0.100, suggesting that a rural location increases the likelihood of being in the highest satisfaction with leisure category by 1.105 times. In other words, compared to an urban location, a rural location makes it more likely that a respondent is either very satisfied with leisure (perhaps enjoying the benefits of a rural idyll) or very dissatisfied (presumably because of reduced access to leisure amenities). The regional variables tend to show a rather more consistent pattern than in table 5 (life satisfaction results) with a greater, significant, effect at the higher levels satisfaction, suggesting that compared to the base category, London, respondents in other regions are more likely to be highly satisfied with leisure. In the West Midlands though, an effect is seen only in the last two columns of the table.

## **Conclusions**

As Lenzi and Perucca (2018) note, life satisfaction data can be taken as a measure of the attractiveness of a place to live and as such it can also highlight a challenge to regional, national and European policy. Social cohesion and quality of life are central to the policy initiatives such as the Euro 2020 strategy and also the UK's National Wellbeing Programme. Yet the UK and other EU states are highly urbanised, suggesting that the majority of the population live in areas where their life satisfaction is reduced. Similarly, regional differences in life satisfaction and the extent to which they can be influenced by policy decisions has also attracted attention (e.g. OECD, 2014).

Taken together, the results suggest that the effect of residential location, when operationalised as urban versus rural, has a stable effect across the range of values of the overall life satisfaction measure. However, in the satisfaction with leisure domain, the effect of a rural location differs at higher and lower satisfaction scores. Hence, whilst the results

here accord with prior findings in the literature, that life satisfaction is greater outside the city, they also suggest that the result can differ across different domains of life satisfaction. Overall though, the effect of rural location on life satisfaction is modest in comparison to the effect of region and of other explanatory variables. However, a caveat should be noted; this conclusion holds for a broad definition of urban and rural. A weakness of the measure used here is that it only captures the size of the settlement, and does not capture proximity to other conurbations. The results obtained here show that the effect of regions of the country (here defined at NUTS 1 level) seems to be greater than the effect of urban/ rural location. In all of the models estimated, the regional coefficients are much greater than the rural coefficients. However, these larger regional effects are also more variable, varying in both the size of the coefficients across the values of the life satisfaction variable and in whether the coefficients are significant or not. Consequently, a single coefficient (such as that estimated in an ordinal regression model) will not fully capture the nature of the relationship with life satisfaction.

The results presented here show that there is a clear spatial influence on life satisfaction that extends beyond the degree of urbanisation. The rural premium for life satisfaction reported in the literature is also found in this study, after a potential problem with prior methods is tested for and discounted. For satisfaction with leisure though, the results suggest a more complicated relationship with rural location. A rural premium on life satisfaction poses a challenge to policy objectives of enhancing well-being and social cohesion when the majority of the population reside in urban areas. However, the results also suggest a stronger regional influence on both life satisfaction and satisfaction with leisure. Life, it seems, is better in English regions outside of the region containing the national capital, London and in Scotland, Wales and Northern Ireland. The policy implication of these findings is that region matters as much if not more than urban location to life satisfaction. Thus, if the drivers of regional differences can be influenced by policy, for

example through devolution of powers to local government or enhancing social cohesion, it offers an additional way of enhancing life satisfaction. If they cannot be influenced, the results will help identify limits to policy action.

It is an open question as to why the effect of regions varies across levels of life satisfaction and why this is only observed for some regions and not others. That life satisfaction is higher in Scotland, Wales and Northern Ireland might potentially be explained by a greater sense of control over the future and of identity. All three of these countries within the UK have their own national identity, which is reinforced by having their own Assemblies and Parliaments with devolved powers. However, the premium on life satisfaction in these countries is not much bigger than that of other English regions outside London. The extent to which regional differences in economic or social conditions and in regional identity influence life satisfaction would seem to be a fruitful avenue for further study. Similarly, given the definitions used and data available in the source survey used here, the effect of degree of urbanization and how it relates to rural location and the effect of region remains an open question.

## **Notes**

1. Whilst life satisfaction, happiness and quality of life are sometimes used interchangeably, they are not synonyms. Happiness is an affective state, whilst life satisfaction is an evaluation of life as a whole. Quality of life is usually measured via a combination of objective factors.

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Table 1. Estimation methods in prior studies

City / urban vs rural			Regional / between city effects		
Author(s)	Estimation method	Definition	Author(s)	Estimation method	Definition
Gerdtham and Johannesson (2001)	ordered probit	City size > 30.000 inhabitants Resident in largest cities (Stockholm, Gothenburg or Malmo)	Grazia Pittau, Zelli and Gelman (2010)	multi-level model	NUTS 1 regions
Peiro (2006)	ordered logit	3 categories of city: 10,000-100,000 inhabitants 100,000-500,000 inhabitants More than 500,000 inhabitants	Oswald and Wu (2011)	OLS regression	US States
Shucksmith, Cameron, Merridew and Pichler (2009)	multi-level model	Rural = Open country and village / small town Urban = medium / large town or city/ city suburb	Aslam and Corrado (2012)	multi-level model	NUTS 1, 2 or 3 regions depending on data availability
Knight and Gunatilaka (2010)	OLS regression	Official definition of urban and rural China	Florida, Mellander and Rentfrow (2013)	OLS regression	US Metropolitan areas
Berry and Okulicz-Kozaryn (2011)	ordered logit	3 categories: small town (<10,000 inhabitants) or rural area; suburbs of medium / large cities (<50,000 inhabitants); small central city <250,000 inhabitants)	Glaeser, Gottlieb and Ziv (2016)	panel regression	US metropolitan areas (controlling for State effects)

Morrison (2011)	ordered probit	11 cities in New Zealand	Lenzi and Perucca (2018)	ordered logit	Degree of urbanization at NUTS2 level based on number of people residing in Large Urban Zones (as defined by EUROSTAT)
Sørensen (2014)	ordered logit	8 categories of city size, ranging from <2000 inhabitants to >500,000 inhabitants			

Table 2. Sample descriptive statistics

	Mean / Proportion (%)	Standard Deviation
<i>Dependent variables</i>		
satisfaction with life overall	5.25	1.43
satisfaction with income	4.72	1.67
satisfaction with amount of leisure time	4.83	1.64
satisfaction with health	4.78	1.74
rural	25.52%	-
London (base category for region)	10.45%	-
North East	3.86%	-
North West	10.02%	-
Yorkshire Humberside	8.08%	-
East Midlands	7.87%	-
West Midlands	8.03%	-
East of England	8.38%	-
South East	12.16%	-
South West	8.56%	-
Wales	6.96%	-
Scotland	8.91%	-
N Ireland	6.71%	-
age	48.40	18.37
age <sup>2</sup> / 100	26.80	18.39
Female	55.70%	-
log of household gross income	10.53	0.76
in employment (base category for economic status)	57.15%	-
unemployed	4.20%	-
retired	24.31%	-
looking after home / family	5.25%	-
studying	6.20%	-
Long term sick or disabled	2.82%	-
married or civil partnership (base category for marital status)	52.84%	-
single	30.17%	-
separated	1.97%	-
divorced	8.78%	-
widowed	6.23%	-
health	3.47	1.09
Higher education qualification	30.87%	-
Number of close friends	5.14	6.44
Responsible for 1 child	7.19%	-
Responsible for 2 children	6.70%	-
Responsible for 3 or more children	2.64%	-

Table 3 Ordered logit results

	Satisfaction with life overall	Satisfaction with leisure
	B	B
rural	0.051*	0.044*
Region (base = London)		
North East	0.132*	0.190***
North West	0.223***	0.199***
Yorkshire Humberside	0.173***	0.188***
East Midlands	0.149***	0.170***
West Midlands	0.107**	0.104**
East of England	0.227***	0.211***
South East	0.146***	0.199***
South West	0.164***	0.221***
Wales	0.197***	0.147***
Scotland	0.194***	0.234***
N Ireland	0.297***	0.347***
age	-0.041***	-0.020***
age <sup>2</sup> / 100	0.049***	0.036***
Female	0.113***	0.014
log of household gross income	0.153***	0.045***
Economic status (base = in employment)		
unemployed	-0.447***	0.487***
retired	0.523***	1.396***
looking after home / family	0.062	0.407***
studying	0.274***	0.487***
Long term sick or disabled	-0.446***	0.418***
Marital status (base = married)		
single	-0.329***	0.080***
separated	-0.529***	-0.110
divorced	-0.377***	-0.018
widowed	-0.234***	0.069
health	0.596***	0.367***
Higher education qualification	0.014	0.025
Number of close friends	0.013***	0.013***
Responsible for 1 child	-0.066	-0.243***
Responsible for 2 children	-0.026	-0.314***
Responsible for 3 or more children	-0.004	-0.468***
Pseudo R <sup>2</sup>	0.055	0.055

\* p<0.10, \*\*p<0.05, \*\*\*p<0.01

Table 4. Brant test of parallel lines assumption (Chi<sup>2</sup>, df=5)

	Satisfaction with life overall	Satisfaction with leisure
rural	4.12	11.10**
North East	10.96*	3.02
North West	7.50	12.05**
Yorkshire Humberside	16.48**	16.90***
East Midlands	3.11	7.43
West Midlands	12.66**	20.17
East of England	4.16	10.94*
South East	21.60***	14.26**
South West	13.93**	23.95***
Wales	13.93**	7.81
Scotland	16.26***	20.68***
N Ireland	24.45**	8.50
All (df = 155)	1340.56***	2676.17***

\* p<0.10, \*\*p<0.05, \*\*\*p<0.01

Table 5 Generalized ordered logit results: Satisfaction with life

	PL <sup>a</sup> coefficient	1 vs 2-7	1-2 vs 3-7	1-3 vs 4-7	1-4 vs 5-7	1-5 vs 6-7	1-6 vs 7
Rural	0.049*	-	-	-	-	-	-
North East	0.137**	-	-	-	-	-	-
North West	0.231***	-	-	-	-	-	-
Yorkshire Humberside	-	0.189	0.078	0.058	0.148**	.242***	.147**
East Midlands	0.158***	-	-	-	-	-	-
West Midlands	-	0.198	-0.028	0.042	0.036	0.125**	.191**
East of England	0.231***	-	-	-	-	-	-
South East	-	0.531***	.278***	.231***	.194***	.204***	-0.022
South West	-	0.181	0.003	0.102	0.133**	.198***	.163**
Wales	-	0.261	0.182**	.293***	.219***	.244***	0.097
Scotland	-	0.307**	0.081	0.163**	.233***	.247***	0.117
N Ireland	-	0.368**	0.240**	.404***	.434***	.371***	0.096
Pseudo R <sup>2</sup>	0.066						

a PL = parallel lines coefficient, \* p<0.10, \*\*p<0.05, \*\*\*p<0.01

Table 6 Generalized ordered logit results: Satisfaction with leisure

	PL <sup>a</sup> coefficient	1 vs 2-7	1-2 vs 3-7	1-3 vs 4-7	1-4 vs 5-7	1-5 vs 6-7	1-6 vs 7
Rural		-0.141**	-0.020	-0.018	0.027	0.050*	0.100***
North East	0.200***		-	-	-	-	-
North West		0.209*	0.123*	0.175***	0.184***	0.194***	0.311***
Yorkshire Humberside		-0.007	0.054	0.118**	0.165***	0.260***	0.232***
East Midlands	0.179***	-	-	-	-	-	-
West Midlands		-0.039	0.051	0.012	0.031	0.0151***	0.237***
East of England	0.219***	-	-	-	-	-	-
South East		0.100	0.166***	0.153***	0.168***	0.193***	0.323***
South West		0.047	0.234***	0.129**	0.127**	0.255***	0.374***
Wales	0.156***	-	-	-	-	-	-
Scotland		0.307***	0.088	0.136**	0.218***	0.275***	0.338***
N Ireland	0.363***	-	-	-	-	-	-
Pseudo R <sup>2</sup>	0.073						

a PL = parallel lines coefficient, \* p<0.10, \*\*p<0.05, \*\*\*p<0.01