

Modelling of the socio-economic and geographical determinants of subjective happiness and well-being

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RES-163-27-1013



Acknowledgements

- Funding from the Economic and Social Research Council (RES-163-27-1013) is gratefully acknowledged.
- Thanks to Professor Danny Dorling (University of Sheffield) and Dr Mark Tranmer (University of Manchester) for all their advice and mentoring support.
- The British Household Panel Survey data were made available through the UK Data Archive. The data were originally collected by the ESRC Research Centre on Micro-social Change at the University of Essex, now incorporated within the Institute for Social and Economic Research.
- The Census Small-area Statistics used in some of the work presented here are Crown Copyright and are provided through the Census Dissemination Unit of the University of Manchester, with the support of the ESRC/JISC/DENI 1991 Census of Population Programme.

Outline

- Measuring happiness and well-being and their socio-economic and demographic determinants
- The impact of major life events upon happiness
- Happy People or Happy Places? A multi-level problem
- Spatial microsimulation models of happiness
- Concluding comments

What is happiness?

- Buddhist philosophies
- Greece, circa 500 BC
- Socrates, Plato →

Aristotle (384-322 BC)

Nicomachean Ethics (350 BC)

<http://classics.mit.edu/Aristotle/nicomachaen.html>

England, 18th century

Jeremy Bentham (1748 – 1832), the principle of Utility

John Stuart Mill (1806 – 1873) – Utilitarianism

<http://www.utilitarianism.com/>

Research questions :

- What are the factors and life events that influence different types of individuals' happiness?
- Is the source of happiness or unhappiness purely personal or do contextual factors matter? (and if they do, to what extent?)
- Happy People or Happy Places?

Research methods:

- **Regression modelling:**

single level analysis to investigate the association between “subjective happiness” and individual level explanatory variables

- **Multi-level modelling:**

assessing variation in happiness at several levels simultaneously

- **Spatial Microsimulation:**

creating small area microdata

General Health Questionnaire (1)

Have you recently:

- Been able to concentrate on whatever you are doing?
- Lost much sleep over worry?
- Felt that you are playing a useful part in things?
- Felt capable of making decisions about things?
- Felt constantly under strain?
- Felt you could not overcome your difficulties?

General Health Questionnaire (2)

Have you recently:

- Been able to enjoy your normal day-to-day activities?
- Been able to face up to your problems?
- Been feeling unhappy or depressed?
- Been losing confidence in yourself?
- Been thinking of yourself as a worthless person?
- Been feeling reasonably happy all things considered?

Subjective happiness measure: HLGHQ1

This measure converts valid answers to questions wGHQA to wGHQL to a single scale by recoding so that the scale for individual variables runs from 0 to 3 instead of 1 to 4, and then summing, giving a scale running from 0 (the least distressed) to 36 (the most distressed). See Cox, B.D *et al*, *The Health and Lifestyle Survey*. (London: Health Promotion Research Trust, 1987).

Factors and variables linked to subjective happiness (individual level studies)

- Age
- Education
- Social Class
- Income
- Marital status/relationships
- Employment
- Leisure
- Religion
- Health
- Life events and activities

Life-events and happiness

- **BHPS: What has happened to you (or your family) which has stood out as important?**
- 145,408 major life events recorded between 1992-1995
- Responses recorded verbatim and classified by event category and subject

Ballas, D., Dorling, D. (2007) Measuring the impact of major life events upon happiness, *International Journal of Epidemiology*, 36, 1244-1252. [doi:10.1093/ije/dym182](https://doi.org/10.1093/ije/dym182)

Life Event	Coefficient	P value
RELATIONSHIPS (MINE ENDING 36,43)	-0.178	0.00
DEATH (PARENT, 45)	-0.166	0.00
HEALTHPARENT (1-9)	-0.139	0.00
DEATH (OTHER 45)	-0.137	0.00
EMPLOYMENT JOB LOSS 24	-0.129	0.00
HEALTH MINE (1-9)	-0.117	0.00
DEATH (FAMILY 45)	-0.098	0.00
HEALTH PARTNER (1-9)	-0.092	0.00
HEALTH CHILD (1-9)	-0.084	0.00
HEALTH OTHER (1-9)	-0.073	0.00
EDUCATION CHILD (12-19)	-0.029	0.12
EMPLOYMENT OTHER (23,26-29)	-0.028	0.13
OTHER EVENT (10-11;32-34;37-39;90-95)	-0.026	0.14
NOTHING IMPORTANT HAPPENED	-0.022	0.11
RELATIONSHIPS (WITH PET 54 AND SUBJECT)	-0.020	0.44
FINANCE (OTHER 60-69;73-79)	-0.019	0.27
RELATIONSHIPS FAMILY (46-53;55-59)	-0.014	0.39

Life Event	Coefficient	P value
RELATIONSHIPS (FAMILY 35. 41-42)	0.002	0.91
LEISURE (OUR HOLIDAY 30)	0.010	0.61
MOVING HOME (44;80-81)	0.013	0.46
EDUCATION OTHER (12-19)	0.024	0.27
FINANCE (CAR 70)	0.027	0.22
LEISURE (MY HOLIDAY 30)	0.029	0.07
PREGNANCY (OTHER 40)	0.031	0.56
PREGNANCY (FAMILY 40)	0.034	0.09
RELATIONSHIPS (CHILD'S STARTING 35, 42)	0.037	0.10
EMPLOYMENT JOB CHANGE (20-21)	0.040	0.02
LEISURE (OTHER 30-31)	0.043	0.02
EDUCATION MINE(12-19)	0.052	0.00
PREGNANCY (CHILD'S 40)	0.053	0.01
PREGNANCY (MINE 40)	0.084	0.00
FINANCE (HOUSE 71)	0.097	0.00
EMPLOYMENT JOB GAIN 22	0.097	0.00
RELATIONSHIPS (MINE STARTING 35. 42)	0.160	0.00

Happiness and social comparisons

“A house may be large or small; as long as the surrounding houses are equally small it satisfies all social demands for a dwelling. But if a palace arises beside the little house, the little house shrinks to a hovel... [and]... the dweller will feel more and more uncomfortable, dissatisfied and cramped within its four walls.”

(Marx, 1847)

Research questions :

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- Is the source of happiness or unhappiness purely personal or do contextual factors matter? (and if they do, to what extent?)
- Happy People or Happy Places?

Multilevel Analysis

World → Nation → Region →
District → Electoral Wards → Neighbourhood
→ Household → Individual

Multilevel modelling enables the analysis of data with complex patterns of variability – suitable to explore the variability of happiness at different levels

Multilevel Analysis

World → Nation → **Region** →
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→ **Household** → **Individual**

Multilevel modelling enables the analysis of data with complex patterns of variability – suitable to explore the variability of happiness at different levels

Combining Data

1991 & 2001 Census of UK population:

100% coverage
fine geographical detail
small area data
available only in tabular
format with limited
variables to preserve
confidentiality

British Household Panel Survey:

sample size: more than
5,000 households
annual surveys since
1991
individual data
more variables than
census
coarse geography
household attrition

Multilevel modelling happiness and well-being (Ballas and Tranmer, 2008)

1. “Null model” – extent of variation
2. Socio-economic variables and health – random intercepts
3. Social context – interaction variables

Ballas, D., Tranmer, M. (2008), *Happy people or happy places? A multilevel modelling approach to the analysis of happiness and well-being*, arXiv e-print archive, <http://eprintweb.org/S/article/stat/0808.1001>

Multi-level modelling (4-levels: region, district, household, individual): “null model”

$$\text{UNHAPPINESSSTD}_{ijkl} \sim N(XB, \Omega)$$

$$\text{UNHAPPINESSSTD}_{ijkl} = \beta_{0ijkl} \text{cons}$$

$$\beta_{0ijkl} = -0.034(0.017) + f_{0i} + v_{0kl} + u_{0jkl} + e_{0ijkl}$$

$$\begin{bmatrix} f_{0i} \end{bmatrix} \sim N(0, \Omega_f) : \Omega_f = \begin{bmatrix} 0.002(0.002) \end{bmatrix}$$

$$\begin{bmatrix} v_{0kl} \end{bmatrix} \sim N(0, \Omega_v) : \Omega_v = \begin{bmatrix} 0.007(0.003) \end{bmatrix}$$

$$\begin{bmatrix} u_{0jkl} \end{bmatrix} \sim N(0, \Omega_u) : \Omega_u = \begin{bmatrix} 0.141(0.014) \end{bmatrix}$$

$$\begin{bmatrix} e_{0ijkl} \end{bmatrix} \sim N(0, \Omega_e) : \Omega_e = \begin{bmatrix} 0.814(0.017) \end{bmatrix}$$

$-2 * \log \text{likelihood}(\text{IGLS Deviance}) = 26755.820(9602 \text{ of } 9912 \text{ cases in use})$

Model 1 variance component estimates

Level	Variance	Variance (%)	SE
Region	0.002	0.21	0.002
District	0.007	0.73	0.003
Household	0.141	14.63	0.014
Individual	0.814	84.44	0.017

Model 2: socio-economic / health characteristics (1)

Model 2 Variables, variance component estimates and coefficients (standard error in brackets)	Subjective well-being	General Happiness
Intercept	0.766 (0.074)	0.607 (0.084)
<i>Individual-level variables:</i>		
Age	-0.016 (0.003)	-0.022 (0.003)
Female	-0.177 (0.021)	-0.068 (0.023)
Individual income	-0.012 (0.013)	0.007 (0.015)
Health good (reference = health excellent)	-0.200 (0.022)	-0.085 (0.024)
Health fair (reference = health excellent)	-0.510 (0.028)	-0.249 (0.031)
Health poor (reference = health excellent)	-0.963 (0.043)	-0.465 (0.047)
Health very poor (reference = health excellent)	-1.471 (0.073)	-0.790 (0.078)
University degree	-0.030 (0.038)	0.079 (0.040)
Employment status: unemployed (reference = employed or self employed)	-0.451 (0.043)	-0.384 (0.047)
Employment status: retired (reference = employed or self employed)	0.038 (0.041)	0.030 (0.044)
Employment status: family care (reference = employed or self employed)	-0.126 (0.035)	-0.078 (0.038)

Model 2: socio-economic / health characteristics (2)

Model 2 Variables, variance component estimates and coefficients (standard error in brackets)	Subjective well-being	General Happiness
Employment status: student (reference = employed or self employed)	0.048 (0.054)	0.022(0.059)
Employment status: sick/disabled (reference = employed or self employed)	-0.458 (0.063)	-0.158 (0.069)
Employment status: on maternity leave (reference = employed or self employed)	0.023 (0.258)	0.492 (0.281)
Employment status: on a government scheme (reference = employed or self employed)	-0.045 (0.153)	-0.274 (0.167)
Employment status: other job status (reference = employed or self employed)	0.082 (0.161)	0.163 (0.176)
Commuting time: up to 40 minutes	0.012 (0.032)	0.040 (0.034)
Commuting time: between 40 – 60 minutes	-0.048 (0.044)	0.024 (0.047)
Commuting time: over an hour	-0.087 (0.072)	-0.051(0.078)
Has lived at current address for between 1-5 years (reference = lived at current address for less than 1 year)	0.027(0.032)	-0.010(0.034)
Has lived at current address for more than 5 years (reference = lived at current address for less than 1 year)	0.120(0.031)	0.030(0.033)

Model 2: socio-economic / health characteristics (3)

Model 2 Variables, variance component estimates and coefficients (standard error in brackets)	Subjective well-being	General Happiness
<i>Household level variables:</i>		
Household type: couple no children (reference = single)	0.117 (0.034)	0.144 (0.036)
Household type: couple with dependent children (reference = single)	-0.030 (0.034)	0.047 (0.041)
Household type: couple with children but not dependent (reference = single)	0.037 (0.046)	0.078 (0.049)
Household type: lone parent with dependent child(ren)	-0.281 (0.058)	-0.092 (0.062)
Household type: lone parent with non dependent child(ren)	-0.051(0.060)	0.067(0.063)
Household type: other	0.098 (0.059)	0.176 (0.064)
Household tenure: private renting (reference = owner occupier)	-0.054 (0.038)	0.055(0.040)
Household tenure: LA/HA renting (reference = owner occupier)	-0.068 (0.028)	-0.011(0.029)
Number of cars	-0.010 (0.016)	0.003 (0.016)
Household income	0.028(0.015)	0.002(0.016)

Model 3: socio-economic / health and interaction (1)

Model 3 Variables, variance component estimates and coefficients (standard error in brackets)	Subjective well-being	General Happiness
Intercept	1.097 (0.117)	0.781 (0.133)
<i>Individual-level variables:</i>		
Age	-0.034 (0.006)	-0.032 (0.006)
Female	-0.195 (0.024)	-0.086 (0.028)
Individual income	-0.002 (0.015)	0.000 (0.017)
Health good (reference = health excellent)	-0.208(0.025)	-0.081 (0.028)
Health fair (reference = health excellent)	-0.506 (0.035)	-0.275 (0.040)
Health poor (reference = health excellent)	-0.725 (0.062)	-0.426 (0.071)
Health very poor (reference = health excellent)	-0.846 (0.144)	-0.642 (0.162)
University degree	-0.033 (0.039)	0.094 (0.044)
Employment status: unemployed (reference = employed or self employed)	-0.882 (0.234)	-0.690 (0.268)
Employment status: retired (reference = employed or self employed)	-0.148 (0.345)	-0.135 (0.369)
Employment status: family care (reference = employed or self employed)	-0.198 (0.217)	-0.334 (0.249)
Employment status: on maternity leave (reference = employed or self employed)	0.312 (0.280)	0.736 (0.321)

Model 3: socio-economic / health and interaction (2)

Model 3 Variables, variance component estimates and coefficients (standard error in brackets)	Subjective well-being	General Happiness
Employment status: student (reference = employed or self employed)	-0.022 (0.081)	0.066(0.093)
Employment status: sick/disabled (reference = employed or self employed)	0.601 (0.487)	0.493 (0.558)
Employment status: on maternity leave (reference = employed or self employed)	0.312 (0.280)	0.736 (0.321)
Employment status: on a government scheme (reference = employed or self employed)	0.289 (0.181)	0.056 (0.207)
Employment status: other job status (reference = employed or self employed)	-0.295 (0.484)	-1.256(0.554)
Commuting time: up to 40 minutes	0.006 (0.030)	0.034 (0.034)
Commuting time: between 40 – 60 minutes	-0.049 (0.041)	0.019 (0.047)
Commuting time: over an hour	-0.084 (0.068)	-0.056(0.077)
Has lived at current address for between 1-5 years (reference = lived at current address for less than 1 year)	0.037(0.036)	0.017(0.041)
Has lived at current address for more than 5 years (reference = lived at current address for less than 1 year)	0.100(0.036)	0.047(0.040)

Model 3: socio-economic / health and interaction (3)

Model 3 Variables, variance component estimates and coefficients (standard error in brackets)	Subjective well-being	General Happiness
<i>Household level variables:</i>		
Household type: couple no children (reference = single)	0.059 (0.048)	0.121 (0.054)
Household type: couple with dependent children (reference = single)	-0.008 (0.047)	0.061 (0.054)
Household type: couple with children but not dependent (reference = single)	0.046 (0.056)	0.084 (0.064)
Household type: lone parent with dependent child(ren)	-0.213 (0.076)	0.029 (0.087)
Household type: lone parent with non dependent child(ren)	-0.135(0.075)	0.113(0.085)
Household type: other	0.069 (0.077)	0.164 (0.086)
Household tenure: private renting (reference = owner occupier)	0.008 (0.047)	0.126(0.052)
Household tenure: LA/HA renting (reference = owner occupier)	-0.033 (0.040)	-0.004 (0.045)
Number of cars	-0.026 (0.018)	-0.025(0.020)
Household income	0.030(0.017)	0.006(0.019)

Model 3: socio-economic / health and interaction (4)

Model 3 Variables, variance component estimates and coefficients (standard error in brackets)	Subjective well-being	General Happiness
<i>Interaction (individual/household x district) terms:</i>		
Unemployment status (individual level) x unemployment rate (district level)	0.815 (0.235)	0.548(0.270)
Owner Occupier (household level) x owner occupier households rate (district level)	0.020 (0.016)	-0.009(0.017)
Private renting (household level) x private renting households rate (district level)	0.020(0.029)	0.015(0.032)
Renting from LA/HA x LA/HA renting households rate	0.029(0.030)	-0.038(0.033)
“Affluent” household (household level) x percentage of “affluent” households in the area (district level)	-0.021(0.025)	-0.007(0.29)
“Middle” household (household level) x percentage of “Middle” households in the area (district level)	0.030(0.019)	-0.001(0.21)
“Poor” household (household level) x percentage of “Poor” households in the area (district level)	0.016(0.019)	0.017(0.021)

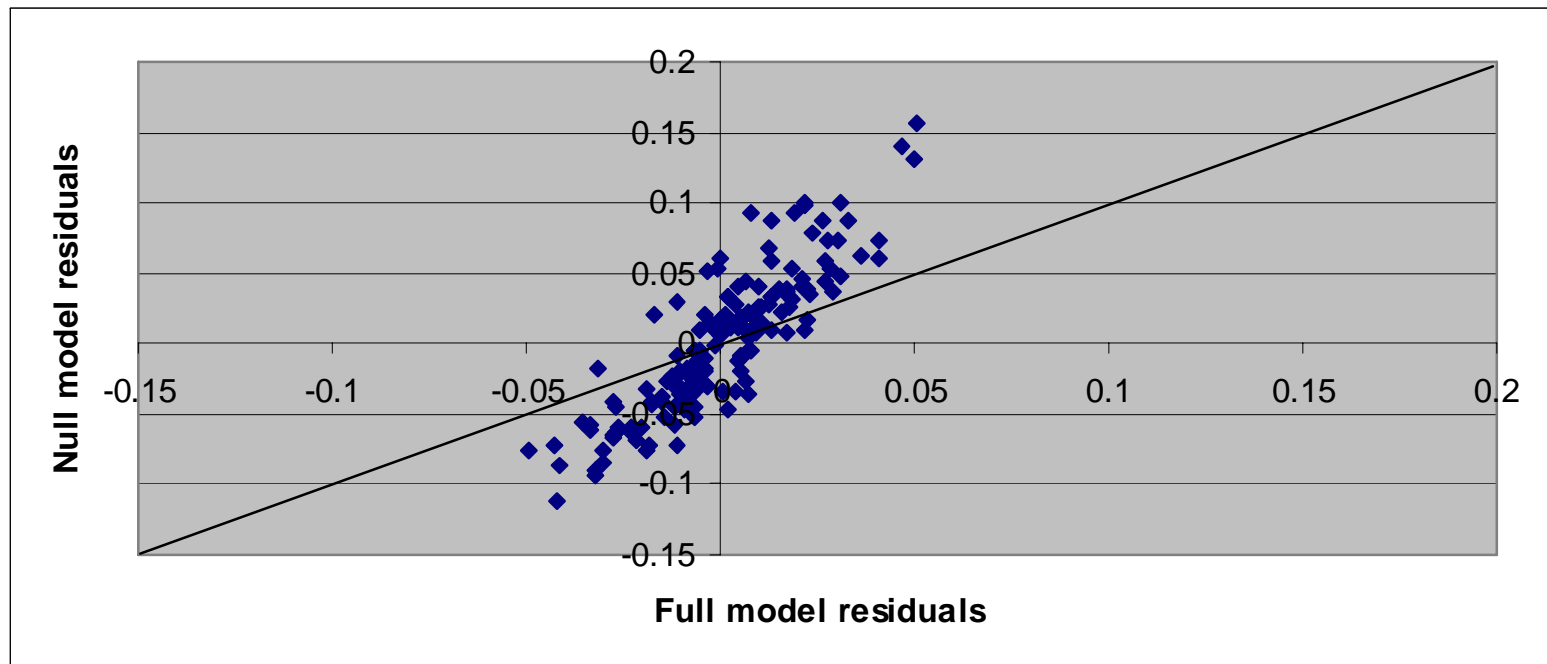
Model 2 and 3 significant main effects (1)

Happiness and well-being determinants	Model 2	Model 3
Age	HLGHQ1(-),GHQL(-)	HLGHQ1(-),GHQL(-)
Female (Reference = Male)	HLGHQ1(-),GHQL(-)	HLGHQ1(-),GHQL(-)
Health good (reference = health excellent)	HLGHQ1(-),GHQL(-)	HLGHQ1(-),GHQL(-)
Health fair (reference = health excellent)	HLGHQ1(-),GHQL(-)	HLGHQ1(-),GHQL(-)
Health poor (reference = health excellent)	HLGHQ1(-),GHQL(-)	HLGHQ1(-),GHQL(-)
Health very poor (reference = health excellent)	HLGHQ1(-),GHQL(-)	HLGHQ1(-),GHQL(-)
Employment status: unemployed (reference = employed or self employed)	HLGHQ1(-),GHQL(-)	HLGHQ1(-),GHQL(-)
Employment status: family care (reference = employed or self employed)	HLGHQ1(-),GHQL(-)	
Employment status: sick/disabled (reference = employed or self employed)	HLGHQ1(-),GHQL(-)	

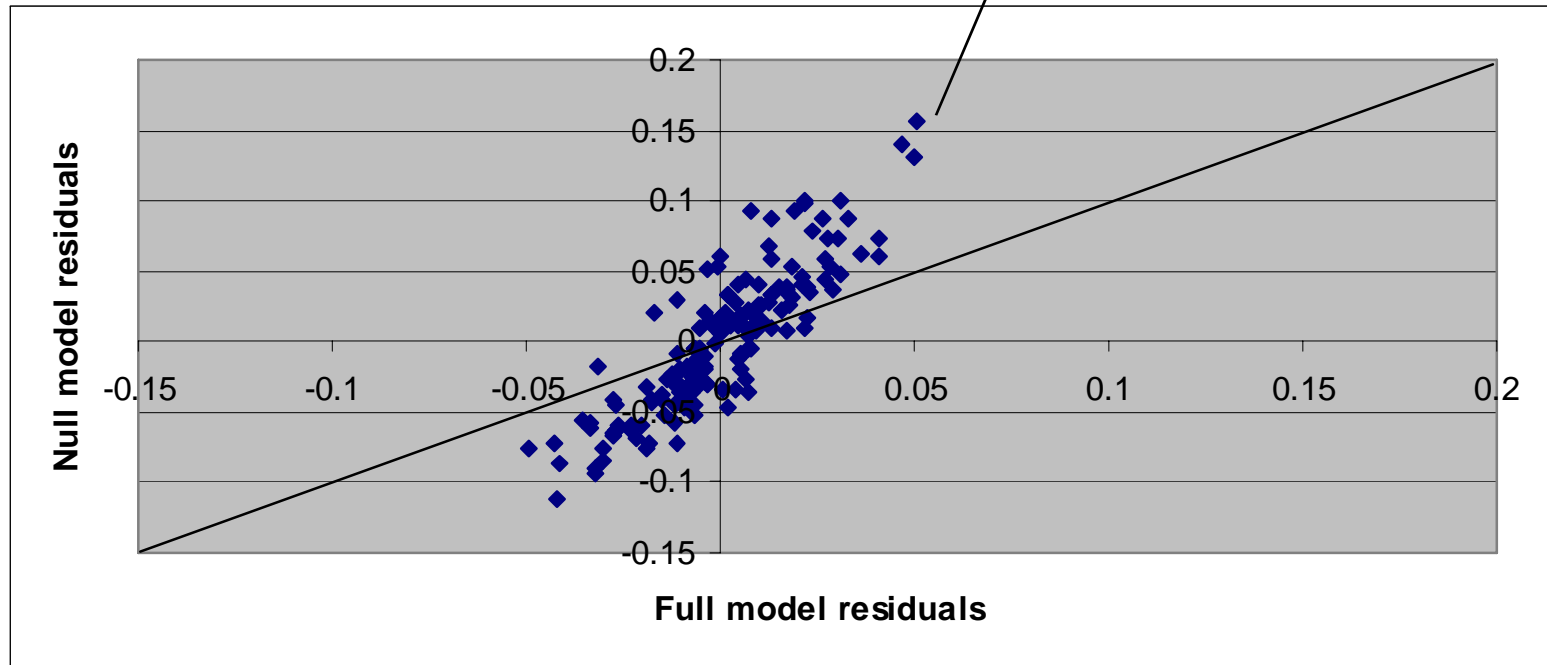
Model 2 and 3 significant main effects (2)

Happiness and well-being determinants	Model 2	Model 3
Employment status: on maternity leave (reference = employed or self employed)		GHQL(+)
Employment status: on a government scheme (reference = employed or self employed)		GHQL(-)
Employment status: other job status (reference = employed or self employed)		
Has lived at current address for more than 5 years (reference = lived at current address for less than one year)	HLGHQ1(+)	HLGHQ1(+)
Household type: couple no children (reference = single)	HLGHQ1(+),GHQL(+)	GHQL(+)
Household type: lone parent with dependent child(ren) (reference = single)	HLGHQ1(-)	HLGHQ1(-)
Household type: lone parent with non dependent child(ren) (reference = single)		
Household type: other (reference = single)	GHQL(+)	
Household tenure: private renting (reference = owner occupier)		GHQL(+)
Household tenure: LA/HA renting (reference = owner occupier)	HLGHQ1(-)	
Unemployment status (individual level) x unemployment rate (district level)	Not included	HLGHQ1(+),GHQL(+)

Model 3 vs model 1 district level residuals

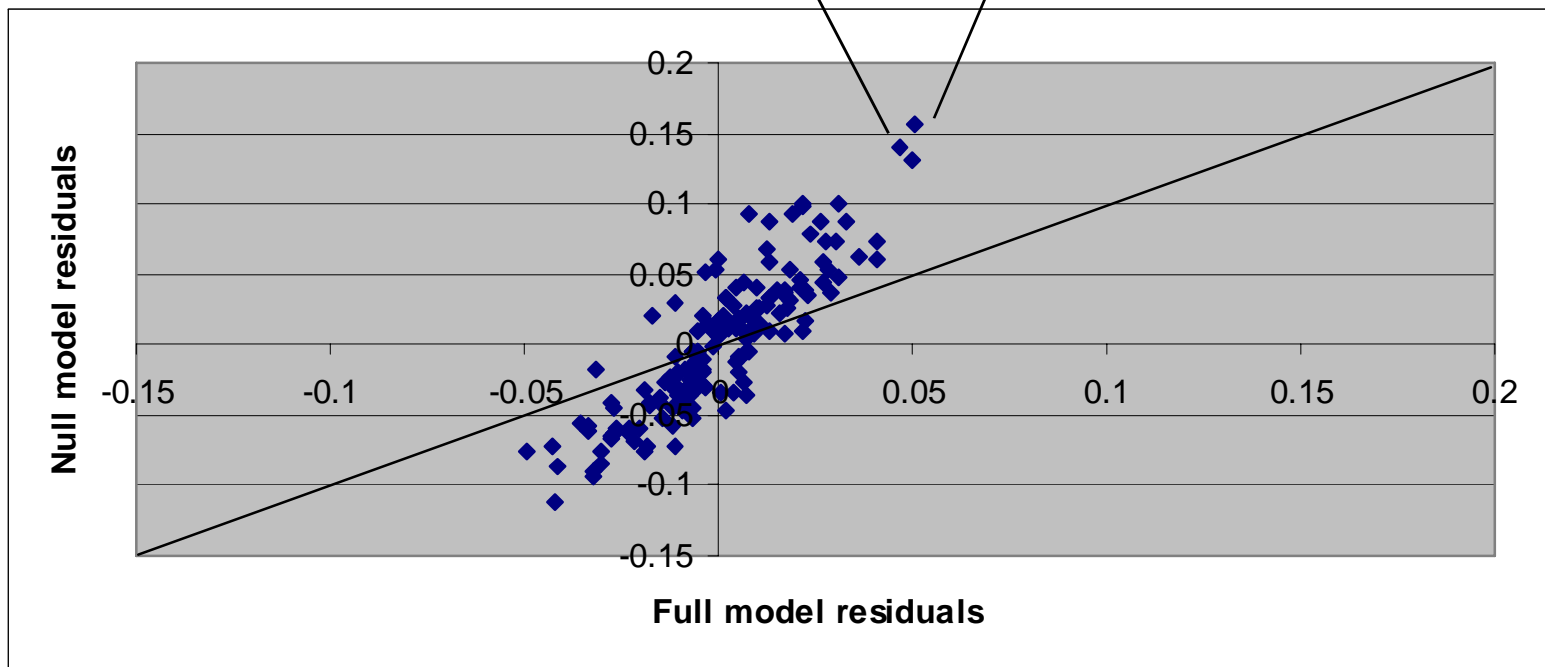


Bracknell Forest; Slough

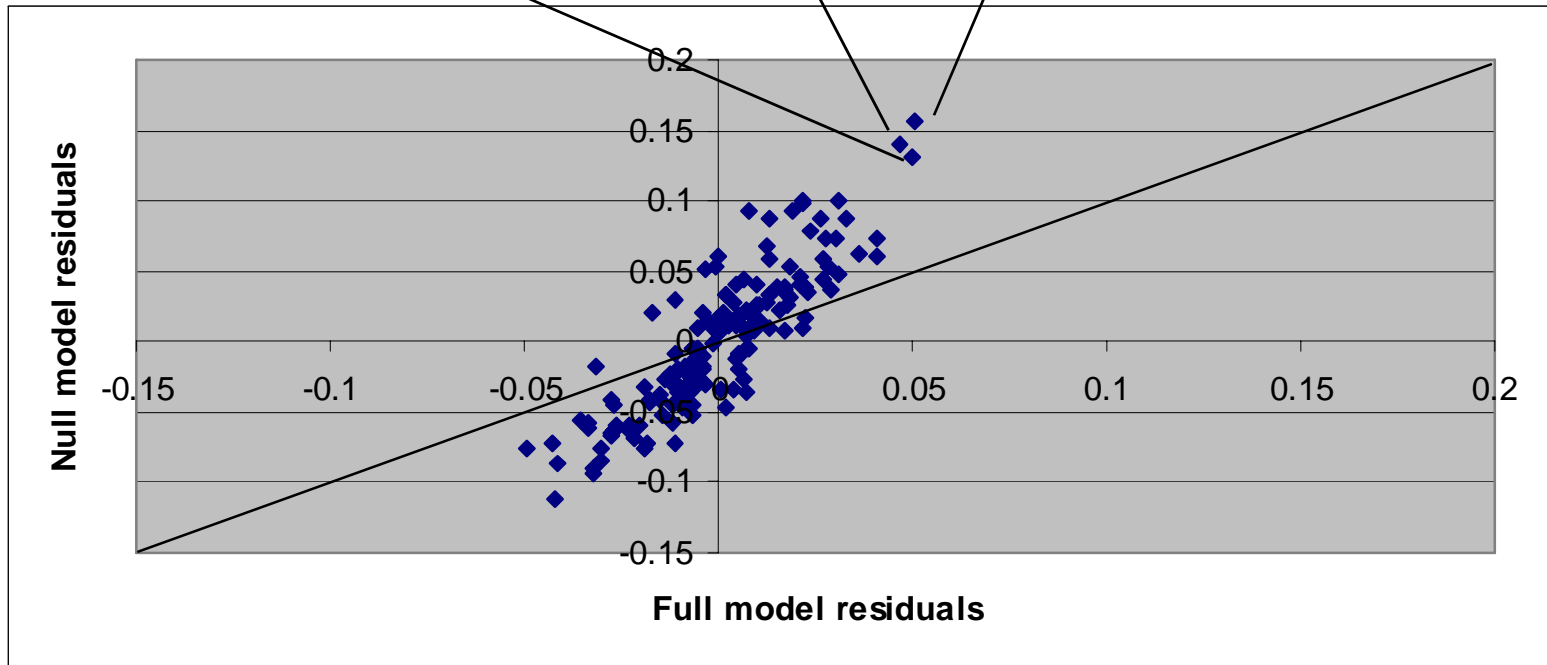


Wakefield

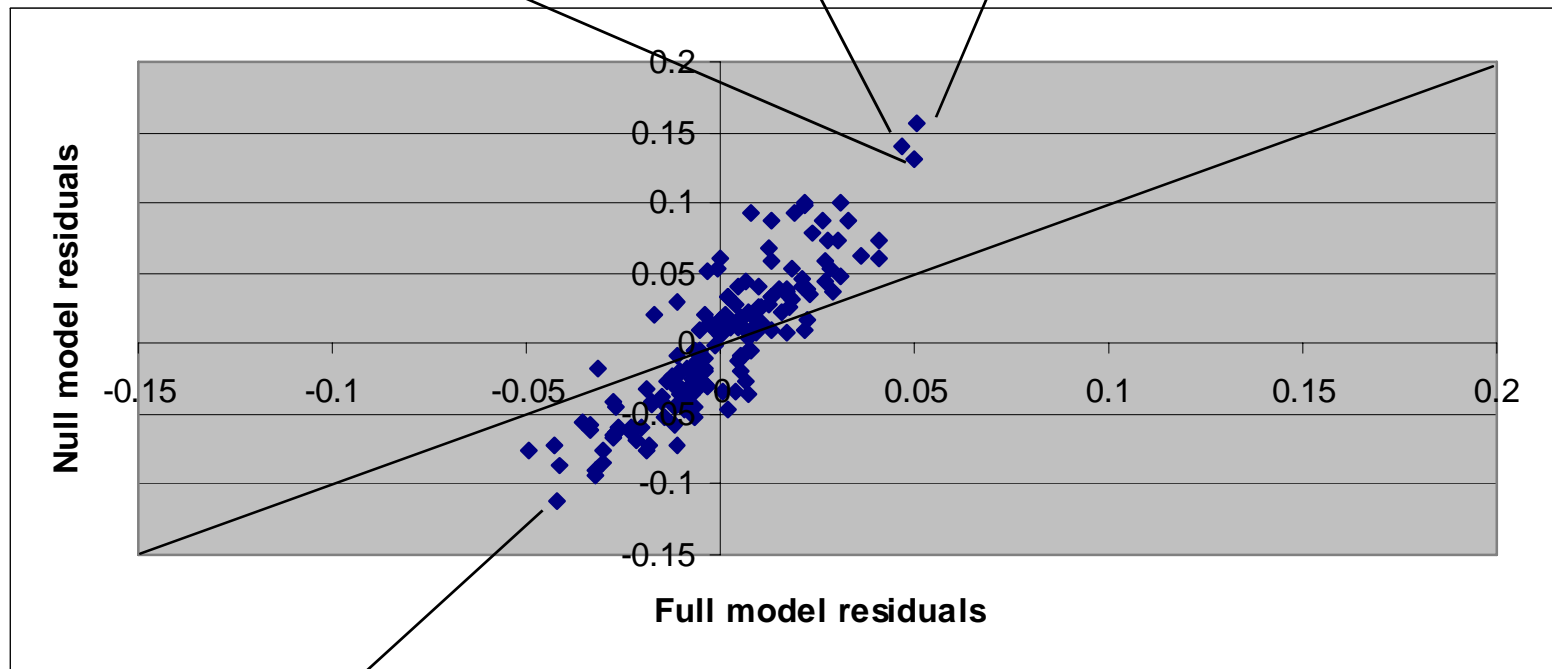
Bracknell Forest; Slough



Wakefield
Alyn and Deeside, Delyn and Wrexham Maelor
Bracknell Forest; Slough



Wakefield
Alyn and Deeside, Delyn and Wrexham Maelor
Bracknell Forest; Slough



Wycombe

Higher level variance components

- When the explanatory variables were added to the model, district level variation was estimated at close to, but not exactly, zero.
- Significant between-household variation remained.

Spatial Microsimulation

- Reweight the first wave of the BHPS microdata to fit small area “constraints”
- Dynamically simulate this population for the years 1991, 2001, 2011, 2021 (“groundhog day” scenario)
- What-if dynamic simulations

Ballas, D. (forthcoming), “Geographical modelling of subjective happiness and well-being”, in Stillwell, J, Norman, P., Thomas, C., Surridge, P., *Understanding Population Trends and Processes, volume 2: Spatial and Social Disparities*, Springer

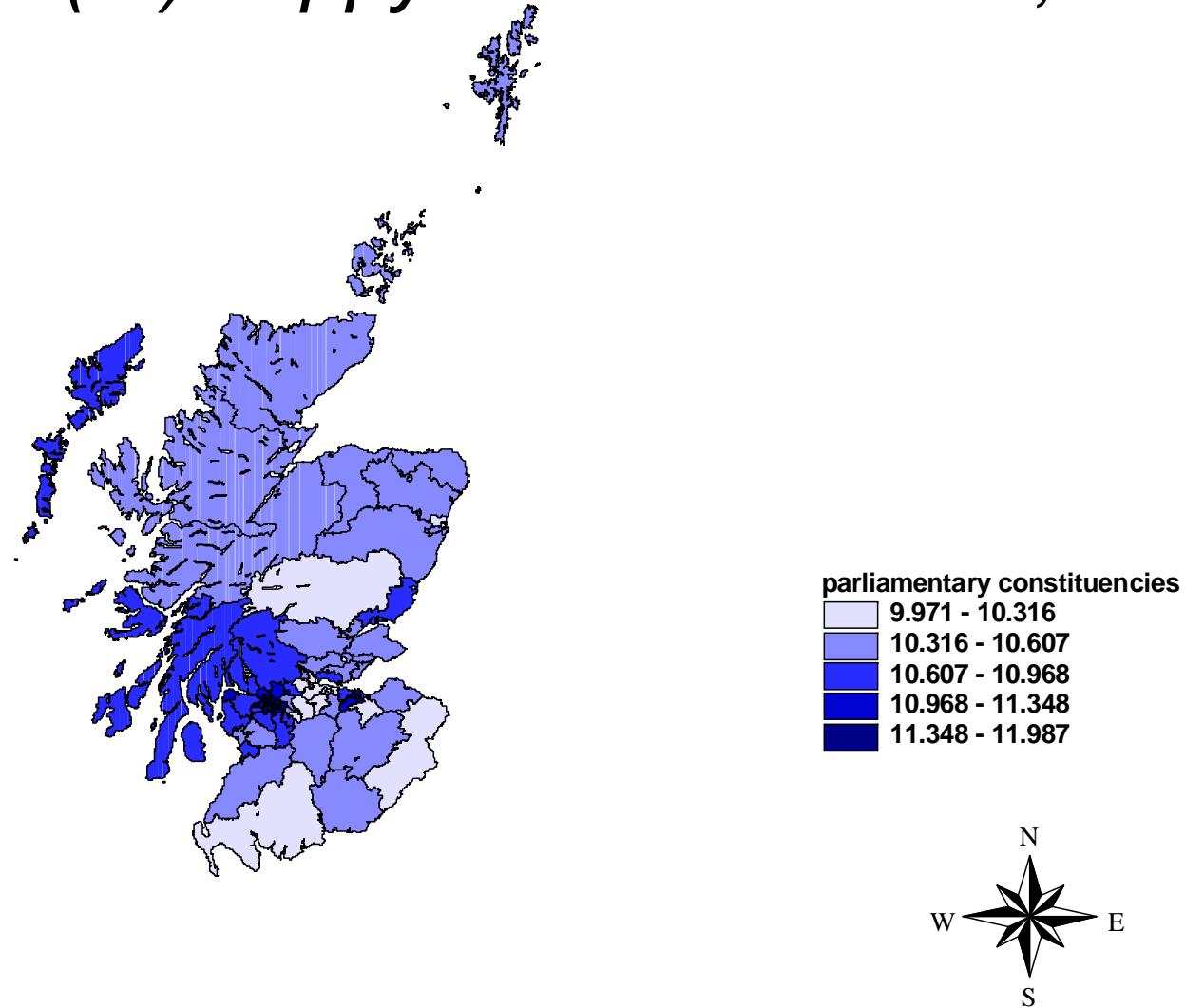
Modelling approach

1. Establish a set of constraints
2. Choose a spatially defined source population
3. Repeatedly sample from source
4. Adjust weightings to match first constraint
5. Adjust weightings to match second constraint
6. ...
7. Adjust weightings to match final constraint
8. Go back to step 4 and repeat loop until results converge
9. Save weightings which define membership of SimBritain

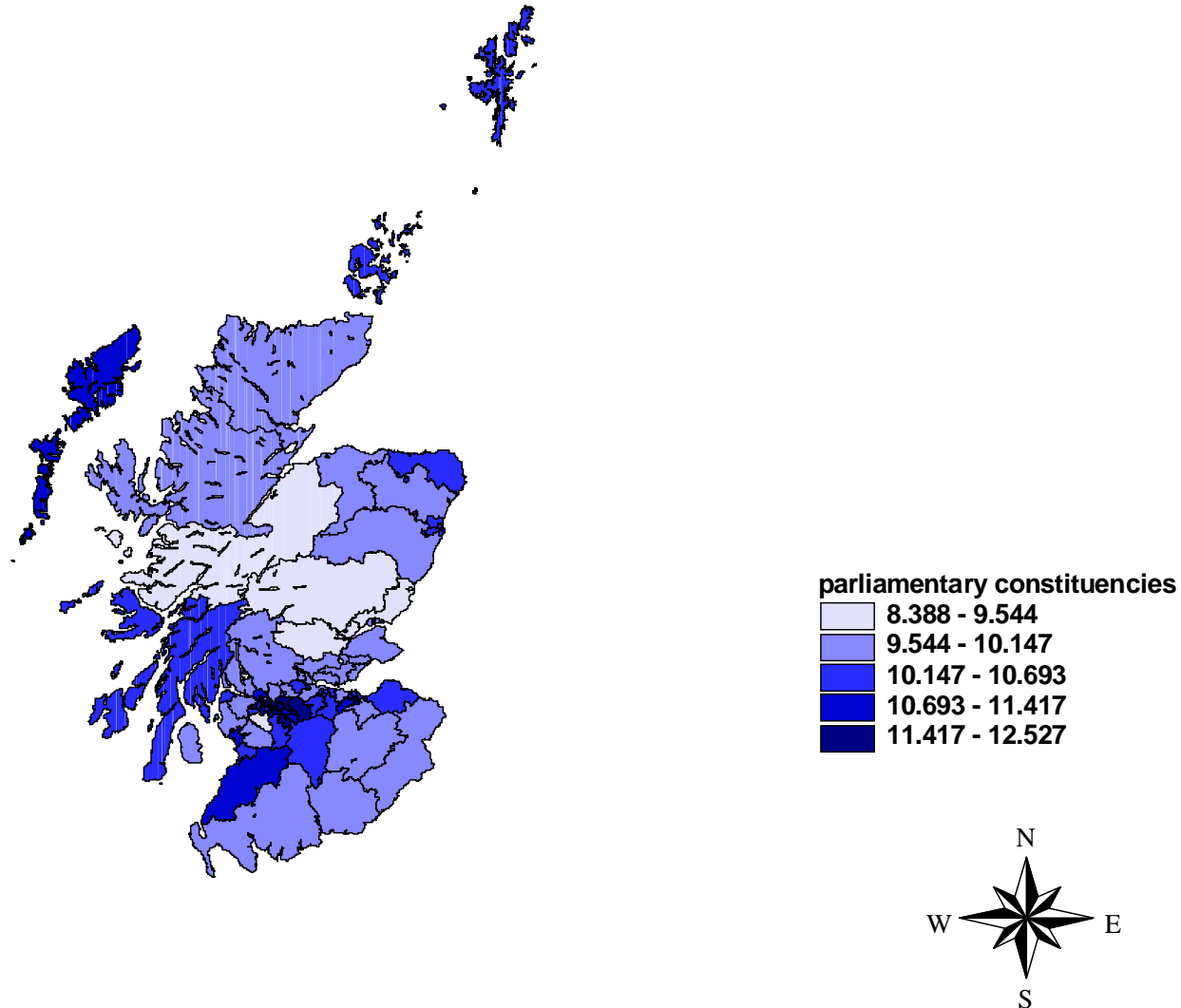
MODEL CONSTRAINTS

- 1971, 1981 and 1991 Census Small Area Statistics (SAS)
- 6 constraint tables with 3 categories
- projected forward for 2001, 2011 and 2021
- ward level projections

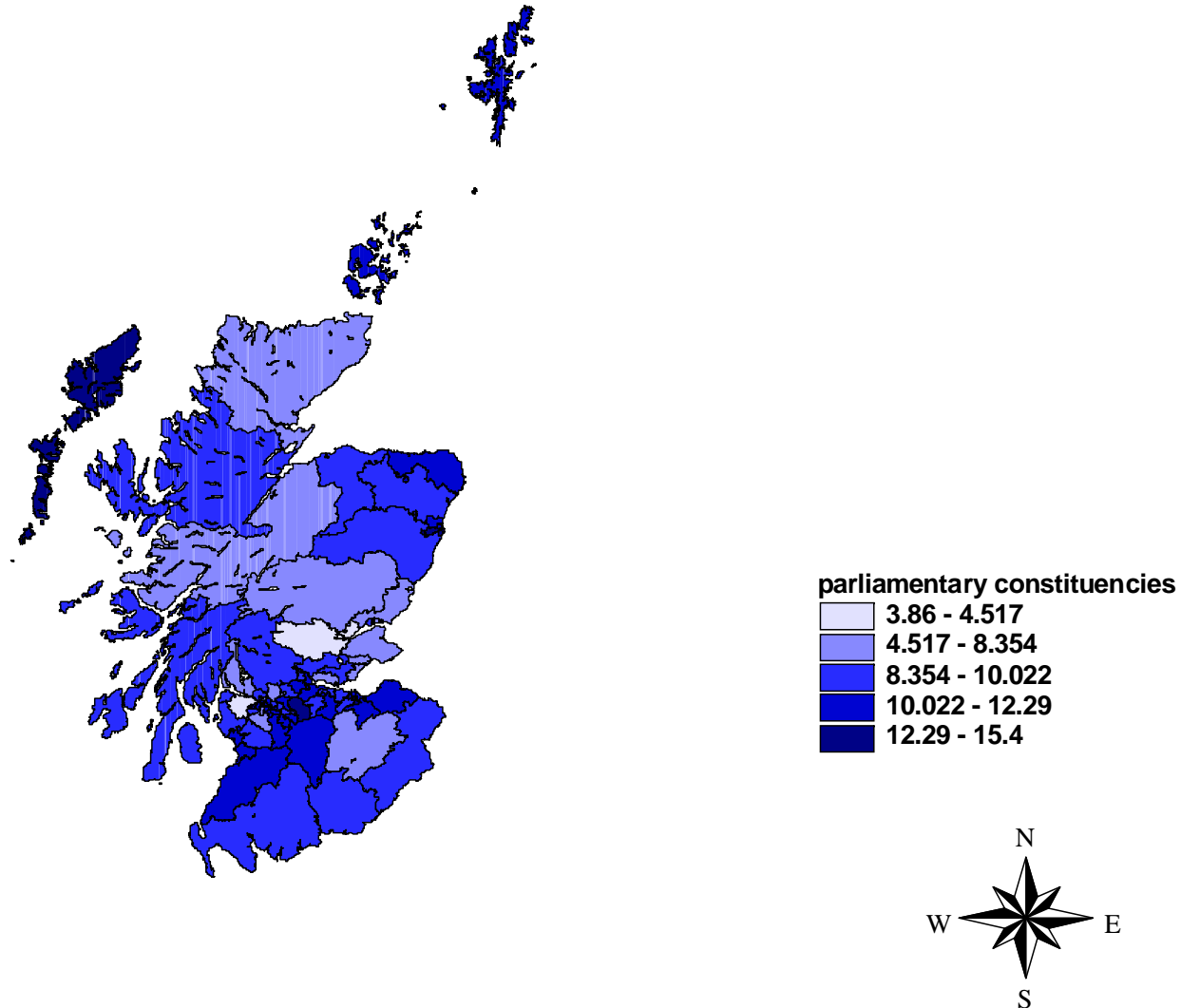
Simulated geography of happiness in Scotland (%) *happy more than usual, 1991*



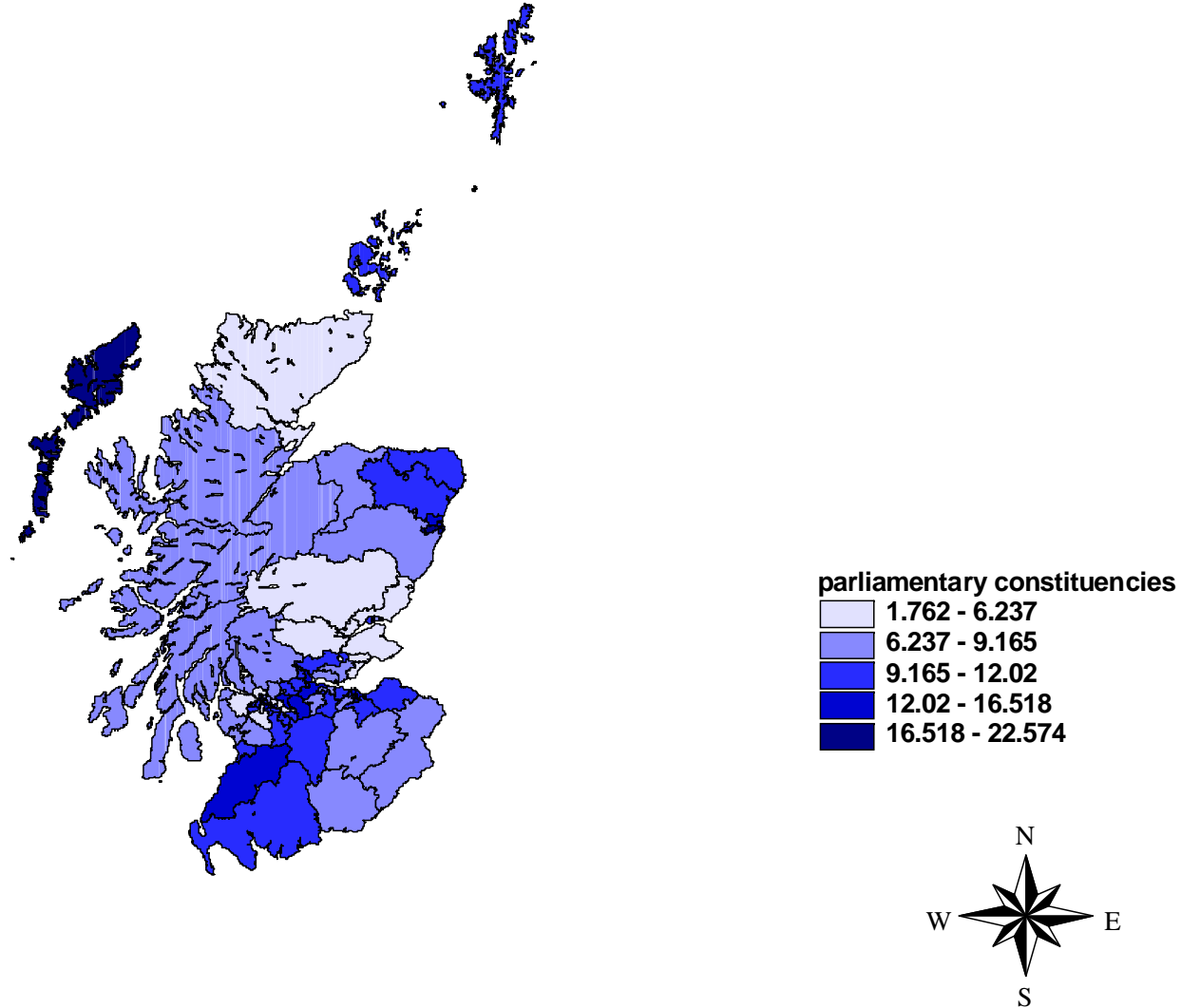
Simulated geography of happiness in Scotland (%) *happy more than usual, 2001*



Simulated geography of happiness in Scotland (%) *happy more than usual, 2011*



Simulated geography of happiness in Scotland (%) *happy more than usual, 2021*



Conclusions

- There are individual variations in happiness
- Can explore the impact of social context and additional geographical variations using multilevel and spatial microsimulation modelling techniques
- Some district level variation in happiness – but the differences from place to place were not statistically significant.
- Need to disaggregate the analysis further (spatial microsimulation)
- Longitudinal analysis
- Environmental variables

On-going and future work

- Public Policy Analysis and Happiness
- Modelling the environmental determinants of happiness
- International happiness comparisons
- Subjective Happiness and Human-Scale Visualisations

Slough (1937)

Come friendly bombs and fall on
Slough!
It isn't fit for humans now,
There isn't grass to graze a cow.
Swarm over, Death!

Come, bombs and blow to
smithereens
Those air -conditioned, bright
canteens,
Tinned fruit, tinned meat, tinned milk,
tinned beans,
Tinned minds, tinned breath.

Mess up the mess they call a town-
A house for ninety-seven down
And once a week a half a crown
For twenty years.

And get that man with double chin
Who'll always cheat and always win,
Who washes his repulsive skin
In women's tears:

And smash his desk of polished oak
And smash his hands so used to
stroke
And stop his boring dirty joke
And make him yell.

But spare the bald young clerks who
add
The profits of the stinking cad;
It's not their fault that they are mad,
They've tasted Hell.

It's not their fault they do not know
The birdsong from the radio,
It's not their fault they often go
To Maidenhead

And talk of sport and makes of cars
In various bogus-Tudor bars
And daren't look up and see the stars
But belch instead.

In labour-saving homes, with care
Their wives frizz out peroxide hair
And dry it in synthetic air
And paint their nails.

Come, friendly bombs and fall on
Slough
To get it ready for the plough.
The cabbages are coming now;
The earth exhales.

by John Betjeman (1906 - 1984)