HIGH-RESOLUTION SOCIO-ECONOMIC PROFILES OF UK REGIONS THROUGH CLUSTERING OF UK CENSUS DATA

A Pilot on the North-East of England

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ABSTRACT

The paper reports on pilot of a methodology for understanding high-resolution spatial patterns in regional populations based upon empirical data, analysis, complexity theory and dialogical interpretation of census data with practitioners and academics.

This paper consists of two parts. The first reports on a quantitative empirical methodology to simplify data and understand an example region in the UK. It reports on the geographical analysis of a regional UK population using empirical data from the 2001 UK census, and through cluster analysis and log linear techniques it presents a significantly simplified (and approximate) spatial typography of high-resolution spatial areas, where initial data (8900 cases with over 120 variables) are significantly simplified (to 20 typical cases differentiated by 10 cluster variables) thereby providing a resource for future GIS mapping and development. The pilot reports on both methodological and substantive findings, and presents approximate representations for the North-East region validated on the Newcastle area. The discussion considers how this pilot study could be developed into a more comprehensive research project. It concludes that the approach piloted, and outlined here, when combined with interpretation of this data by governance practitioners and cross-disciplinary academics in dialogical interaction, in a mixed qualitative-quantitative study, might be a practical way forward for developing understanding with greater validity and higher utilisation than existing approaches.

ACKNOWLEDGEMENTS

Many thanks to Prof. David Byrne, Head of Sociology, Durham University, for discussions on the exploratory clustering and loglinear techniques, complexity, and supervision of the pilot project. To Chris Stephens, Statistician, Newcastle City Council (NCC), for early discussions, and communication, of NCC data, and to Mark Rowntree, Policy and Research, NCC, for the example mapping of two of my cluster variables (presented in the appendix) to aid validation of the analysis and to further demonstrate the potential. Finally, Census output is Crown copyright and is reproduced with the permission of the Controller of HMSO and the Queen's Printer for Scotland (Source: 2001 Census Area Statistics). Any errors and omissions are of course my own.

Many thanks. Trevor Wren..

CONTENTS

PART A: INTRODUCTION AND METHODOLOGY

1 INTRODUCTION

The aim of this study is to pilot a larger proposed study. The larger study will explore, develop and apply mixed quantitative and qualitative approaches to better understand the spatial and temporal patterns, associations, and interactions within UK neighbourhoods, through evidence-based comparisons within and between regions, using Census data and also through interpretation by practitioners familiar with the different types of spatial neighbourhoods.

This pilot includes the empirical investigation and exploration of the 2001 Census data at high spatial resolution (down to Output Area level - with around 300 people), the use of clustering and analysis techniques to give a simplified typology of spatial areas and an initial understanding of the significant associations (between variables within output areas cases and across the spatial levels). The pilot reports on both methodological and substantive findings, and presents approximate representations for the North-East region validated on one area that of Newcastle.

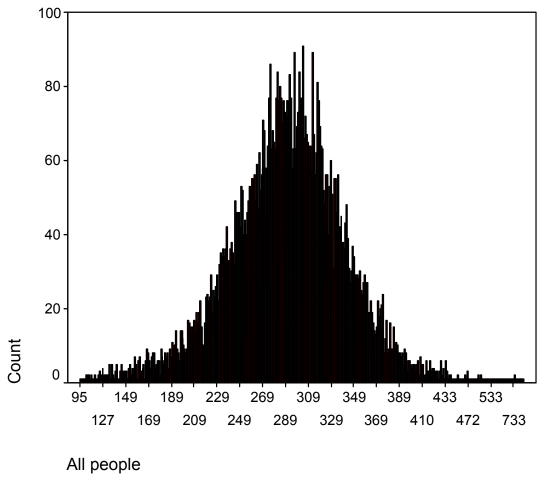
The final part of the project concerns the possible interpretation and validation of the data, which does not form part of the empirical study. In this project the interpretation and validation will be done in a scaled down manner by the author, by utilizing the authors the local knowledge of Newcastle as a validation area within the study. The interpretation and validation of the data would be a major component of the future development of the study, and the potential role of complexity theory and involvement of governance practitioners is noted.

2 THE CENSUS DATA AND SIMPLIFICATION METHODS

2.1 The 2001 Census and Output Areas

The UK Census Data for 2001 is defined at a number of spatial levels from the highest country level (e.g. England), to the regional level (e.g. North-east), to local government level (e.g. Newcastle) to ward level (e.g. Scotswood or Jesmond) to the highest resolution level of the Output Areas within a ward (e.g. 00CJFU0001 or 00CJFM0039 – here CJ is Newcastle, FU is Scotswood, FM is Jesmond, 0001 denotes the first Output Area, 0039 the 39th Output Area).

The North-East region comprises 8599 output areas (and Newcastle for instance has 859). The numbers of people in each Output Areas vary widely in the North-East (by a factor of 30 from 95 to 3344), but in most cases they have around 290-300 people with the vast majority being between 140 and 440 people, as is shown in the following example frequency distribution for the North-East:



Clustering including absolute population numbers may therefore create clusters representing high and low population areas (which is relevant but not important throughout the whole analysis).

For this reason all of the data will be normalised with respect to the absolute population numbers which is the subject of the next section.

2.2 Raw Census Data Used and Conversion to Normalised Variables

All census data is given as a case/data matrix, with rows representing the cases (output areas) and columns representing the raw data. The raw data in row i and in column j: X_{ij}, will be normalised with respect to the larger relevant population in the output area (total, economically active, with children etc). If this is P_i, we create a new normalised column of data, with entry, in the ith row and jth column, given by Y_{ij}, where $Y_{jj} = X_{ij} / P_i$. This means that all data entries $0 <= Y_{ij} <= 1$, and this is the normalised data. This reduces the number of raw data columns by 1 and gives more constrained and standardised metric variables. The following table gives the resulting normalised variables.

Feature and Ref Table with Data	Census Raw Data	Normalised Variables
Numbers and Sex Ks01n_15_1600_8	Total; population male; population female; population in households; population in communal; Students away from home	% male % female (not useful in distinguishing areas)
Age Ks02n_15_38_8	16 age-banded variables from 0-4 to 90+	%Under 16 %17-29 %30-44 %45-59 %60 or over
Couple Status Ks03n_15_575_8	People aged 16 and over living in households: All (pa16aolih: All); pa16aolih: couple married or remarried; pa16aolih:cohabiting; pa16aolih: not living in a couple (nliac), single never married; pa16aolih:nliac:married or remarried; pa16aolih:nliac:separated still legally married; pa16aolih:nliac:divorced; pa16aolih:nliac:widowed	%Married cohabiting (marcoh) %Unmarried Cohabiting (unmarcoh) % Not cohabiting never married (ncohnm) % not cohabiting separated or divorced ncohsod % not cohabiting widowed (ncohwid)

Feature Table of Data	Census Raw Data	Normalised Variables
Ethnicity Ks06n_15_1520_8	16 variables All, from white-related, mixed-related, asian-related, black-related, chinese-related. other	%White-related and white mixed. %Asian-related %Black-related %Chinese-related
Religion Ks07n_15_43_8	All, Christian, Buddhist, Hindu, Muslim, Sikh, Other religion, No Religion, Religion not stated.	%Christian %Other %none %not stated
Health Ks08n_15_44_8	All, people with limiting long term illness, people of working age with limiting long term illness, general health good, general health fairly good, general health poor, Provision of unpaid care in 3 categories by hours (under 19, 19-50, over 50)	%with llt illness %with general health good %provision of unpaid care
Economic Activity (16-74yrs old) Ks09AN_15_72_8	14 variables: all people 16-74 Economically Active: part-time, full-time, self-employed, unemployed, full-time student, Economically Inactive: retired, inactive student, looking after home/family, permanently sick/disabled, other, Unemployed: 16-24, over 50, never worked, 16-79 long-term unemployed	% in relation to all people 16-74 Ptime, Ftime, Semp, Unemp, Ftstu, Ret, Instu, Lahf Psicdis, Unempy, Unempo, Nevwk, ltunemp

Feature **Table of Data**	**Census Raw Data**	**Normalised Variables**
As above Males Ks09AN_15_73_8	As above 14 variables	% in relation to all males 16-74 % variables in relation to all mptime, mftime, msemp, munemp, mftstu, mret, minstu, mlahf mpsicdis, munempy, munempo, mnevwk, mltunemp
As above Females Ks09CN_15_74_8	As above 14 variables	% in relation to all females 16-74 fptime, fftime, fsemp, funemp, fftstu, fret, finstu, flahf fpsicdis, funempy, funempo, fnevwk, fltunemp
Work status Ks12AN_15_77_8	Managers and senior officials, professionals, associate professional and technical, admin and secretarial, Skilled trades, personal service, sales and customer service, process, plant and machine, elementary occupations	Do %: mansen profess aprosec skiltrad perser salcus proplama elemoc

Feature **Table of Data**	**Census Raw Data**	**Normalised Variables**
Education (16-74) Ks13N_15_80_8	No qualifications, highest level, level2, level 3, level4/5, unknown, Total students and school children under 17, total students 18-74, Full-time students economically active in employment, unemployed, or inactive	noqual lev1 lev2 lev3 lev45 otherun
Tenure Types Ks18N_15_86_8	Owner occupied - owned; owner occupied–mortgaged; Owner occupied-shared ownership; rented-local authority; rented – association, rented – private; other	Ownout, Ownmort Ownshar Rentcoun, renthasl, rentpriv, rentoth
Household composition Ks20N_15_170_8	One person-pensioner; one person – other; family-pensioners; married couple no children; married couple with dependent children; married couple all non-dependent children; Cohabiting couple no children; cohabiting couple with dependent children; cohabiting couple all non-dependent children; Lone parent with dependent children; lone parent with all children non-dependent children; other households with dependent children; households all student; other households all pensioner; other other.	1=higher pensioner 2=higher lone parent and cohabiting 3 = highest single 4= highest married

2.3 Clustering of Cases

The pilot project aims to generate categorisation of census data at high spatial resolution (around 300 people per area) using cluster analysis to change *sets* of metric data (e.g. the *sets* economic activity variables) into more manageable *single* categorical variables which utilise *all* of the census information available. Using this technique large numbers of cases may be reduced to a significantly smaller number of types. Clustering is therefore a classification or categorisation technique.

For instance the 14 normalised economic activity metric variables will be used to cluster the 8599 cases (Output Areas) to give a single categorical variable representing economic activity, with a number of values to reflect the different types of output areas defined in terms of economic activity. Similarly the 6 metric tenure variables will be used to cluster the output areas/cases to give a single categorical variable representing tenure; with the different value representing the different ways of classifying output areas by tenure. This can be done for all sets of metric variables in the Census data, and will be done for those sets noted in the table in section 2.2.

For large data sets (as is the north-East data) the k-Means Cluster method is appropriate. The method attempts to create homogeneous groups of cases based on the variables/characteristics of the output areas. The procedure requires the specification of the number of clusters but using syntax it is possible to generate and explore several clustering choices in a single run.

The convergence of iterations, the number required, the resulting cluster membership, the distance of each case from cluster centres, and the final cluster centres are all generated as output and can be saved. Furthermore the generation of analysis of variance (F) statistics can be generated, and this varies for every variable involved in the clustering. The relative size of this statistic gives information on each variable's contribution to the differentiation of the clusters identified.

2.4 Specific Method for Simplifying by Clustering

Stage 1: General Preparation

- Get the SPSS software and the Census Data
- Select the Region of interest
- Explore the data.

Stage 2: Data Preparation

- Collect up similar data within a single worksheet (for instance all health variables or economic activity variables). Do for all data of interest
- Normalise: Convert raw data into percentages (manually or with syntax).
- Combine variables to reduce detail where appropriate (e.g. age bands)

Stage 3: Clustering

- Choose number of clusters: Set number of iterations.
- Select ANOVA table (to show which variables contribute most to the cluster)
  - Create composite elemental cluster variables
- Check iterations have settled down on all clusters
- Check the ANOVA table – variables with largest F provide the greatest separation between clusters. Check the relative distances between the clusters
- Check the number of cases in each cluster
- Iterate on the number of clusters, and compare results. Try 2 3 4 5 clusters etc. take the minimum number possible, which converge to give separated clusters (this can be done simply and automatically using syntax).
- Choose a clustering scheme which is both meaningful and useful. To do this use high, moderate, and low classifications where appropriate; examine cluster centres and associate these with highest and lowest values for the variables to give an interpretation of the cluster. Use largest and lowest F factors in the ANOVA tables, the membership (numbers of cases), to gain insight into the meaning, naming and number of clusters to settle upon and use.
- Where particular cluster types recur independently of the number of clusters this gives added confidence in the reality of that cluster.

- Stage 5: Do for all the available sets of metric variables of interest; to give several categorical variables (one for each set)

Note on the choice of clusters numbers. This may also be aided by the stability of clusters as the numbers of clusters changes. Ultimately choosing a particular number of clusters involves subjective judgement - but the choice nevertheless has consequences; some benefits and some disadvantages. It might be advisable to have a memorable and manageable number of categories (2-6 perhaps). Furthermore, if too many clusters are chosen, then the number of cases within each cluster may be small. If too few clusters are chosen then there may be little differentiation, furthermore this will limit the cross-tabulation analysis that is possible. To illustrate this the following table gives some idea of the numbers of states that follow from particular clustering.

Table: Approximate number of states by variable sets and cluster categories

	5 variables-sets	10 variable-sets	15 variable-sets
2 categories	$2^5 = 32$ states	$2^{10} = 1024$ states	$2^{15} = 33000$ states
3 categories	$3^5 = 243$ states	$3^{10} = 59000$	$3^{15} = 14{,}000{,}000$
4 categories	$4^5 = 1024$ states	$4^{10} = 1{,}000{,}000$ states	4^{15} = over 1000 million states
5 categories	$5^5 = 3125$ states	5^{10} = over 9 million states	5^{15} = over 30,000 million states

Because the North-East data has almost 9000 output areas (cases) those options in blue are likely to have many states occupied, and it might be expected that the log-linear approach would not significantly simplify the model. If we try to get the number of states just less than or equal to the number of cases, this might be a way to maximise differentiation of cases, while ensuring statistically significant findings and a parsimonious unsaturated model. Since the census sets of variables are around 10 variable sets, this suggests using around 2-3 category clusters (possibly with some 4 where needed).

2.5 Analysis of Clusters: Cross-Tabulation & Loglinear Analysis

Once the clustering has been achieved it is then possible to analyse the categorical data further. The use of two-way and three-way cross-tabulation tables will be informative to examine association between the categorical variables on the Output Areas. Three-way tables could also be used to examine how the associations varied with spatial areas (such as local government areas or across wards).

The Loglinear modelling approaches will be particularly useful in modelling non-linear interactions and associations (Gilbert, 1981, p91, and Byrne, 2002, p82). The log linear technique does not require a dependent variable (it is an association technique). It works on grouped data (tables) and can be used to simplify the view of interactions and relevant variables down to a parsimonious reduced set, and examine the complex patterns of association between many categorical variables. It requires large n, and with some sparsely populated cells. (It will be shown that this is certainly the case in the clustering of the UK census variables).

Furthermore, after clustering, each output area can be assigned to a multi-dimensional parameter space (as represented by the full set of categorical variables created by clustering). Each and every Output Area can be assigned to membership of one of the cells in this multi-dimensional space. This can be achieved through a saturated loglinear model which then gives all cases and their membership. By neglecting cells with low membership and only retaining those with significant membership, it may be possible to create a simplified classification scheme which represents the region but which is more manageable than the saturated model.

2.6 Further Interpretation and Validation of Clustering and Analysis

Clusters can be further interpreted and validated through the use of local knowledge. In local knowledge of particular areas can be compared against the clustering classifications. This might broaden, confirm or contradict clustering, and therefore also provides an important validation function. A simple visual scanning of the data (in the SPSS data file) is one way of exploring the data at local level. By simply observing the area of the data file where the locality begins, it will be possible to qualitatively discern patterns and connections. From the spatially-ordered data set and a focus upon variables of interest it will be possible to scroll down and simply look at areas of data to see what is types are associated with familiar spatial areas. To for patterns, coincidences, differences, trends, agglomeration of types, and to try to come offer possible plausible explanations for these. This is only possible for modestly sized data (where patterns can be discerned over a screen scale or when scrolling down) and it is essentially visual exploration of the data. Clustering can be followed by multi-dimensional definition of areas, GIS mapping of key spatial types found, the exploration of spatial patterns, and case/variable associations and interactions within and across these reduced spatial types. These results can again be interpreted or validated using local knowledge.

PART B: EMPIRICAL WORK

3 CLUSTERING OF 2001 CENSUS DATA

Chapter 3 records the process of clustering the various sets of metric variables to produce a single categorical variable to represent that set.

3.1 Economic Activity

The following section examines the NE Output Areas by economic activity of the residents. The data is normalised with respect to the numbers of people between 16 and 74 in an Output Area. A 5-Cluster approach to Economic Activity is given below.

Final Cluster Centers

	Cluster				
	1	2	3	4	5
%aged 16-74:Part-time*	13	11	5	11	12
%aged 16-74:Full-time*	52	31	25	27	40
%aged 16-74:Self - employed	6	6	4	3	7
%aged 16-74: Unemployed	3	3	4	8	4
%aged 16-74: Full-time student	2	2	10	2	2
%aged 16-74: Retired	9	28	6	14	15
%aged 16-74: Inactive Student	4	3	36	4	4
%aged 16-74: Looking after home/family	4	5	3	11	6
%aged 16-74: Permanently sick/disabled	5	9	4	15	8
%aged 16-74: Other	2	3	3	6	3
%Unemployed:16 - 24	1	1	1	2	1
%Unemployed: 50 and over	1	1	1	1	1
%Unemployed: never worked	0	0	1	1	0
%long-term unemployed	1	1	1	3	1

5-Cluster Interpretation: 1 is highest working, 2 is working and retired, 3 is high-student low work, 4 is higher unemployed, sick, stay at home. Cluster 5 seems similar to cluster 2 suggesting a reduction to 4 clusters.

Final Cluster Centers

	Cluster			
	1	2	3	4
%aged 16-74:Part-time*	6	13	12	11
%aged 16-74:Full-time*	25	**47**	35	27
%aged 16-74:Self - employed	4	6	7	3
%aged 16-74: Unemployed	4	3	3	**8**
%aged 16-74: Full-time student	**10**	2	2	2
%aged 16-74: Retired	6	11	**23**	14
%aged 16-74: Inactive Student	**35**	4	3	4
%aged 16-74: Looking after home/family	3	5	5	**10**
%aged 16-74: Permanently sick/disabled	4	6	8	**15**
%aged 16-74: Other	3	2	3	6
%Unemployed:16 - 24	1	1	1	2
%Unemployed: 50 and over	1	1	1	1
%Unemployed: never worked	1	0	0	1
%long-term unemployed	1	1	1	3

4-Cluster Interpretation: It appears as if 2 is highest working, 3 is high-retired and working, 1 is high-student/low-work in previous clustering, 4 is high unemployed, sick, home, and other. This reduced 4-clustering captures much of the previous 5-clustering. This seems to give a meaningful clustering.

Number of Cases in each Cluster

Cluster	1	158.000
	2	3107.000
	3	2772.000
	4	2562.000
Valid		8599.000
Missing		.000

This shows that the clusters are more or less balanced in size (except for the student areas in the region).

ANOVA

	Cluster		Error			
	Mean Square	df	Mean Square	df	F	Sig.
%aged 16-74:Part-time*	3228.592	3	9.102	8595	354.696	.000
%aged 16-74:Full-time*	205935.260	3	36.370	8595	**5662**.210	.000
%aged 16-74:Self - employed	7511.596	3	14.646	8595	512.889	.000
%aged 16-74: Unemployed	12856.151	3	5.748	8595	**2236.662**	.000
%aged 16-74: Full-time student	3665.542	3	2.222	8595	1649.995	.000
%aged 16-74: Retired	71608.100	3	30.547	8595	**2344.162**	.000
%aged 16-74: Inactive Student	52890.045	3	8.701	8595	**6078**.342	.000
%aged 16-74: Looking after home/family	15001.315	3	7.190	8595	2086.461	.000
%aged 16-74: Permanently sick/disabled	41322.802	3	15.766	8595	**2621.089**	.000
%aged 16-74: Other	6455.534	3	4.254	8595	1517.557	.000
%Unemployed:16 - 24	1263.662	3	1.284	8595	984.380	.000
%Unemployed: 50 and over	122.909	3	.799	8595	153.837	.000
%Unemployed: never worked	393.863	3	.614	8595	641.359	.000
%long-term unemployed	2604.558	3	1.743	8595	1494.102	.000

The F tests should be used only for descriptive purposes because the clusters have been chosen to maximize the differences among cases in different clusters. The observed significance levels are not corrected for this and thus cannot be interpreted as tests of the hypothesis that the cluster means are equal.

ANOVA Interpretation. The anova table shows the variables that most differentiate the cases/output areas are; full-time working, economically inactive students, retired, the sick and disabled, unemployed, and those looking after home and family. This supports the previous interpretation. Those in part-time, self-employed, and unemployed over 50 and never worked differentiate locations least.

When 3 and 2 clusters are tested it is found that the high-student cluster remains and is stable, whereas the other clusters join together.

The following shows the relative stability of high-student areas, and the gradual merging of the remaining areas.

Number of Cases in each Cluster

Cluster	1	170.000
	2	4079.000
	3	4350.000
Valid		8599.000
Missing		.000

Number of Cases in each Cluster

Cluster	1	190.000
	2	8409.000
Valid		8599.000
Missing		.000

Futhermore it is noted that from 5,4,3,2 clusters the number of iterations drops steadily from 30, 28, 21, to 8 in the two cluster case.

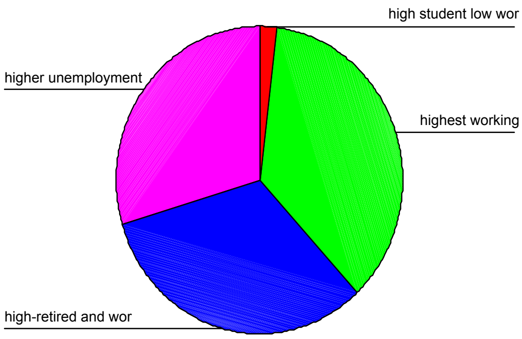
These observations suggests that high-student areas should be a location category and that this category is very significant in distinguishing economic activity of an area. Economically inactive students are the most significant distinguishing group (as opposed to economically active students).

Economic Activity	Transform to a 4-Cluster: C4ecact with value:	Case Members within each cluster
High-student low work	1	158
Highest working	2	3107
Highest retired	3	2772
Higher unemployment, sick and at home	4	2562

Economic Activity 4-cluster

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	high student low work	158	1.8	1.8	1.8
	highest working	3107	36.1	36.1	38.0
	high-retired and working	2772	32.2	32.2	70.2
	higher unemployment sick and at home	2562	29.8	29.8	100.0
	Total	8599	100.0	100.0	

Economic Activity 4-cluster



3.2 Economic Activity: Females

The method to generate 5,4,3 and 2-Clusters is given in appendix 1, and following that procedure gives the following results:

<table>
<tr><th>Clusters</th><th>Distribution between clusters</th></tr>
<tr><td>5</td><td>
Number of Cases in each Cluster
<table>
<tr><td>Cluster</td><td>1</td><td>1960.000</td></tr>
<tr><td></td><td>2</td><td>1755.000</td></tr>
<tr><td></td><td>3</td><td>145.000</td></tr>
<tr><td></td><td>4</td><td>1678.000</td></tr>
<tr><td></td><td>5</td><td>3061.000</td></tr>
<tr><td>Valid</td><td></td><td>8599.000</td></tr>
<tr><td>Missing</td><td></td><td>.000</td></tr>
</table>
</td></tr>
<tr><td>4</td><td>
Number of Cases in each Cluster
<table>
<tr><td>Cluster</td><td>1</td><td>2516.000</td></tr>
<tr><td></td><td>2</td><td>2623.000</td></tr>
<tr><td></td><td>3</td><td>148.000</td></tr>
<tr><td></td><td>4</td><td>3312.000</td></tr>
<tr><td>Valid</td><td></td><td>8599.000</td></tr>
<tr><td>Missing</td><td></td><td>.000</td></tr>
</table>
</td></tr>
<tr><td>3</td><td>
Number of Cases in each Cluster
<table>
<tr><td>Cluster</td><td>1</td><td>4760.000</td></tr>
<tr><td></td><td>2</td><td>151.000</td></tr>
<tr><td></td><td>3</td><td>3688.000</td></tr>
<tr><td>Valid</td><td></td><td>8599.000</td></tr>
<tr><td>Missing</td><td></td><td>.000</td></tr>
</table>
</td></tr>
<tr><td>2</td><td>
Number of Cases in each Cluster
<table>
<tr><td>Cluster</td><td>1</td><td>168.000</td></tr>
<tr><td></td><td>2</td><td>8431.000</td></tr>
<tr><td>Valid</td><td></td><td>8599.000</td></tr>
<tr><td>Missing</td><td></td><td>.000</td></tr>
</table>
</td></tr>
</table>

The various outputs for different cluster numbers

Final Cluster Centers

	Cluster	
	1	2
FPTIME	8	20
FFTIME	23	27
FSEMP	2	3
FUNEMP	2	3
FFTSTU	11	2
FRET	7	18
FINSTU	34	3
FLAHF	6	12
FPSICDIS	4	8
FOTHER	3	4
FUNEMPY	1	1
FUNEMPO	0	0
FNEVWK	0	0
FLTUNEMP	1	1

1=less female working-more student , 2= more female working

Final Cluster Centers

	Cluster		
	1	2	3
FPTIME	19	8	**22**
FFTIME	20	22	**35**
FSEMP	2	2	4
FUNEMP	4	2	2
FFTSTU	2	**12**	3
FRET	**21**	6	14
FINSTU	3	**36**	3
FLAHF	**14**	5	9
FPSICDIS	**10**	3	5
FOTHER	5	3	3
FUNEMPY	1	1	1
FUNEMPO	0	0	0
FNEVWK	1	0	0
FLTUNEMP	1	1	1

1= higher female retired, at home, or sick, 2= higher female student, 3= higher female working**.**

Final Cluster Centers

	Cluster			
	1	2	3	4
FPTIME	19	19	8	22
FFTIME	19	23	23	36
FSEMP	2	3	2	4
FUNEMP	5	2	2	2
FFTSTU	2	2	12	3
FRET	14	28	6	13
FINSTU	4	3	36	4
FLAHF	18	10	5	9
FPSICDIS	11	8	3	5
FOTHER	6	3	2	3
FUNEMPY	2	1	1	1
FUNEMPO	0	0	0	0
FNEVWK	1	0	0	0
FLTUNEMP	2	1	1	1

1 = highest unemp/looking after the home & family/sick, 2 = higher retired

3 = higher female student, 4 = higher full- and part-work

Final Cluster Centers

	Cluster				
	1	2	3	4	5
FPTIME	18	17	7	21	23
FFTIME	17	21	22	41	28
FSEMP	1	3	2	3	3
FUNEMP	5	2	2	2	2
FFTSTU	2	2	12	3	2
FRET	14	30	6	11	17
FINSTU	4	3	36	4	3
FLAHF	19	9	5	8	11
FPSICDIS	12	9	3	5	7
FOTHER	7	3	2	2	3
FUNEMPY	2	1	1	1	1
FUNEMPO	0	0	0	0	0
FNEVWK	1	0	0	0	0
FLTUNEMP	2	1	1	1	1

ANOVA

	Cluster		Error			
	Mean Square	df	Mean Square	df	F	Sig.
FPTIME	13945.899	3	30.465	8595	457.764	.000
FFTIME	162809.328	3	39.438	8595	4128.286	.000
FSEMP	1826.577	3	8.543	8595	213.821	.000
FUNEMP	3958.483	3	4.977	8595	795.425	.000
FFTSTU	4816.787	3	4.271	8595	1127.861	.000
FRET	123245.278	3	32.438	8595	3799.359	.000
FINSTU	52267.806	3	9.862	8595	5299.728	.000
FLAHF	48049.636	3	17.288	8595	2779.427	.000
FPSICDIS	18340.891	3	17.824	8595	1028.991	.000
FOTHER	6954.423	3	6.901	8595	1007.711	.000
FUNEMPY	627.556	3	2.012	8595	311.850	.000
FUNEMPO	4.520	3	.953	8595	4.744	.003
FNEVWK	199.596	3	.982	8595	203.177	.000
FLTUNEMP	783.629	3	2.274	8595	344.543	.000

The F tests should be used only for descriptive purposes because the clusters have been chosen to maximize the differences among cases in different clusters. The observed significance levels are not corrected for this and thus cannot be interpreted as tests of the hypothesis that the cluster means are equal.

Variables which most distinguish locations with a 4-cluster are female economically inactive, female full-time, female retired, female looking after home or family. Variables which least distinguish areas are female unemployed over 50s, females never worked, female long-term unemployed, female part-time, female unemployed.

3.3 Economic Activity: Males

An initial attempt to form a 5-cluster failed to converge within 40 iterations. A 4-cluster approach did converge:

Final Cluster Centers

	Cluster			
	1	2	3	4
male %long-term unemployed	3	4	3	4
%male aged 16-74:Full-time*	62	29	47	36
%male aged 16-74:Self - employed	8	5	10	4
%male aged 16-74: Unemployed	4	6	5	11
%male aged 16-74: Full-time student	2	9	2	1
%male aged 16-74: Retired	9	5	17	13
%Male aged 16-74:Part-time*	3	34	4	4
%male aged 16-74: Inactive Student	1	1	1	2
%male aged 16-74: Looking after home/family	7	6	9	19
%male aged 16-74: Permanently sick/disabled	2	3	2	5
%male aged 16-74: Other	1	1	1	3
%male Unemployed:16 - 24	1	1	1	2
male %Unemployed: 50 and over	0	1	0	1
%male Unemployed: never worked	1	2	2	5

This seems to suggest categorisation of output areas as:

- High full-time employment - 1
- High part-time and student - 2
- Higher retired and self-employed. Half-working - 3
- Higher unemployed, looking after family, sick, low working - 4

These categories correspond approximately to the economic activity analysis without gender.

Number of Cases in each Cluster

Cluster	1	2503.000
	2	182.000
	3	3485.000
	4	2429.000
Valid		8599.000
Missing		.000

ANOVA

	Cluster		Error			
	Mean Square	df	Mean Square	df	F	Sig.
male %long-term unemployed	354.443	3	4.752	8595	74.582	.000
%male aged 16-74:Full-time*	315250.151	3	42.374	8595	7439.687	.000
%male aged 16-74:Self - employed	17847.816	3	28.599	8595	624.075	.000
%male aged 16-74: Unemployed	26621.878	3	13.495	8595	1972.722	.000
%male aged 16-74: Full-time student	2904.300	3	3.782	8595	767.826	.000
%male aged 16-74: Retired	30701.712	3	35.097	8595	874.767	.000
%Male aged 16-74:Part-time*	55062.289	3	12.035	8595	4575.204	.000
%male aged 16-74: Inactive Student	1622.278	3	2.683	8595	604.751	.000
%male aged 16-74: Looking after home/famil	72854.968	3	22.843	8595	3189.373	.000
%male aged 16-74: Permanently sick/disabled	5248.498	3	6.333	8595	828.792	.000
%male aged 16-74: Othe	1955.464	3	3.541	8595	552.279	.000
%male Unemployed:16 - 24	467.065	3	2.797	8595	167.006	.000
male %Unemployed: 50 and over	642.000	3	1.747	8595	367.508	.000
%male Unemployed: never worked	5435.279	3	4.786	8595	1135.601	.000

The F tests should be used only for descriptive purposes because the clusters have been chosen to m the differences among cases in different clusters. The observed significance levels are not corrected f thus cannot be interpreted as tests of the hypothesis that the cluster means are equal.

This suggests the output areas are most differentiated with male full-time employment, male part-time working, looking after home and family, and unemployed. Output Areas are little differentiated by male long-term employment, self-employment, full-time student, retired, inactive student, young unemployed, unemployed 50 and over.

Comparing this with the ungendered analysis of economic activity, the first main difference that economically inactive students do not differentiate the areas as much. The second main difference is that whereas for both genders part-time work does not significantly differentiate areas, for males alone it does.

A 3-Cluster approach converges in 33 iterations. To what appears to be: student/part-time working, higher working, and lower working categories.

Final Cluster Centers

	Cluster		
	1	2	3
male %long-term unemployed	4	3	4
%male aged 16-74:Full-time*	28	57	38
%male aged 16-74:Self - employed	5	9	7
%male aged 16-74: Unemployed	6	4	9
%male aged 16-74: Full-time student	9	2	2
%male aged 16-74: Retired	5	12	15
%Male aged 16-74:Part-time*	34	4	4
%male aged 16-74: Inactive Student	1	1	2
%male aged 16-74: Looking after home/family	6	7	16
%male aged 16-74: Permanently sick/disabled	3	2	4
%male aged 16-74: Other	1	1	2
%male Unemployed:16 - 24	1	1	2
male %Unemployed: 50 and over	1	0	1
%male Unemployed: never worked	2	1	4

The following anova table shows that the same variables distinguish cases as they did in the 4-cluster case.

ANOVA

	Cluster		Error			
	Mean Square	df	Mean Square	df	F	Sig.
male %long-term unemployed	448.191	2	4.771	8596	93.935	.000
%male aged 16-74:Full-time*	395235.208	2	60.433	8596	6540.012	.000
%male aged 16-74:Self - employed	6652.455	2	33.277	8596	199.914	.000
%male aged 16-74: Unemployed	26891.000	2	16.528	8596	1627.015	.000
%male aged 16-74: Full-time student	4387.844	2	3.775	8596	1162.419	.000
%male aged 16-74: Retired	15462.666	2	42.210	8596	366.326	.000
%Male aged 16-74:Part-time*	82080.518	2	12.153	8596	6754.000	.000
%male aged 16-74: Inactive Student	1717.970	2	2.849	8596	603.071	.000
%male aged 16-74: Looking after home/family	86085.471	2	28.238	8596	3048.618	.000
%male aged 16-74: Permanently sick/disabled	5578.528	2	6.866	8596	812.515	.000
%male aged 16-74: Other	1838.781	2	3.795	8596	484.535	.000
%male Unemployed:16 - 24	555.180	2	2.830	8596	196.163	.000
male %Unemployed: 50 and over	617.829	2	1.827	8596	338.164	.000
%male Unemployed: never worked	5483.797	2	5.407	8596	1014.256	.000

The F tests should be used only for descriptive purposes because the clusters have been chosen to maxir the differences among cases in different clusters. The observed significance levels are not corrected for th thus cannot be interpreted as tests of the hypothesis that the cluster means are equal.

The student group still remains, and the remainder of the population has divided into two – richer or poorer in work areas.

Number of Cases in each Cluster

Cluster	1	183.000
	2	4575.000
	3	3841.000
Valid		8599.000
Missing		.000

3.4 Marital Status

Using a five-cluster classification on the five variables gives slow convergence (40 iterations)

Final Cluster Centers

	Cluster				
	1	2	3	4	5
MARCOH	38	19	51	37	66
UNMARCOH	8	11	10	12	6
NCOHNMAR	21	48	21	29	17
NCOHSOD	12	13	8	13	4
NCOHWID	21	7	9	8	6

If we call this cluster run A then these cluster centres can be labelled:

A1= highest widowed (middling married)

A2 = highest non-cohabiting and never married

A3 = mixed & moderate (but higher marriage)

A4 = mixed moderate (slightly higher unmarried cohabitation, separations and divorces)

A5= highest marriage (lowest unmarried cohabiting, lowest

Three and four may be combined as they are close. Note that ncohsod is fairly constant across two sets of cluster (clusters 1,2, and 4) and (clusters3 and 5) as is ncohwid (for clusters 2, 3, 4, & 5) Note also that the unmarried cohabiting are relatively constant, and this is further shown in the F values in the following ANOVA table, demonstrating that this variable does not much distinguish the clusters.

ANOVA

	Cluster		Error			
	Mean Square	df	Mean Square	df	F	Sig.
MARCOH	350160.600	4	24.754	8594	14145.573	.000
UNMARCOH	10671.409	4	14.989	8594	711.968	.000
NCOHNMAR	105982.548	4	20.062	8594	5282.675	.000
NCOHSOD	22450.915	4	9.995	8594	2246.243	.000
NCOHWID	29028.242	4	15.284	8594	1899.215	.000

The F tests should be used only for descriptive purposes because the clusters have been chosen to maximize the differences among cases in different clusters. The observed significance levels are not corrected for this and thus cannot be interpreted as tests of the hypothesis that the cluster means are equal.

The largest determinant between the clusters is married cohabiting, and least is unmarried cohabiting.

Number of Cases in each Cluster

Cluster	1	723.000
	2	363.000
	3	3003.000
	4	1979.000
	5	2531.000
Valid		8599.000
Missing		.000

Note if A3 and A4 were combined then given that this would represent many people and they are moderate and mixed cases, it may represent the mainstream. Some variables have little effect across clusters, and some clusters have few relatively few members. This suggests it may be useful to examine a lower number of clusters. In trying 4 and 3 clusters both converge in 31 iterations (an improvement over the 5-cluster). Comparing these side by side gives:

Final Cluster Centers

	Cluster			
	1	2	3	4
MARCOH	37	65	51	20
UNMARCO	11	7	10	11
NCOHNMA	28	17	21	47
NCOHSOD	13	5	8	13
NCOHWID	11	6	10	7

Final Cluster

	Clust		
	1	2	3
MARC	**64**	29	46
UNMAR	7	**12**	10
NCOHN	17	**35**	23
NCOHS	5	**14**	10
NCOH	7	9	**11**

Number of Cases in each Cluster

Cluster	1	2359.000
	2	2651.000
	3	3174.000
	4	415.000
Valid		8599.000
Missing		.000

Number of Cases in each Cluster

Cluster	1	3278.000
	2	1497.000
	3	3824.000
Valid		8599.000
Missing		.000

In calling these clustering results B (4-clusters) and C (3-clusters). It can be noted that:

- Cluster B2 and C1 seem similar in their centres (and are also close to the previous cluster A5). This points to the stability of the cluster as it is relatively independent of the number of clusters. This is therefore a good candidate for a cluster: Higher marriage, lower unmarried cohabiting, low separation, divorce, and widowhood.
- Clusters B1 and B3 appear to have averaged their centres to give C3. This is one of the largest, representing a mainstream cluster which is both moderate in values and typical in cases.
- B4 is a small cluster whose centre is characterised by highest non-cohabiting never married, and lowest marriage. It seems to merge with some of B1, to give C2. To give a high non-cohabiting never married, low marriage, higher cohabiting, higher separation and divorce cluster.
- The following ANOVA table for the three cluster suggest that the three variables married, non-cohabiting and never married, and non-cohabiting through separation or divorce are the key differentiating variables. With the non-married cohabiting, and those living alone and widowed are have weaker effects on clustering.

ANOV

	Cluste		Error			
	Mean	df	Mean	df	F	Sig.
MARCO	655558.67	2	35.16	8596	**18643.39**	.000
UNMARC	14507.50	2	16.57	8596	875.23	.000
NCOHNM	163815.04	2	31.26	8596	**5240.31**	.000
NCOHSO	43795.40	2	10.25	8596	**4272.73**	.000
NCOHWI	12890.44	2	25.78	8596	499.83	.000

The F tests should be used only for descriptive purposes because the clusters have to maximize the differences among cases in different clusters. The observed not corrected for this and thus cannot be interpreted as tests of the hypothesis that means are

This suggests a 3-cluster approach:

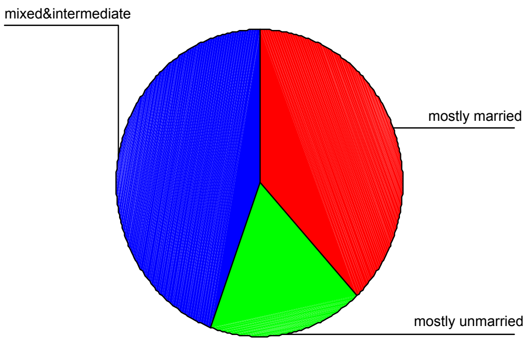
- Cluster 1: The Mostly Married (lower non-cohabiting never married, lower separated, divorced or widowed, and lower unmarried cohabiting)
- Cluster 2: The Mostly Unmarried (higher never married non-cohabiting, higher separated and divorced) higher unmarried cohabiting
- Cluster 3: The Mixed (intermediate married levels, but higher separation and divorce, non-cohabiting never-married, and cohabiting, than cluster 1)

Cluster 3 is largest but comparable to Cluster 1, whereas Cluster 2 is less than half the size of either Clusters 1 or 3.

Cluster Number of Case

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	mostly married	3278	38.1	38.1	38.1
	mostly unmarried	1497	17.4	17.4	55.5
	mixed&intermediate	3824	44.5	44.5	100.0
	Total	8599	100.0	100.0	

Cluster Number of Case



3.5 Health

The census data gives several different metric variables which are related (e,g numbers with limiting long term illness, numbers reporting good, fair, or poor health). Instead of taking one of these many variables as 'representative' of the them all, cluster analysis can be attempted to produce a single categorical variable that represent them all.

A 3-cluster approach gives:

Final Cluster Centers

	Cluster		
	1	2	3
NOTGOOD2	13.21	7.22	21.44
HEALTHAL	61.2	73.2	49.0
ILLPERAL	24.8	14.9	37.9

1= middle health

2= most healthy

3 = least healthy

ANOVA

	Cluster		Error			
	Mean Square	df	Mean Square	df	F	Sig.
NOTGOOD2	101863.942	2	9.211	8596	11058.431	.000
HEALTHAL	307990.421	2	22.548	8596	13659.379	.000
ILLPERAL	266830.101	2	20.297	8596	13146.605	.000

The F tests should be used only for descriptive purposes because the clusters have been chosen to maximize the differences among cases in different clusters. The observed significance levels are not corrected for this and thus cannot be interpreted as tests of the hypothesis that the cluster means are equal.

Number of Cases in each Cluster

Cluster	1	4057.000
	2	3100.000
	3	1442.000
Valid		8599.000
Missing		.000

It is convenient to alter the definition of the clusters to give a quasi-ordinal scale through RECODE 1<->2, to give

1 most healthy

2 middle health

3 least healthy

3.6 Age

Using the census data, the age groups can be recoded, to give more manageable groups such as under 16s, between 16 and 29, between 30 and 44, between 45 and 59, and 60 and over. At the Output area level there is significant variation in the age distribution of the people in that area. For instance some have 90% of the population being 60 or over whereas others have none. Output areas can be classified in terms of age.

Try a 4-cluster

Final Cluster

	Cluste			
	1	2	3	4
% under	**25**	18	9	12
% 16 to	19	15	**52**	11
%between 30 and	**26**	21	19	16
%People aged 45 -	17	**21**	10	19
%People aged over	13	24	10	**41**

3= young adults lowest children mixed

1= most 30-44 and most children mixed

2= most 44-59 mixed

4= most over 59 mixed

ANOV

	Cluste		Error			
	Mean	df	Mean	df	F	Sig.
% under	58328.10	3	20.49	8595	**2845.80**	.000
% 16 to	101131.08	3	19.94	8595	**5071.62**	.000
%between 30 and	31096.97	3	16.89	8595	1841.18	.000
%People aged 45 -	15292.28	3	26.39	8595	579.41	.000
%People aged over	262355.38	3	29.94	8595	**8762.08**	.000

The F tests should be used only for descriptive purposes because the clusters have maximize the differences among cases in different clusters. The observed significance corrected for this and thus cannot be interpreted as tests of the hypothesis that the cluster

Number of Cases in each Cluster

Cluster	1	3040.000
	2	4034.000
	3	185.000
	4	1340.000
Valid		8599.000
Missing		.000

NOTE this has been recoded this as 1= young adults lowest children mixed, 2= most 30-44 and most children mixed, 3= most 44-59 mixed, 4= most over 59 mixed.

A 3-cluster for age gives

Final Cluster Centers

	Cluster		
	1	2	3
% under 16	10	22	15
% 16 to 29	50	18	13
%between 30 and 44	19	24	18
%People aged 45 - 59	11	19	20
%People aged over 59	10	17	34

ANOVA

	Cluster		Error			
	Mean Square	df	Mean Square	df	F	Sig.
% under 16	67530.064	2	25.138	8596	2686.341	.000
% 16 to 29	143509.766	2	21.843	8596	6570.034	.000
%between 30 and 44	34834.662	2	19.636	8596	1774.054	.000
%People aged 45 - 59	10026.569	2	29.394	8596	341.114	.000
%People aged over 59	312820.913	2	48.718	8596	6421.102	.000

The F tests should be used only for descriptive purposes because the clusters have been chosen to maximize the differences among cases in different clusters. The observed significance levels are not corrected for this and thus cannot be interpreted as tests of the hypothesis that the cluster means are equal.

Number of Cases in each Cluster

Cluster	1	213.000
	2	5246.000
	3	3140.000
Valid		8599.000
Missing		.000

This clustering could be useful but there are a large number of cases in category two. This suggests that output areas might be classified on their 'ages'. Cluster 1 is predominantly younger adult-mixed, cluster 2: younger-families-mixed, and cluster 3 is older-families mixed. The F factor notes that the young and old people categories have greatest effect on the separation of clusters, then children, and least of all the ages between 30-44 and 45-59. This might be interpreted as these are fairly common across all cases (and therefore many cases). This suggests that for purposes of differentiating cases the 30-59 age group could be combined. This again shows that three distinct clusters can be defined; cluster 1 as being older-mixed; cluster 2 being younger-mixed, 3 being middle-mixed.

3.7 Education

A 5-cluster failed to converge in 40 iterations, as did a 4 cluster. The 3 and 2 clusters both converged within 40 iterations.

The variables that most distinguish the areas are the no qualifications and the highest qualification at level 4 or 5.

Final Cluster Centers

	Cluster		
	1	2	3
NOQUAL	29.95	16.64	49.59
LEV1	18.81	13.05	16.74
LEV2	20.97	20.11	15.78
LEV3	7.14	10.88	4.51
LEV45	14.84	33.06	6.37
OTHERUN	8.29	6.27	7.01

1=intermediate , 2 highest qualified, 3 lowest qualified (note however this is recoded below).

ANOVA

	Cluster		Error			
	Mean Square	df	Mean Square	df	F	Sig.
NOQUAL	688454.247	2	40.323	8596	17073.472	.000
LEV1	17593.275	2	18.003	8596	977.233	.000
LEV2	25814.665	2	15.700	8596	1644.251	.000
LEV3	22527.738	2	20.258	8596	1112.056	.000
LEV45	385634.919	2	28.291	8596	13631.178	.000
OTHERUN	2613.139	2	5.957	8596	438.635	.000

The F tests should be used only for descriptive purposes because the clusters have been chosen to maximize the differences among cases in different clusters. The observed significance levels are not corrected for this and thus cannot be interpreted as tests of the hypothesis that the cluster means are equal.

Most of the difference across locations comes from the extremes of no qualifications or qualifications at level 4 or 5.

Number of Cases in each Cluster

Cluster	1	3397.000
	2	1535.000
	3	3667.000
Valid		8599.000
Missing		.000

The group with the most members is lowest qualified, the group with similar numbers is intermediate, the locations with the highest qualifications are the least in number.

These clusters were recoded:

1= higher qualified, 2= intermediate qualified, 3= lowest qualified

Clusters correspond quite simply to areas with higher, middle, lower qualifications, or higher and lower qualifications (providing a quasi-ordinal variable).

3.8 Tenure

A 2-cluster is attempted which divides into 1= higher social renting areas 2 = higher owned properties:

Final Cluster Centers

	Cluster	
	1	2
OWNOUT	12	33
OWNMORT	22	47
OWNSHAR	0	0
RENTCOUN	52	6
RENTHASL	8	4
RENTPRIV	4	8
RENTOTH	2	3

ANOVA

	Cluster		Error			
	Mean Square	df	Mean Square	df	F	Sig.
OWNOUT	796115.950	1	134.764	8597	5907.493	.000
OWNMORT	1280985.871	1	191.684	8597	6682.802	.000
OWNSHAR	3.549	1	1.940	8597	1.830	.176
RENTCOUN	4157336.612	1	154.245	8597	26952.788	.000
RENTHASL	33359.669	1	128.268	8597	260.077	.000
RENTPRIV	38830.430	1	84.454	8597	459.784	.000
RENTOTH	5.621	1	12.239	8597	.459	.498

The F tests should be used only for descriptive purposes because the clusters have been chosen to maximize the differences among cases in different clusters. The observed significance levels are not corrected for this and thus cannot be interpreted as tests of the hypothesis that the cluster means are equal.

Council renting is the biggest differentiator of location, with ownership also important. The other factors have little influence on differentiating the locations within the region

Number of Cases in each Cluster

Cluster	1	3097.000
	2	5502.000
Valid		8599.000
Missing		.000

The majority of cases are characterised by ownership and less so by council renting. Convergence was achieved in 10 iterations.

A 3-cluster approach gives the following:

Final Cluster

	Cluste		
	1	2	3
OWNOU	13	**35**	18
OWNMO	22	**51**	26
OWNSHA	0	0	1
RENTCO	**55**	5	11
RENTHA	5	1	**21**
RENTPR	3	5	**19**
RENTOT	2	2	5

Here 1=high council renting, 2= high ownership and mortgages, 3= high private and HA rentals.

ANOVA

	Cluster		Error			
	Mean Square	df	Mean Square	df	F	Sig.
OWNOUT	475655.234	2	116.725	8596	4075.001	.000
OWNMORT	821460.143	2	149.601	8596	5490.998	.000
OWNSHAR	40.393	2	1.931	8596	20.916	.000
RENTCOUN	2215414.996	2	122.447	8596	18092.888	.000
RENTHASL	186217.536	2	88.837	8596	2096.161	.000
RENTPRIV	126985.799	2	59.435	8596	2136.536	.000
RENTOTH	3979.829	2	11.315	8596	351.718	.000

The F tests should be used only for descriptive purposes because the clusters have been chosen to maximize the differences among cases in different clusters. The observed significance levels are not corrected for this and thus cannot be interpreted as tests of the hypothesis that the cluster means are equal.

Again the main differentiators of areas is the level of council renting, followed by owner occupied.

Number of Cases in each Cluster

Cluster	1	2759.000
	2	4586.000
	3	1254.000
Valid		8599.000
Missing		.000

This converges in 23 iterations.

3.9 Work status

Final Cluster Centers

	Cluster	
	1	2
% managers	15	8
% professionals	15	4
%associate professions	16	9
% admin secretarial	14	11
%skilled trade	11	14
% personal services	6	9
% sales and customer	8	11
% process	7	15
% elementary	9	20

ANOVA

	Cluster		Error			
	Mean Square	df	Mean Square	df	F	Sig.
% managers	116167.853	1	18.492	8597	6282.144	.000
% professionals	225320.009	1	33.420	8597	6742.124	.000
%associate professions	100901.462	1	14.553	8597	6933.506	.000
% admin secretarial	27889.831	1	17.589	8597	1585.607	.000
%skilled trade	14970.159	1	19.709	8597	759.561	.000
% personal services	17582.268	1	10.786	8597	1630.105	.000
% sales and customer	22684.749	1	13.912	8597	1630.541	.000
% process	130369.910	1	20.049	8597	6502.508	.000
% elementary	284656.652	1	28.716	8597	9912.679	.000

The F tests should be used only for descriptive purposes because the clusters have been chosen to maximize the differences among cases in different clusters. The observed significance levels are not corrected for this and thus cannot be interpreted as tests of the hypothesis that the cluster means are equal.

Number of Cases in each Cluster

Cluster	1	3760.000
	2	4839.000
Valid		8599.000
Missing		.000

Here cluster 1 represents management and professional work status, whereas cluster 2 represents more elementary and process work

A 3-cluster approach gives:

Final Cluster Centers

	Cluster		
	1	2	3
% managers	7	18	12
% professionals	4	21	8
%associate professions	8	17	14
% admin secretarial	10	13	14
%skilled trade	13	8	14
% personal services	9	5	8
% sales and customer	11	6	10
% process	16	5	10
% elementary	22	7	11

ANOVA

	Cluster		Error			
	Mean Square	df	Mean Square	df	F	Sig.
% managers	70332.580	2	15.644	8596	4495.803	.000
% professionals	169380.678	2	20.227	8596	8374.142	.000
%associate professions	54750.572	2	13.554	8596	4039.441	.000
% admin secretarial	20407.011	2	16.088	8596	1268.469	.000
%skilled trade	18698.342	2	17.102	8596	1093.322	.000
% personal services	10174.536	2	10.465	8596	972.211	.000
% sales and customer	13651.397	2	13.377	8596	1020.529	.000
% process	73857.567	2	18.034	8596	4095.534	.000
% elementary	172137.748	2	21.784	8596	7901.987	.000

The F tests should be used only for descriptive purposes because the clusters have been chosen to maximize the differences among cases in different clusters. The observed significance levels are not corrected for this and thus cannot be interpreted as tests of the hypothesis that the cluster means are equal.

Number of Cases in each Cluster

Cluster	1	3644.000
	2	1581.000
	3	3374.000
Valid		8599.000
Missing		.000

where 1 = most elementary and process work, 2= most managers and professions, 3= middle work and this can be recoded to (2 to 1, 3 to 2, 1 to 3) giving:

1= most managers and professions

2= middle work – higher secretarial and skilled trade

3 = most elementary and process work

3.10 Household Composition

Try 5,4,3 clusters on household composition.

Final Cluster Centers

	Cluster				
	1	2	3	4	5
% single pensioner	30	13	15	8	10
% single other	12	15	34	24	9
% family pensioners	13	7	5	3	10
% Married couple no children	11	11	8	6	19
% married coule dependent children	11	15	9	8	25
% married all children non-dependent	6	7	3	2	9
% cohabiting no children	3	4	5	7	4
% cohabiting dependent children	3	5	3	2	3
% cohabiting all children non-dependent	0	0	0	0	0
%lone parent dependent children	5	12	8	5	4
%lone parent all children non-dependent	4	4	3	2	3
% other with dependent children	1	3	2	2	2
% all student	0	0	1	18	0
% other all pensioner	1	0	0	0	0
% other	2	3	3	11	2

Here the clusters can be identified with:

1=higher pensioners

2=higher lone parents higher cohabiting with children

3=higher single other

4=higher student and cohabiting no children

5=highest married

ANOVA

	Cluster		Error			
	Mean Square	df	Mean Square	df	F	Sig.
% single pensioner	107482.959	4	39.709	8594	2706.742	.000
% single other	124660.255	4	34.407	8594	3623.129	.000
% family pensioners	14395.144	4	20.866	8594	689.885	.000
% Married couple no children	36420.106	4	20.303	8594	1793.845	.000
% married coule dependent children	91151.395	4	33.681	8594	2706.302	.000
% married all children non-dependent	8168.525	4	9.778	8594	835.371	.000
% cohabiting no children	1575.071	4	7.744	8594	203.379	.000
% cohabiting dependent children	2548.660	4	5.019	8594	507.845	.000
% cohabiting all children non-dependent	15.835	4	.687	8594	23.044	.000
%lone parent dependent children	28479.401	4	20.914	8594	1361.770	.000
%lone parent all children non-dependent	1430.446	4	4.184	8594	341.887	.000
% other with dependent children	653.483	4	3.145	8594	207.788	.000
% all student	8665.714	4	2.689	8594	3222.254	.000
% other all pensioner	19.654	4	.850	8594	23.128	.000
% other	2956.342	4	3.534	8594	836.536	.000

The F tests should be used only for descriptive purposes because the clusters have been chosen to maximize the differences among cases in different clusters. The observed significance levels are not corrected for this and thus cannot be interpreted as tests of the hypothesis that the cluster means are equal.

Number of Cases in each Cluster

Cluster	1	1655.000
	2	2799.000
	3	1023.000
	4	115.000
	5	3007.000
Valid		8599.000
Missing		.000

The 4-cluster gives:

Final Cluster Centers

	Cluster			
	1	2	3	4
% single pensioner	29	13	14	10
% single other	13	15	34	9
% family pensioners	13	7	5	10
% Married couple no children	11	11	8	19
% married coule dependent children	11	15	9	25
% married all children non-dependent	6	7	3	9
% cohabiting no children	3	4	6	4
% cohabiting dependent children	3	5	3	3
% cohabiting all children non-dependent	0	0	0	0
%lone parent dependent children	5	12	8	4
%lone parent all children non-dependent	4	4	3	3
% other with dependent children	1	3	2	2
% all student	0	0	2	0
% other all pensioner	1	0	0	0
% other	2	3	4	2

where,

1=higher pensioner

2=higher lone parent and cohabiting with children

3=highest single other

4=highest married

ANOVA

	Cluster		Error			
	Mean Square	df	Mean Square	df	F	Sig.
% single pensioner	142105.493	3	40.125	8595	3541.538	.000
% single other	166098.716	3	34.443	8595	4822.435	.000
% family pensioners	19064.685	3	20.909	8595	911.813	.000
% Married couple no children	48000.093	3	20.496	8595	2341.933	.000
% married coule dependent children	121468.692	3	33.700	8595	3604.364	.000
% married all children non-dependent	10603.157	3	9.878	8595	1073.435	.000
% cohabiting no children	2035.358	3	7.766	8595	262.079	.000
% cohabiting dependent children	3263.719	3	5.065	8595	644.375	.000
% cohabiting all children non-dependent	20.314	3	.687	8595	29.554	.000
%lone parent dependent children	37481.671	3	21.082	8595	1777.864	.000
%lone parent all children non-dependent	1821.470	3	4.213	8595	432.301	.000
% other with dependent children	902.218	3	3.134	8595	287.899	.000
% all student	726.589	3	6.468	8595	112.330	.000
% other all pensioner	25.903	3	.850	8595	30.482	.000
% other	1282.695	3	4.462	8595	287.487	.000

The F tests should be used only for descriptive purposes because the clusters have been chosen to maximize the differences among cases in different clusters. The observed significance levels are not corrected for this and thus cannot be interpreted as tests of the hypothesis that the cluster means are equal.

Number of Cases in each Cluster

Cluster	1	1700.000
	2	2799.000
	3	1098.000
	4	3002.000
Valid		8599.000
Missing		.000

The 3-cluster gives:

Final Cluster Centers

	Cluster		
	1	2	3
% single pensioner	27	11	13
% single other	13	10	25
% family pensioners	12	10	5
% Married couple no children	11	17	9
% married coule dependent children	11	24	12
% married all children non-dependent	6	9	5
% cohabiting no children	3	4	5
% cohabiting dependent children	3	3	4
% cohabiting all children non-dependent	0	0	0
%lone parent dependent children	7	5	11
%lone parent all children non-dependent	4	3	4
% other with dependent children	2	2	2
% all student	0	0	1
% other all pensioner	1	0	0
% other	2	2	3

where,

1=higher pensioner mixed

2= higher married (with and without children)

3= higher lone parent, single other, slightly higher cohabiting

ANOVA

	Cluster		Error			
	Mean Square	df	Mean Square	df	F	Sig.
% single pensioner	202284.786	2	42.651	8596	4742.837	.000
% single other	182633.077	2	49.915	8596	3658.903	.000
% family pensioners	27912.182	2	21.065	8596	1325.022	.000
% Married couple no children	61604.234	2	22.912	8596	2688.694	.000
% married coule dependent children	161546.964	2	38.503	8596	4195.752	.000
% married all children non-dependent	14356.539	2	10.237	8596	1402.438	.000
% cohabiting no children	2443.812	2	7.907	8596	309.068	.000
% cohabiting dependent children	1368.524	2	5.885	8596	232.545	.000
% cohabiting all children non-dependent	1.327	2	.694	8596	1.912	.148
%lone parent dependent children	32104.607	2	26.691	8596	1202.808	.000
%lone parent all children non-dependent	813.558	2	4.659	8596	174.608	.000
% other with dependent children	452.862	2	3.343	8596	135.468	.000
% all student	822.965	2	6.530	8596	126.035	.000
% other all pensioner	37.786	2	.850	8596	44.457	.000
% other	1524.924	2	4.554	8596	334.847	.000

The F tests should be used only for descriptive purposes because the clusters have been chosen to maximize the differences among cases in different clusters. The observed significance levels are not corrected for this and thus cannot be interpreted as tests of the hypothesis that the cluster means are equal.

Number of Cases in each Cluster

Cluster	1	2262.000
	2	3770.000
	3	2567.000
Valid		8599.000
Missing		.000

3.11 Ethnicity

A 3-cluster distinguishes different areas:

Final Cluster Centers

	Cluster 1	Cluster 2	Cluster 3
WHITEBR	60.97	97.99	87.78
WHITEIR	.91	.29	.83
MXWHBLC	.24	.10	.22
MXWHBLA	.46	.05	.20
MIXOTH	.50	.09	.35
ASIANBI	2.94	.21	1.71
ASIANBP	16.52	.13	2.06
ASIANBB	5.14	.06	1.23
ASIANOT	1.35	.07	.55
BLKBBC	.18	.03	.10
BLKBBA	1.05	.06	.44
BLKBOB	.11	.01	.06
CHIN	1.48	.13	.98
CHINOTH	1.89	.09	.63

ANOVA

	Cluster		Error			
	Mean Square	df	Mean Square	df	F	Sig.
WHITEBR	103576.850	2	5.846	8596	17717.584	.000
WHITEIR	121.183	2	.333	8596	364.344	.000
MXWHBLC	6.290	2	.118	8596	53.159	.000
MXWHBLA	15.767	2	.077	8596	204.608	.000
MIXOTH	33.105	2	.123	8596	268.896	.000
ASIANBI	1136.174	2	.791	8596	1436.129	.000
ASIANBP	14808.241	2	2.988	8596	4956.228	.000
ASIANBB	1750.304	2	1.724	8596	1015.010	.000
ASIANOT	162.468	2	.186	8596	873.389	.000
BLKBBC	3.032	2	.038	8596	79.233	.000
BLKBBA	97.888	2	.142	8596	688.915	.000
BLKBOB	1.390	2	.021	8596	65.895	.000
CHIN	332.190	2	.554	8596	599.481	.000
CHINOTH	262.369	2	.257	8596	1022.735	.000

The F tests should be used only for descriptive purposes because the clusters have been chosen to maximize the differences among cases in different clusters. The observed significance levels are not corrected for this and thus cannot be interpreted as tests of the hypothesis that the cluster means are equal.

Number of Cases in each Cluster

Cluster	1	104.000
	2	7721.000
	3	774.000
Valid		8599.000
Missing		.000

The clustering above suggests a 3-cluster approach:

1= highest ethnicity

2= highest british white

3 = intermediate ethnicity

this can be recoded as:

1 british white

2 intermediate

3 highest ethnicity

3.12 Validation & Interpretation on a Known Area: Newcastle

The purpose of this section is to help understand and validate the resulting clusters from knowledge of a particular locality. Newcastle is chosen as an example as it is familiar to the author. Other areas could be used interpreted and (further) validated by others familiar with particular localities. This interpretation could be done through a number of approaches:

- Scanning: viewing a sub-set of the data in the SPSS data view to see if it ‘makes sense’ for known areas.
- Tabulating: Newcastle, its wards, and Output Areas/numbers of cases associated with each cluster variable and value
- Mapping: Plots of the output areas and gaining visual information as a prompt to interpretation

The population of Newcastle is distributed between 889 Output Areas. The following table shows the ranges and mean values for these Output Areas. It shows that the output areas as cases vary in population terms typically by a factor of 10.

Descriptive Statistics

	N	Minimum	Maximum	Sum	Mean
population	889	108	1233	259536	291.94
male population	889	53	530	125473	141.14
female population	889	40	703	134063	150.80
population in households	889	108	554	253748	285.43
population in community dwelling	889	0	945	5790	6.51
Valid N (listwise)	889				

The population in community dwellings is generally quite low in comparison with the overall population. In some cases it can significantly skew the population profile: 781 (88%) cases have no population in community dwellings, 11% of OAs have under 100 people in community dwellings, and 1% of the OAs have community dwelling populations of over 100 people and these account for a large number of the community dwelling population (possibly student halls of residence and homes for older people – this can be tested as we can correlate retired and students with locations). A quick k-means cluster on Newcastle on the five population variables, identifies two different types of cluster: Cluster 1 is by far the most prevalent – it has close to the average OA population, it is low in community dwelling population, has balanced gender. Cluster 2 represents 5 cases of higher population (because of community dwelling population) with more women than men.

Final Cluster Centers

	Cluster	
	1	2
population	289	778
population in community dwelling	4	489
male population	140	364
female population	149	414
population in households	285	289

Number of Cases in each Cluster

Cluster	1	884.000
	2	5.000
Valid		889.000
Missing		.000

This suggests an initial clustering approach of Large Community Dwelling Output Areas (cases 140, 163, 305, 559, 562). This (un-normalised) clustering is useful as it identifies 5 Output Areas with significant community dwelling populations, but which are minority clusters.

When exploring economic activity in Newcastle at ward level the 4-clusters about half the wards (13) seem to be mixed 2/3/4. This suggests that around half of the wards have no overall or dominant economic status. Six wards (Byker, Monkchester. Moorside, Scotswood, Walker and West City) seem to be dominated by cluster 4 (unemployment) in conjunction with others (1,2,3) and this is consistent with local knowledge of these wards. Three wards were 2/3 (Castle, Dene, and South Gosforth) corresponding to high numbers of cases largely working or retired, which is consistent with local knowledge. Three of wards were dominated by output areas assigned to cluster 1 (Heaton, Jesmond, Sandyford) and these are the main student areas in the city. The economic activity clustering seems consistent with Newcastle and is therefore partly validated. On validating marital Status on Newcastle, it is found that; many areas are mixed (cluster 1/2/3) such as Grange, Kenton, Scotswood, South Gosforth, Walkergate, Wingrove, Woolsington; Several are mostly young people (cluster 2): Heaton, Jesmond, Moorside, Byker, Sandyford, Walker, which corresponds to single people (either students, or young areas, or single parents); Some are mostly 1 + 3; Castle, Denton, Westerhope. Some are mostly 2+ 3: Elswick, Fawdon, Lemington, Monkchester, and Fenham. On validating health in Newcastle, most the Wards are generally very variable and diverse when considered this way. Most wards are mixed; some with good health may be concerned with young people (Heaton, Jesmond, Sandyford, South Gosforth, Wingrove). Walker has one of the worst health profiles in the city when the clustering is examined. This again does not contradict local knowledge. On validating Age of output areas in Newcastle, it is found that most wards are 2/3 mixes, exceptions include those that are mostly 1 (young) such as Heaton and Jesmond, partly validating the age clustering. On validating ethnicity in Newcastle, the scans of the data show Elswick, Fenham, Moorside, Sandyford, and Wingrove have relatively high ethnic populations; mostly Asian ancestory and mostly Muslem religion (analysis not recorded here). This tallies with local knowledge of those areas, validating the ethnicity clustering. On validating educational qualifications in Newcastle some areas were mostly higher qualified: South Gosforth, Sandyford, Heaton, Jesmond, corresponding to the professional and managerial areas, or student areas. Low qualifications tended to be associated with known deprived areas - again validating the educational clustering analysis.

3.13 GIS Maps of Selected Cluster Variables in Validating Area: Newcastle

The cluster variables can be plotted using GIS, and this visual representation aids both validation and interpretation.

The example maps are given in the Appendix 3.4 and include:

- A map of the Newcastle wards and the geographical Output Areas
- A map of the tenure cluster variable in Newcastle
- A map of the economic activity cluster variable in Newcastle

The visual data on tenure and economic activity seem consistent with local knowledge of these areas and gives some additional confidence in the clustering techniques and in validation of these.

The maps show a number of additional features which are noted here. Firstly (from either tenure or economic activity) it can be seen that there are spatial clusters which are smaller than the ward boundaries but larger than the output areas, suggesting an intermediate level as relevant. Secondly, these intermediate level spatial clusters (in some cases) cross the ward boundaries. Thirdly there appears to be some association between wards, tenure and economic activity. Finally, it can be seen that there is also a visual association between the tenure and economic activity; areas high in council renting appear high in unemployment; high student areas appear high in private renting; and high working appears to be associated with highownership. These visual associations (and others) will be explored in more detail and more rigorously (statistically) in the following chapter.

4 ASSOCIATIONS BETWEEN CLUSTER VARIABLES

In the following I will use the convention that a phi value of less than 0.4 is a weak association, 0.4-0.7 is a moderate association, and 0.7 or above is a strong association. A statistically significant association is defined as one where the significance is less than 0.01.

4.1 Age and qualification

There is a weak statistically significant association between area age and qualification characteristics of output areas; areas with more young adults are more likely to be also areas of higher qualifications. For other area ages there is little association with qualifications of that area.

Cluster Number of Case * qualification 3 cluster Crosstabulation

			qualification 3 cluster			
			highest qualified	intermediate qualification	lowest qualification	Total
Cluster Number of Case	young adults lowest children mixed	Count	151	29	5	185
		Expected Count	33.0	73.1	78.9	185.0
	most 30-44 and most children mixed	Count	460	1341	1239	3040
		Expected Count	542.7	1200.9	1296.4	3040.0
	most 44-59 mixed	Count	745	1601	1688	4034
		Expected Count	720.1	1593.6	1720.3	4034.0
	most over 59 mixed	Count	179	426	735	1340
		Expected Count	239.2	529.4	571.4	1340.0
Total		Count	1535	3397	3667	8599
		Expected Count	1535.0	3397.0	3667.0	8599.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	632.378[a]	6	.000
Likelihood Ratio	492.100	6	.000
Linear-by-Linear Association	134.942	1	.000
N of Valid Cases	8599		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 33.02.

Symmetric Measures

		Value	Asymp. Std. Error [a]	Approx. T [b]	Approx. Sig.
Nominal by Nominal	Phi	.271			.000
	Cramer's V	.192			.000
Interval by Interval	Pearson's R	.125	.011	11.708	.000[c]
Ordinal by Ordinal	Spearman Correlation	.106	.011	9.893	.000[c]
N of Valid Cases		8599			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

4.2 Age and tenure

There is a weak statistically significant association between age and tenure; but young adult areas are more likely to be also high private rental area.

Cluster Number of Case * Cluster Number of Case Crosstabulation

			Cluster Number of Case			
			high council renting	high ownership and mortgages	high rental HA & private	Total
Cluster Number of Case	young adults lowest children mixed	Count	11	25	149	185
		Expected Count	59.4	98.7	27.0	185.0
	most 30-44 and most children mixed	Count	1007	1584	449	3040
		Expected Count	975.4	1621.3	443.3	3040.0
	most 44-59 mixed	Count	1187	2381	466	4034
		Expected Count	1294.3	2151.4	588.3	4034.0
	most over 59 mixed	Count	554	596	190	1340
		Expected Count	429.9	714.6	195.4	1340.0
Total		Count	2759	4586	1254	8599
		Expected Count	2759.0	4586.0	1254.0	8599.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	762.698[a]	6	.000
Likelihood Ratio	519.510	6	.000
Linear-by-Linear Association	97.937	1	.000
N of Valid Cases	8599		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 26.98.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.298	.000
	Cramer's V	.211	.000
N of Valid Cases		8599	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

4.3 Tenure and Marital Status

The association between marital status and tenure is moderate and significant. Council renting areas associate with less marriage and more unmarried areas; high ownership and mortgage areas are more likely more married areas and less likely unmarried area; private renting areas are more likely unmarried than married areas.

Cluster Number of Case * Couple Status 3-cluster Crosstabulation

			Couple Status 3-cluster			
			mostly married	mostly unmarried	mixed&intermediate	Total
Cluster Number of Case	high council renting	Count	126	791	1842	2759
		Expected Count	1051.8	480.3	1226.9	2759.0
	high ownership and mortgages	Count	3012	131	1443	4586
		Expected Count	1748.2	798.4	2039.4	4586.0
	high rental HA & private	Count	140	575	539	1254
		Expected Count	478.0	218.3	557.7	1254.0
Total		Count	3278	1497	3824	8599
		Expected Count	3278.0	1497.0	3824.0	8599.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3792.467[a]	4	.000
Likelihood Ratio	4289.794	4	.000
Linear-by-Linear Association	484.062	1	.000
N of Valid Cases	8599		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 218.31.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.664	.000
	Cramer's V	.470	.000
N of Valid Cases		8599	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

4.4 Tenure and Qualification

There is a significant and strong association overall between the tenure profile of an area and the qualification profile of an area. Qualification is inversely associated with high council renting, and associated with high-ownership and mortgage, but has little association with housing associations and private rentals.

Cluster Number of Case * qualification 3 cluster Crosstabulation

			qualification 3 cluster			
			highest qualified	intermediate qualification	lowest qualification	Total
Cluster Number of Case	high council renting	Count	13	260	2486	2759
		Expected Count	492.5	1089.9	1176.6	2759.0
	high ownership and mortgages	Count	1286	2681	619	4586
		Expected Count	818.6	1811.7	1955.7	4586.0
	high rental HA & private	Count	236	456	562	1254
		Expected Count	223.9	495.4	534.8	1254.0
Total		Count	1535	3397	3667	8599
		Expected Count	1535.0	3397.0	3667.0	8599.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4158.849[a]	4	.000
Likelihood Ratio	4723.926	4	.000
Linear-by-Linear Association	1543.893	1	.000
N of Valid Cases	8599		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 223.85.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.695	.000
	Cramer's V	.492	.000
N of Valid Cases		8599	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

4.5 Economic Activity and Tenure

There is a strong and significant association between economic activity and tenure of areas: student areas are more likely to be private renting areas but less likely to be high council renting or high ownership areas; the highest working areas are more likely to be high in ownership and less likely to be high in renting; high retired areas are slightly more likely to be high in ownership; higher unemployment areas are more likely to be higher in council renting areas, and less likely to be higher ownership areas.

Economic Activity 4-cluster * Cluster Number of Case Crosstabulation

			Cluster Number of Case			Total
			high council renting	high ownership and mortgages	high rental HA & private	
Economic Activity 4-cluster	high student low work	Count	12	20	126	158
		Expected Coun	50.7	84.3	23.0	158.0
	highest working	Count	196	2635	276	3107
		Expected Coun	996.9	1657.0	453.1	3107.0
	high-retired and workin	Count	708	1729	335	2772
		Expected Coun	889.4	1478.4	404.2	2772.0
	higher unemployment sick and at home	Count	1843	202	517	2562
		Expected Coun	822.0	1366.4	373.6	2562.0
Total		Count	2759	4586	1254	8599
		Expected Coun	2759.0	4586.0	1254.0	8599.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4235.155[a]	6	.000
Likelihood Ratio	4501.623	6	.000
Linear-by-Linear Association	1175.205	1	.000
N of Valid Cases	8599		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 23.04.

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Nominal by Nominal	Phi	.702			.000
	Cramer's V	.496			.000
Interval by Interval	Pearson's R	-.370	.011	-36.893	.000[c]
Ordinal by Ordinal	Spearman Correlation	-.400	.011	-40.426	.000[c]
N of Valid Cases		8599			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

4.6 Economic activity and marital status

There is a moderate statistically significant association between economic activity and marital status. Student areas are more likely to be mostly unmarried. Highest working areas are more likely to be mostly married than mostly unmarried. The high retired areas are more likely to be mostly married than not. The areas with high unemployed, the sick and at home more likely to be mostly unmarried than mostly marries areas.

Economic Activity 4-cluster * Couple Status 3-cluster Crosstabulation

			Couple Status 3-cluster			
			mostly married	mostly unmarried	mixed&intermediate	Total
Economic Activity 4-cluster	high student low work	Count	6	143	9	158
		Expected Count	60.2	27.5	70.3	158.0
	highest working	Count	1682	250	1175	3107
		Expected Count	1184.4	540.9	1381.7	3107.0
	high-retired and working	Count	1516	83	1173	2772
		Expected Count	1056.7	482.6	1232.7	2772.0
	higher unemployment sick and at home	Count	74	1021	1467	2562
		Expected Count	976.7	446.0	1139.3	2562.0
Total		Count	3278	1497	3824	8599
		Expected Count	3278.0	1497.0	3824.0	8599.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3186.701[a]	6	.000
Likelihood Ratio	3556.537	6	.000
Linear-by-Linear Association	743.348	1	.000
N of Valid Cases	8599		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 27.51.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.609	.000
	Cramer's V	.430	.000
N of Valid Cases		8599	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

4.7 Economic Activity and Qualifications

There is a strong statistically significant association between economic activity of output areas and the qualification profile for output areas: higher-student areas are more likely to be higher qualification areas; higher unemployed are unlikely to be higher qualifications and more likely to be lower qualification areas; higher retired areas have little association with qualifications; but higher working areas are more likely to be higher or intermediate qualification areas.

Economic Activity 4-cluster * qualification 3 cluster Crosstabulation

			qualification 3 cluster			
			highest qualified	intermediate qualification	lowest qualification	Total
Economic Activity 4-cluster	high student low work	Count	131	24	3	158
		Expected Count	28.2	62.4	67.4	158.0
	highest working	Count	846	1994	267	3107
		Expected Count	554.6	1227.4	1325.0	3107.0
	high-retired and working	Count	541	1122	1109	2772
		Expected Count	494.8	1095.1	1182.1	2772.0
	higher unemployment sick and at home	Count	17	257	2288	2562
		Expected Count	457.3	1012.1	1092.6	2562.0
Total		Count	1535	3397	3667	8599
		Expected Count	1535.0	3397.0	3667.0	8599.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4241.303[a]	6	.000
Likelihood Ratio	4707.306	6	.000
Linear-by-Linear Association	3261.942	1	.000
N of Valid Cases	8599		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 28.20.

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Nominal by Nominal	Phi	.702			.000
	Cramer's V	.497			.000
Interval by Interval	Pearson's R	.616	.006	72.494	.000[c]
Ordinal by Ordinal	Spearman Correlation	.636	.007	76.442	.000[c]
N of Valid Cases		8599			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

4.8 Economic Activity and Area Age Characteristics

There is a very strong and statistically significant association. Economic activity of areas is linked to the age profiles of that area. Young adult areas are often high student areas. Areas over 50 more likely to high-retired and working. Highest working areas unlikely to be middle-aged areas rather than young or old. High retired and working are unlikely to be 30-44, and more likely 44-59 or over 59. Higher unemployment, sick, and stay at stay at home areas are unlikely to be young adults.

Economic Activity 4-cluster * Cluster Number of Case Crosstabulation

			Cluster Number of Case				Total
			young adults lowest children mixed	most 30-44 and most children mixed	most 44-59 mixed	most over 59 mixed	
Economic Activity 4-cluster	high student low work	Count	135	16	4	3	158
		Expected Count	3.4	55.9	74.1	24.6	158.0
	highest working	Count	35	1667	1362	43	3107
		Expected Count	66.8	1098.4	1457.6	484.2	3107.0
	high-retired and working	Count	0	103	1637	1032	2772
		Expected Count	59.6	980.0	1300.4	432.0	2772.0
	higher unemployment sick and at home	Count	15	1254	1031	262	2562
		Expected Count	55.1	905.7	1201.9	399.2	2562.0
Total		Count	185	3040	4034	1340	8599
		Expected Count	185.0	3040.0	4034.0	1340.0	8599.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7926.057[a]	9	.000
Likelihood Ratio	4197.651	9	.000
Linear-by-Linear Association	318.027	1	.000
N of Valid Cases	8599		

a. 1 cells (6.3%) have expected count less than 5. The minimum expected count is 3.40.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.960	.000
	Cramer's V	.554	.000
N of Valid Cases		8599	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

4.9 Marital Status and Qualifications

There is a moderate statistical association for output areas between educational profile of areas and the marital status of areas: the mostly married areas are moderately associated with higher qualification areas; mostly unmarried areas and mixed areas are more likely to be lower qualification areas.

Couple Status 3-cluster * qualification 3 cluster Crosstabulation

			qualification 3 cluster			
			highest qualified	intermediate qualification	lowest qualification	Total
Couple Statu: 3-cluster	mostly married	Count	1090	1816	372	3278
		Expected Cou	585.2	1295.0	1397.9	3278.0
	mostly unmarried	Count	210	334	953	1497
		Expected Cou	267.2	591.4	638.4	1497.0
	mixed&intermedia	Count	235	1247	2342	3824
		Expected Cou	682.6	1510.7	1630.7	3824.0
Total		Count	1535	3397	3667	8599
		Expected Cou	1535.0	3397.0	3667.0	8599.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2327.185[a]	4	.000
Likelihood Ratio	2596.134	4	.000
Linear-by-Linear Association	1883.185	1	.000
N of Valid Cases	8599		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 267.23.

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Nominal by Nominal	Phi	.520			.000
	Cramer's V	.368			.000
Interval by Interval	Pearson's R	.468	.008	49.102	.000[c]
Ordinal by Ordinal	Spearman Correlation	.470	.009	49.356	.000[c]
N of Valid Cases		8599			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

4.10 Marital Status and Age

There is a weak statistically significant association between marital status of an output area and the age profile of an output area: but areas with high young adults are more likely to be also mostly unmarried areas; Areas which are mostly 30-44 are slightly more likely to be unmarried than mostly married; whereas mostly 44-59 areas are slightly more likely to be mostly married than unmarried. There is little association of the areas with mostly over 59s where there is an even distribution across areas mostly married, unmarried, and mixed.

Couple Status 3-cluster * Cluster Number of Case Crosstabulation

			Cluster Number of Case				
			young adults lowest children mixed	most 30-44 and most children mixed	most 44-59 mixed	most over 59 mixed	Total
Couple Status 3-cluster	mostly married	Count	5	892	1856	525	3278
		Expected Cour	70.5	1158.9	1537.8	510.8	3278.0
	mostly unmarried	Count	168	781	373	175	1497
		Expected Cour	32.2	529.2	702.3	233.3	1497.0
	mixed&intermediat	Count	12	1367	1805	640	3824
		Expected Cour	82.3	1351.9	1793.9	595.9	3824.0
Total		Count	185	3040	4034	1340	8599
		Expected Cour	185.0	3040.0	4034.0	1340.0	8599.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1113.362[a]	6	.000
Likelihood Ratio	921.464	6	.000
Linear-by-Linear Association	15.488	1	.000
N of Valid Cases	8599		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 32.21.

Symmetric Measures

		Value	Asymp. Std. Error [a]	Approx. T [b]	Approx. Sig.
Nominal by Nominal	Phi	.360			.000
	Cramer's V	.254			.000
Interval by Interval	Pearson's R	-.042	.010	-3.939	.000[c]
Ordinal by Ordinal	Spearman Correlation	-.045	.010	-4.151	.000[c]
N of Valid Cases		8599			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

4.11 Household Composition and Marital status

There is a strong statistically significant association due to the overlap in definitions (the common married and single characteristics)

Cluster Number of Case * Couple Status 3-cluster Crosstabulation

			Couple Status 3-cluster			
			mostly married	mostly unmarried	mixed&intermediate	Total
Cluster Number of Case	higher pensioner mixed	Count	437	239	1586	2262
		Expected Count	862.3	393.8	1005.9	2262.0
	higher married	Count	2812	25	933	3770
		Expected Count	1437.2	656.3	1676.5	3770.0
	higher lone parent, single, cohab	Count	29	1233	1305	2567
		Expected Count	978.6	446.9	1141.6	2567.0
Total		Count	3278	1497	3824	8599
		Expected Count	3278.0	1497.0	3824.0	8599.0

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.777	.000
	Cramer's V	.549	.000
N of Valid Cases		8599	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

4.12 Health and Economic activity

There is a moderate and statistically significant association between health and economic activity; high student areas are more likely better health; higher working areas are more likely better health; high-retired and working, slightly less likely better health; higher unemployment sick and at home more likely to be middle and worse health.

Economic Activity 4-cluster * Cluster Number of Case Crosstabulation

			Cluster Number of Case			
			better health	middle health	worse health	Total
Economic Activity 4-cluster	high student low work	Count	139	17	2	158
		Expected Coui	57.3	74.3	26.5	158.0
	highest working	Count	2125	943	39	3107
		Expected Coui	1125.9	1460.1	521.0	3107.0
	high-retired and worki	Count	705	1496	571	2772
		Expected Coui	1004.5	1302.7	464.8	2772.0
	higher unemployment sick and at home	Count	147	1585	830	2562
		Expected Coui	928.4	1204.0	429.6	2562.0
Total		Count	3116	4041	1442	8599
		Expected Coui	3116.0	4041.0	1442.0	8599.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2992.783[a]	6	.000
Likelihood Ratio	3431.606	6	.000
Linear-by-Linear Association	2702.749	1	.000
N of Valid Cases	8599		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 26.50.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.590	.000
	Cramer's V	.417	.000
N of Valid Cases		8599	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

4.13 Health and Qualifications

There is a moderate statistically significant association between health classification of an area and the qualification classification; better health areas are more likely to be higher qualification areas; worse health areas are more likely to be lowest qualification; intermediate qualification areas are more likely to be better health areas than worse; and lowest qualification areas are more likely to middle or lower health areas.

qualification 3 cluster * health 3-cluster Crosstabulation

			health 3-cluster			Total
			better health	middle health	worse health	
qualification 3 cluster	highest qualified	Count	1285	232	18	1535
		Expected Cou	556.2	721.4	257.4	1535.0
	intermediate qualificati	Count	1674	1563	160	3397
		Expected Cou	1231.0	1596.4	569.7	3397.0
	lowest qualification	Count	157	2246	1264	3667
		Expected Cou	1328.8	1723.3	614.9	3667.0
Total		Count	3116	4041	1442	8599
		Expected Cou	3116.0	4041.0	1442.0	8599.0

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.668	.000
	Cramer's V	.473	.000
N of Valid Cases		8599	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

4.14 Health and Marital Status

There is a moderate statistically significant association between health and marital status: mostly married areas more likely to be better health than mixed or worse health, the mixed areas more likely to be middle to worse health; more unmarried areas more likely to be middle or worse health.

couple status recoded 3-=cluster * health 3-cluster Crosstabulation

			health 3-cluster			
			better health	middle health	worse health	Total
couple status recoded 3-=clust	mostly married	Count	2045	1089	144	3278
		Expected Cou	1187.8	1540.5	549.7	3278.0
	mixed married/unmarr	Count	747	2202	875	3824
		Expected Cou	1385.7	1797.0	641.3	3824.0
	more unmarried	Count	324	750	423	1497
		Expected Cou	542.5	703.5	251.0	1497.0
Total		Count	3116	4041	1442	8599
		Expected Cou	3116.0	4041.0	1442.0	8599.0

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.449	.000
	Cramer's V	.317	.000
N of Valid Cases		8599	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

4.15 Health and Tenure

There is a moderate statistically significant association between health classification and tenure classification of an area: council areas more likely to be middle or worse health; high ownership more likely better and mixed health; rental is slightly more likely to be middle or worse health area.

tenure 3-cluster * health 3-cluster Crosstabulation

			health 3-cluster			Total
			better health	middle health	worse health	
tenure 3-cluster	high council renting	Count	141	1627	991	2759
		Expected Count	999.8	1296.6	462.7	2759.0
	high ownership and mortgages	Count	2617	1784	185	4586
		Expected Count	1661.8	2155.1	769.0	4586.0
	high rental HA & private	Count	358	630	266	1254
		Expected Count	454.4	589.3	210.3	1254.0
Total		Count	3116	4041	1442	8599
		Expected Count	3116.0	4041.0	1442.0	8599.0

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.541	.000
	Cramer's V	.383	.000
N of Valid Cases		8599	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

4.16 Health and Age

There is a moderate statistically significant association between of age and health; young areas are more likely to be better health; 30-44 more likely to better health than worse health; 44-59 middle slightly more likely middle health; over 59 areas are more likely to worse health.

area age 4 cluster * health 3-cluster Crosstabulation

			health 3-cluster			
			better health	middle health	worse health	Total
area age 4 cluster	young adults lowest children mixed	Count	157	21	7	185
		Expected Count	67.0	86.9	31.0	185.0
	most 30-44 and most children mixed	Count	1539	1426	75	3040
		Expected Count	1101.6	1428.6	509.8	3040.0
	most 44-59 mixed	Count	1330	2077	627	4034
		Expected Count	1461.8	1895.7	676.5	4034.0
	most over 59 mixed	Count	90	517	733	1340
		Expected Count	485.6	629.7	224.7	1340.0
Total		Count	3116	4041	1442	8599
		Expected Count	3116.0	4041.0	1442.0	8599.0

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.513	.000
	Cramer's V	.362	.000
N of Valid Cases		8599	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

4.17 Health and work status

There is a moderate statistically significant association between health and work status of areas: areas with mostly managers and professionals and middle (i.e. skilled trade and secretarial) are more likely to be better health areas; areas high in elementary and process workers are more likely to be middle and worse health.

health 3-cluster * recoded work status Crosstabulation

			recoded work status			
			most managers and professionals	middle	most elementary and process	Total
health 3-cluster	better health	Count	1206	1555	355	3116
		Expected Count	572.9	1222.6	1320.5	3116.0
	middle health	Count	316	1464	2261	4041
		Expected Count	743.0	1585.6	1712.5	4041.0
	worse health	Count	59	355	1028	1442
		Expected Count	265.1	565.8	611.1	1442.0
Total		Count	1581	3374	3644	8599
		Expected Count	1581.0	3374.0	3644.0	8599.0

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.534	.000
	Cramer's V	.377	.000
N of Valid Cases		8599	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

4.18 Ethnicity and work status

Ethnicity and work status a weak association; however there may be a slight under-representation of highly white areas and mostly managers and professionals, and over representation of mixed ethnicity and managers and professionals.

ETHNIC3 * recoded work status Crosstabulation

			recoded work status			
			most managers and professionals	middle	most elementary and process	Total
ETHNIC3	highly white british	Count	1243	3083	3395	7721
		Expected Count	1419.6	3029.5	3271.9	7721.0
	mixed ethnicity	Count	313	257	204	774
		Expected Count	142.3	303.7	328.0	774.0
	highest ethnicity	Count	25	34	45	104
		Expected Count	19.1	40.8	44.1	104.0
Total		Count	1581	3374	3644	8599
		Expected Count	1581.0	3374.0	3644.0	8599.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	289.299[a]	4	.000
Likelihood Ratio	245.176	4	.000
Linear-by-Linear Association	156.462	1	.000
N of Valid Cases	8599		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 19.12.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.183	.000
	Cramer's V	.130	.000
N of Valid Cases		8599	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

4.19 Ethnicity and tenure

There is a weak association between ethnicity and tenure; but mixed and highest ethnic areas are more likely to be higher private renting and lower council renting than white British areas.

ETHNIC3 * tenure 3-cluster Crosstabulation

			tenure 3-cluster			
			high council renting	high ownership and mortgages	high rental HA & private	Total
ETHNIC3	highly white british	Count	2635	4199	887	7721
		Expected Count	2477.3	4117.7	1126.0	7721.0
	mixed ethnicity	Count	117	362	295	774
		Expected Count	248.3	412.8	112.9	774.0
	highest ethnicity	Count	7	25	72	104
		Expected Count	33.4	55.5	15.2	104.0
Total		Count	2759	4586	1254	8599
		Expected Count	2759.0	4586.0	1254.0	8599.0

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.282	.000
	Cramer's V	.199	.000
N of Valid Cases		8599	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

4.20 Ethnicity and qualifications

Only weak association between ethnicity and qualifications; but perhaps ethnic areas are more likely to be higher qualification areas.

ETHNIC3 * qualification 3 cluster Crosstabulation

			qualification 3 cluster			
			highest qualified	intermediate qualification	lowest qualification	Total
ETHNIC3	highly white british	Count	1159	3118	3444	7721
		Expected Count	1378.3	3050.1	3292.6	7721.0
	mixed ethnicity	Count	341	234	199	774
		Expected Count	138.2	305.8	330.1	774.0
	highest ethnicity	Count	35	45	24	104
		Expected Count	18.6	41.1	44.4	104.0
Total		Count	1535	3397	3667	8599
		Expected Count	1535.0	3397.0	3667.0	8599.0

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.225	.000
	Cramer's V	.159	.000
N of Valid Cases		8599	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

4.21 Ethnicity and Marital Status

There is a weak association between ethnicity of areas and marital status of areas. The ethnic areas (less white British) are more likely to be also mostly unmarried than mostly married (possibly because of area age effects).

ETHNIC3 * Couple Status 3-cluster Crosstabulation

			Couple Status 3-cluster			
			mostly married	mostly unmarried	mixed&intermediate	Total
ETHNIC3	highly white british	Count	3086	1042	3593	7721
		Expected Count	2943.3	1344.1	3433.6	7721.0
	mixed ethnicity	Count	187	385	202	774
		Expected Count	295.1	134.7	344.2	774.0
	highest ethnicity	Count	5	70	29	104
		Expected Count	39.6	18.1	46.2	104.0
Total		Count	3278	1497	3824	8599
		Expected Count	3278.0	1497.0	3824.0	8599.0

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.311	.000
	Cramer's V	.220	.000
N of Valid Cases		8599	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

4.22 Ethnicity and Economic activity.

Shows a moderate statistically significant association between ethnicity and economic activity. High student areas tend to be more ethnic than highly white British. Ethnic areas appear less likely to high-retired, and more likely unemployed, sick, or stay at home.

ETHNIC3 * Economic Activity 4-cluster Crosstabulation

			Economic Activity 4-cluster				
			high student low work	highest working	high-retired and working	higher unemployment sick and at home	Total
ETHNIC3	highly white british	Count	8	2810	2648	2255	7721
		Expected Count	141.9	2789.8	2489.0	2300.4	7721.0
	mixed ethnicity	Count	115	288	118	253	774
		Expected Count	14.2	279.7	249.5	230.6	774.0
	highest ethnicity	Count	35	9	6	54	104
		Expected Count	1.9	37.6	33.5	31.0	104.0
Total		Count	158	3107	2772	2562	8599
		Expected Count	158.0	3107.0	2772.0	2562.0	8599.0

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.426	.000
	Cramer's V	.301	.000
N of Valid Cases		8599	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

4.23 Ethnicity and Age.

Moderate association: Mixed and high ethnic areas are more likely to be younger areas (mostly young adults or mostly 30-44) and less likely to be the older areas.

ETHNIC3 * area age 4 cluster Crosstabulation

			area age 4 cluster				
			young adults lowest children mixed	most 30-44 and most children mixed	most 44-59 mixed	most over 59 mixed	Total
ETHNIC3	highly white briti	Count	16	2641	3772	1292	7721
		Expected Cou	166.1	2729.6	3622.1	1203.2	7721.0
	mixed ethnicity	Count	137	340	249	48	774
		Expected Cou	16.7	273.6	363.1	120.6	774.0
	highest ethnicity	Count	32	59	13	0	104
		Expected Cou	2.2	36.8	48.8	16.2	104.0
Total		Count	185	3040	4034	1340	8599
		Expected Cou	185.0	3040.0	4034.0	1340.0	8599.0

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.427	.000
	Cramer's V	.302	.000
N of Valid Cases		8599	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

4.24 Work status and economic activity

There is a moderate significant association between work status classifications and economic activity classifications: high student areas are more likely to be also manager and professional areas, rather than middle or elementary and process areas. Higher unemployment areas are more likely to elementary and process areas rather than professional or middle. The highest working areas are more likely to be also professional or middle areas rather than elementary and process areas.

Economic Activity 4-cluster * recoded work status Crosstabulation

			recoded work status			
			most managers and professionals	middle	most elementary and process	Total
Economic Activity 4-cluster	high student low work	Count	92	31	35	158
		Expected Coun	29.0	62.0	67.0	158.0
	highest working	Count	798	1796	513	3107
		Expected Coun	571.2	1219.1	1316.7	3107.0
	high-retired and workin	Count	657	1268	847	2772
		Expected Coun	509.7	1087.7	1174.7	2772.0
	higher unemployment sick and at home	Count	34	279	2249	2562
		Expected Coun	471.0	1005.3	1085.7	2562.0
Total		Count	1581	3374	3644	8599
		Expected Coun	1581.0	3374.0	3644.0	8599.0

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.625	.000
	Cramer's V	.442	.000
N of Valid Cases		8599	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

4.25 Work status and tenure.

Moderate statistical association between work status and tenure. Managers and middle have higher ownership and lower council renting. Elementary and process workers have higher renting and lower ownership.

recoded work status * tenure 3-cluster Crosstabulation

			tenure 3-cluster			
			high council renting	high ownership and mortgages	high rental HA & private	Total
recoded work status	most managers and professionals	Count	20	1351	210	1581
		Expected Count	507.3	843.2	230.6	1581.0
	middle	Count	347	2568	459	3374
		Expected Count	1082.6	1799.4	492.0	3374.0
	most elementary and process	Count	2392	667	585	3644
		Expected Count	1169.2	1943.4	531.4	3644.0
Total		Count	2759	4586	1254	8599
		Expected Count	2759.0	4586.0	1254.0	8599.0

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.658	.000
	Cramer's V	.466	.000
N of Valid Cases		8599	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

4.26 Work status and Marital Status.

Moderate significant association between work status and marital status. Mostly managers and professionals, and also middle status, are more likely to be mostly married areas; elementary and process areas more likely to be mixed or unmarried areas.

recoded work status * Couple Status 3-cluster Crosstabulation

			Couple Status 3-cluster			
			mostly married	mostly unmarried	mixed&intermediate	Total
recoded work status	most managers and professionals	Count	1151	180	250	1581
		Expected Count	602.7	275.2	703.1	1581.0
	middle	Count	1837	300	1237	3374
		Expected Count	1286.2	587.4	1500.4	3374.0
	most elementary and process	Count	290	1017	2337	3644
		Expected Count	1389.1	634.4	1620.5	3644.0
Total		Count	3278	1497	3824	8599
		Expected Count	3278.0	1497.0	3824.0	8599.0

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.557	.000
	Cramer's V	.394	.000
N of Valid Cases		8599	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

4.27 Work status and qualification.

There is a very strong statistically significant association between Work Status classifications of areas and Qualification classification of areas: those areas with high work status and high qualification; middle with intermediate qualification; elementary with lowest qualification areas.

recoded work status * qualification 3 cluster Crosstabulation

			qualification 3 cluster			
			highest qualified	intermediate qualification	lowest qualification	Total
recoded work status	most managers and professionals	Count	1292	273	16	1581
		Expected Count	282.2	624.6	674.2	1581.0
	middle	Count	227	2575	572	3374
		Expected Count	602.3	1332.9	1438.8	3374.0
	most elementary and process	Count	16	549	3079	3644
		Expected Count	650.5	1439.5	1554.0	3644.0
Total		Count	1535	3397	3667	8599
		Expected Count	1535.0	3397.0	3667.0	8599.0

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	1.025	.000
	Cramer's V	.725	.000
N of Valid Cases		8599	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

5 MULTI-LEVEL ASSOCIATION: OUTPUT AREAS TO WARDS AND COUNCILS

5.1 Overview

The purpose of this chapter is to examine the association between higher and lower spatial levels: between the association of the specific cluster variables at the level of the output area with the ward level. This will be explored in detail in one city and local government area: Newcastle.

5.2 Health and Ward Association

There is a moderate significant association between health and the wards in Newcastle.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	307.440[a]	50	.000
Likelihood Ratio	340.174	50	.000
Linear-by-Linear Association	.004	1	.950
N of Valid Cases	889		

a. 4 cells (5.1%) have expected count less than 5. The minimum expected count is 3.93.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.588	.000
	Cramer's V	.416	.000
N of Valid Cases		889	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

The following table shows the distribution of output areas, classified in health terms, throughout the wards in Newcastle. Some wards have predominantly better health output areas within them (such as south gosforth, heaton, and jesmond) others are mixed, and some have mostly worse health areas (e.g. walker).

newcastle wards * health 3-cluster Crosstabulation

			health 3-cluster			Total
			better health	middle health	worse health	
newcastle wards	benwell	Count	4	16	5	25
		Expected Count	10.1	10.4	4.5	25.0
	blakelaw	Count	13	18	9	40
		Expected Count	16.2	16.6	7.2	40.0
	byker	Count	3	15	15	33
		Expected Count	13.4	13.7	5.9	33.0
	castle	Count	24	11	4	39
		Expected Count	15.8	16.2	7.0	39.0
	dene	Count	33	15	1	49
		Expected Count	19.8	20.4	8.8	49.0
	denton	Count	10	18	6	34
		Expected Count	13.8	14.2	6.1	34.0
	elswick	Count	6	17	3	26
		Expected Count	10.5	10.8	4.7	26.0
	fawdon	Count	4	23	8	35
		Expected Count	14.2	14.6	6.3	35.0
	fenham	Count	10	22	5	37
		Expected Count	15.0	15.4	6.6	37.0
	grange	Count	19	14	9	42
		Expected Count	17.0	17.5	7.5	42.0
	heaton	Count	31	6	0	37
		Expected Count	15.0	15.4	6.6	37.0
	jesmond	Count	34	5	0	39
		Expected Count	15.8	16.2	7.0	39.0
	kenton	Count	12	14	9	35
		Expected Count	14.2	14.6	6.3	35.0
	lemington	Count	16	15	3	34
		Expected Count	13.8	14.2	6.1	34.0
	monkchester	Count	1	20	8	29
		Expected Count	11.7	12.1	5.2	29.0
	moorside	Count	16	7	11	34
		Expected Count	13.8	14.2	6.1	34.0
	newburn	Count	5	17	9	31
		Expected Count	12.6	12.9	5.5	31.0
	sandyford	Count	27	7	9	43
		Expected Count	17.4	17.9	7.7	43.0
	scotswood	Count	4	13	5	22
		Expected Count	8.9	9.2	3.9	22.0
	south gosforth	Count	31	3	0	34
		Expected Count	13.8	14.2	6.1	34.0
	walker	Count	1	11	16	28
		Expected Count	11.3	11.7	5.0	28.0
	walkergate	Count	9	20	6	35
		Expected Count	14.2	14.6	6.3	35.0
	west city	Count	6	13	9	28
		Expected Count	11.3	11.7	5.0	28.0
	westerhope	Count	18	21	3	42
		Expected Count	17.0	17.5	7.5	42.0
	wingrove	Count	21	10	0	31
		Expected Count	12.6	12.9	5.5	31.0
	woolsington	Count	2	19	6	27
		Expected Count	10.9	11.2	4.8	27.0
Total		Count	360	370	159	889
		Expected Count	360.0	370.0	159.0	889.0

newcastle wards * health 3-cluster Crosstabulation

			health 3-cluster			
			better health	middle health	worse health	Total
newcastle wards	benwell	% within newcastle wards	16.0%	64.0%	20.0%	100.0%
		% within health 3-cluster	1.1%	4.3%	3.1%	2.8%
	blakelaw	% within newcastle wards	32.5%	45.0%	22.5%	100.0%
		% within health 3-cluster	3.6%	4.9%	5.7%	4.5%
	byker	% within newcastle wards	9.1%	45.5%	45.5%	100.0%
		% within health 3-cluster	.8%	4.1%	9.4%	3.7%
	castle	% within newcastle wards	61.5%	28.2%	10.3%	100.0%
		% within health 3-cluster	6.7%	3.0%	2.5%	4.4%
	dene	% within newcastle wards	67.3%	30.6%	2.0%	100.0%
		% within health 3-cluster	9.2%	4.1%	.6%	5.5%
	denton	% within newcastle wards	29.4%	52.9%	17.6%	100.0%
		% within health 3-cluster	2.8%	4.9%	3.8%	3.8%
	elswick	% within newcastle wards	23.1%	65.4%	11.5%	100.0%
		% within health 3-cluster	1.7%	4.6%	1.9%	2.9%
	fawdon	% within newcastle wards	11.4%	65.7%	22.9%	100.0%
		% within health 3-cluster	1.1%	6.2%	5.0%	3.9%
	fenham	% within newcastle wards	27.0%	59.5%	13.5%	100.0%
		% within health 3-cluster	2.8%	5.9%	3.1%	4.2%
	grange	% within newcastle wards	45.2%	33.3%	21.4%	100.0%
		% within health 3-cluster	5.3%	3.8%	5.7%	4.7%
	heaton	% within newcastle wards	83.8%	16.2%		100.0%
		% within health 3-cluster	8.6%	1.6%		4.2%
	jesmond	% within newcastle wards	87.2%	12.8%		100.0%
		% within health 3-cluster	9.4%	1.4%		4.4%
	kenton	% within newcastle wards	34.3%	40.0%	25.7%	100.0%
		% within health 3-cluster	3.3%	3.8%	5.7%	3.9%
	lemington	% within newcastle wards	47.1%	44.1%	8.8%	100.0%
		% within health 3-cluster	4.4%	4.1%	1.9%	3.8%
	monkchester	% within newcastle wards	3.4%	69.0%	27.6%	100.0%
		% within health 3-cluster	.3%	5.4%	5.0%	3.3%
	moorside	% within newcastle wards	47.1%	20.6%	32.4%	100.0%
		% within health 3-cluster	4.4%	1.9%	6.9%	3.8%
	newburn	% within newcastle wards	16.1%	54.8%	29.0%	100.0%
		% within health 3-cluster	1.4%	4.6%	5.7%	3.5%
	sandyford	% within newcastle wards	62.8%	16.3%	20.9%	100.0%
		% within health 3-cluster	7.5%	1.9%	5.7%	4.8%
	scotswood	% within newcastle wards	18.2%	59.1%	22.7%	100.0%
		% within health 3-cluster	1.1%	3.5%	3.1%	2.5%
	south gosforth	% within newcastle wards	91.2%	8.8%		100.0%
		% within health 3-cluster	8.6%	.8%		3.8%
	walker	% within newcastle wards	3.6%	39.3%	57.1%	100.0%
		% within health 3-cluster	.3%	3.0%	10.1%	3.1%
	walkergate	% within newcastle wards	25.7%	57.1%	17.1%	100.0%
		% within health 3-cluster	2.5%	5.4%	3.8%	3.9%
	west city	% within newcastle wards	21.4%	46.4%	32.1%	100.0%
		% within health 3-cluster	1.7%	3.5%	5.7%	3.1%
	westerhope	% within newcastle wards	42.9%	50.0%	7.1%	100.0%
		% within health 3-cluster	5.0%	5.7%	1.9%	4.7%
	wingrove	% within newcastle wards	67.7%	32.3%		100.0%
		% within health 3-cluster	5.8%	2.7%		3.5%
	woolsington	% within newcastle wards	7.4%	70.4%	22.2%	100.0%
		% within health 3-cluster	.6%	5.1%	3.8%	3.0%
Total		% within newcastle wards	40.5%	41.6%	17.9%	100.0%
		% within health 3-cluster	100.0%	100.0%	100.0%	100.0%

5.3 Age and Ward

The association between the age classification of the output areas and the ward area is strong and statistically significant.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.771	.000
	Cramer's V	.445	.000
N of Valid Cases		889	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Some wards areas such as Heaton, Jesmond and Sandyford have predominantly young areas, whereas some, such as Denton and Westerhope have output areas which are older. In such cases the characteristic then applies to the larger spatial region. The wards each have their own combination of age classified output areas and this also is a characteristic of the ward.

newcastle wards * area age 4 cluster Crosstabulation

			area age 4 cluster				
			young adults lowest children mixed	most 30-44 and most children mixed	most 44-59 mixed	most over 59 mixed	Total
newcastle wards	benwell	% within newcastle wards		52.0%	40.0%	8.0%	100.0%
		% within area age 4 cluster		4.2%	3.0%	1.7%	2.8%
	blakelaw	% within newcastle wards		55.0%	32.5%	12.5%	100.0%
		% within area age 4 cluster		7.1%	3.9%	4.1%	4.5%
	byker	% within newcastle wards	6.1%	36.4%	36.4%	21.2%	100.0%
		% within area age 4 cluster	1.6%	3.9%	3.6%	5.8%	3.7%
	castle	% within newcastle wards		30.8%	59.0%	10.3%	100.0%
		% within area age 4 cluster		3.9%	6.9%	3.3%	4.4%
	dene	% within newcastle wards	6.1%	28.6%	61.2%	4.1%	100.0%
		% within area age 4 cluster	2.5%	4.5%	9.0%	1.7%	5.5%
	denton	% within newcastle wards	2.9%	23.5%	38.2%	35.3%	100.0%
		% within area age 4 cluster	.8%	2.6%	3.9%	9.9%	3.8%
	elswick	% within newcastle wards	3.8%	57.7%	34.6%	3.8%	100.0%
		% within area age 4 cluster	.8%	4.8%	2.7%	.8%	2.9%
	fawdon	% within newcastle wards		37.1%	42.9%	20.0%	100.0%
		% within area age 4 cluster		4.2%	4.5%	5.8%	3.9%
	fenham	% within newcastle wards	2.7%	37.8%	48.6%	10.8%	100.0%
		% within area age 4 cluster	.8%	4.5%	5.4%	3.3%	4.2%
	grange	% within newcastle wards		38.1%	33.3%	28.6%	100.0%
		% within area age 4 cluster		5.1%	4.2%	9.9%	4.7%
	heaton	% within newcastle wards	73.0%	10.8%	10.8%	5.4%	100.0%
		% within area age 4 cluster	22.1%	1.3%	1.2%	1.7%	4.2%
	jesmond	% within newcastle wards	61.5%	23.1%	10.3%	5.1%	100.0%
		% within area age 4 cluster	19.7%	2.9%	1.2%	1.7%	4.4%
	kenton	% within newcastle wards		37.1%	42.9%	20.0%	100.0%
		% within area age 4 cluster		4.2%	4.5%	5.8%	3.9%
	lemington	% within newcastle wards		35.3%	64.7%		100.0%
		% within area age 4 cluster		3.9%	6.6%		3.8%
	monkchester	% within newcastle wards		62.1%	27.6%	10.3%	100.0%
		% within area age 4 cluster		5.8%	2.4%	2.5%	3.3%
	moorside	% within newcastle wards	41.2%	32.4%	17.6%	8.8%	100.0%
		% within area age 4 cluster	11.5%	3.5%	1.8%	2.5%	3.8%
	newburn	% within newcastle wards		25.8%	58.1%	16.1%	100.0%
		% within area age 4 cluster		2.6%	5.4%	4.1%	3.5%
	sandyford	% within newcastle wards	67.4%	4.7%	14.0%	14.0%	100.0%
		% within area age 4 cluster	23.8%	.6%	1.8%	5.0%	4.8%
	scotswood	% within newcastle wards		54.5%	40.9%	4.5%	100.0%
		% within area age 4 cluster		3.9%	2.7%	.8%	2.5%
	south gosforth	% within newcastle wards	14.7%	35.3%	41.2%	8.8%	100.0%
		% within area age 4 cluster	4.1%	3.9%	4.2%	2.5%	3.8%
	walker	% within newcastle wards		35.7%	50.0%	14.3%	100.0%
		% within area age 4 cluster		3.2%	4.2%	3.3%	3.1%
	walkergate	% within newcastle wards		31.4%	51.4%	17.1%	100.0%
		% within area age 4 cluster		3.5%	5.4%	5.0%	3.9%
	west city	% within newcastle wards	32.1%	35.7%	25.0%	7.1%	100.0%
		% within area age 4 cluster	7.4%	3.2%	2.1%	1.7%	3.1%
	westerhope	% within newcastle wards		23.8%	35.7%	40.5%	100.0%
		% within area age 4 cluster		3.2%	4.5%	14.0%	4.7%
	wingrove	% within newcastle wards	19.4%	64.5%	16.1%		100.0%
		% within area age 4 cluster	4.9%	6.4%	1.5%		3.5%
	woolsington	% within newcastle wards		37.0%	48.1%	14.8%	100.0%
		% within area age 4 cluster		3.2%	3.9%	3.3%	3.0%
Total		% within newcastle wards	13.7%	35.0%	37.7%	13.6%	100.0%
		% within area age 4 cluster	100.0%	100.0%	100.0%	100.0%	100.0%

5.4 Economic Activity & Newcastle Wards

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.886	.000
	Cramer's V	.512	.000
N of Valid Cases		889	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

This shows a strong and statistically significant association with economic activity and the wards.

The following table shows that some wards have high numbers of student areas (Heaton, Jesmond, Sandyford, Moorside), others have high unemployment, sick or staying at home (Benwell, Byker, Walker and West City), others have high numbers of largely retired areas (Westerhope, Denton, and Newburn), and others have high numbers of areas where there is a mostly working population (South Gosforth, Castle). Each ward has a characteristic distribution of output areas which distinguishes it from the others.

newcastle wards * Economic Activity 4-cluster Crosstabulation

			Economic Activity 4-cluster				
			high student low work	highest working	high-retired and working	higher unemployment sick and at home	Total
newcastle wards	benwell	% within newcastle wards		28.0%	16.0%	56.0%	100.0%
		% within Economic Activity 4-cluster		2.6%	1.9%	4.6%	2.8%
	blakelaw	% within newcastle wards		37.5%	22.5%	40.0%	100.0%
		% within Economic Activity 4-cluster		5.5%	4.2%	5.3%	4.5%
	byker	% within newcastle wards	3.0%	18.2%	9.1%	69.7%	100.0%
		% within Economic Activity 4-cluster	1.0%	2.2%	1.4%	7.6%	3.7%
	castle	% within newcastle wards		59.0%	30.8%	10.3%	100.0%
		% within Economic Activity 4-cluster		8.5%	5.6%	1.3%	4.4%
	dene	% within newcastle wards	4.1%	67.3%	20.4%	8.2%	100.0%
		% within Economic Activity 4-cluster	2.0%	12.2%	4.7%	1.3%	5.5%
	denton	% within newcastle wards		20.6%	47.1%	32.4%	100.0%
		% within Economic Activity 4-cluster		2.6%	7.4%	3.6%	3.8%
	elswick	% within newcastle wards	3.8%	7.7%	11.5%	76.9%	100.0%
		% within Economic Activity 4-cluster	1.0%	.7%	1.4%	6.6%	2.9%
	fawdon	% within newcastle wards		17.1%	34.3%	48.6%	100.0%
		% within Economic Activity 4-cluster		2.2%	5.6%	5.6%	3.9%
	fenham	% within newcastle wards	2.7%	24.3%	32.4%	40.5%	100.0%
		% within Economic Activity 4-cluster	1.0%	3.3%	5.6%	5.0%	4.2%
	grange	% within newcastle wards		45.2%	38.1%	16.7%	100.0%
		% within Economic Activity 4-cluster		7.0%	7.4%	2.3%	4.7%
	heaton	% within newcastle wards	54.1%	37.8%	8.1%		100.0%
		% within Economic Activity 4-cluster	20.0%	5.2%	1.4%		4.2%
	jesmond	% within newcastle wards	56.4%	28.2%	12.8%	2.6%	100.0%
		% within Economic Activity 4-cluster	22.0%	4.1%	2.3%	.3%	4.4%
	kenton	% within newcastle wards		31.4%	34.3%	34.3%	100.0%
		% within Economic Activity 4-cluster		4.1%	5.6%	4.0%	3.9%
	lemington	% within newcastle wards		50.0%	23.5%	26.5%	100.0%
		% within Economic Activity 4-cluster		6.3%	3.7%	3.0%	3.8%
	monkchester	% within newcastle wards		6.9%	3.4%	89.7%	100.0%
		% within Economic Activity 4-cluster		.7%	.5%	8.6%	3.3%
	moorside	% within newcastle wards	35.3%	2.9%	5.9%	55.9%	100.0%
		% within Economic Activity 4-cluster	12.0%	.4%	.9%	6.3%	3.8%
	newburn	% within newcastle wards		25.8%	45.2%	29.0%	100.0%
		% within Economic Activity 4-cluster		3.0%	6.5%	3.0%	3.5%
	sandyford	% within newcastle wards	62.8%	11.6%	7.0%	18.6%	100.0%
		% within Economic Activity 4-cluster	27.0%	1.8%	1.4%	2.6%	4.8%
	scotswood	% within newcastle wards		27.3%	13.6%	59.1%	100.0%
		% within Economic Activity 4-cluster		2.2%	1.4%	4.3%	2.5%
	south gosforth	% within newcastle wards	2.9%	76.5%	20.6%		100.0%
		% within Economic Activity 4-cluster	1.0%	9.6%	3.3%		3.8%
	walker	% within newcastle wards		3.6%	10.7%	85.7%	100.0%
		% within Economic Activity 4-cluster		.4%	1.4%	7.9%	3.1%
	walkergate	% within newcastle wards		37.1%	34.3%	28.6%	100.0%
		% within Economic Activity 4-cluster		4.8%	5.6%	3.3%	3.9%
	west city	% within newcastle wards	21.4%	7.1%		71.4%	100.0%
		% within Economic Activity 4-cluster	6.0%	.7%		6.6%	3.1%
	westerhope	% within newcastle wards		35.7%	64.3%		100.0%
		% within Economic Activity 4-cluster		5.5%	12.6%		4.7%
	wingrove	% within newcastle wards	22.6%	25.8%	19.4%	32.3%	100.0%
		% within Economic Activity 4-cluster	7.0%	3.0%	2.8%	3.3%	3.5%
	woolsington	% within newcastle wards		14.8%	44.4%	40.7%	100.0%
		% within Economic Activity 4-cluster		1.5%	5.6%	3.6%	3.0%
Total		% within newcastle wards	11.2%	30.5%	24.2%	34.1%	100.0%
		% within Economic Activity 4-cluster	100.0%	100.0%	100.0%	100.0%	100.0%

5.5 Ethnicity and Ward

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.854	.000
	Cramer's V	.604	.000
N of Valid Cases		889	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

There is a strong statistically significant association between ethnicity and ward area in Newcastle.

The following table shows that some wards have the majority of output areas as mixed ethnicity (Elswick, Wingrove), others have largely highly white British areas (Newburn, Fawdon, Westerhope, Lemington), some consist of predominantly mixed areas (Heaton, Jesmond, South Gosforth).

newcastle wards * ethnicity 3-cluster Crosstabulation

			ethnicity 3-cluster			
			highly white british	mixed ethnicity	highest ethnicity	Total
newcastle wards	benwell	% within newcastle wards	68.0%	32.0%		100.0%
		% within ethnicity 3-cluster	3.4%	2.4%		2.8%
	blakelaw	% within newcastle wards	85.0%	15.0%		100.0%
		% within ethnicity 3-cluster	6.8%	1.8%		4.5%
	byker	% within newcastle wards	51.5%	48.5%		100.0%
		% within ethnicity 3-cluster	3.4%	4.8%		3.7%
	castle	% within newcastle wards	69.2%	30.8%		100.0%
		% within ethnicity 3-cluster	5.4%	3.6%		4.4%
	dene	% within newcastle wards	32.7%	67.3%		100.0%
		% within ethnicity 3-cluster	3.2%	9.9%		5.5%
	denton	% within newcastle wards	94.1%	5.9%		100.0%
		% within ethnicity 3-cluster	6.4%	.6%		3.8%
	elswick	% within newcastle wards	15.4%	30.8%	53.8%	100.0%
		% within ethnicity 3-cluster	.8%	2.4%	26.4%	2.9%
	fawdon	% within newcastle wards	91.4%	8.6%		100.0%
		% within ethnicity 3-cluster	6.4%	.9%		3.9%
	fenham	% within newcastle wards	51.4%	35.1%	13.5%	100.0%
		% within ethnicity 3-cluster	3.8%	3.9%	9.4%	4.2%
	grange	% within newcastle wards	33.3%	64.3%	2.4%	100.0%
		% within ethnicity 3-cluster	2.8%	8.1%	1.9%	4.7%
	heaton	% within newcastle wards	10.8%	89.2%		100.0%
		% within ethnicity 3-cluster	.8%	9.9%		4.2%
	jesmond	% within newcastle wards	7.7%	92.3%		100.0%
		% within ethnicity 3-cluster	.6%	10.8%		4.4%
	kenton	% within newcastle wards	68.6%	25.7%	5.7%	100.0%
		% within ethnicity 3-cluster	4.8%	2.7%	3.8%	3.9%
	lemington	% within newcastle wards	94.1%	5.9%		100.0%
		% within ethnicity 3-cluster	6.4%	.6%		3.8%
	monkchester	% within newcastle wards	89.7%	10.3%		100.0%
		% within ethnicity 3-cluster	5.2%	.9%		3.3%
	moorside	% within newcastle wards	11.8%	55.9%	32.4%	100.0%
		% within ethnicity 3-cluster	.8%	5.7%	20.8%	3.8%
	newburn	% within newcastle wards	100.0%			100.0%
		% within ethnicity 3-cluster	6.2%			3.5%
	sandyford	% within newcastle wards	14.0%	83.7%	2.3%	100.0%
		% within ethnicity 3-cluster	1.2%	10.8%	1.9%	4.8%
	scotswood	% within newcastle wards	81.8%	18.2%		100.0%
		% within ethnicity 3-cluster	3.6%	1.2%		2.5%
	south gosforth	% within newcastle wards	23.5%	73.5%	2.9%	100.0%
		% within ethnicity 3-cluster	1.6%	7.5%	1.9%	3.8%
	walker	% within newcastle wards	85.7%	14.3%		100.0%
		% within ethnicity 3-cluster	4.8%	1.2%		3.1%
	walkergate	% within newcastle wards	88.6%	11.4%		100.0%
		% within ethnicity 3-cluster	6.2%	1.2%		3.9%
	west city	% within newcastle wards	32.1%	57.1%	10.7%	100.0%
		% within ethnicity 3-cluster	1.8%	4.8%	5.7%	3.1%
	westerhope	% within newcastle wards	97.6%	2.4%		100.0%
		% within ethnicity 3-cluster	8.2%	.3%		4.7%
	wingrove	% within newcastle wards	16.1%	35.5%	48.4%	100.0%
		% within ethnicity 3-cluster	1.0%	3.3%	28.3%	3.5%
	woolsington	% within newcastle wards	88.9%	11.1%		100.0%
		% within ethnicity 3-cluster	4.8%	.9%		3.0%
Total		% within newcastle wards	56.5%	37.6%	6.0%	100.0%
		% within ethnicity 3-cluster	100.0%	100.0%	100.0%	100.0%

5.6 Qualifications and Newcastle Wards

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.817	.000
	Cramer's V	.578	.000
N of Valid Cases		889	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

There is a strong statistically significant association between qualification classifications and the wards in Newcastle.

The following table shows that some wards are exclusively comprised of high-qualification output areas (Jesmond and South Gosforth), others are exclusively comprised of low qualification areas (Walker), and others are largely comprised of intermediate qualification areas (Westerhope, Lemington)

newcastle wards * qualification 3 cluster Crosstabulation

			qualification 3 cluster			
			highest qualified	intermediate qualification	lowest qualification	Total
newcastle wards	benwell	% within newcastle wards		32.0%	68.0%	100.0%
		% within qualification 3 cluster		3.4%	4.6%	2.8%
	blakelaw	% within newcastle wards	12.5%	22.5%	65.0%	100.0%
		% within qualification 3 cluster	1.8%	3.8%	7.0%	4.5%
	byker	% within newcastle wards	9.1%	6.1%	84.8%	100.0%
		% within qualification 3 cluster	1.1%	.8%	7.6%	3.7%
	castle	% within newcastle wards	53.8%	25.6%	20.5%	100.0%
		% within qualification 3 cluster	7.4%	4.2%	2.2%	4.4%
	dene	% within newcastle wards	61.2%	26.5%	12.2%	100.0%
		% within qualification 3 cluster	10.6%	5.5%	1.6%	5.5%
	denton	% within newcastle wards		44.1%	55.9%	100.0%
		% within qualification 3 cluster		6.4%	5.1%	3.8%
	elswick	% within newcastle wards	3.8%	38.5%	57.7%	100.0%
		% within qualification 3 cluster	.4%	4.2%	4.1%	2.9%
	fawdon	% within newcastle wards	5.7%	37.1%	57.1%	100.0%
		% within qualification 3 cluster	.7%	5.5%	5.4%	3.9%
	fenham	% within newcastle wards	8.1%	45.9%	45.9%	100.0%
		% within qualification 3 cluster	1.1%	7.2%	4.6%	4.2%
	grange	% within newcastle wards	59.5%	26.2%	14.3%	100.0%
		% within qualification 3 cluster	8.8%	4.7%	1.6%	4.7%
	heaton	% within newcastle wards	86.5%	10.8%	2.7%	100.0%
		% within qualification 3 cluster	11.3%	1.7%	.3%	4.2%
	jesmond	% within newcastle wards	100.0%			100.0%
		% within qualification 3 cluster	13.7%			4.4%
	kenton	% within newcastle wards	31.4%	28.6%	40.0%	100.0%
		% within qualification 3 cluster	3.9%	4.2%	3.8%	3.9%
	lemington	% within newcastle wards		58.8%	41.2%	100.0%
		% within qualification 3 cluster		8.5%	3.8%	3.8%
	monkchester	% within newcastle wards		3.4%	96.6%	100.0%
		% within qualification 3 cluster		.4%	7.6%	3.3%
	moorside	% within newcastle wards	47.1%	14.7%	38.2%	100.0%
		% within qualification 3 cluster	5.6%	2.1%	3.5%	3.8%
	newburn	% within newcastle wards		45.2%	54.8%	100.0%
		% within qualification 3 cluster		5.9%	4.6%	3.5%
	sandyford	% within newcastle wards	74.4%	11.6%	14.0%	100.0%
		% within qualification 3 cluster	11.3%	2.1%	1.6%	4.8%
	scotswood	% within newcastle wards		31.8%	68.2%	100.0%
		% within qualification 3 cluster		3.0%	4.1%	2.5%
	south gosforth	% within newcastle wards	100.0%			100.0%
		% within qualification 3 cluster	12.0%			3.8%
	walker	% within newcastle wards			100.0%	100.0%
		% within qualification 3 cluster			7.6%	3.1%
	walkergate	% within newcastle wards		48.6%	51.4%	100.0%
		% within qualification 3 cluster		7.2%	4.9%	3.9%
	west city	% within newcastle wards	32.1%	14.3%	53.6%	100.0%
		% within qualification 3 cluster	3.2%	1.7%	4.1%	3.1%
	westerhope	% within newcastle wards	7.1%	64.3%	28.6%	100.0%
		% within qualification 3 cluster	1.1%	11.4%	3.3%	4.7%
	wingrove	% within newcastle wards	48.4%	32.3%	19.4%	100.0%
		% within qualification 3 cluster	5.3%	4.2%	1.6%	3.5%
	woolsington	% within newcastle wards	11.1%	14.8%	74.1%	100.0%
		% within qualification 3 cluster	1.1%	1.7%	5.4%	3.0%
Total		% within newcastle wards	31.9%	26.5%	41.5%	100.0%
		% within qualification 3 cluster	100.0%	100.0%	100.0%	100.0%

5.7 Tenure and Newcastle Wards

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.775	.000
	Cramer's V	.548	.000
N of Valid Cases		889	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

There is a strong statistically significant association between tenure and ward.

The following table shows that some wards are largely comprised of high numbers of areas dominated by council renting (walker, monkchester, byker, woolsington) whereas others have no areas of largely council housing (Jesmond and South Gosforth), others have high numbers of areas with high ownership (Dene, Denton, South Gosforth), others have high private renting (Heaton, Jesmond) wheras others have none (Walker).

newcastle wards * tenure 3-cluster Crosstabulation

			tenure 3-cluster			
			high council renting	high ownership and mortgages	high rental HA & private	Total
newcastle wards	benwell	% within newcastle wards	28.0%	28.0%	44.0%	100.0%
		% within tenure 3-cluster	2.2%	1.9%	5.4%	2.8%
	blakelaw	% within newcastle wards	52.5%	42.5%	5.0%	100.0%
		% within tenure 3-cluster	6.5%	4.7%	1.0%	4.5%
	byker	% within newcastle wards	78.8%	15.2%	6.1%	100.0%
		% within tenure 3-cluster	8.0%	1.4%	1.0%	3.7%
	castle	% within newcastle wards	15.4%	76.9%	7.7%	100.0%
		% within tenure 3-cluster	1.9%	8.3%	1.5%	4.4%
	dene	% within newcastle wards	12.2%	85.7%	2.0%	100.0%
		% within tenure 3-cluster	1.9%	11.6%	.5%	5.5%
	denton	% within newcastle wards	55.9%	41.2%	2.9%	100.0%
		% within tenure 3-cluster	5.9%	3.9%	.5%	3.8%
	elswick	% within newcastle wards	26.9%	15.4%	57.7%	100.0%
		% within tenure 3-cluster	2.2%	1.1%	7.4%	2.9%
	fawdon	% within newcastle wards	57.1%	34.3%	8.6%	100.0%
		% within tenure 3-cluster	6.2%	3.3%	1.5%	3.9%
	fenham	% within newcastle wards	43.2%	48.6%	8.1%	100.0%
		% within tenure 3-cluster	4.9%	5.0%	1.5%	4.2%
	grange	% within newcastle wards	21.4%	61.9%	16.7%	100.0%
		% within tenure 3-cluster	2.8%	7.2%	3.5%	4.7%
	heaton	% within newcastle wards	2.7%	32.4%	64.9%	100.0%
		% within tenure 3-cluster	.3%	3.3%	11.9%	4.2%
	jesmond	% within newcastle wards		23.1%	76.9%	100.0%
		% within tenure 3-cluster		2.5%	14.9%	4.4%
	kenton	% within newcastle wards	48.6%	45.7%	5.7%	100.0%
		% within tenure 3-cluster	5.2%	4.4%	1.0%	3.9%
	lemington	% within newcastle wards	29.4%	64.7%	5.9%	100.0%
		% within tenure 3-cluster	3.1%	6.1%	1.0%	3.8%
	monkchester	% within newcastle wards	82.8%	3.4%	13.8%	100.0%
		% within tenure 3-cluster	7.4%	.3%	2.0%	3.3%
	moorside	% within newcastle wards	32.4%		67.6%	100.0%
		% within tenure 3-cluster	3.4%		11.4%	3.8%
	newburn	% within newcastle wards	51.6%	38.7%	9.7%	100.0%
		% within tenure 3-cluster	4.9%	3.3%	1.5%	3.5%
	sandyford	% within newcastle wards	30.2%	9.3%	60.5%	100.0%
		% within tenure 3-cluster	4.0%	1.1%	12.9%	4.8%
	scotswood	% within newcastle wards	45.5%	36.4%	18.2%	100.0%
		% within tenure 3-cluster	3.1%	2.2%	2.0%	2.5%
	south gosforth	% within newcastle wards		82.4%	17.6%	100.0%
		% within tenure 3-cluster		7.7%	3.0%	3.8%
	walker	% within newcastle wards	92.9%	7.1%		100.0%
		% within tenure 3-cluster	8.0%	.6%		3.1%
	walkergate	% within newcastle wards	34.3%	54.3%	11.4%	100.0%
		% within tenure 3-cluster	3.7%	5.2%	2.0%	3.9%
	west city	% within newcastle wards	67.9%		32.1%	100.0%
		% within tenure 3-cluster	5.9%		4.5%	3.1%
	westerhope	% within newcastle wards	14.3%	83.3%	2.4%	100.0%
		% within tenure 3-cluster	1.9%	9.6%	.5%	4.7%
	wingrove	% within newcastle wards	12.9%	41.9%	45.2%	100.0%
		% within tenure 3-cluster	1.2%	3.6%	6.9%	3.5%
	woolsington	% within newcastle wards	66.7%	25.9%	7.4%	100.0%
		% within tenure 3-cluster	5.6%	1.9%	1.0%	3.0%
Total		% within newcastle wards	36.4%	40.8%	22.7%	100.0%
		% within tenure 3-cluster	100.0%	100.0%	100.0%	100.0%

5.8 Work Status and Newcastle Wards

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.780	.000
	Cramer's V	.552	.000
N of Valid Cases		889	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

This shows a strong statistically significant association between Work Status at output area level and Ward level. Some wards are exclusively made up of higher managers and professionals (South Gosforth and Jesmond), some are dominated by middle professions of secretarial and skilled trades (such as Westerhope and Denton), others are dominated by elementary and process workers (walker, monkchester, byker, benwell).

newcastle wards * recoded work status Crosstabulation

			recoded work status			
			most managers and professionals	middle	most elementary and process	Total
newcastle wards	benwell	% within newcastle wards		32.0%	68.0%	100.0%
		% within recoded work status		2.7%	5.1%	2.8%
	blakelaw	% within newcastle wards	2.5%	32.5%	65.0%	100.0%
		% within recoded work status	.4%	4.3%	7.8%	4.5%
	byker	% within newcastle wards	9.1%	18.2%	72.7%	100.0%
		% within recoded work status	1.2%	2.0%	7.2%	3.7%
	castle	% within newcastle wards	41.0%	41.0%	17.9%	100.0%
		% within recoded work status	6.3%	5.3%	2.1%	4.4%
	dene	% within newcastle wards	55.1%	30.6%	14.3%	100.0%
		% within recoded work status	10.6%	5.0%	2.1%	5.5%
	denton	% within newcastle wards		61.8%	38.2%	100.0%
		% within recoded work status		7.0%	3.9%	3.8%
	elswick	% within newcastle wards	11.5%	34.6%	53.8%	100.0%
		% within recoded work status	1.2%	3.0%	4.2%	2.9%
	fawdon	% within newcastle wards		54.3%	45.7%	100.0%
		% within recoded work status		6.3%	4.8%	3.9%
	fenham	% within newcastle wards	2.7%	59.5%	37.8%	100.0%
		% within recoded work status	.4%	7.3%	4.2%	4.2%
	grange	% within newcastle wards	59.5%	26.2%	14.3%	100.0%
		% within recoded work status	9.8%	3.7%	1.8%	4.7%
	heaton	% within newcastle wards	70.3%	29.7%		100.0%
		% within recoded work status	10.2%	3.7%		4.2%
	jesmond	% within newcastle wards	100.0%			100.0%
		% within recoded work status	15.4%			4.4%
	kenton	% within newcastle wards	31.4%	25.7%	42.9%	100.0%
		% within recoded work status	4.3%	3.0%	4.5%	3.9%
	lemington	% within newcastle wards		52.9%	47.1%	100.0%
		% within recoded work status		6.0%	4.8%	3.8%
	monkchester	% within newcastle wards		10.3%	89.7%	100.0%
		% within recoded work status		1.0%	7.8%	3.3%
	moorside	% within newcastle wards	35.3%	29.4%	35.3%	100.0%
		% within recoded work status	4.7%	3.3%	3.6%	3.8%
	newburn	% within newcastle wards	6.5%	48.4%	45.2%	100.0%
		% within recoded work status	.8%	5.0%	4.2%	3.5%
	sandyford	% within newcastle wards	51.2%	39.5%	9.3%	100.0%
		% within recoded work status	8.7%	5.6%	1.2%	4.8%
	scotswood	% within newcastle wards	4.5%	40.9%	54.5%	100.0%
		% within recoded work status	.4%	3.0%	3.6%	2.5%
	south gosforth	% within newcastle wards	100.0%			100.0%
		% within recoded work status	13.4%			3.8%
	walker	% within newcastle wards		7.1%	92.9%	100.0%
		% within recoded work status		.7%	7.8%	3.1%
	walkergate	% within newcastle wards		57.1%	42.9%	100.0%
		% within recoded work status		6.6%	4.5%	3.9%
	west city	% within newcastle wards	35.7%	10.7%	53.6%	100.0%
		% within recoded work status	3.9%	1.0%	4.5%	3.1%
	westerhope	% within newcastle wards	19.0%	61.9%	19.0%	100.0%
		% within recoded work status	3.1%	8.6%	2.4%	4.7%
	wingrove	% within newcastle wards	32.3%	45.2%	22.6%	100.0%
		% within recoded work status	3.9%	4.7%	2.1%	3.5%
	woolsington	% within newcastle wards	11.1%	14.8%	74.1%	100.0%
		% within recoded work status	1.2%	1.3%	6.0%	3.0%
Total		% within newcastle wards	28.6%	33.9%	37.6%	100.0%
		% within recoded work status	100.0%	100.0%	100.0%	100.0%

5.9 Marital Status and Newcastle Ward

This shows a strong statistically significant association between marital status and ward.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.744	.000
	Cramer's V	.526	.000
N of Valid Cases		889	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

The following table shows that some areas are dominated by mostly married areas (Castle), others by mixed areas (Blakelaw, Denton, Fenham) and others by mostly unmarried (Sandyford, Heaton, Jesmond, Moorside, West City, Byker).

newcastle wards * Couple Status 3-cluster Crosstabulation

			Couple Status 3-cluster			
			mostly married	mostly unmarried	mixed&intermediate	Total
newcastle wards	benwell	% within newcastle wards	20.0%	52.0%	28.0%	100.0%
		% within Couple Status 3-cluster	2.5%	3.4%	2.3%	2.8%
	blakelaw	% within newcastle wards	17.5%	17.5%	65.0%	100.0%
		% within Couple Status 3-cluster	3.4%	1.9%	8.4%	4.5%
	byker	% within newcastle wards		78.8%	21.2%	100.0%
		% within Couple Status 3-cluster		6.9%	2.3%	3.7%
	castle	% within newcastle wards	66.7%	2.6%	30.8%	100.0%
		% within Couple Status 3-cluster	12.7%	.3%	3.9%	4.4%
	dene	% within newcastle wards	51.0%	10.2%	38.8%	100.0%
		% within Couple Status 3-cluster	12.3%	1.3%	6.2%	5.5%
	denton	% within newcastle wards	29.4%	8.8%	61.8%	100.0%
		% within Couple Status 3-cluster	4.9%	.8%	6.8%	3.8%
	elswick	% within newcastle wards		65.4%	34.6%	100.0%
		% within Couple Status 3-cluster		4.5%	2.9%	2.9%
	fawdon	% within newcastle wards	8.6%	40.0%	51.4%	100.0%
		% within Couple Status 3-cluster	1.5%	3.7%	5.8%	3.9%
	fenham	% within newcastle wards	8.1%	21.6%	70.3%	100.0%
		% within Couple Status 3-cluster	1.5%	2.1%	8.4%	4.2%
	grange	% within newcastle wards	33.3%	23.8%	42.9%	100.0%
		% within Couple Status 3-cluster	6.9%	2.7%	5.8%	4.7%
	heaton	% within newcastle wards	10.8%	81.1%	8.1%	100.0%
		% within Couple Status 3-cluster	2.0%	8.0%	1.0%	4.2%
	jesmond	% within newcastle wards	10.3%	79.5%	10.3%	100.0%
		% within Couple Status 3-cluster	2.0%	8.2%	1.3%	4.4%
	kenton	% within newcastle wards	34.3%	34.3%	31.4%	100.0%
		% within Couple Status 3-cluster	5.9%	3.2%	3.6%	3.9%
	lemington	% within newcastle wards	23.5%	5.9%	70.6%	100.0%
		% within Couple Status 3-cluster	3.9%	.5%	7.8%	3.8%
	monkchester	% within newcastle wards		69.0%	31.0%	100.0%
		% within Couple Status 3-cluster		5.3%	2.9%	3.3%
	moorside	% within newcastle wards		91.2%	8.8%	100.0%
		% within Couple Status 3-cluster		8.2%	1.0%	3.8%
	newburn	% within newcastle wards	29.0%	19.4%	51.6%	100.0%
		% within Couple Status 3-cluster	4.4%	1.6%	5.2%	3.5%
	sandyford	% within newcastle wards		100.0%		100.0%
		% within Couple Status 3-cluster		11.4%		4.8%
	scotswood	% within newcastle wards	9.1%	54.5%	36.4%	100.0%
		% within Couple Status 3-cluster	1.0%	3.2%	2.6%	2.5%
	south gosforth	% within newcastle wards	32.4%	35.3%	32.4%	100.0%
		% within Couple Status 3-cluster	5.4%	3.2%	3.6%	3.8%
	walker	% within newcastle wards	7.1%	64.3%	28.6%	100.0%
		% within Couple Status 3-cluster	1.0%	4.8%	2.6%	3.1%
	walkergate	% within newcastle wards	48.6%	17.1%	34.3%	100.0%
		% within Couple Status 3-cluster	8.3%	1.6%	3.9%	3.9%
	west city	% within newcastle wards		96.4%	3.6%	100.0%
		% within Couple Status 3-cluster		7.2%	.3%	3.1%
	westerhope	% within newcastle wards	76.2%		23.8%	100.0%
		% within Couple Status 3-cluster	15.7%		3.2%	4.7%
	wingrove	% within newcastle wards	9.7%	51.6%	38.7%	100.0%
		% within Couple Status 3-cluster	1.5%	4.2%	3.9%	3.5%
	woolsington	% within newcastle wards	25.9%	25.9%	48.1%	100.0%
		% within Couple Status 3-cluster	3.4%	1.9%	4.2%	3.0%
Total		% within newcastle wards	22.9%	42.4%	34.6%	100.0%
		% within Couple Status 3-cluster	100.0%	100.0%	100.0%	100.0%

5.10 Female Economic Activity & Newcastle Wards

newcastle wards * female economic activity 4-cluster Crosstabulation

% within newcastle wards

		female economic activity 4-cluster				
		higher female unemp	higher female retired	higher female student	higher female woking	Total
newcastle wards	benwell	48.0%	20.0%		32.0%	100.0%
	blakelaw	35.0%	22.5%		42.5%	100.0%
	byker	51.5%	21.2%	3.0%	24.2%	100.0%
	castle	10.3%	28.2%		61.5%	100.0%
	dene	10.2%	16.3%	6.1%	67.3%	100.0%
	denton	26.5%	52.9%		20.6%	100.0%
	elswick	88.5%	11.5%			100.0%
	fawdon	42.9%	37.1%		20.0%	100.0%
	fenham	37.8%	35.1%	2.7%	24.3%	100.0%
	grange	7.1%	35.7%		57.1%	100.0%
	heaton		5.4%	59.5%	35.1%	100.0%
	jesmond		10.3%	53.8%	35.9%	100.0%
	kenton	31.4%	28.6%		40.0%	100.0%
	lemington	32.4%	17.6%		50.0%	100.0%
	monkchester	82.8%	10.3%		6.9%	100.0%
	moorside	38.2%	17.6%	32.4%	11.8%	100.0%
	newburn	25.8%	41.9%		32.3%	100.0%
	sandyford	7.0%	14.0%	60.5%	18.6%	100.0%
	scotswood	59.1%	4.5%		36.4%	100.0%
	south gosforth		11.8%	2.9%	85.3%	100.0%
	walker	78.6%	17.9%		3.6%	100.0%
	walkergate	28.6%	31.4%		40.0%	100.0%
	west city	60.7%	7.1%	25.0%	7.1%	100.0%
	westerhope	2.4%	54.8%		42.9%	100.0%
	wingrove	38.7%	3.2%	22.6%	35.5%	100.0%
	woolsington	37.0%	44.4%		18.5%	100.0%
Total		30.5%	23.7%	11.2%	34.5%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.873	.000
	Cramer's V	.504	.000
N of Valid Cases		889	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

There is a strong association between female economic activity and the wards.

5.11 Male Economic Activity by Newcastle Wards

newcastle wards * male economic activity 4-cluster Crosstabulation

% within newcastle wards

		male economic activity 4-cluster				
		higher male working	higher male student	higher male retired	higher male unemply/sick	Total
newcastle wards	benwell	28.0%		16.0%	56.0%	100.0%
	blakelaw	32.5%		27.5%	40.0%	100.0%
	byker	12.1%	3.0%	9.1%	75.8%	100.0%
	castle	51.3%		38.5%	10.3%	100.0%
	dene	49.0%	4.1%	44.9%	2.0%	100.0%
	denton	20.6%		47.1%	32.4%	100.0%
	elswick	3.8%	11.5%	11.5%	73.1%	100.0%
	fawdon	14.3%		40.0%	45.7%	100.0%
	fenham	18.9%	2.7%	40.5%	37.8%	100.0%
	grange	31.0%		57.1%	11.9%	100.0%
	heaton	16.2%	54.1%	27.0%	2.7%	100.0%
	jesmond	2.6%	69.2%	25.6%	2.6%	100.0%
	kenton	11.4%		42.9%	45.7%	100.0%
	lemington	50.0%		26.5%	23.5%	100.0%
	monkchester	6.9%		3.4%	89.7%	100.0%
	moorside	2.9%	41.2%		55.9%	100.0%
	newburn	19.4%		48.4%	32.3%	100.0%
	sandyford	11.6%	53.5%	4.7%	30.2%	100.0%
	scotswood	22.7%		13.6%	63.6%	100.0%
	south gosforth	52.9%	2.9%	44.1%		100.0%
	walker	3.6%		3.6%	92.9%	100.0%
	walkergate	37.1%		34.3%	28.6%	100.0%
	west city		17.9%	10.7%	71.4%	100.0%
	westerhope	28.6%		71.4%		100.0%
	wingrove	12.9%	29.0%	41.9%	16.1%	100.0%
	woolsington	7.4%		40.7%	51.9%	100.0%
Total		22.3%	11.9%	31.2%	34.6%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.902	.000
	Cramer's V	.521	.000
N of Valid Cases		889	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

The economic activity of males is strongly associated and statistically significant between output areas level and the wards.

5.12 Multi-Level Association between Output Area Level and Council Level

In this project the multi-level associations between the low-level out put areas abd the high-level local government areas have been investigated. The detailed analysis is to be found in Appendix 2. However the associations between the these levels are found to be weak associations (in comparison with ward output areas). Nevertheless the detailed output gives a informative overview of the region.

6 APPROXIMATION THROUGH LOGLINEAR MODELLING

Loglinear (saturated) modelling will be useful to plot the membership of cases in the multi-dimensional space represented by the categorical cluster variables created above. By approximating the saturated model it will be possible to approximate the dominant spatial types found in the region, and provide a simplified multi-dimensional categorisation of actual output areas in the region, which will be of use in conceptualising the region at high-resolution.

6.1 A 5-Dimensional Approximation of the Output Areas in the North-East Region

The approach can be piloted and illustrated through the use of 5 cluster variables, to give a five dimensional space. In this illustration the following variables are used.

C4ECACT 4 Economic Activity 4-cluster

1 high student low work
2 highest working
3 high-retired and working
4 higher unemployment sick and at home

C3MARCOH 3 Couple Status 3-cluster

1 mostly married
2 mostly unmarried
3 mixed&intermediate

AREAAGE4 4 area age 4 cluster

1 young adults lowest children mixed
2 most 30-44 and most children mixed
3 most 44-59 mixed
4 most over 59 mixed

EDQUAL3 3 qualification 3 cluster

1 highest qualified
2 intermediate qualification
3 lowest qualification

TENURE3 3 tenure 3-cluster

1 high council renting
2 high ownership and mortgages
3 high rental HA & private

The saturated loglinear model above contains 4x3x4x3x3= 432 possible states, and requires 1600 terms to represent every possible interaction; the output alone runs to around 30 pages, so ways to simplify and approximate the reality would aid communication, utility and understanding.

In practice many of the possible states are empty and interactions are zero. This simplifies because the reality is relatively simple. One further way is to ignore all cells with case membership below a certain minimum. For instance if the minimum is taken to be 1% membership then (as there were 8599 cases) the cut off for inclusion is taken to be 86 cases in a cell: if the cell members number less then that state is approximated by zero (disregarded) and if the cell members number greater or equal to 86 then that term is retained. Note that this sort of procedure could be easily automated. Furthermore it is possible to see how many cases have been neglected (by adding up those included) and this gives one measure of approximation to the saturated model. Following this procedure the Region can be approximated by a greatly reduced number of 'occupied states'. These prevalent types of areas are significantly reduced in number, can then be represented on one page, and are found to be:

a) Areas with mostly Students, mostly unmarried, mostly young adults (16-29) without children, higher qualified, mostly private rented or housing associations (100 cases).
b) Highest working, mostly married,
    - most 30-44 and most children,
        - highest qualified, and higher ownership (320)
        - intermediate qualified and higher ownership (500)
    - most 45-59 mixed
        - highest qualified, and higher ownership (230)
        - intermediate qualified and higher ownership (500)
c) Mixed intermediate working, mostly married
    - most 30-44 and most children,
        - intermediate qualified and higher ownership (420)
    - most 45-59 mixed
        - intermediate qualified and higher ownership (240)
d) high-retired and working, mostly married
    - most 45-59 mixed
        - highest qualified, and higher ownership (320)
        - intermediate qualified and higher ownership (440)
        - lowest qualified, and higher ownership (100)
    - over 59 mixed, mostly married
        - highest qualified, and higher ownership (120)
        - intermediate qualified and higher ownership (250)

e) high-retired and working, mixed married and unmarried
    - most 45-59 mixed
        - intermediate qualified and higher ownership (120)
        - lowest qualified, and council renting (250)
        - lowest qualified, and higher ownership (120)
    - over 59 mixed,
        - lowest qualified and council renting (240)

f) higher unemployment sick and stay at home, mostly unmarried
    - most 30-44 and most children,
        - lowest qualified, and council renting (380)
        - lowest qualified and higher private rental (130)
    - most 45-59 mixed
        - lowest qualified, and council renting (200)
    - over 59 mixed,
        - lowest qualified, and higher council renting (100)

g) higher unemployment sick and stay at home, mixed married and unmarried
    - most 30-44 and most children,
        - lowest qualified, and council renting (430)
    - most 45-59 mixed
        - lowest qualified, and council renting (510)
        - lowest qualified, private rental (90)
    - over 59 mixed,
        - lowest qualified, and higher council renting (110)

This approach has reduced the original model to 24 dominant states from 432 possible states. Showing that the approximation is a significant simplification. However the number of states can be reduced further. Note that in groups (b) (c) and (d) of the above approximation common factors can be taken out: all have in common (i) higher ownership and (ii) mostly married. So these factors can be factored out. This decoupling is a consequence of the approximation. Group (e) stands alone. Groups (f) and (g) also have common factors of (i) higher unemployment, sick, and stay at home, and (ii) lowest qualified. These common factors can be factored out, reducing the number of types further.

Here the clustering and loglinear approach a has greatly reduced the complexity of the 2001 Census data; it has reduced 8900 cases each with around 120 associated metric variables, to under 20 distinct types with only 5 associated categorical variables. By summing the numbers of cases included in this approximation we arrive at another indicator of the degree of accuracy of the approximation. It is found that the above approximation includes 6180 of all cases (or 6180/8600=) 70% of the total number of cases. Therefore 30% of cases are not accurately represented in this approximation.

6.2 A 3-Dimensional Approximation of the Output Areas in Newcastle

The aim of this section is create to an approximation to Newcastle (reproduce the diversity) in a simplified reduced model. This will be illustrated with a three variable approach, using: ward, economic activity and tenure. The variables have been specifically chosen to approximate the more complex situation for the following reasons. Firstly the previous analysis has shown that the wards strongly associate with many of the cluster variables at the output level, so the ward variable is a significant 'proxy' variable for many others. Secondly the economic activity and tenure variables have been shown to be strongly or moderately associated with other variables (such as age, qualifications, work status). Thirdly, tenure reflects something real and relatively permanent about a spatial area (whereas people - and their attributes - may come and go from an output area). Fourthly, they represent a simple multi-level model (the ward name is high level variable, the other two are low-level). These variables have the following values:

NEWWARD 26 Newcastle wards

1 benwell,	2 blakelaw
3 byker,	4 castle
5 dene,	6 denton
7 elswick,	8 fawdon
9 fenham,	10 grange
11 heaton,	12 jesmond
13 kenton,	14 lemington
15 monkchester,	16 moorside
17 newburn,	18 sandyford
19 scotswood,	20 south gosforth
21 walker,	22 walkergate
23 west city,	24 westerhope
25 wingrove,	26 woolsington

C4ECACT 4 Economic Activity 4-cluster

1 high student low work
2 highest working
3 high-retired and working
4 higher unemployment sick and at home

TENURE3 3 tenure 3-cluster

1 high council renting
2 high ownership and mortgages
3 high rental HA & private

The loglinear analysis is given in the appendix 3.1. By examining this data the an an accurate model can be formed by neglecting all zero terms, and an approximate model can be formed, by neglecting states with relatively few cases (e.g. those with only one member[1] for instance. In this way Benwell might be approximated by the following distribution of cases:

NEWWARD = benwell

C4ECACT highest working		
TENURE3 high ownership	6	output areas
C4ECACT high-retired and working		
TENURE3 high rental HA & pri	2	output areas
C4ECACT higher unemployment		
TENURE3 high council renting	6	output areas
TENURE3 high rental HA & private	8	output areas

Benwell is then modelled in terms of its constituent spatial areas: as an spatial area with around a third being high ownership and working, roughly two thirds of the area being largely unemployed (dividing between private and council rental); and a small area of mixed retired and working in private rental.

This could be developed further for other wards, in the following table only states with 2 or more members has been kept (those with only one or zero cases have been neglected). This gives an approximation to Newcastle (other approximations – neglecting 2-case membership etc are possible).

[1] Some caution might be noted here – small numbers do not mean negligible dynamical effects (see complexity theory) but as a spatial snapshot the approximated profile may be useful.

Table of an Approximate Model of Newcastle and its Wards

NEWWARD benwell C4ECACT highest working TENURE3 high ownership 6 C4ECACT high-retired and working TENURE3 high rental HA & pri 2 C4ECACT higher unemployment TENURE3 high council renting 6 TENURE3 high rental HA & private 8	NEWWARD blakelaw C4ECACT highest working TENURE3 high ownership and m 15 TENURE3 high council renting 5 TENURE3 high ownership and m 2 TENURE3 high rental HA & pri 2 C4ECACT higher unemployment TENURE3 high council renting 16
NEWWARD byker C4ECACT highest working TENURE3 high ownership and m 5 C4ECACT high-retired and wor TENURE3 high council renting 3 C4ECACT higher unemployment TENURE3 high council renting 21 TENURE3 high rental HA & pri 2	NEWWARD castle C4ECACT highest working TENURE3 high ownership and m 21 TENURE3 high rental HA & pri 2 C4ECACT high-retired and working TENURE3 high council renting 2 TENURE3 high ownership and m 9 C4ECACT higher unemployment TENURE3 high council renting 4
NEWWARD dene C4ECACT high student low wor TENURE3 high ownership and m 2 C4ECACT highest working TENURE3 high ownership and m 33 C4ECACT high-retired and wor TENURE3 high council renting 2 TENURE3 high ownership and m 7 C4ECACT higher unemployment TENURE3 high council renting 4	NEWWARD denton C4ECACT highest working TENURE3 high ownership and m 6 C4ECACT high-retired and wor TENURE3 high council renting 7 TENURE3 high ownership and m 8 C4ECACT higher unemployment TENURE3 high council renting 11
NEWWARD elswick C4ECACT highest working TENURE3 high ownership and m 2 C4ECACT high-retired and wor TENURE3 high council renting 2 C4ECACT higher unemployment TENURE3 high council renting 5 TENURE3 high rental HA & pri 14	NEWWARD fawdon C4ECACT highest working TENURE3 high ownership and m 4 C4ECACT high-retired and wor TENURE3 high council renting 3 TENURE3 high ownership and m 7 TENURE3 high rental HA & pri 2 C4ECACT higher unemployment TENURE3 high council renting 16
NEWWARD fenham C4ECACT highest working TENURE3 high ownership and m 8 C4ECACT high-retired and wor TENURE3 high council renting 3 TENURE3 high ownership and m 6 TENURE3 high rental HA & pri 3 C4ECACT higher unemployment TENURE3 high council renting 11 TENURE3 high ownership and m 4	NEWWARD grange C4ECACT highest working TENURE3 high ownership and m 15 TENURE3 high rental HA & pri 3 C4ECACT high-retired and wor TENURE3 high council renting 3 TENURE3 high ownership and m 10 TENURE3 high rental HA & pri 3 C4ECACT higher unemployment TENURE3 high council renting 5
NEWWARD heaton C4ECACT high student low wor TENURE3 high rental HA & pri 18 C4ECACT highest working TENURE3 high ownership and m 8 TENURE3 high rental HA & pri 6 C4ECACT high-retired and wor TENURE3 high ownership and m 3	NEWWARD jesmond C4ECACT high student low wor TENURE3 high rental HA & pri 21 C4ECACT highest working TENURE3 high ownership and m 4 TENURE3 high rental HA & pri 7 C4ECACT high-retired and wor TENURE3 high ownership and m 4)

NEWWARD kenton C4ECACT highest working TENURE3 high council renting 2 TENURE3 high ownership and m 9 C4ECACT high-retired and wor TENURE3 high council renting 4 TENURE3 high ownership and m 7 C4ECACT higher unemployment TENURE3 high council renting 11	NEWWARD lemington C4ECACT highest working TENURE3 high ownership and m 17 C4ECACT high-retired and wor TENURE3 high council renting 3 TENURE3 high ownership and m 5 C4ECACT higher unemployment TENURE3 high council renting 7 TENURE3 high rental HA & pri 2
NEWWARD monkchester C4ECACT higher unemployment TENURE3 high council renting 23 TENURE3 high rental HA & pri 3	NEWWARD moorside C4ECACT high student low wor TENURE3 high rental HA & pri 11 C4ECACT high-retired and wor TENURE3 high council renting 2 C4ECACT higher unemployment TENURE3 high council renting 8 TENURE3 high rental HA & pri 11
NEWWARD newburn C4ECACT highest working TENURE3 high council renting 3 TENURE3 high ownership and m 5 C4ECACT high-retired and wor TENURE3 high council renting 5 TENURE3 high ownership and m 7 TENURE3 high rental HA & pri 2 TENURE3 high council renting 8	NEWWARD sandyford C4ECACT high student low wor TENURE3 high council renting 2 TENURE3 high ownership and m 2 TENURE3 high rental HA & pri 23 C4ECACT highest working TENURE3 high ownership and m 2 TENURE3 high rental HA & pri 3 C4ECACT high-retired and wor TENURE3 high council renting 3 C4ECACT higher unemployment TENURE3 high council renting 8
NEWWARD scotswood C4ECACT highest working TENURE3 high ownership and m 6 C4ECACT high-retired and wor TENURE3 high ownership and m 2 C4ECACT higher unemployment TENURE3 high council renting 10 TENURE3 high rental HA & pri 3	NEWWARD south gosforth C4ECACT highest working TENURE3 high ownership and m 21 TENURE3 high rental HA & pri 5 C4ECACT high-retired and wor TENURE3 high ownership and m 7
NEWWARD walker C4ECACT high-retired and wor TENURE3 high council renting 2 C4ECACT higher unemployment TENURE3 high council renting 24	NEWWARD walkergate C4ECACT highest working TENURE3 high council renting 2 TENURE3 high ownership and m 10 C4ECACT high-retired and wor TENURE3 high ownership and m 9 TENURE3 high rental HA & pri 2 C4ECACT higher unemployment TENURE3 high council renting 9
NEWWARD west city C4ECACT high student low wor TENURE3 high council renting 3 TENURE3 high rental HA & pri 3 C4ECACT highest working TENURE3 high rental HA & pri 2 C4ECACT higher unemployment TENURE3 high council renting 16 TENURE3 high rental HA & pri 4	NEWWARD westerhope C4ECACT highest working TENURE3 high ownership and m 15 C4ECACT high-retired and wor TENURE3 high council renting 6 TENURE3 high ownership and m 20
NEWWARD wingrove C4ECACT high student low wor TENURE3 high rental HA & pri 6 C4ECACT highest working TENURE3 high ownership and m 5 TENURE3 high rental HA & pri 3 C4ECACT high-retired and wor TENURE3 high ownership and m 5 C4ECACT higher unemployment TENURE3 high council renting 4 TENURE3 high ownership and m 2 TENURE3 high rental HA & pri 4	NEWWARD woolsington C4ECACT highest working TENURE3 high rental HA & pri 2 C4ECACT high-retired and wor TENURE3 high council renting 6 TENURE3 high ownership and m 6 C4ECACT higher unemployment TENURE3 high council renting 11

PART C: SUMMARY AND DISCUSSION

7 SUMMARY

7.1 Methodological Findings

The clustering approach has greatly reduced the complexity of the 2001 Census data; it has reduced 8900 cases each with around 120 associated metric variables, to 11 categorical variables. Further approximation reduces the cases to under 20 types in 5 categorical variables. In addition this has a further advantage that no available information has been thrown away (from those metric variables used) or dismissed (as in arbitrary choice of specific indicators). One consequence of the approach is that the process is that it creates a categorical multi-dimensional space, with assignments of cases to particular cells or states within this space. In many instances the sets of metric variables have clustered into quasi-ordinal variables, which are easy to interpret. The clustering also aids conceptualisation as many of the possible cells or states are empty; the cases do not distribute themselves evenly nor randomly, but aggregate into a reduced number of actual states which are less intricate than the available possibilities. This reduced number of actual states can serve as an useful approximation of the region.

Through use of loglinear techniques this situation can be accurately represented, and by further approximation can lead to even simpler models of the situation. Loglinear approaches could be developed more systematically to model interactions, changes, and associations across time or across spatial levels.

Clustering techniques (through the ANOVA tests and F-factors) can also help identify the variables that most (and least) differentiate areas, it therefore can help decide which variables are perhaps of most interest, and can be a technique to reduce information needed (in terms of the variables that are monitored). These variables are ones that vary most at local levels and therefore may have local explanations. Analysis at this local level can also concentrate on the connections between these variables and not others. By definition these variables will also be the ones that illustrate the most diversity (or inequality) within the region under study, and they are *differentiating* variables:

Table: Metric variables which most distinguish Output Areas

Variables	Largest F-Factors Noted
Tenure: % Council Renting	18-27,000
Ethnicity: % White British	18,000
Qualification: % No qualifications	17,000
Marital status: % Married or Cohabiting	14-18,000
Qualification: % Highest qualifications	14,000
Health: Any % Health Variable	11-14,000
Work status: % elementary workers	7-10,000
Age: % over 59	8800
Work status: % professional	6-8,000
Tenure: % Owner occupation	6-7,000
Age: % 16-29	6, 500
Work Status: % inactive student	6,000

This supports the idea that tenure is an important variable (in terms of degree of council renting), qualifications are important, as are marital status, health, age and work status of areas. It may be interesting to see if this subset of metric variables gives rise to new clusters. This might suggest that an approximate model of the region is possible on only 5 or 6 of the variables noted above.

7.1 Clusters Created

The 120 metric variables have been reduced to 11 categorical variables. The details on these clusters are given below and these have been partly validated on the Newcastle area.

Original Census Variable Set	**Original Number of variables in the Census Data set**	**Derived Cluster Variables, Interpretation and membership (number of cases - total = 8599 cases)**
Age	16 normalised (%) variables combined into 5 collected variables	1= Most 16-29 and lowest children (185) 2= Most 30-44 and most under 16s (3040) 3= Most 44-59 mixed (4034) 4= Most over 59 mixed (1340)
Economic Activity	14 normalised (%) variables	1= High-student (158) 2= Higher working (3107) 3= Higher retired & mixed (2772) 4= Higher unemployment sick and at home (2562)
Ethnicity	14 normalised (%) variables	1= High white British 2= Mixed ethnicity 3= Highest ethnicity
Health	3 variables	1= most healthy (3100) 2= middle health (4057) 3= least healthy (1442)
Couple Status	8 normalised (%) variables combined to 5 normalised	1= Mostly married (3278) 2= Mostly unmarried (1496) 3= Mixed (3824)
Work Status	9 (%) normalised variables	1= more managers/professionals 2= middle 3 = more elementary/process workers
Educational Qualifications	6 (%) normalised variables	1= Higher qualified (1535) 2= Intermediate qualified (3397) 3= Lower qualified (3667)
Tenure	7 normalised (%) variables	1= Higher Council Renting (2759) 2= Higher ownership & mortgage (4586) 3= Higher HA & private renting (1254)
Household Composition	15 normalised (%) variables	1= higher pensioner 2= higher married 3= higher lone parent, single, cohabiting
Female Economic Activity	14 variables	High-student Higher working Higher retired & mixed Higher unemployment sick and at home
Male Economic Activity	14 variables	High-student Higher working Higher retired & mixed Higher unemployment sick and at home
Summary Numbers	120 normalised variables	Reduced to 11 categorical variables (with 36 values in total)

The clustering variables and relative frequencies of case membership are given below:

area age 4 cluster

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	young adults lowest children mixed	185	2.2	2.2	2.2
	most 30-44 and most children mixed	3040	35.4	35.4	37.5
	most 44-59 mixed	4034	46.9	46.9	84.4
	most over 59 mixed	1340	15.6	15.6	100.0
	Total	8599	100.0	100.0	

Couple Status 3-cluster

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	mostly married	3278	38.1	38.1	38.1
	mostly unmarried	1497	17.4	17.4	55.5
	mixed&intermediate	3824	44.5	44.5	100.0
	Total	8599	100.0	100.0	

Economic Activity 4-cluster

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	high student low work	158	1.8	1.8	1.8
	highest working	3107	36.1	36.1	38.0
	high-retired and working	2772	32.2	32.2	70.2
	higher unemployment sick and at home	2562	29.8	29.8	100.0
	Total	8599	100.0	100.0	

This economic activity cluster variable is mapped for Newcastle in the Appendix

qualification 3 cluster

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	highest qualified	1535	17.9	17.9	17.9
	intermediate qualification	3397	39.5	39.5	57.4
	lowest qualification	3667	42.6	42.6	100.0
	Total	8599	100.0	100.0	

ethnicity 3-cluster

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	highly white british	7721	89.8	89.8	89.8
	mixed ethnicity	774	9.0	9.0	98.8
	highest ethnicity	104	1.2	1.2	100.0
	Total	8599	100.0	100.0	

household composition 3-cluster

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	higher pensioner mixed	2262	26.3	26.3	26.3
	higher married	3770	43.8	43.8	70.1
	higher lone parent, single, cohab	2567	29.9	29.9	100.0
	Total	8599	100.0	100.0	

recoded work status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	most managers and professionals	1581	18.4	18.4	18.4
	middle	3374	39.2	39.2	57.6
	most elementary and process	3644	42.4	42.4	100.0
	Total	8599	100.0	100.0	

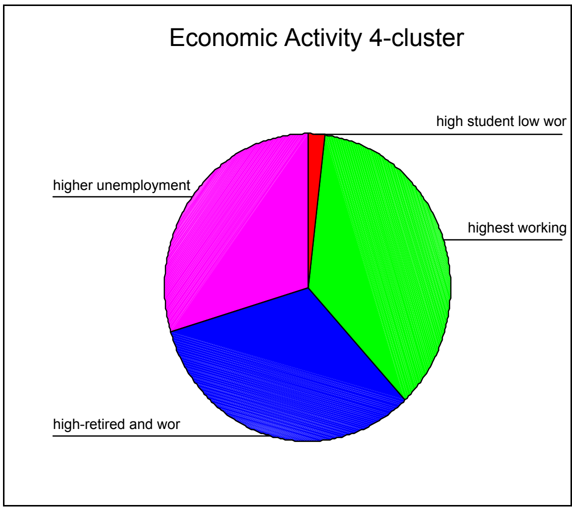
tenure 3-cluster

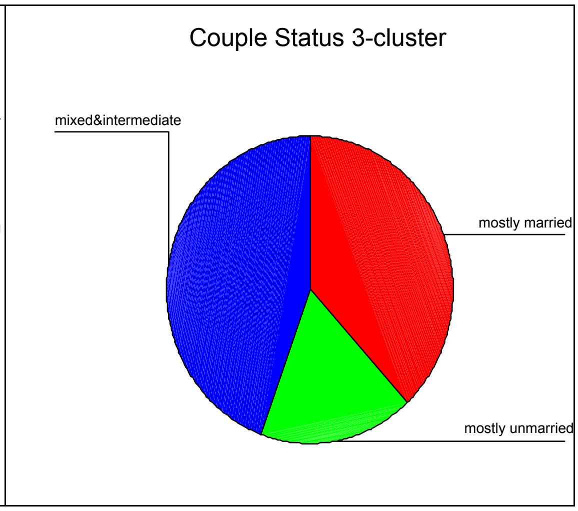
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	high council renting	2759	32.1	32.1	32.1
	high ownership and mortgages	4586	53.3	53.3	85.4
	high rental HA & private	1254	14.6	14.6	100.0
	Total	8599	100.0	100.0	

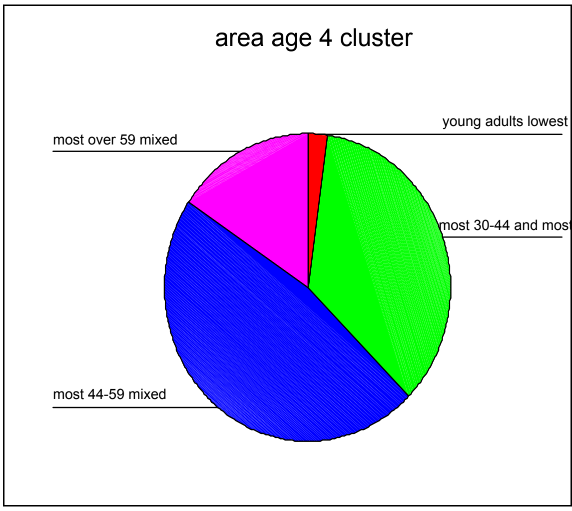
The tenure cluster variable is mapped for Newcastle in the Appendix.

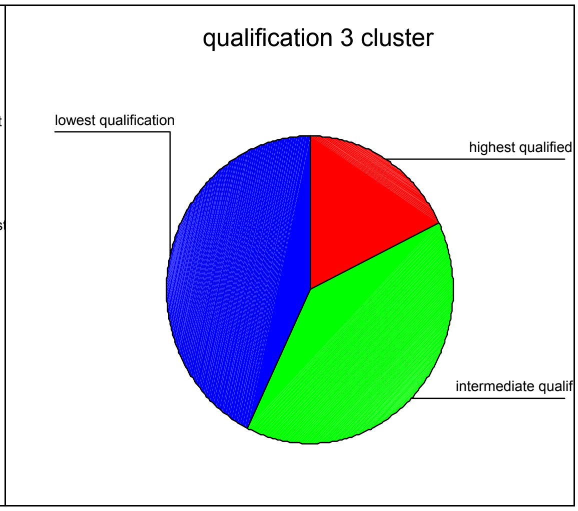
health 3-cluster

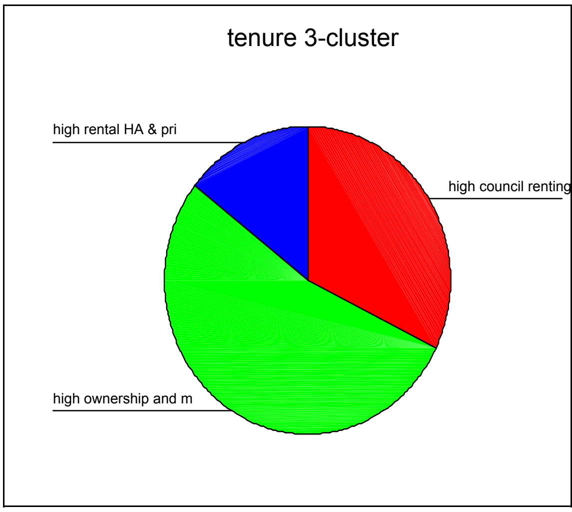
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	better health	3116	36.2	36.2	36.2
	middle health	4041	47.0	47.0	83.2
	worse health	1442	16.8	16.8	100.0
	Total	8599	100.0	100.0	

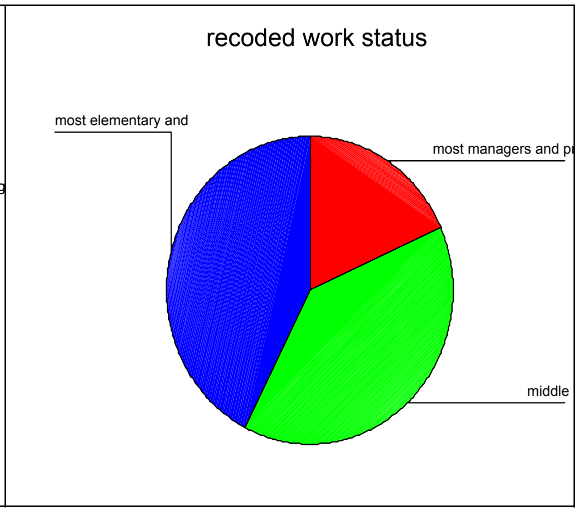

Economic Activity 4-cluster
high student low wor
higher unemployment
highest working
high-retired and wor

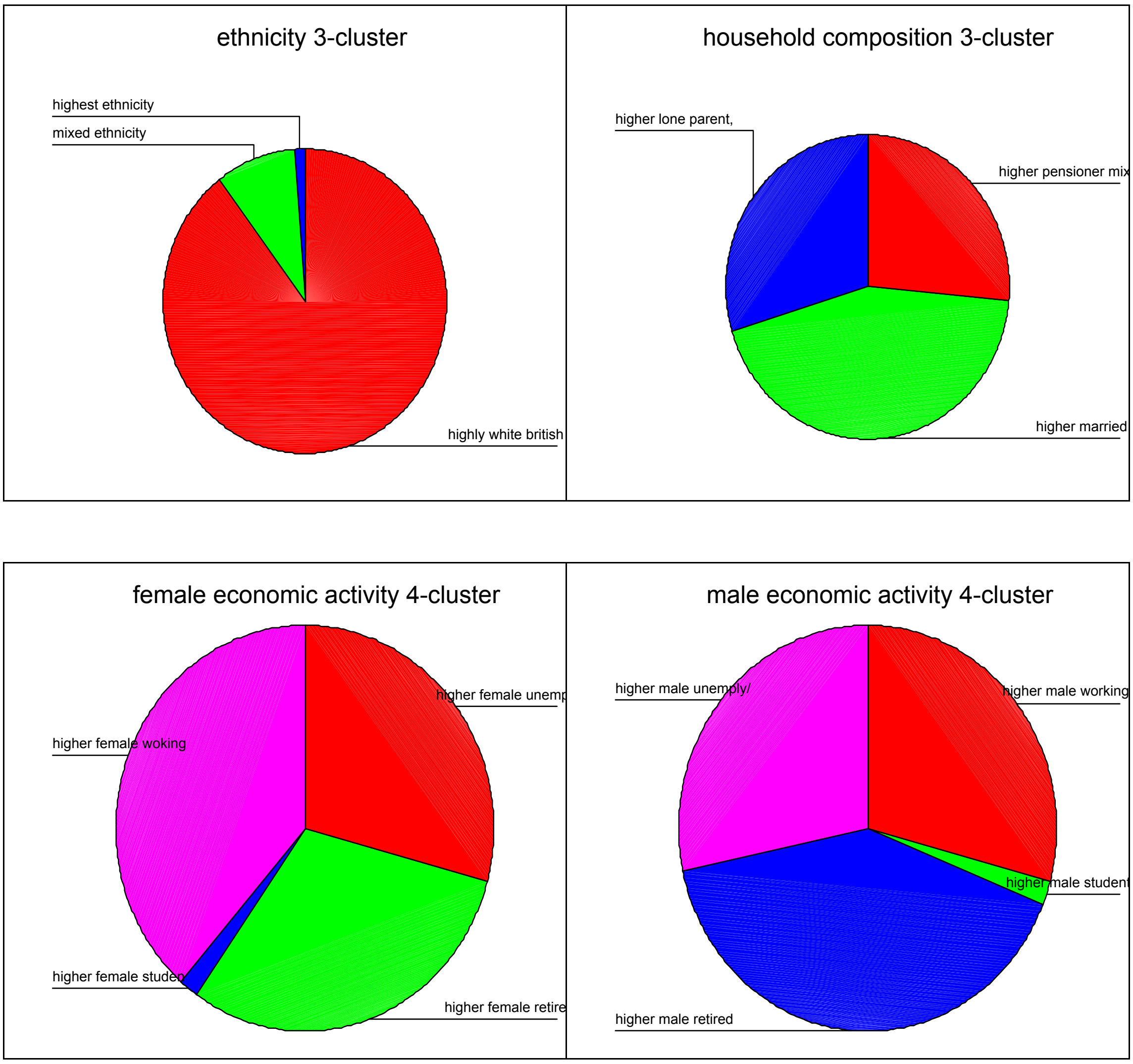

Couple Status 3-cluster
mixed&intermediate
mostly married
mostly unmarried


area age 4 cluster
young adults lowest
most over 59 mixed
most 30-44 and most
most 44-59 mixed


qualification 3 cluster
lowest qualification
highest qualified
intermediate qualif


tenure 3-cluster
high rental HA & pri
high council renting
high ownership and m


recoded work status
most elementary and
most managers and p
middle



The clusters have been validated in one area of the region (Newcastle) and two of the clusters are mapped in the Appendix.

7.2 Spatial Associations between Cluster Variables

An analysis of the associations between clustered variables has been undertaken. It has been found that there are strong and statistically significant associations.

Work Status classifications of areas strongly associates with Qualification classification of areas: areas with high work status with high qualification; middle work with intermediate qualification, and elementary work with lowest qualification areas. Economic activity of areas associates with the age profiles of areas: young adult areas with high student areas; highest working areas likely to be middle-aged areas rather than young or old areas; and higher unemployment, sick, and stay at stay at home areas are unlikely to be young adult areas. The tenure profile of an area associates with the qualification profile of an area: low qualification areas are more likely to be high council renting, and higher qualification areas are associated with high-ownership and mortgage, but there is little association with private rental areas. Economic activity of output areas associates with the qualification profile for output areas: higher-student areas are more likely to be higher qualification areas; higher unemployed areas are more likely to be lower qualification areas; higher working areas are more likely to be higher or intermediate qualification areas. Economic activity and tenure of areas: student areas are more likely to be private renting areas but less likely to be high council renting or high ownership areas; the highest working areas are more likely to be high in ownership and less likely to be high in renting; higher unemployment areas are more likely to be high council renting areas, and less likely to be higher ownership areas.

There are also moderate strength statistically significant associations.

Economic activity associates with marital status: student areas are more likely to be mostly unmarried; highest working areas are more likely to be mostly married than mostly unmarried; the high retired areas are more likely to be mostly married than not; the areas with high unemployed, the sick and at home are more likely to be mostly unmarried than mostly married areas. Marital status associates with Tenure: council renting areas associate with less marriage and more unmarried areas; high ownership and mortgage areas are more likely more married areas and less likely unmarried; private renting areas are more likely unmarried than married areas.   The educational profile of areas associates with the marital status of areas: the mostly married areas are moderately associated with higher qualification areas; mostly unmarried areas and mixed areas are more likely to be lower qualification areas.

Health associates with economic activity; high student areas are more likely better health; higher working areas are more likely better health; high-retired and working, slightly less likely better health; higher unemployment sick and at home more likely to be middle and worse health. Health classification of an area also associate with the Qualification classification; better health areas are more likely to be higher qualification areas; worse health areas are more likely to be lowest qualification; intermediate qualification areas are more likely to be better health areas than worse; and lowest qualification areas are more likely to middle or lower health areas. Health is associated with marital status: mostly married areas are more likely to be better health than mixed or worse health, the mixed areas more likely to be middle to worse health; more unmarried areas more likely to be middle or worse health. Health classification links also to tenure classification of an area: council areas more likely to be middle or worse health; high ownership more likely better and mixed health; rental is slightly more likely to be middle or worse health area. Health and work status of areas are associated: areas with mostly managers and professionals and middle (i.e. skilled trade and secretarial) are more likely to be better health areas; areas high in elementary and process workers are more likely to be middle and worse health.

Age of areas associates with Health; young areas are more likely to be better health; 30-44 more likely to better health than worse health; 44-59 middle slightly more likely middle health; over 59 areas are more likely to worse health. Ethnicity and economic activity are associated: high student areas tend to be more ethnic than highly white British; ethnic areas appear less likely to high-retired, and more likely unemployed, sick, or stay at home; mixed and high ethnic areas are more likely to be younger areas (mostly young adults or mostly 30-44) and less likely to be the older areas.

Work status classifications and economic activity classifications are associated: high student areas are more likely to be also manager and professional areas, rather than middle or elementary and process areas; higher unemployment areas are more likely to elementary and process areas rather than professional or middle; the highest working areas are more likely to be also professional or middle areas rather than elementary and process areas. Work status and tenure: managers and middle have higher ownership and lower council renting; elementary and process workers have higher renting and lower ownership. Work status also associates with marital status; mostly managers and professional areas and also middle status, are more likely to be mostly married areas; elementary and process areas more likely to be mixed or unmarried areas. These associations are summarised in the table below.

Table of Associations Found between Output Areas Characteristics

Area Characteristics	Association	Strength (phi value)
Work Status and Qualification	strong	1.03
Economic activity and Age	strong	0.96
Economic activity and Qualifications	strong	0.70
Economic activity and Tenure	strong	0.70
Tenure and qualification	strong	0.70
Health and Qualifications	moderate	0.67
Work Status and economic Activity	moderate	0.66
Work status and tenure	moderate	0.66
Marital status and tenure	moderate	0.66
Economic activity and marital status	moderate	0.60
Health and economic activity	moderate	0.59
Work Status and Marital status	moderate	0.56
Health and Tenure	moderate	0.54
Health and work status	moderate	0.53
Qualifications and marital Status	moderate	0.52
Health and Age	moderate	0.51
Health and Marital Status	moderate	0.45
Ethnicity and economic activity	moderate	0.43
Ethnicity ands Age	moderate	0.43
Marital Status and Age	weak	0.36
Ethnicity and marital status	weak	0.30
Age and Tenure	weak	0.30
Ethnicity and tenure	weak	0.28
Age and Qualification	weak	0.27
Ethnicity and qualifications	weak	0.23
Ethnicity and work status	weak	0.18

7.3 Multi-Level Modelling Findings

An analysis of associations between characteristics at the output area level and the ward level has been conducted on the regional capital of Newcastle. It was found that there were strong associations between the characteristics found at the ward and output level. Some associations across these spatial levels are stronger than the association of the variables with each other at the output level. Ward name and types of Output Areas are associated.

The association between the age and the ward area is strong and statistically significant. Heaton, Jesmond and Sandyford have predominantly young areas, whereas Denton and Westerhope have output areas which are older. There is a strong and significant association with economic activity and the wards. Some have high numbers of student areas (Heaton, Jesmond, Sandyford, Moorside), others have high unemployment, sick or staying at home (Benwell, Byker, Walker and West City), others have high numbers of largely retired areas (Westerhope, Denton, and Newburn), and others have high numbers of areas where there is a mostly working population (South Gosforth, Castle). There is a strong significant association between ethnicity and ward area in Newcastle. Some wards have the majority of output areas as mixed ethnicity (Elswick, Wingrove), others have largely highly white British areas (Newburn, Fawdon, Westerhope, Lemington), and some consist of predominantly mixed areas (Heaton, Jesmond, South Gosforth). There is a strong significant association between qualification classifications and the wards in Newcastle. Some are exclusively comprised of high-qualification output areas (Jesmond and South Gosforth), others are exclusively comprised of low qualification areas (Walker), while others are largely comprised of intermediate qualification areas (Westerhope, Lemington). There is a strong statistically significant association between tenure and ward. Some wards are largely comprised of high numbers of council renting areas (Walker, Monkchester, Byker, Woolsington) whereas others have no such areas (Jesmond and South Gosforth), others have high numbers of high ownership (Dene, Denton, South Gosforth), some have high private renting (Heaton, Jesmond) wheras others have none (Walker).

There is a strong statistically significant association between Work Status at output area level and Ward level. Some wards are exclusively higher managers and professionals (South Gosforth and Jesmond), some are middle professions of secretarial and skilled trades (such as Westerhope and Denton), others are elementary and process workers (Walker, Monkchester, Byker, Benwell). Some areas are mostly married areas (Castle), others are mixed areas (Blakelaw, Denton, Fenham) and others mostly unmarried (Sandyford, Heaton, Jesmond, Moorside, West City, Byker). There is also a moderate significant association between health and the wards; some have predominantly better health output areas (such as South Gosforth, Heaton, and Jesmond) others are mixed, and some have mostly worse health areas (e.g. Walker). The following table summarises the associations from Output Area to Ward level:

Table of Association between Output Area Level Variables and Ward Level

Output Area Characteristic	**Association at Ward level**	**Strength (phi value)**
Male Economic Activity	strong	0.90
Economic Activity	strong	0.89
Female economic Activity	strong	0.87
Ethnicity	strong	0.85
Qualifications	strong	0.81
Work Status	strong	0.78
Tenure	strong	0.78
Age	strong	0.77
Marital Status	strong	0.74
Health	moderate	0.59

The associations between the output area level and the local government level were investigated. These were generally found to be weak associations (in comparison with the ward level associations above). Nevertheless the detailed output gives an overview of the region and this detail is presented in Appendix 3.

Finally, loglinear modelling has been used to clarify nature and occupancy of the multi-dimensional space represented by the clustered categorical data. By neglecting terms in the loglinear models, approximate models of the spatial patterns within the region or within sub-areas of it, have been created.

7.4 Spatial Dependence of Socio-Economic Features: Area Inequality and Area Class?

Most of the Census data is associated to some degree (at the Output Area level) and therefore demonstrates the spatial dependence (and coupling) of social and economic features. Variables such as Economic Activity strongly differentiate areas within the region demonstrating spatial diversity (or stratification or inequality). Many clusters arise which are quasi-ordinal, and areas are then relatively (and often multiply) advantaged and disadvantaged. The characteristics of areas, cluster in class-like ways: in coherent patterns of economic activity, qualifications, work status, tenure, and ward location. Approximate models of the region reduce areas to just a handful of types - from a vast number of possibilities – in ways consistent again with class-like association and interpretation; albeit complicated by other differentiating factors (including ethnicity, age, health, and marital status profiles of areas).

8 DISCUSSION AND FUTURE DEVELOPMENT

8.1 Developing the Quantitative Approach and Scope

The pilot project has shown how cluster analysis and log linear analysis can simplify the spatial data of the 2001 Census. This process can be developed by (a) including additional census variables (e.g. number of cars, travel to work etc) or clustering in different ways; (b) by investigating more than one region with cross comparisons and validation; (c) clustering of wards as well as output areas, because of multi-level associations and political responsibilities; (d) by use of SPSS programming to further sort and classify results; (e) by detailed GIS mapping and spatial statistical analysis (including identification of adjacent clustering to form sub-ward neighbourhoods).

The approach can also be repeated for the 1991 data at the smallest spatial level (this time the Enumeration District level rather than the Output Area level). By mapping and displaying both the 1991 and 2001 data sets through a GIS, the changes between 1991 and 2001 may be apparent, more systematic comparisons may be possible[2]. Furthermore causal analysis will be then possible across the 1991 and 2001 surveys and this can also be facilitated by investigation of associations and through loglinear analysis. Explaining the observed changes and the internal associations identified for each of the spatial types will be one aim. Quantitative methods such as the loglinear approach can also be used to identify and model non-linear interactions and associations (Gilbert, 1981, p91, and Byrne, 2002, p82) and therefore they are particularly suited to a complexity framework. Furthermore simplified and approximate representations of types and occupied multi-dimensional 'states' could be developed and compared more systematically.

8.2 Validation, Interpretation, and Theory Development: A Qualitative Approach

Understanding the social world requires both qualitative and quantitative research methods, these overlap and can be combined in a critical realist approach (Bryman, 1996). A complimentary qualitative methodology could be adopted to help validate and interpret the (cluster and loglinear) analyses. The interpretation of the reduced data can be achieved through complimentary qualitative exploration with those with local knowledge of the cases resulting from clustering, case by case. Cases can be iteratively compared and hypotheses adapted to fit, as advised in the grounded theory approach of Glaser and Strauss (1967). The

[2] The boundary differences between Enumeration Districts and Output Areas prevent direct comparison, so focus upon geographical coordinates across the two surveys might be one way forward.

approach is to examine counter-cases, and sampling to give comprehensive coverage of the important spatial types and can be judged adequate if no extending cases are found. The aim is to have a conceptually clear categorisation of the cases and the interpretations that encompass the characteristics and properties of these cases. Other approaches consistent with this methodology include analytical induction of Znaniecki (1934) and the qualitative comparative analysis of Ragin (1987).

Those with local knowledge include practitioners, policy makers, and politicians associated with governance organisations. These have an interest in the geographical areas and populations under their responsibility; partly to better understand the population and associated issues (research), partly to influence these circumstances (action research) and partly to judge the effectiveness or impact of governance initiatives (evaluation). Interpretation should include qualitative research with local practitioners within governance organisations and a wider range of academics than sociologists. Argyris (1974, 1986) argues that practitioners have complimentary knowledge to that of academics, and that this should be recognised and utilized in developing knowledge. This view also connects with that of Paulo Freire on dialogical learning. Friere advocates pedagogical study methods and activities in teaching, where the emphasis is upon dialogue in informal educational settings. This is entirely consistent with the report of the Gulbenkian Commission on opening the social sciences (1996), and the integrative method of Lemon and Seaton (1999) advocating interdisciplinary research (including here the links with economics, geography and history, for instance[3]).

Patton (1987: p39-40) further notes that applied research and evaluation are largely non-theoretical, and that a qualitative methodology is useful in developing grounded theory (which is inductive, pragmatic, and concrete and therefore likely to be appealing to practitioners). This approach can help practitioners understand how programs or organisations work, why they function as they do, and how impacts might follow. Practitioners can interpret the spatial differences and similarities, the temporal changes, the associations, and the reduced types and classifications created. Practitioners can also 'reality-test' their own theories, the relationship between actions and effects, encouraging engagement with the empirical to test these theories. This is supported by Argyris & Schon (1974) who claim that such situations can be best considered through a conceptual framework which analyses the 'theories of action' of practitioners. Pawson and Tilley (1997) further argue that theory-based

[3] Relevant authors are cited in the bibliography such as Abrams, Giddens, Gregory, Urry, Massey, etc.

evaluation is an important (often implicit) aspect of evaluation, which compliments empirical approaches.

The interpretation stage is also a form of validation for the research. Typically interpretation could be centred on a discussion of the data (in mapped or tabular form). When practitioners interact with this data, they will also validate it.

There are further reasons for engaging practitioners in interpretation. One of the major criticisms of academic research is that it has limited impact on policy and decision makers. Rothman (1980) investigates this and concludes that when researchers and appliers are closely linked then research is more likely to have impact. Percy-Smith et al (2002) also surveyed the impact of research on policy and practice in over 100 UK local government organisations and found that university research accounted for less than 1% of the material read by practitioners, and that research utilization is greatest when the work is undertaken which involves practitioners interests, needs, and involvement. Booth (1988) and Weiss (1972: p105) further argue there are additional advantages in the direct involvement of practitioners; in disseminating the purposes of research, in gaining ideas and information, in identifying the norms and realities of the situation, in preventing misunderstandings. Therefore research will be better received, disseminated, and utilised if it involves practitioners and agencies than would traditional academic approaches, thereby increasing the likelihood of impact of the research.

8.3 A Complexity and Critical Realism Framework

Byrne (1998) argues that complexity theory and critical realism are closely related and complimentary perspectives in understanding the social world. He describes this as a 'complex realist' approach. Complexity and critical realism can inform the interpretation of this project and its development.

The ontological and epistemological perspective deals explicitly with the nature of the social world and how it works; what we can know and how; and what we cannot know and why. This follows the ontology of Bhaskar (1978) as noted by Collier (1994). The social world includes the empirical - what is experienced; the actual - events and circumstances; and the real - including embedded or inter-permeable structures, powers, mechanisms and tendencies. Local knowledge is empirical, the data represents something of the actual, and the interpretation will aim to understand the real. Complex Realism sees social structure as a result of complex contingent interactions, working within the locality through underlying mechanisms; and emphasises difficulties in generalisation and prediction beyond these, again supporting the need to understand the local (and not generalise aspatially and atemporally). Complexity theory and critical realism further suggest that the social world is stratified into different levels, with lower levels embedded within (or permeating) and interacting with the higher levels. Stratification and Emergence is discussed in Collier (1994: Chapter 4). This might suggest that the neighbourhood and the output areas would be in a mutual relationship. The output areas influence the neighbourhood/ward but the neighbourhood/ward influences the output areas. This suggests multi-level modelling. Emergence theories recognise that more complex aspects of reality presuppose the less complex, but that they may also have features which are irreducible. Furthermore, it is theoretically plausible that the character of adjacent areas should be mutually influencing, and the explanation of an area's character is not all contained 'within' the boundaries of that area.

The investigation of causality includes the search for underlying generative mechanisms which explain circumstances in particular contexts (Pawson and Tilley, 1997). Policy research and evaluation aims to find out how things are, how they will be, how they can be influenced, how the expected influence compares with the actual. As such it seeks to understand some object (society, or an aspect of it, or the total system), it seeks to influence this object through agency (individual, collective, organisational, and multi-faceted approaches), and it seeks to monitor and compare changes against pre-set goals. The complex realist perspective offers a unifying perspective: it deals with a real and complicated world which can not be fully controlled nor predicted, it takes the world to be essentially causal and society as explicable, it does not shy from the interactions of many agents, it accepts both free-will and constraint of social structures, powers of the individual agency and emergent powers of social structures, it has the potential to seamlessly link the natural and human sciences to begin to reintegrate our fragmented studies, it is consistent with a broad range of research methods, it has potential to engage a wide range of stakeholders. As it is fallible it can be improved upon with time so that it gradually can improve knowledge and keep it relevant within an ever-changing world.

Critical Realism also emphasizes the possibility of the contextual-dependence of phenomena. One aspect of this dependence is the spatial and temporal context, which not only influences the sociology of an area but to some degree constitutes it. Where spatial and temporal context does matter sociology will interlink with both geography and history, and this perspective is entirely appropriate when considering temporal change and high spatial resolution. Sayer (2000: p108-154) comments on the neglect of space in sociological theory. He argues that sociology has often abstracted processes from their spatial locations (p119) and that this may invalidate theorizing in sociology in a number of ways (a) the situation and context influence whether or not the causal powers are activated so that the spatial context may be relevant for realizing and understanding causal mechanisms. The mechanisms are always mediated by the conditions in which they operate; (b) abstraction of sociological theory from its spatial context is often done for different social processes, but then the different social processes (or objects) are recombined in a way which fails to match up with their relevant social forms, thereby 'scrambling' the original causal structure (p113). Furthermore, government programmes directed at broad areas may not target the deprived pockets well, nor isolated pockets in relatively affluent areas.

It is important to note spatial context *may or may not* make a difference (some phenomena are little affected by space but others are significantly) but the critical realist ontology makes explicit the possibility. The empirical question is then whether, and if so how, social phenomena vary with space. This pilot suggests this may indeed be so, and therefore theorising should itself reflect the variation and variety, and spatial dependence.

Furthermore note that the area clusters and maps presented here, represent something of the social and spatial *context* of individuals; the approach may be one way to categorise spatial context (and perhaps link this to individual trajectories[4]).

Complexity theory further recognises the interactions between structure and agency: including the influence of (agency of) organisations and people, residents, businesses, governance organisations (health, police, local and regional government) and the choices people make in deciding where to live. The critical realist Archer (1998, 1995) advocates an agency-structure model. Structure pre-exists contemporary agency, has durability and relative autonomy, it can be causal and can be changed through interaction. Structure is the outcome of past agency, and structure emerges with time through social interaction between actors. This has implications for understanding spatial structure and understanding contemporary circumstances in terms of past histories and trajectories.

Finally, the case/data matrices of the Census data, representing the region, have effectively been transformed into a multi-dimensional categorical space. Complexity is well-equiped to handle this conceptually and dynamically through the ideas of trajectories and attractors which could be explored.

[4] Thos may be possible with the BHPS surveys; following trajectories of individuals or households through different spatial contexts.

8.4 Summary of Proposed Development

It is proposed that the pilot project can be developed by a mixed quantitative and qualitative study, involving clustering and loglinear analysis of the Census data for 2001 and 1991. The spatial patterns and temporal changes can be analysed and discerned giving a description of changes and associations between cluster variables and spatial levels, and should be interpreted by practitioners and academics in collaboration. The first phase will include the development of clustering approaches leading to mapped GIS output. A second phase would include validation and interpretation of the statistical and visual data, and associate theory development and testing. The project will be guided by the critical realist and complexity approaches in developing interpretations of spatial patterns and temporal change.

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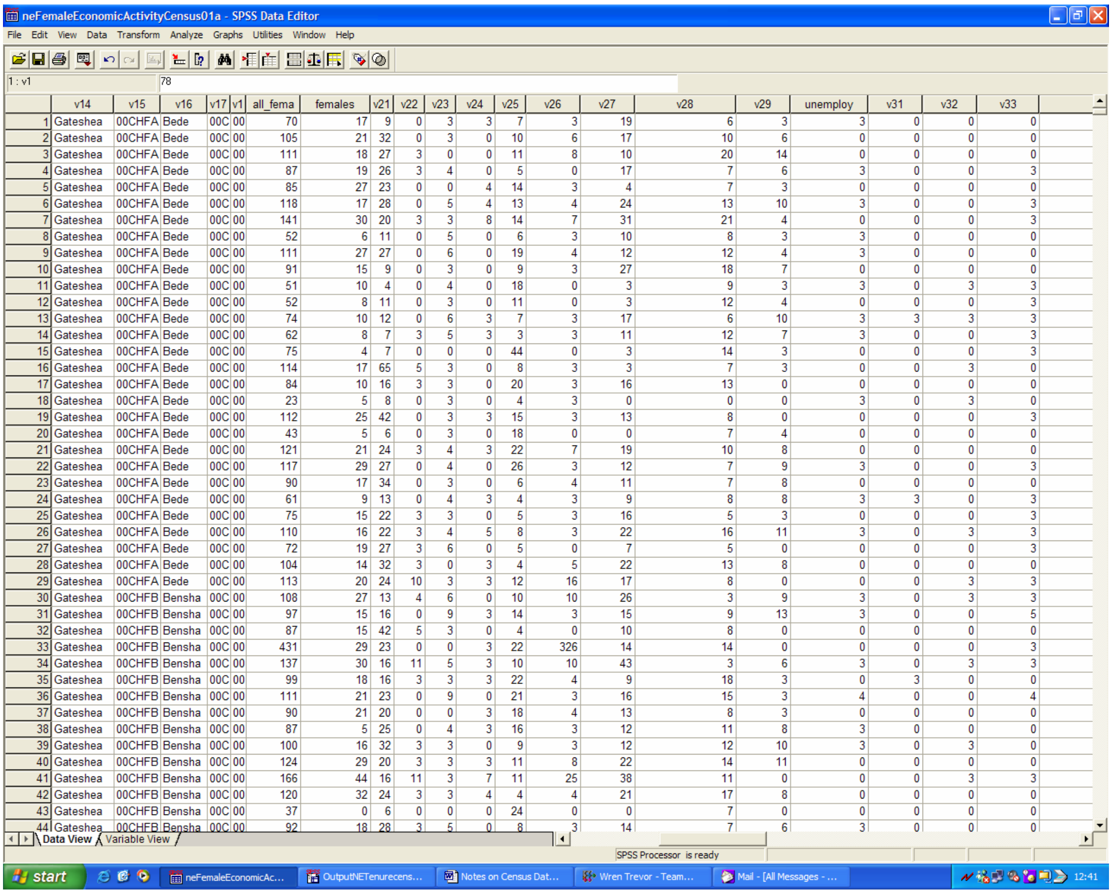
APPENDICES

1 PREPARING DATA THROUGH SPSS SYNTAX COMMANDS

This appendix gives an example of how the data sets appear and can be simplified through syntax. The Female Economic Activity data is given as 15 sets of raw variables with 8890 cases, of which the first SPSS workfile screen is shown below.



	v14	v15	v16	v17	v1	all_fema	females	v21	v22	v23	v24	v25	v26	v27	v28	v29	unemploy	v31	v32	v33
1	Gateshea	00CHFA	Bede	00C	00	70	17	9	0	3	3	7	3	19	6	3	3	0	0	0
2	Gateshea	00CHFA	Bede	00C	00	105	21	32	0	3	0	10	6	17	10	6	0	0	0	0
3	Gateshea	00CHFA	Bede	00C	00	111	18	27	3	0	0	11	8	10	20	14	0	0	0	0
4	Gateshea	00CHFA	Bede	00C	00	87	19	26	3	4	0	5	0	17	7	6	3	0	0	3
5	Gateshea	00CHFA	Bede	00C	00	85	27	23	0	0	4	14	3	4	7	3	0	0	0	0
6	Gateshea	00CHFA	Bede	00C	00	118	17	28	0	5	4	13	4	24	13	10	3	0	0	3
7	Gateshea	00CHFA	Bede	00C	00	141	30	20	3	3	8	14	7	31	21	4	0	0	0	3
8	Gateshea	00CHFA	Bede	00C	00	52	6	11	0	5	0	6	3	10	8	3	3	0	0	0
9	Gateshea	00CHFA	Bede	00C	00	111	27	27	0	6	0	19	4	12	12	4	3	0	0	0
10	Gateshea	00CHFA	Bede	00C	00	91	15	9	0	3	0	9	3	27	18	7	0	0	0	0
11	Gateshea	00CHFA	Bede	00C	00	51	10	4	0	4	0	18	0	3	9	3	3	0	3	3
12	Gateshea	00CHFA	Bede	00C	00	52	8	11	0	3	0	11	0	3	12	4	0	0	0	3
13	Gateshea	00CHFA	Bede	00C	00	74	10	12	0	6	3	7	3	17	6	10	3	3	3	3
14	Gateshea	00CHFA	Bede	00C	00	62	8	7	3	5	3	3	3	11	12	7	3	0	0	3
15	Gateshea	00CHFA	Bede	00C	00	75	4	7	0	0	0	44	0	3	14	3	0	0	0	3
16	Gateshea	00CHFA	Bede	00C	00	114	17	65	5	3	0	8	3	3	7	3	0	0	3	0
17	Gateshea	00CHFA	Bede	00C	00	84	10	16	3	3	0	20	3	16	13	0	0	0	0	0
18	Gateshea	00CHFA	Bede	00C	00	23	5	8	0	3	0	4	3	0	0	0	3	0	3	0
19	Gateshea	00CHFA	Bede	00C	00	112	25	42	0	3	3	15	3	13	8	0	0	0	0	3
20	Gateshea	00CHFA	Bede	00C	00	43	5	6	0	3	0	18	0	0	7	4	0	0	0	0
21	Gateshea	00CHFA	Bede	00C	00	121	21	24	3	4	3	22	7	19	10	8	0	0	0	0
22	Gateshea	00CHFA	Bede	00C	00	117	29	27	0	4	0	26	3	12	7	9	3	0	0	3
23	Gateshea	00CHFA	Bede	00C	00	90	17	34	0	3	0	6	4	11	7	8	0	0	0	0
24	Gateshea	00CHFA	Bede	00C	00	61	9	13	0	4	3	4	3	9	8	8	3	3	0	3
25	Gateshea	00CHFA	Bede	00C	00	75	15	22	3	3	0	5	3	16	5	3	0	0	0	3
26	Gateshea	00CHFA	Bede	00C	00	110	16	22	3	4	5	8	3	22	16	11	3	0	3	3
27	Gateshea	00CHFA	Bede	00C	00	72	19	27	3	6	0	5	0	7	5	0	0	0	0	3
28	Gateshea	00CHFA	Bede	00C	00	104	14	32	3	0	3	4	5	22	13	8	0	0	0	0
29	Gateshea	00CHFA	Bede	00C	00	113	20	24	10	3	3	12	16	17	8	0	0	0	3	3
30	Gateshea	00CHFB	Bensha	00C	00	108	27	13	4	6	0	10	10	26	3	9	3	0	3	3
31	Gateshea	00CHFB	Bensha	00C	00	97	15	16	0	9	3	14	3	15	9	13	3	0	0	5
32	Gateshea	00CHFB	Bensha	00C	00	87	15	42	5	3	0	4	0	10	8	0	0	0	0	0
33	Gateshea	00CHFB	Bensha	00C	00	431	29	23	0	0	3	22	326	14	14	0	0	0	0	3
34	Gateshea	00CHFB	Bensha	00C	00	137	30	16	11	5	3	10	10	43	3	6	3	0	3	3
35	Gateshea	00CHFB	Bensha	00C	00	99	18	16	3	3	3	22	4	9	18	3	0	3	0	0
36	Gateshea	00CHFB	Bensha	00C	00	111	21	23	0	9	0	21	3	16	15	3	4	0	0	4
37	Gateshea	00CHFB	Bensha	00C	00	90	21	20	0	0	3	18	4	13	8	3	0	0	0	0
38	Gateshea	00CHFB	Bensha	00C	00	87	5	25	0	4	3	16	3	12	11	8	3	0	0	0
39	Gateshea	00CHFB	Bensha	00C	00	100	16	32	3	3	0	9	3	12	12	10	3	0	3	0
40	Gateshea	00CHFB	Bensha	00C	00	124	29	20	3	3	3	11	8	22	14	11	0	0	0	0
41	Gateshea	00CHFB	Bensha	00C	00	166	44	16	11	3	7	11	25	38	11	0	0	0	3	3
42	Gateshea	00CHFB	Bensha	00C	00	120	32	24	3	3	4	4	4	21	17	8	0	0	0	0
43	Gateshea	00CHFB	Bensha	00C	00	37	0	6	0	0	0	24	0	0	7	0	0	0	0	0
44	Gateshea	00CHFB	Bensha	00C	00	92	18	28	3	5	0	8	3	14	7	6	3	0	0	0

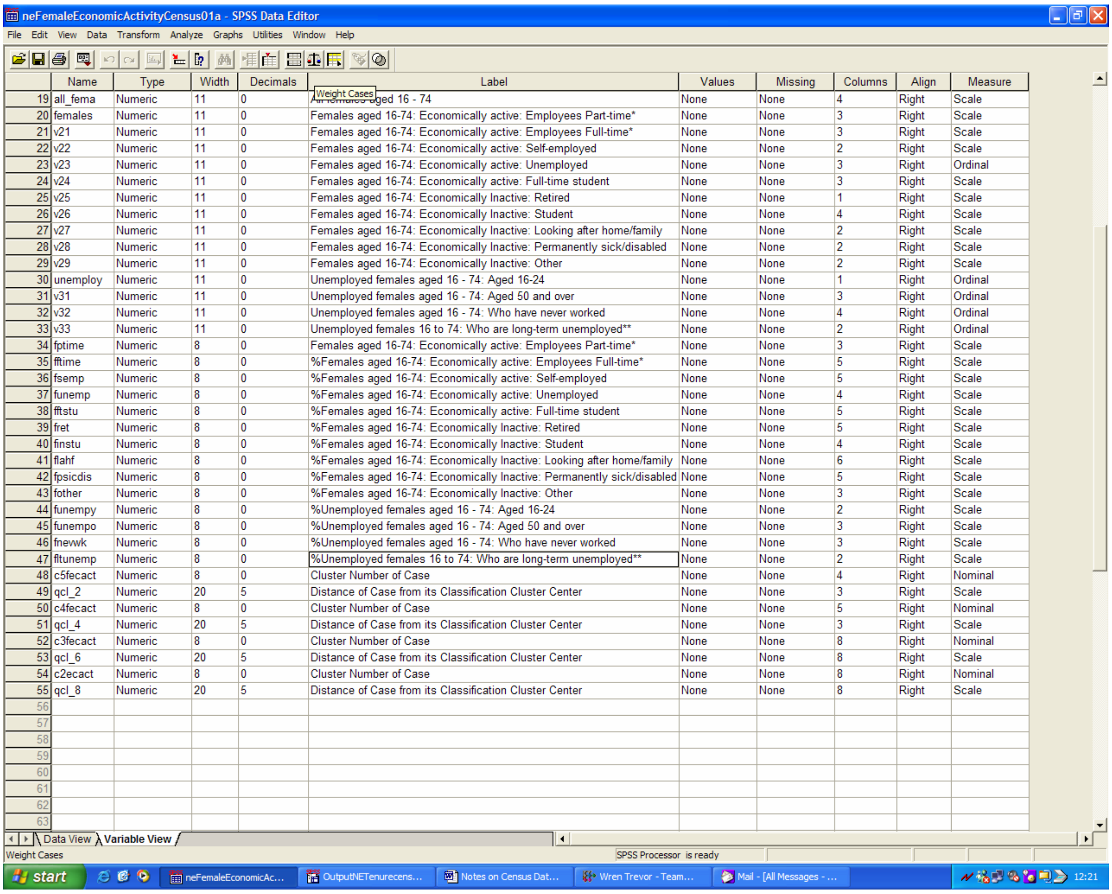
The data given is raw data in the form of numbers of individuals in each output area. It is possible to normalise this using the total number. The syntax for doing these calculations is given below to compute the percentage variables from the raw data

```
COMPUTE fptime = females/ all_fema  * 100 .
COMPUTE fftime = v21/ all_fema  * 100 .
COMPUTE fsemp = v22 / all_fema  * 100 .
COMPUTE funemp = v23/ all_fema  * 100 .
COMPUTE  fftstu= v24/ all_fema  * 100 .
COMPUTE  fret= v25/ all_fema  * 100 .
COMPUTE  finstu= v26/ all_fema  * 100 .
COMPUTE  flahf= v27/ all_fema  * 100 .
COMPUTE  fpsicdis= v28/ all_fema  * 100 .
COMPUTE  fother= v29/ all_fema  * 100 .
COMPUTE  funempy= unemploy/ all_fema  * 100 .
COMPUTE  funempo= v31/ all_fema  * 100 .
COMPUTE  fnevwk= v32/ all_fema  * 100 .
COMPUTE  fltunemp= v33/ all_fema  * 100 .
EXECUTE.
```

The following commands cluster on the % variables. Try 5, 4, 3, and 2 –clusters in one go:

```
 QUICK CLUSTER
  fptime fftime fsemp funemp fftstu fret finstu flahf fpsicdis fother funempy funempo fnevwk
fltunemp
  /MISSING=LISTWISE
  /CRITERIA= CLUSTER(5) MXITER(40) CONVERGE(0)
  /METHOD=KMEANS(NOUPDATE)
  /SAVE CLUSTER DISTANCE
  /PRINT INITIAL ANOVA.
QUICK CLUSTER
   fptime fftime fsemp funemp fftstu fret finstu flahf fpsicdis fother funempy funempo fnevwk
fltunemp
 /MISSING=LISTWISE
  /CRITERIA= CLUSTER(4) MXITER(40) CONVERGE(0)
  /METHOD=KMEANS(NOUPDATE)
  /SAVE CLUSTER DISTANCE
  /PRINT INITIAL ANOVA.
QUICK CLUSTER
   fptime fftime fsemp funemp fftstu fret finstu flahf fpsicdis fother funempy funempo fnevwk
fltunemp
  /MISSING=LISTWISE
  /CRITERIA= CLUSTER(3) MXITER(40) CONVERGE(0)
  /METHOD=KMEANS(NOUPDATE)
  /SAVE CLUSTER DISTANCE
  /PRINT INITIAL ANOVA.
QUICK CLUSTER
  fptime fftime fsemp funemp fftstu fret finstu flahf fpsicdis fother funempy funempo fnevwk
fltunemp
  /MISSING=LISTWISE
  /CRITERIA= CLUSTER(2) MXITER(40) CONVERGE(0)
  /METHOD=KMEANS(NOUPDATE)
  /SAVE CLUSTER DISTANCE
  /PRINT INITIAL ANOVA.
```

When this is done the SPSS data file in variable view has the following appearance. This gives an additional list of variables (reduced from 15 to 14) that can be labelled and named. The 5, 4,3,2 –clusters (as shown in the following screen dump).



	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure
19	all_fema	Numeric	11	0	All females aged 16 - 74	None	None	4	Right	Scale
20	females	Numeric	11	0	Females aged 16-74: Economically active: Employees Part-time*	None	None	3	Right	Scale
21	v21	Numeric	11	0	Females aged 16-74: Economically active: Employees Full-time*	None	None	3	Right	Scale
22	v22	Numeric	11	0	Females aged 16-74: Economically active: Self-employed	None	None	2	Right	Scale
23	v23	Numeric	11	0	Females aged 16-74: Economically active: Unemployed	None	None	3	Right	Ordinal
24	v24	Numeric	11	0	Females aged 16-74: Economically active: Full-time student	None	None	3	Right	Scale
25	v25	Numeric	11	0	Females aged 16-74: Economically Inactive: Retired	None	None	1	Right	Scale
26	v26	Numeric	11	0	Females aged 16-74: Economically Inactive: Student	None	None	4	Right	Scale
27	v27	Numeric	11	0	Females aged 16-74: Economically Inactive: Looking after home/family	None	None	2	Right	Scale
28	v28	Numeric	11	0	Females aged 16-74: Economically Inactive: Permanently sick/disabled	None	None	2	Right	Scale
29	v29	Numeric	11	0	Females aged 16-74: Economically Inactive: Other	None	None	2	Right	Scale
30	unemploy	Numeric	11	0	Unemployed females aged 16 - 74: Aged 16-24	None	None	1	Right	Ordinal
31	v31	Numeric	11	0	Unemployed females aged 16 - 74: Aged 50 and over	None	None	3	Right	Ordinal
32	v32	Numeric	11	0	Unemployed females aged 16 - 74: Who have never worked	None	None	4	Right	Ordinal
33	v33	Numeric	11	0	Unemployed females 16 to 74: Who are long-term unemployed**	None	None	2	Right	Ordinal
34	fptime	Numeric	8	0	Females aged 16-74: Economically active: Employees Part-time*	None	None	3	Right	Scale
35	fftime	Numeric	8	0	%Females aged 16-74: Economically active: Employees Full-time*	None	None	5	Right	Scale
36	fsemp	Numeric	8	0	%Females aged 16-74: Economically active: Self-employed	None	None	5	Right	Scale
37	funemp	Numeric	8	0	%Females aged 16-74: Economically active: Unemployed	None	None	4	Right	Scale
38	fftstu	Numeric	8	0	%Females aged 16-74: Economically active: Full-time student	None	None	5	Right	Scale
39	fret	Numeric	8	0	%Females aged 16-74: Economically Inactive: Retired	None	None	5	Right	Scale
40	finstu	Numeric	8	0	%Females aged 16-74: Economically Inactive: Student	None	None	4	Right	Scale
41	flahf	Numeric	8	0	%Females aged 16-74: Economically Inactive: Looking after home/family	None	None	6	Right	Scale
42	fpsicdis	Numeric	8	0	%Females aged 16-74: Economically Inactive: Permanently sick/disabled	None	None	5	Right	Scale
43	fother	Numeric	8	0	%Females aged 16-74: Economically Inactive: Other	None	None	3	Right	Scale
44	funempy	Numeric	8	0	%Unemployed females aged 16 - 74: Aged 16-24	None	None	2	Right	Scale
45	funempo	Numeric	8	0	%Unemployed females aged 16 - 74: Aged 50 and over	None	None	3	Right	Scale
46	fnevwk	Numeric	8	0	%Unemployed females aged 16 - 74: Who have never worked	None	None	3	Right	Scale
47	fltunemp	Numeric	8	0	%Unemployed females 16 to 74: Who are long-term unemployed**	None	None	2	Right	Scale
48	c5fecact	Numeric	8	0	Cluster Number of Case	None	None	4	Right	Nominal
49	qcl_2	Numeric	20	5	Distance of Case from its Classification Cluster Center	None	None	3	Right	Scale
50	c4fecact	Numeric	8	0	Cluster Number of Case	None	None	5	Right	Nominal
51	qcl_4	Numeric	20	5	Distance of Case from its Classification Cluster Center	None	None	3	Right	Scale
52	c3fecact	Numeric	8	0	Cluster Number of Case	None	None	8	Right	Nominal
53	qcl_6	Numeric	20	5	Distance of Case from its Classification Cluster Center	None	None	8	Right	Scale
54	c2ecact	Numeric	8	0	Cluster Number of Case	None	None	8	Right	Nominal
55	qcl_8	Numeric	20	5	Distance of Case from its Classification Cluster Center	None	None	8	Right	Scale
56										
57										
58										
59										
60										
61										
62										
63										

2 LOCAL GOVERNMENT AND OUTPUT AREA ASSOCIATIONS

By coding at a council level it is possible to examine if the council has any association with the variables and output are cases. This gives an interesting overview of the region. In terms of easily understandable meaningful categories. The description is particularly useful for comparative analysis of council areas within the region. It is found that the associations at this level are weak to moderate. It would be possible to also do three way tables at this level as there will be enough cases in each cell to make this feasible.

2.1 Ethnicity and Council

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1601.852[a]	44	.000
Likelihood Ratio	1339.994	44	.000
Linear-by-Linear Association	362.824	1	.000
N of Valid Cases	8599		

a. 15 cells (21.7%) have expected count less than 5. The minimum expected count is 1.10.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.432	.000
	Cramer's V	.305	.000
N of Valid Cases		8599	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

There is a moderate statistical association with council area and ethnicity

HIGHCODE * ethnicity 3-cluster Crosstabulation

			ethnicity 3-cluster			
			highly white british	mixed ethnicity	highest ethnicity	Total
HIGHCODE	gateshead	Count	627	50	2	679
		Expected Count	609.7	61.1	8.2	679.0
	newcastle	Count	502	334	53	889
		Expected Count	798.2	80.0	10.8	889.0
	noth tyneside	Count	629	49	0	678
		Expected Count	608.8	61.0	8.2	678.0
	south tyneside	Count	465	64	1	530
		Expected Count	475.9	47.7	6.4	530.0
	sunderland	Count	884	49	5	938
		Expected Count	842.2	84.4	11.3	938.0
	hartlepool	Count	289	11	0	300
		Expected Count	269.4	27.0	3.6	300.0
	middlesborough	Count	327	89	28	444
		Expected Count	398.7	40.0	5.4	444.0
	redcar & clevland	Count	450	11	1	462
		Expected Count	414.8	41.6	5.6	462.0
	stockton	Count	526	45	11	582
		Expected Count	522.6	52.4	7.0	582.0
	darlington	Count	323	19	2	344
		Expected Count	308.9	31.0	4.2	344.0
	chester-lee-street	Count	182	1	0	183
		Expected Count	164.3	16.5	2.2	183.0
	derwentside	Count	293	0	0	293
		Expected Count	263.1	26.4	3.5	293.0
	durham	Count	250	31	1	282
		Expected Count	253.2	25.4	3.4	282.0
	easington	Count	314	1	0	315
		Expected Count	282.8	28.4	3.8	315.0
	sedgefield	Count	302	0	0	302
		Expected Count	271.2	27.2	3.7	302.0
	teesdale	Count	90	1	0	91
		Expected Count	81.7	8.2	1.1	91.0
	wear valley	Count	213	1	0	214
		Expected Count	192.1	19.3	2.6	214.0
	alnwick	Count	116	0	0	116
		Expected Count	104.2	10.4	1.4	116.0
	berwick	Count	102	0	0	102
		Expected Count	91.6	9.2	1.2	102.0
	blyth valley	Count	276	1	0	277
		Expected Count	248.7	24.9	3.4	277.0
	castle morpeth	Count	150	13	0	163
		Expected Count	146.4	14.7	2.0	163.0
	tynedale	Count	202	1	0	203
		Expected Count	182.3	18.3	2.5	203.0
	wansbeck	Count	209	3	0	212
		Expected Count	190.4	19.1	2.6	212.0
Total		Count	7721	774	104	8599
		Expected Count	7721.0	774.0	104.0	8599.0

2.2 Economic Activity and Council

HIGHCODE * Economic Activity 4-cluster Crosstabulation

			Economic Activity 4-cluster				
			high student low work	highest working	high-retired and working	higher unemployment sick and at home	Total
HIGHCODE	gateshead	Count	3	245	222	209	679
		Expected Count	12.5	245.3	218.9	202.3	679.0
	newcastle	Count	100	271	215	303	889
		Expected Count	16.3	321.2	286.6	264.9	889.0
	noth tyneside	Count	0	327	211	140	678
		Expected Count	12.5	245.0	218.6	202.0	678.0
	south tyneside	Count	1	164	159	206	530
		Expected Count	9.7	191.5	170.9	157.9	530.0
	sunderland	Count	16	329	259	334	938
		Expected Count	17.2	338.9	302.4	279.5	938.0
	hartlepool	Count	0	86	88	126	300
		Expected Count	5.5	108.4	96.7	89.4	300.0
	middlesborough	Count	13	112	98	221	444
		Expected Count	8.2	160.4	143.1	132.3	444.0
	redcar & clevland	Count	0	124	187	151	462
		Expected Count	8.5	166.9	148.9	137.6	462.0
	stockton	Count	1	234	175	172	582
		Expected Count	10.7	210.3	187.6	173.4	582.0
	darlington	Count	0	167	111	66	344
		Expected Count	6.3	124.3	110.9	102.5	344.0
	chester-lee-street	Count	0	86	61	36	183
		Expected Count	3.4	66.1	59.0	54.5	183.0
	derwentside	Count	0	132	88	73	293
		Expected Count	5.4	105.9	94.5	87.3	293.0
	durham	Count	22	129	85	46	282
		Expected Count	5.2	101.9	90.9	84.0	282.0
	easington	Count	0	75	69	171	315
		Expected Count	5.8	113.8	101.5	93.9	315.0
	sedgefield	Count	0	133	101	68	302
		Expected Count	5.5	109.1	97.4	90.0	302.0
	teesdale	Count	1	24	60	6	91
		Expected Count	1.7	32.9	29.3	27.1	91.0
	wear valley	Count	0	79	67	68	214
		Expected Count	3.9	77.3	69.0	63.8	214.0
	alnwick	Count	0	33	77	6	116
		Expected Count	2.1	41.9	37.4	34.6	116.0
	berwick	Count	0	17	79	6	102
		Expected Count	1.9	36.9	32.9	30.4	102.0
	blyth valley	Count	0	145	60	72	277
		Expected Count	5.1	100.1	89.3	82.5	277.0
	castle morpeth	Count	1	43	102	17	163
		Expected Count	3.0	58.9	52.5	48.6	163.0
	tynedale	Count	0	65	129	9	203
		Expected Count	3.7	73.3	65.4	60.5	203.0
	wansbeck	Count	0	87	69	56	212
		Expected Count	3.9	76.6	68.3	63.2	212.0
Total		Count	158	3107	2772	2562	8599
		Expected Count	158.0	3107.0	2772.0	2562.0	8599.0

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.408	.000
	Cramer's V	.236	.000
N of Valid Cases		8599	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

2.3 Qualification and Council

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.340	.000
	Cramer's V	.240	.000
N of Valid Cases		8599	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

There is a weak association between qualifications and council area. The following table gives the detailed output.

HIGHCODE * qualification 3 cluster Crosstabulation

			qualification 3 cluster			
			highest qualified	intermediate qualification	lowest qualification	Total
HIGHCODE	gateshead	Count	67	281	331	679
		Expected Count	121.2	268.2	289.6	679.0
	newcastle	Count	284	236	369	889
		Expected Count	158.7	351.2	379.1	889.0
	noth tyneside	Count	163	269	246	678
		Expected Count	121.0	267.8	289.1	678.0
	south tyneside	Count	52	219	259	530
		Expected Count	94.6	209.4	226.0	530.0
	sunderland	Count	96	377	465	938
		Expected Count	167.4	370.6	400.0	938.0
	hartlepool	Count	33	107	160	300
		Expected Count	53.6	118.5	127.9	300.0
	middlesborough	Count	53	191	200	444
		Expected Count	79.3	175.4	189.3	444.0
	redcar & clevland	Count	51	223	188	462
		Expected Count	82.5	182.5	197.0	462.0
	stockton	Count	127	249	206	582
		Expected Count	103.9	229.9	248.2	582.0
	darlington	Count	73	166	105	344
		Expected Count	61.4	135.9	146.7	344.0
	chester-lee-street	Count	33	88	62	183
		Expected Count	32.7	72.3	78.0	183.0
	derwentside	Count	45	119	129	293
		Expected Count	52.3	115.7	124.9	293.0
	durham	Count	111	74	97	282
		Expected Count	50.3	111.4	120.3	282.0
	easington	Count	11	79	225	315
		Expected Count	56.2	124.4	134.3	315.0
	sedgefield	Count	29	119	154	302
		Expected Count	53.9	119.3	128.8	302.0
	teesdale	Count	20	50	21	91
		Expected Count	16.2	35.9	38.8	91.0
	wear valley	Count	13	95	106	214
		Expected Count	38.2	84.5	91.3	214.0
	alnwick	Count	40	56	20	116
		Expected Count	20.7	45.8	49.5	116.0
	berwick	Count	11	60	31	102
		Expected Count	18.2	40.3	43.5	102.0
	blyth valley	Count	21	147	109	277
		Expected Count	49.4	109.4	118.1	277.0
	castle morpeth	Count	89	40	34	163
		Expected Count	29.1	64.4	69.5	163.0
	tynedale	Count	97	73	33	203
		Expected Count	36.2	80.2	86.6	203.0
	wansbeck	Count	16	79	117	212
		Expected Count	37.8	83.7	90.4	212.0
Total		Count	1535	3397	3667	8599
		Expected Count	1535.0	3397.0	3667.0	8599.0

2.4 Tenure and Council

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.262	.000
	Cramer's V	.185	.000
N of Valid Cases		8599	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

There is a weak association between tenure and council. The following table gives the details for each council area.

HIGHCODE * tenure 3-cluster Crosstabulation

			tenure 3-cluster			
			high council renting	high ownership and mortgages	high rental HA & private	Total
HIGHCODE	gateshead	Count	278	308	93	679
		Expected Count	217.9	362.1	99.0	679.0
	newcastle	Count	324	363	202	889
		Expected Count	285.2	474.1	129.6	889.0
	noth tyneside	Count	201	390	87	678
		Expected Count	217.5	361.6	98.9	678.0
	south tyneside	Count	249	211	70	530
		Expected Count	170.1	282.7	77.3	530.0
	sunderland	Count	346	449	143	938
		Expected Count	301.0	500.3	136.8	938.0
	hartlepool	Count	89	156	55	300
		Expected Count	96.3	160.0	43.7	300.0
	middlesborough	Count	139	216	89	444
		Expected Count	142.5	236.8	64.7	444.0
	redcar & clevland	Count	123	294	45	462
		Expected Count	148.2	246.4	67.4	462.0
	stockton	Count	144	378	60	582
		Expected Count	186.7	310.4	84.9	582.0
	darlington	Count	65	233	46	344
		Expected Count	110.4	183.5	50.2	344.0
	chester-lee-street	Count	56	122	5	183
		Expected Count	58.7	97.6	26.7	183.0
	derwentside	Count	100	180	13	293
		Expected Count	94.0	156.3	42.7	293.0
	durham	Count	80	164	38	282
		Expected Count	90.5	150.4	41.1	282.0
	easington	Count	124	163	28	315
		Expected Count	101.1	168.0	45.9	315.0
	sedgefield	Count	127	147	28	302
		Expected Count	96.9	161.1	44.0	302.0
	teesdale	Count	8	59	24	91
		Expected Count	29.2	48.5	13.3	91.0
	wear valley	Count	56	137	21	214
		Expected Count	68.7	114.1	31.2	214.0
	alnwick	Count	20	58	38	116
		Expected Count	37.2	61.9	16.9	116.0
	berwick	Count	26	36	40	102
		Expected Count	32.7	54.4	14.9	102.0
	blyth valley	Count	92	161	24	277
		Expected Count	88.9	147.7	40.4	277.0
	castle morpeth	Count	26	118	19	163
		Expected Count	52.3	86.9	23.8	163.0
	tynedale	Count	13	126	64	203
		Expected Count	65.1	108.3	29.6	203.0
	wansbeck	Count	73	117	22	212
		Expected Count	68.0	113.1	30.9	212.0
Total		Count	2759	4586	1254	8599
		Expected Count	2759.0	4586.0	1254.0	8599.0

2.5 Work status and Council

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.317	.000
	Cramer's V	.224	.000
N of Valid Cases		8599	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

There is a weak association between work status and council. The following table gives the details for each council area.

HIGHCODE * recoded work status Crosstabulation

			recoded work status			Total
			most managers and professionals	middle	most elementary and process	
HIGHCODE	gateshead	Count	86	289	304	679
		Expected Count	124.8	266.4	287.7	679.0
	newcastle	Count	254	301	334	889
		Expected Count	163.5	348.8	376.7	889.0
	noth tyneside	Count	172	306	200	678
		Expected Count	124.7	266.0	287.3	678.0
	south tyneside	Count	64	218	248	530
		Expected Count	97.4	208.0	224.6	530.0
	sunderland	Count	97	364	477	938
		Expected Count	172.5	368.0	397.5	938.0
	hartlepool	Count	28	108	164	300
		Expected Count	55.2	117.7	127.1	300.0
	middlesborough	Count	61	152	231	444
		Expected Count	81.6	174.2	188.2	444.0
	redcar & clevland	Count	57	211	194	462
		Expected Count	84.9	181.3	195.8	462.0
	stockton	Count	134	230	218	582
		Expected Count	107.0	228.4	246.6	582.0
	darlington	Count	83	147	114	344
		Expected Count	63.2	135.0	145.8	344.0
	chester-lee-street	Count	42	87	54	183
		Expected Count	33.6	71.8	77.5	183.0
	derwentside	Count	43	119	131	293
		Expected Count	53.9	115.0	124.2	293.0
	durham	Count	114	65	103	282
		Expected Count	51.8	110.6	119.5	282.0
	easington	Count	11	92	212	315
		Expected Count	57.9	123.6	133.5	315.0
	sedgefield	Count	33	94	175	302
		Expected Count	55.5	118.5	128.0	302.0
	teesdale	Count	19	52	20	91
		Expected Count	16.7	35.7	38.6	91.0
	wear valley	Count	22	88	104	214
		Expected Count	39.3	84.0	90.7	214.0
	alnwick	Count	36	55	25	116
		Expected Count	21.3	45.5	49.2	116.0
	berwick	Count	4	55	43	102
		Expected Count	18.8	40.0	43.2	102.0
	blyth valley	Count	28	147	102	277
		Expected Count	50.9	108.7	117.4	277.0
	castle morpeth	Count	90	40	33	163
		Expected Count	30.0	64.0	69.1	163.0
	tynedale	Count	89	70	44	203
		Expected Count	37.3	79.7	86.0	203.0
	wansbeck	Count	14	84	114	212
		Expected Count	39.0	83.2	89.8	212.0
Total		Count	1581	3374	3644	8599
		Expected Count	1581.0	3374.0	3644.0	8599.0

2.6 Age and Council

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.347	.000
	Cramer's V	.200	.000
N of Valid Cases		8599	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

There is a weak association between age and council. The following table gives the details for each council area.

HIGHCODE * area age 4 cluster Crosstabulation

			area age 4 cluster				
			young adults lowest children mixed	most 30-44 and most children mixed	most 44-59 mixed	most over 59 mixed	Total
HIGHCODE	gateshead	Count	2	249	306	122	679
		Expected Count	14.6	240.0	318.5	105.8	679.0
	newcastle	Count	122	311	335	121	889
		Expected Count	19.1	314.3	417.1	138.5	889.0
	noth tyneside	Count	1	226	320	131	678
		Expected Count	14.6	239.7	318.1	105.7	678.0
	south tyneside	Count	1	188	244	97	530
		Expected Count	11.4	187.4	248.6	82.6	530.0
	sunderland	Count	16	377	421	124	938
		Expected Count	20.2	331.6	440.0	146.2	938.0
	hartlepool	Count	1	134	121	44	300
		Expected Count	6.5	106.1	140.7	46.7	300.0
	middlesborough	Count	12	216	163	53	444
		Expected Count	9.6	157.0	208.3	69.2	444.0
	redcar & clevland	Count	1	168	210	83	462
		Expected Count	9.9	163.3	216.7	72.0	462.0
	stockton	Count	6	267	227	82	582
		Expected Count	12.5	205.8	273.0	90.7	582.0
	darlington	Count	0	126	160	58	344
		Expected Count	7.4	121.6	161.4	53.6	344.0
	chester-lee-street	Count	0	71	85	27	183
		Expected Count	3.9	64.7	85.8	28.5	183.0
	derwentside	Count	0	85	162	46	293
		Expected Count	6.3	103.6	137.5	45.7	293.0
	durham	Count	20	82	150	30	282
		Expected Count	6.1	99.7	132.3	43.9	282.0
	easington	Count	0	121	153	41	315
		Expected Count	6.8	111.4	147.8	49.1	315.0
	sedgefield	Count	0	105	156	41	302
		Expected Count	6.5	106.8	141.7	47.1	302.0
	teesdale	Count	1	7	69	14	91
		Expected Count	2.0	32.2	42.7	14.2	91.0
	wear valley	Count	0	54	133	27	214
		Expected Count	4.6	75.7	100.4	33.3	214.0
	alnwick	Count	0	16	75	25	116
		Expected Count	2.5	41.0	54.4	18.1	116.0
	berwick	Count	0	11	57	34	102
		Expected Count	2.2	36.1	47.9	15.9	102.0
	blyth valley	Count	0	109	130	38	277
		Expected Count	6.0	97.9	129.9	43.2	277.0
	castle morpeth	Count	2	24	104	33	163
		Expected Count	3.5	57.6	76.5	25.4	163.0
	tynedale	Count	0	30	142	31	203
		Expected Count	4.4	71.8	95.2	31.6	203.0
	wansbeck	Count	0	63	111	38	212
		Expected Count	4.6	74.9	99.5	33.0	212.0
Total		Count	185	3040	4034	1340	8599
		Expected Count	185.0	3040.0	4034.0	1340.0	8599.0

2.7 Marital Status and Council

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.344	.000
	Cramer's V	.244	.000
N of Valid Cases		8599	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

There is a weak association between Marital Status and Council. The following table gives the details for each council area.

HIGHCODE * Couple Status 3-cluster Crosstabulation

			Couple Status 3-cluster			Total
			mostly married	mostly unmarried	mixed&intermediate	
HIGHCODE	gateshead	Count	229	145	305	679
		Expected Count	258.8	118.2	302.0	679.0
	newcastle	Count	204	377	308	889
		Expected Count	338.9	154.8	395.3	889.0
	noth tyneside	Count	248	95	335	678
		Expected Count	258.5	118.0	301.5	678.0
	south tyneside	Count	147	104	279	530
		Expected Count	202.0	92.3	235.7	530.0
	sunderland	Count	297	160	481	938
		Expected Count	357.6	163.3	417.1	938.0
	hartlepool	Count	115	54	131	300
		Expected Count	114.4	52.2	133.4	300.0
	middlesborough	Count	134	158	152	444
		Expected Count	169.3	77.3	197.4	444.0
	redcar & clevland	Count	197	80	185	462
		Expected Count	176.1	80.4	205.5	462.0
	stockton	Count	262	101	219	582
		Expected Count	221.9	101.3	258.8	582.0
	darlington	Count	151	58	135	344
		Expected Count	131.1	59.9	153.0	344.0
	chester-lee-street	Count	95	11	77	183
		Expected Count	69.8	31.9	81.4	183.0
	derwentside	Count	111	16	166	293
		Expected Count	111.7	51.0	130.3	293.0
	durham	Count	124	36	122	282
		Expected Count	107.5	49.1	125.4	282.0
	easington	Count	110	18	187	315
		Expected Count	120.1	54.8	140.1	315.0
	sedgefield	Count	121	12	169	302
		Expected Count	115.1	52.6	134.3	302.0
	teesdale	Count	57	2	32	91
		Expected Count	34.7	15.8	40.5	91.0
	wear valley	Count	84	15	115	214
		Expected Count	81.6	37.3	95.2	214.0
	alnwick	Count	78	4	34	116
		Expected Count	44.2	20.2	51.6	116.0
	berwick	Count	64	3	35	102
		Expected Count	38.9	17.8	45.4	102.0
	blyth valley	Count	124	22	131	277
		Expected Count	105.6	48.2	123.2	277.0
	castle morpeth	Count	110	4	49	163
		Expected Count	62.1	28.4	72.5	163.0
	tynedale	Count	134	7	62	203
		Expected Count	77.4	35.3	90.3	203.0
	wansbeck	Count	82	15	115	212
		Expected Count	80.8	36.9	94.3	212.0
Total		Count	3278	1497	3824	8599
		Expected Count	3278.0	1497.0	3824.0	8599.0

2.8 Health and Council

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.260	.000
	Cramer's V	.184	.000
N of Valid Cases		8599	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

There is a weak association between Health and Council. The following table gives the details for councils.

HIGHCODE * health 3-cluster Crosstabulation

			health 3-cluster			Total
			better health	middle health	worse health	
HIGHCODE	gateshead	Count	196	340	143	679
		Expected Count	246.0	319.1	113.9	679.0
	newcastle	Count	360	370	159	889
		Expected Count	322.1	417.8	149.1	889.0
	noth tyneside	Count	269	318	91	678
		Expected Count	245.7	318.6	113.7	678.0
	south tyneside	Count	168	281	81	530
		Expected Count	192.1	249.1	88.9	530.0
	sunderland	Count	280	488	170	938
		Expected Count	339.9	440.8	157.3	938.0
	hartlepool	Count	93	153	54	300
		Expected Count	108.7	141.0	50.3	300.0
	middlesborough	Count	179	202	63	444
		Expected Count	160.9	208.7	74.5	444.0
	redcar & clevland	Count	147	240	75	462
		Expected Count	167.4	217.1	77.5	462.0
	stockton	Count	270	248	64	582
		Expected Count	210.9	273.5	97.6	582.0
	darlington	Count	170	144	30	344
		Expected Count	124.7	161.7	57.7	344.0
	chester-lee-street	Count	72	79	32	183
		Expected Count	66.3	86.0	30.7	183.0
	derwentside	Count	69	165	59	293
		Expected Count	106.2	137.7	49.1	293.0
	durham	Count	129	112	41	282
		Expected Count	102.2	132.5	47.3	282.0
	easington	Count	33	144	138	315
		Expected Count	114.1	148.0	52.8	315.0
	sedgefield	Count	77	162	63	302
		Expected Count	109.4	141.9	50.6	302.0
	teesdale	Count	50	37	4	91
		Expected Count	33.0	42.8	15.3	91.0
	wear valley	Count	57	115	42	214
		Expected Count	77.5	100.6	35.9	214.0
	alnwick	Count	68	45	3	116
		Expected Count	42.0	54.5	19.5	116.0
	berwick	Count	44	52	6	102
		Expected Count	37.0	47.9	17.1	102.0
	blyth valley	Count	111	119	47	277
		Expected Count	100.4	130.2	46.5	277.0
	castle morpeth	Count	95	52	16	163
		Expected Count	59.1	76.6	27.3	163.0
	tynedale	Count	132	63	8	203
		Expected Count	73.6	95.4	34.0	203.0
	wansbeck	Count	47	112	53	212
		Expected Count	76.8	99.6	35.6	212.0
Total		Count	3116	4041	1442	8599
		Expected Count	3116.0	4041.0	1442.0	8599.0

2.9 Health and Tenure by Council

health 3-cluster * tenure 3-cluster * HIGHCODE Crosstabulation

HIGHCODE				tenure 3-cluster: high council renting	tenure 3-cluster: high ownership and mortgages	tenure 3-cluster: high rental HA & private	Total
gateshead	health 3-cluster	better health	Count	7	176	13	196
			Expected Count	80.2	88.9	26.8	196.0
		middle health	Count	154	128	58	340
			Expected Count	139.2	154.2	46.6	340.0
		worse health	Count	117	4	22	143
			Expected Count	58.5	64.9	19.6	143.0
	Total		Count	278	308	93	679
			Expected Count	278.0	308.0	93.0	679.0
newcastle	health 3-cluster	better health	Count	14	239	107	360
			Expected Count	131.2	147.0	81.8	360.0
		middle health	Count	182	121	67	370
			Expected Count	134.8	151.1	84.1	370.0
		worse health	Count	128	3	28	159
			Expected Count	57.9	64.9	36.1	159.0
	Total		Count	324	363	202	889
			Expected Count	324.0	363.0	202.0	889.0
noth tyneside	health 3-cluster	better health	Count	12	243	14	269
			Expected Count	79.7	154.7	34.5	269.0
		middle health	Count	129	135	54	318
			Expected Count	94.3	182.9	40.8	318.0
		worse health	Count	60	12	19	91
			Expected Count	27.0	52.3	11.7	91.0
	Total		Count	201	390	87	678
			Expected Count	201.0	390.0	87.0	678.0
south tyneside	health 3-cluster	better health	Count	19	140	9	168
			Expected Count	78.9	66.9	22.2	168.0
		middle health	Count	162	66	53	281
			Expected Count	132.0	111.9	37.1	281.0
		worse health	Count	68	5	8	81
			Expected Count	38.1	32.2	10.7	81.0
	Total		Count	249	211	70	530
			Expected Count	249.0	211.0	70.0	530.0
sunderland	health 3-cluster	better health	Count	21	231	28	280
			Expected Count	103.3	134.0	42.7	280.0
		middle health	Count	221	196	71	488
			Expected Count	180.0	233.6	74.4	488.0
		worse health	Count	104	22	44	170
			Expected Count	62.7	81.4	25.9	170.0
	Total		Count	346	449	143	938
			Expected Count	346.0	449.0	143.0	938.0
hartlepool	health 3-cluster	better health	Count	1	87	5	93
			Expected Count	27.6	48.4	17.1	93.0
		middle health	Count	54	63	36	153
			Expected Count	45.4	79.6	28.1	153.0
		worse health	Count	34	6	14	54
			Expected Count	16.0	28.1	9.9	54.0
	Total		Count	89	156	55	300
			Expected Count	89.0	156.0	55.0	300.0
middlesborough	health 3-cluster	better health	Count	14	132	33	179
			Expected Count	56.0	87.1	35.9	179.0
		middle health	Count	90	73	39	202
			Expected Count	63.2	98.3	40.5	202.0
		worse health	Count	35	11	17	63
			Expected Count	19.7	30.6	12.6	63.0
	Total		Count	139	216	89	444
			Expected Count	139.0	216.0	89.0	444.0
redcar & clevland	health 3-cluster	better health	Count	5	141	1	147
			Expected Count	39.1	93.5	14.3	147.0
		middle health	Count	72	138	30	240
			Expected Count	63.9	152.7	23.4	240.0
		worse health	Count	46	15	14	75
			Expected Count	20.0	47.7	7.3	75.0
	Total		Count	123	294	45	462
			Expected Count	123.0	294.0	45.0	462.0
stockton	health 3-cluster	better health	Count	8	251	11	270
			Expected Count	66.8	175.4	27.8	270.0
		middle health	Count	94	119	35	248
			Expected Count	61.4	161.1	25.6	248.0
		worse health	Count	42	8	14	64
			Expected Count	15.8	41.6	6.6	64.0
	Total		Count	144	378	60	582
			Expected Count	144.0	378.0	60.0	582.0
darlington	health 3-cluster	better health	Count	6	154	10	170
			Expected Count	32.1	115.1	22.7	170.0
		middle health	Count	41	73	30	144
			Expected Count	27.2	97.5	19.3	144.0
		worse health	Count	18	6	6	30
			Expected Count	5.7	20.3	4.0	30.0
	Total		Count	65	233	46	344
			Expected Count	65.0	233.0	46.0	344.0
chester-lee-street	health 3-cluster	better health	Count	1	71	0	72
			Expected Count	22.0	48.0	2.0	72.0
		middle health	Count	28	47	4	79
			Expected Count	24.2	52.7	2.2	79.0
		worse health	Count	27	4	1	32
			Expected Count	9.8	21.3	.9	32.0
	Total		Count	56	122	5	183
			Expected Count	56.0	122.0	5.0	183.0
derwentside	health 3-cluster	better health	Count	4	64	1	69
			Expected Count	23.5	42.4	3.1	69.0
		middle health	Count	58	99	8	165
			Expected Count	56.3	101.4	7.3	165.0
		worse health	Count	38	17	4	59
			Expected Count	20.1	36.2	2.6	59.0
	Total		Count	100	180	13	293
			Expected Count	100.0	180.0	13.0	293.0
durham	health 3-cluster	better health	Count	2	109	18	129
			Expected Count	36.6	75.0	17.4	129.0
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			Expected Count	31.8	65.1	15.1	112.0
		worse health	Count	39	0	2	41
			Expected Count	11.6	23.8	5.5	41.0
	Total		Count	80	164	38	282

Symmetric Measures

HIGHCODE			Value	Approx. Sig.
gateshead	Nominal by Nominal	Phi	.647	.000
		Cramer's V	.457	.000
	N of Valid Cases		679	
newcastle	Nominal by Nominal	Phi	.620	.000
		Cramer's V	.438	.000
	N of Valid Cases		889	
noth tyneside	Nominal by Nominal	Phi	.577	.000
		Cramer's V	.408	.000
	N of Valid Cases		678	
south tyneside	Nominal by Nominal	Phi	.634	.000
		Cramer's V	.448	.000
	N of Valid Cases		530	
sunderland	Nominal by Nominal	Phi	.505	.000
		Cramer's V	.357	.000
	N of Valid Cases		938	
hartlepool	Nominal by Nominal	Phi	.610	.000
		Cramer's V	.431	.000
	N of Valid Cases		300	
middlesborough	Nominal by Nominal	Phi	.472	.000
		Cramer's V	.333	.000
	N of Valid Cases		444	
redcar & clevland	Nominal by Nominal	Phi	.537	.000
		Cramer's V	.380	.000
	N of Valid Cases		462	
stockton	Nominal by Nominal	Phi	.594	.000
		Cramer's V	.420	.000
	N of Valid Cases		582	
darlington	Nominal by Nominal	Phi	.535	.000
		Cramer's V	.378	.000
	N of Valid Cases		344	
chester-lee-street	Nominal by Nominal	Phi	.662	.000
		Cramer's V	.468	.000
	N of Valid Cases		183	
derwentside	Nominal by Nominal	Phi	.436	.000
		Cramer's V	.308	.000
	N of Valid Cases		293	
durham	Nominal by Nominal	Phi	.711	.000
		Cramer's V	.502	.000
	N of Valid Cases		282	
easington	Nominal by Nominal	Phi	.463	.000
		Cramer's V	.327	.000
	N of Valid Cases		315	
sedgefield	Nominal by Nominal	Phi	.575	.000
		Cramer's V	.406	.000
	N of Valid Cases		302	
teesdale	Nominal by Nominal	Phi	.380	.011
		Cramer's V	.269	.011
	N of Valid Cases		91	
wear valley	Nominal by Nominal	Phi	.570	.000
		Cramer's V	.403	.000
	N of Valid Cases		214	
alnwick	Nominal by Nominal	Phi	.394	.001
		Cramer's V	.278	.001
	N of Valid Cases		116	
berwick	Nominal by Nominal	Phi	.277	.097
		Cramer's V	.196	.097
	N of Valid Cases		102	
blyth valley	Nominal by Nominal	Phi	.666	.000
		Cramer's V	.471	.000
	N of Valid Cases		277	
castle morpeth	Nominal by Nominal	Phi	.513	.000
		Cramer's V	.363	.000
	N of Valid Cases		163	
tynedale	Nominal by Nominal	Phi	.418	.000
		Cramer's V	.295	.000
	N of Valid Cases		203	
wansbeck	Nominal by	Phi	.550	.000

3 APPROXIMATON THROUGH LOGLINEAR MODELLING

3.1 The Saturated Model and Interaction Terms

Model and Design Information

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Model: Poisson
Design: Constant + NEWWARD + C4ECACT + TENURE3 + NEWWARD*C4ECACT +
NEWWARD*TENURE3 + C4ECACT*TENURE3 + NEWWARD*C4ECACT*TENURE3
```

Parameter	Aliased	Term
1		Constant
2		[NEWWARD = 1]
3		[NEWWARD = 2]
4		[NEWWARD = 3]
5		[NEWWARD = 4]
6		[NEWWARD = 5]
7		[NEWWARD = 6]
8		[NEWWARD = 7]
9		[NEWWARD = 8]
10		[NEWWARD = 9]
11		[NEWWARD = 10]
12		[NEWWARD = 11]
13		[NEWWARD = 12]
14		[NEWWARD = 13]
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22		[NEWWARD = 21]
23		[NEWWARD = 22]
24		[NEWWARD = 23]
25		[NEWWARD = 24]
26		[NEWWARD = 25]
27	x	[NEWWARD = 26]
28		[C4ECACT = 1]
29		[C4ECACT = 2]
30		[C4ECACT = 3]
31	x	[C4ECACT = 4]
32		[TENURE3 = 1]
33		[TENURE3 = 2]
34	x	[TENURE3 = 3]
35		[NEWWARD = 1]*[C4ECACT = 1]
36		[NEWWARD = 1]*[C4ECACT = 2]
37		[NEWWARD = 1]*[C4ECACT = 3]
38	x	[NEWWARD = 1]*[C4ECACT = 4]
39		[NEWWARD = 2]*[C4ECACT = 1]
40		[NEWWARD = 2]*[C4ECACT = 2]
41		[NEWWARD = 2]*[C4ECACT = 3]
42	x	[NEWWARD = 2]*[C4ECACT = 4]
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44		[NEWWARD = 3]*[C4ECACT = 2]
45		[NEWWARD = 3]*[C4ECACT = 3]
46	x	[NEWWARD = 3]*[C4ECACT = 4]
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50	x	[NEWWARD = 4]*[C4ECACT = 4]
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60		[NEWWARD = 7]*[C4ECACT = 2]
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66	x	[NEWWARD = 8]*[C4ECACT = 4]
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70	x	[NEWWARD = 9]*[C4ECACT = 4]
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72		[NEWWARD = 10]*[C4ECACT = 2]
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74	x	[NEWWARD = 10]*[C4ECACT = 4]
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76		[NEWWARD = 11]*[C4ECACT = 2]
77		[NEWWARD = 11]*[C4ECACT = 3]
78	x	[NEWWARD = 11]*[C4ECACT = 4]
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81		[NEWWARD = 12]*[C4ECACT = 3]
82	x	[NEWWARD = 12]*[C4ECACT = 4]
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86	x	[NEWWARD = 13]*[C4ECACT = 4]
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90	x	[NEWWARD = 14]*[C4ECACT = 4]
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94	x	[NEWWARD = 15]*[C4ECACT = 4]
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98	x	[NEWWARD = 16]*[C4ECACT = 4]
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101		[NEWWARD = 17]*[C4ECACT = 3]
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137	x	[NEWWARD = 26]*[C4ECACT = 3]
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195	x	[NEWWARD = 19]*[TENURE3 = 3]
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206		[NEWWARD = 23]*[TENURE3 = 2]
207	x	[NEWWARD = 23]*[TENURE3 = 3]
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209		[NEWWARD = 24]*[TENURE3 = 2]

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212		[NEWWARD = 25]*[TENURE3 = 2]
213	x	[NEWWARD = 25]*[TENURE3 = 3]
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215	x	[NEWWARD = 26]*[TENURE3 = 2]
216	x	[NEWWARD = 26]*[TENURE3 = 3]
217		[C4ECACT = 1]*[TENURE3 = 1]
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219	x	[C4ECACT = 1]*[TENURE3 = 3]
220		[C4ECACT = 2]*[TENURE3 = 1]
221		[C4ECACT = 2]*[TENURE3 = 2]
222	x	[C4ECACT = 2]*[TENURE3 = 3]
223		[C4ECACT = 3]*[TENURE3 = 1]
224		[C4ECACT = 3]*[TENURE3 = 2]
225	x	[C4ECACT = 3]*[TENURE3 = 3]
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227	x	[C4ECACT = 4]*[TENURE3 = 2]
228	x	[C4ECACT = 4]*[TENURE3 = 3]
229		[NEWWARD = 1]*[C4ECACT = 1]*[TENURE3 = 1]
230		[NEWWARD = 1]*[C4ECACT = 1]*[TENURE3 = 2]
231	x	[NEWWARD = 1]*[C4ECACT = 1]*[TENURE3 = 3]
232		[NEWWARD = 1]*[C4ECACT = 2]*[TENURE3 = 1]
233		[NEWWARD = 1]*[C4ECACT = 2]*[TENURE3 = 2]
234	x	[NEWWARD = 1]*[C4ECACT = 2]*[TENURE3 = 3]
235		[NEWWARD = 1]*[C4ECACT = 3]*[TENURE3 = 1]
236		[NEWWARD = 1]*[C4ECACT = 3]*[TENURE3 = 2]
237	x	[NEWWARD = 1]*[C4ECACT = 3]*[TENURE3 = 3]
238	x	[NEWWARD = 1]*[C4ECACT = 4]*[TENURE3 = 1]
239	x	[NEWWARD = 1]*[C4ECACT = 4]*[TENURE3 = 2]
240	x	[NEWWARD = 1]*[C4ECACT = 4]*[TENURE3 = 3]
241		[NEWWARD = 2]*[C4ECACT = 1]*[TENURE3 = 1]
242		[NEWWARD = 2]*[C4ECACT = 1]*[TENURE3 = 2]
243	x	[NEWWARD = 2]*[C4ECACT = 1]*[TENURE3 = 3]
244		[NEWWARD = 2]*[C4ECACT = 2]*[TENURE3 = 1]
245		[NEWWARD = 2]*[C4ECACT = 2]*[TENURE3 = 2]
246	x	[NEWWARD = 2]*[C4ECACT = 2]*[TENURE3 = 3]
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248		[NEWWARD = 2]*[C4ECACT = 3]*[TENURE3 = 2]
249	x	[NEWWARD = 2]*[C4ECACT = 3]*[TENURE3 = 3]
250	x	[NEWWARD = 2]*[C4ECACT = 4]*[TENURE3 = 1]
251	x	[NEWWARD = 2]*[C4ECACT = 4]*[TENURE3 = 2]
252	x	[NEWWARD = 2]*[C4ECACT = 4]*[TENURE3 = 3]
253		[NEWWARD = 3]*[C4ECACT = 1]*[TENURE3 = 1]
254		[NEWWARD = 3]*[C4ECACT = 1]*[TENURE3 = 2]
255	x	[NEWWARD = 3]*[C4ECACT = 1]*[TENURE3 = 3]
256		[NEWWARD = 3]*[C4ECACT = 2]*[TENURE3 = 1]
257		[NEWWARD = 3]*[C4ECACT = 2]*[TENURE3 = 2]
258	x	[NEWWARD = 3]*[C4ECACT = 2]*[TENURE3 = 3]
259		[NEWWARD = 3]*[C4ECACT = 3]*[TENURE3 = 1]
260		[NEWWARD = 3]*[C4ECACT = 3]*[TENURE3 = 2]
261	x	[NEWWARD = 3]*[C4ECACT = 3]*[TENURE3 = 3]
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263	x	[NEWWARD = 3]*[C4ECACT = 4]*[TENURE3 = 2]
264	x	[NEWWARD = 3]*[C4ECACT = 4]*[TENURE3 = 3]
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266		[NEWWARD = 4]*[C4ECACT = 1]*[TENURE3 = 2]
267	x	[NEWWARD = 4]*[C4ECACT = 1]*[TENURE3 = 3]
268		[NEWWARD = 4]*[C4ECACT = 2]*[TENURE3 = 1]
269		[NEWWARD = 4]*[C4ECACT = 2]*[TENURE3 = 2]
270	x	[NEWWARD = 4]*[C4ECACT = 2]*[TENURE3 = 3]
271		[NEWWARD = 4]*[C4ECACT = 3]*[TENURE3 = 1]
272		[NEWWARD = 4]*[C4ECACT = 3]*[TENURE3 = 2]
273	x	[NEWWARD = 4]*[C4ECACT = 3]*[TENURE3 = 3]
274	x	[NEWWARD = 4]*[C4ECACT = 4]*[TENURE3 = 1]
275	x	[NEWWARD = 4]*[C4ECACT = 4]*[TENURE3 = 2]
276	x	[NEWWARD = 4]*[C4ECACT = 4]*[TENURE3 = 3]
277		[NEWWARD = 5]*[C4ECACT = 1]*[TENURE3 = 1]
278		[NEWWARD = 5]*[C4ECACT = 1]*[TENURE3 = 2]
279	x	[NEWWARD = 5]*[C4ECACT = 1]*[TENURE3 = 3]
280		[NEWWARD = 5]*[C4ECACT = 2]*[TENURE3 = 1]
281		[NEWWARD = 5]*[C4ECACT = 2]*[TENURE3 = 2]
282	x	[NEWWARD = 5]*[C4ECACT = 2]*[TENURE3 = 3]
283		[NEWWARD = 5]*[C4ECACT = 3]*[TENURE3 = 1]
284		[NEWWARD = 5]*[C4ECACT = 3]*[TENURE3 = 2]
285	x	[NEWWARD = 5]*[C4ECACT = 3]*[TENURE3 = 3]
286	x	[NEWWARD = 5]*[C4ECACT = 4]*[TENURE3 = 1]

287	x	[NEWWARD = 5]*[C4ECACT = 4]*[TENURE3 = 2]
288	x	[NEWWARD = 5]*[C4ECACT = 4]*[TENURE3 = 3]
289		[NEWWARD = 6]*[C4ECACT = 1]*[TENURE3 = 1]
290		[NEWWARD = 6]*[C4ECACT = 1]*[TENURE3 = 2]
291	x	[NEWWARD = 6]*[C4ECACT = 1]*[TENURE3 = 3]
292		[NEWWARD = 6]*[C4ECACT = 2]*[TENURE3 = 1]
293		[NEWWARD = 6]*[C4ECACT = 2]*[TENURE3 = 2]
294	x	[NEWWARD = 6]*[C4ECACT = 2]*[TENURE3 = 3]
295		[NEWWARD = 6]*[C4ECACT = 3]*[TENURE3 = 1]
296		[NEWWARD = 6]*[C4ECACT = 3]*[TENURE3 = 2]
297	x	[NEWWARD = 6]*[C4ECACT = 3]*[TENURE3 = 3]
298	x	[NEWWARD = 6]*[C4ECACT = 4]*[TENURE3 = 1]
299	x	[NEWWARD = 6]*[C4ECACT = 4]*[TENURE3 = 2]
300	x	[NEWWARD = 6]*[C4ECACT = 4]*[TENURE3 = 3]
301		[NEWWARD = 7]*[C4ECACT = 1]*[TENURE3 = 1]
302		[NEWWARD = 7]*[C4ECACT = 1]*[TENURE3 = 2]
303	x	[NEWWARD = 7]*[C4ECACT = 1]*[TENURE3 = 3]
304		[NEWWARD = 7]*[C4ECACT = 2]*[TENURE3 = 1]
305		[NEWWARD = 7]*[C4ECACT = 2]*[TENURE3 = 2]
306	x	[NEWWARD = 7]*[C4ECACT = 2]*[TENURE3 = 3]
307		[NEWWARD = 7]*[C4ECACT = 3]*[TENURE3 = 1]
308		[NEWWARD = 7]*[C4ECACT = 3]*[TENURE3 = 2]
309	x	[NEWWARD = 7]*[C4ECACT = 3]*[TENURE3 = 3]
310	x	[NEWWARD = 7]*[C4ECACT = 4]*[TENURE3 = 1]
311	x	[NEWWARD = 7]*[C4ECACT = 4]*[TENURE3 = 2]
312	x	[NEWWARD = 7]*[C4ECACT = 4]*[TENURE3 = 3]
313		[NEWWARD = 8]*[C4ECACT = 1]*[TENURE3 = 1]
314		[NEWWARD = 8]*[C4ECACT = 1]*[TENURE3 = 2]
315	x	[NEWWARD = 8]*[C4ECACT = 1]*[TENURE3 = 3]
316		[NEWWARD = 8]*[C4ECACT = 2]*[TENURE3 = 1]
317		[NEWWARD = 8]*[C4ECACT = 2]*[TENURE3 = 2]
318	x	[NEWWARD = 8]*[C4ECACT = 2]*[TENURE3 = 3]
319		[NEWWARD = 8]*[C4ECACT = 3]*[TENURE3 = 1]
320		[NEWWARD = 8]*[C4ECACT = 3]*[TENURE3 = 2]
321	x	[NEWWARD = 8]*[C4ECACT = 3]*[TENURE3 = 3]
322	x	[NEWWARD = 8]*[C4ECACT = 4]*[TENURE3 = 1]
323	x	[NEWWARD = 8]*[C4ECACT = 4]*[TENURE3 = 2]
324	x	[NEWWARD = 8]*[C4ECACT = 4]*[TENURE3 = 3]
325		[NEWWARD = 9]*[C4ECACT = 1]*[TENURE3 = 1]
326		[NEWWARD = 9]*[C4ECACT = 1]*[TENURE3 = 2]
327	x	[NEWWARD = 9]*[C4ECACT = 1]*[TENURE3 = 3]
328		[NEWWARD = 9]*[C4ECACT = 2]*[TENURE3 = 1]
329		[NEWWARD = 9]*[C4ECACT = 2]*[TENURE3 = 2]
330	x	[NEWWARD = 9]*[C4ECACT = 2]*[TENURE3 = 3]
331		[NEWWARD = 9]*[C4ECACT = 3]*[TENURE3 = 1]
332		[NEWWARD = 9]*[C4ECACT = 3]*[TENURE3 = 2]
333	x	[NEWWARD = 9]*[C4ECACT = 3]*[TENURE3 = 3]
334	x	[NEWWARD = 9]*[C4ECACT = 4]*[TENURE3 = 1]
335	x	[NEWWARD = 9]*[C4ECACT = 4]*[TENURE3 = 2]
336	x	[NEWWARD = 9]*[C4ECACT = 4]*[TENURE3 = 3]
337		[NEWWARD = 10]*[C4ECACT = 1]*[TENURE3 = 1]
338		[NEWWARD = 10]*[C4ECACT = 1]*[TENURE3 = 2]
339	x	[NEWWARD = 10]*[C4ECACT = 1]*[TENURE3 = 3]
340		[NEWWARD = 10]*[C4ECACT = 2]*[TENURE3 = 1]
341		[NEWWARD = 10]*[C4ECACT = 2]*[TENURE3 = 2]
342	x	[NEWWARD = 10]*[C4ECACT = 2]*[TENURE3 = 3]
343		[NEWWARD = 10]*[C4ECACT = 3]*[TENURE3 = 1]
344		[NEWWARD = 10]*[C4ECACT = 3]*[TENURE3 = 2]
345	x	[NEWWARD = 10]*[C4ECACT = 3]*[TENURE3 = 3]
346	x	[NEWWARD = 10]*[C4ECACT = 4]*[TENURE3 = 1]
347	x	[NEWWARD = 10]*[C4ECACT = 4]*[TENURE3 = 2]
348	x	[NEWWARD = 10]*[C4ECACT = 4]*[TENURE3 = 3]
349		[NEWWARD = 11]*[C4ECACT = 1]*[TENURE3 = 1]
350		[NEWWARD = 11]*[C4ECACT = 1]*[TENURE3 = 2]
351	x	[NEWWARD = 11]*[C4ECACT = 1]*[TENURE3 = 3]
352		[NEWWARD = 11]*[C4ECACT = 2]*[TENURE3 = 1]
353		[NEWWARD = 11]*[C4ECACT = 2]*[TENURE3 = 2]
354	x	[NEWWARD = 11]*[C4ECACT = 2]*[TENURE3 = 3]
355		[NEWWARD = 11]*[C4ECACT = 3]*[TENURE3 = 1]
356		[NEWWARD = 11]*[C4ECACT = 3]*[TENURE3 = 2]
357	x	[NEWWARD = 11]*[C4ECACT = 3]*[TENURE3 = 3]
358	x	[NEWWARD = 11]*[C4ECACT = 4]*[TENURE3 = 1]
359	x	[NEWWARD = 11]*[C4ECACT = 4]*[TENURE3 = 2]
360	x	[NEWWARD = 11]*[C4ECACT = 4]*[TENURE3 = 3]
361		[NEWWARD = 12]*[C4ECACT = 1]*[TENURE3 = 1]
362		[NEWWARD = 12]*[C4ECACT = 1]*[TENURE3 = 2]
363	x	[NEWWARD = 12]*[C4ECACT = 1]*[TENURE3 = 3]

364		[NEWWARD = 12]*[C4ECACT = 2]*[TENURE3 = 1]
365		[NEWWARD = 12]*[C4ECACT = 2]*[TENURE3 = 2]
366	x	[NEWWARD = 12]*[C4ECACT = 2]*[TENURE3 = 3]
367		[NEWWARD = 12]*[C4ECACT = 3]*[TENURE3 = 1]
368		[NEWWARD = 12]*[C4ECACT = 3]*[TENURE3 = 2]
369	x	[NEWWARD = 12]*[C4ECACT = 3]*[TENURE3 = 3]
370	x	[NEWWARD = 12]*[C4ECACT = 4]*[TENURE3 = 1]
371	x	[NEWWARD = 12]*[C4ECACT = 4]*[TENURE3 = 2]
372	x	[NEWWARD = 12]*[C4ECACT = 4]*[TENURE3 = 3]
373		[NEWWARD = 13]*[C4ECACT = 1]*[TENURE3 = 1]
374		[NEWWARD = 13]*[C4ECACT = 1]*[TENURE3 = 2]
375	x	[NEWWARD = 13]*[C4ECACT = 1]*[TENURE3 = 3]
376		[NEWWARD = 13]*[C4ECACT = 2]*[TENURE3 = 1]
377		[NEWWARD = 13]*[C4ECACT = 2]*[TENURE3 = 2]
378	x	[NEWWARD = 13]*[C4ECACT = 2]*[TENURE3 = 3]
379		[NEWWARD = 13]*[C4ECACT = 3]*[TENURE3 = 1]
380		[NEWWARD = 13]*[C4ECACT = 3]*[TENURE3 = 2]
381	x	[NEWWARD = 13]*[C4ECACT = 3]*[TENURE3 = 3]
382	x	[NEWWARD = 13]*[C4ECACT = 4]*[TENURE3 = 1]
383	x	[NEWWARD = 13]*[C4ECACT = 4]*[TENURE3 = 2]
384	x	[NEWWARD = 13]*[C4ECACT = 4]*[TENURE3 = 3]
385		[NEWWARD = 14]*[C4ECACT = 1]*[TENURE3 = 1]
386		[NEWWARD = 14]*[C4ECACT = 1]*[TENURE3 = 2]
387	x	[NEWWARD = 14]*[C4ECACT = 1]*[TENURE3 = 3]
388		[NEWWARD = 14]*[C4ECACT = 2]*[TENURE3 = 1]
389		[NEWWARD = 14]*[C4ECACT = 2]*[TENURE3 = 2]
390	x	[NEWWARD = 14]*[C4ECACT = 2]*[TENURE3 = 3]
391		[NEWWARD = 14]*[C4ECACT = 3]*[TENURE3 = 1]
392		[NEWWARD = 14]*[C4ECACT = 3]*[TENURE3 = 2]
393	x	[NEWWARD = 14]*[C4ECACT = 3]*[TENURE3 = 3]
394	x	[NEWWARD = 14]*[C4ECACT = 4]*[TENURE3 = 1]
395	x	[NEWWARD = 14]*[C4ECACT = 4]*[TENURE3 = 2]
396	x	[NEWWARD = 14]*[C4ECACT = 4]*[TENURE3 = 3]
397		[NEWWARD = 15]*[C4ECACT = 1]*[TENURE3 = 1]
398		[NEWWARD = 15]*[C4ECACT = 1]*[TENURE3 = 2]
399	x	[NEWWARD = 15]*[C4ECACT = 1]*[TENURE3 = 3]
400		[NEWWARD = 15]*[C4ECACT = 2]*[TENURE3 = 1]
401		[NEWWARD = 15]*[C4ECACT = 2]*[TENURE3 = 2]
402	x	[NEWWARD = 15]*[C4ECACT = 2]*[TENURE3 = 3]
403		[NEWWARD = 15]*[C4ECACT = 3]*[TENURE3 = 1]
404		[NEWWARD = 15]*[C4ECACT = 3]*[TENURE3 = 2]
405	x	[NEWWARD = 15]*[C4ECACT = 3]*[TENURE3 = 3]
406	x	[NEWWARD = 15]*[C4ECACT = 4]*[TENURE3 = 1]
407	x	[NEWWARD = 15]*[C4ECACT = 4]*[TENURE3 = 2]
408	x	[NEWWARD = 15]*[C4ECACT = 4]*[TENURE3 = 3]
409		[NEWWARD = 16]*[C4ECACT = 1]*[TENURE3 = 1]
410		[NEWWARD = 16]*[C4ECACT = 1]*[TENURE3 = 2]
411	x	[NEWWARD = 16]*[C4ECACT = 1]*[TENURE3 = 3]
412		[NEWWARD = 16]*[C4ECACT = 2]*[TENURE3 = 1]
413		[NEWWARD = 16]*[C4ECACT = 2]*[TENURE3 = 2]
414	x	[NEWWARD = 16]*[C4ECACT = 2]*[TENURE3 = 3]
415		[NEWWARD = 16]*[C4ECACT = 3]*[TENURE3 = 1]
416		[NEWWARD = 16]*[C4ECACT = 3]*[TENURE3 = 2]
417	x	[NEWWARD = 16]*[C4ECACT = 3]*[TENURE3 = 3]
418	x	[NEWWARD = 16]*[C4ECACT = 4]*[TENURE3 = 1]
419	x	[NEWWARD = 16]*[C4ECACT = 4]*[TENURE3 = 2]
420	x	[NEWWARD = 16]*[C4ECACT = 4]*[TENURE3 = 3]
421		[NEWWARD = 17]*[C4ECACT = 1]*[TENURE3 = 1]
422		[NEWWARD = 17]*[C4ECACT = 1]*[TENURE3 = 2]
423	x	[NEWWARD = 17]*[C4ECACT = 1]*[TENURE3 = 3]
424		[NEWWARD = 17]*[C4ECACT = 2]*[TENURE3 = 1]
425		[NEWWARD = 17]*[C4ECACT = 2]*[TENURE3 = 2]
426	x	[NEWWARD = 17]*[C4ECACT = 2]*[TENURE3 = 3]
427		[NEWWARD = 17]*[C4ECACT = 3]*[TENURE3 = 1]
428		[NEWWARD = 17]*[C4ECACT = 3]*[TENURE3 = 2]
429	x	[NEWWARD = 17]*[C4ECACT = 3]*[TENURE3 = 3]
430	x	[NEWWARD = 17]*[C4ECACT = 4]*[TENURE3 = 1]
431	x	[NEWWARD = 17]*[C4ECACT = 4]*[TENURE3 = 2]
432	x	[NEWWARD = 17]*[C4ECACT = 4]*[TENURE3 = 3]
433		[NEWWARD = 18]*[C4ECACT = 1]*[TENURE3 = 1]
434		[NEWWARD = 18]*[C4ECACT = 1]*[TENURE3 = 2]
435	x	[NEWWARD = 18]*[C4ECACT = 1]*[TENURE3 = 3]
436		[NEWWARD = 18]*[C4ECACT = 2]*[TENURE3 = 1]
437		[NEWWARD = 18]*[C4ECACT = 2]*[TENURE3 = 2]
438	x	[NEWWARD = 18]*[C4ECACT = 2]*[TENURE3 = 3]
439		[NEWWARD = 18]*[C4ECACT = 3]*[TENURE3 = 1]
440		[NEWWARD = 18]*[C4ECACT = 3]*[TENURE3 = 2]

441	x	[NEWWARD = 18]*[C4ECACT = 3]*[TENURE3 = 3]
442	x	[NEWWARD = 18]*[C4ECACT = 4]*[TENURE3 = 1]
443	x	[NEWWARD = 18]*[C4ECACT = 4]*[TENURE3 = 2]
444	x	[NEWWARD = 18]*[C4ECACT = 4]*[TENURE3 = 3]
445		[NEWWARD = 19]*[C4ECACT = 1]*[TENURE3 = 1]
446		[NEWWARD = 19]*[C4ECACT = 1]*[TENURE3 = 2]
447	x	[NEWWARD = 19]*[C4ECACT = 1]*[TENURE3 = 3]
448		[NEWWARD = 19]*[C4ECACT = 2]*[TENURE3 = 1]
449		[NEWWARD = 19]*[C4ECACT = 2]*[TENURE3 = 2]
450	x	[NEWWARD = 19]*[C4ECACT = 2]*[TENURE3 = 3]
451		[NEWWARD = 19]*[C4ECACT = 3]*[TENURE3 = 1]
452		[NEWWARD = 19]*[C4ECACT = 3]*[TENURE3 = 2]
453	x	[NEWWARD = 19]*[C4ECACT = 3]*[TENURE3 = 3]
454	x	[NEWWARD = 19]*[C4ECACT = 4]*[TENURE3 = 1]
455	x	[NEWWARD = 19]*[C4ECACT = 4]*[TENURE3 = 2]
456	x	[NEWWARD = 19]*[C4ECACT = 4]*[TENURE3 = 3]
457		[NEWWARD = 20]*[C4ECACT = 1]*[TENURE3 = 1]
458		[NEWWARD = 20]*[C4ECACT = 1]*[TENURE3 = 2]
459	x	[NEWWARD = 20]*[C4ECACT = 1]*[TENURE3 = 3]
460		[NEWWARD = 20]*[C4ECACT = 2]*[TENURE3 = 1]
461		[NEWWARD = 20]*[C4ECACT = 2]*[TENURE3 = 2]
462	x	[NEWWARD = 20]*[C4ECACT = 2]*[TENURE3 = 3]
463		[NEWWARD = 20]*[C4ECACT = 3]*[TENURE3 = 1]
464		[NEWWARD = 20]*[C4ECACT = 3]*[TENURE3 = 2]
465	x	[NEWWARD = 20]*[C4ECACT = 3]*[TENURE3 = 3]
466	x	[NEWWARD = 20]*[C4ECACT = 4]*[TENURE3 = 1]
467	x	[NEWWARD = 20]*[C4ECACT = 4]*[TENURE3 = 2]
468	x	[NEWWARD = 20]*[C4ECACT = 4]*[TENURE3 = 3]
469		[NEWWARD = 21]*[C4ECACT = 1]*[TENURE3 = 1]
470		[NEWWARD = 21]*[C4ECACT = 1]*[TENURE3 = 2]
471	x	[NEWWARD = 21]*[C4ECACT = 1]*[TENURE3 = 3]
472		[NEWWARD = 21]*[C4ECACT = 2]*[TENURE3 = 1]
473		[NEWWARD = 21]*[C4ECACT = 2]*[TENURE3 = 2]
474	x	[NEWWARD = 21]*[C4ECACT = 2]*[TENURE3 = 3]
475		[NEWWARD = 21]*[C4ECACT = 3]*[TENURE3 = 1]
476		[NEWWARD = 21]*[C4ECACT = 3]*[TENURE3 = 2]
477	x	[NEWWARD = 21]*[C4ECACT = 3]*[TENURE3 = 3]
478	x	[NEWWARD = 21]*[C4ECACT = 4]*[TENURE3 = 1]
479	x	[NEWWARD = 21]*[C4ECACT = 4]*[TENURE3 = 2]
480	x	[NEWWARD = 21]*[C4ECACT = 4]*[TENURE3 = 3]
481		[NEWWARD = 22]*[C4ECACT = 1]*[TENURE3 = 1]
482		[NEWWARD = 22]*[C4ECACT = 1]*[TENURE3 = 2]
483	x	[NEWWARD = 22]*[C4ECACT = 1]*[TENURE3 = 3]
484		[NEWWARD = 22]*[C4ECACT = 2]*[TENURE3 = 1]
485		[NEWWARD = 22]*[C4ECACT = 2]*[TENURE3 = 2]
486	x	[NEWWARD = 22]*[C4ECACT = 2]*[TENURE3 = 3]
487		[NEWWARD = 22]*[C4ECACT = 3]*[TENURE3 = 1]
488		[NEWWARD = 22]*[C4ECACT = 3]*[TENURE3 = 2]
489	x	[NEWWARD = 22]*[C4ECACT = 3]*[TENURE3 = 3]
490	x	[NEWWARD = 22]*[C4ECACT = 4]*[TENURE3 = 1]
491	x	[NEWWARD = 22]*[C4ECACT = 4]*[TENURE3 = 2]
492	x	[NEWWARD = 22]*[C4ECACT = 4]*[TENURE3 = 3]
493		[NEWWARD = 23]*[C4ECACT = 1]*[TENURE3 = 1]
494		[NEWWARD = 23]*[C4ECACT = 1]*[TENURE3 = 2]
495	x	[NEWWARD = 23]*[C4ECACT = 1]*[TENURE3 = 3]
496		[NEWWARD = 23]*[C4ECACT = 2]*[TENURE3 = 1]
497		[NEWWARD = 23]*[C4ECACT = 2]*[TENURE3 = 2]
498	x	[NEWWARD = 23]*[C4ECACT = 2]*[TENURE3 = 3]
499		[NEWWARD = 23]*[C4ECACT = 3]*[TENURE3 = 1]
500		[NEWWARD = 23]*[C4ECACT = 3]*[TENURE3 = 2]
501	x	[NEWWARD = 23]*[C4ECACT = 3]*[TENURE3 = 3]
502	x	[NEWWARD = 23]*[C4ECACT = 4]*[TENURE3 = 1]
503	x	[NEWWARD = 23]*[C4ECACT = 4]*[TENURE3 = 2]
504	x	[NEWWARD = 23]*[C4ECACT = 4]*[TENURE3 = 3]
505		[NEWWARD = 24]*[C4ECACT = 1]*[TENURE3 = 1]
506		[NEWWARD = 24]*[C4ECACT = 1]*[TENURE3 = 2]
507	x	[NEWWARD = 24]*[C4ECACT = 1]*[TENURE3 = 3]
508		[NEWWARD = 24]*[C4ECACT = 2]*[TENURE3 = 1]
509		[NEWWARD = 24]*[C4ECACT = 2]*[TENURE3 = 2]
510	x	[NEWWARD = 24]*[C4ECACT = 2]*[TENURE3 = 3]
511		[NEWWARD = 24]*[C4ECACT = 3]*[TENURE3 = 1]
512		[NEWWARD = 24]*[C4ECACT = 3]*[TENURE3 = 2]
513	x	[NEWWARD = 24]*[C4ECACT = 3]*[TENURE3 = 3]
514	x	[NEWWARD = 24]*[C4ECACT = 4]*[TENURE3 = 1]
515	x	[NEWWARD = 24]*[C4ECACT = 4]*[TENURE3 = 2]
516	x	[NEWWARD = 24]*[C4ECACT = 4]*[TENURE3 = 3]
517		[NEWWARD = 25]*[C4ECACT = 1]*[TENURE3 = 1]

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     518            [NEWWARD = 25]*[C4ECACT = 1]*[TENURE3 = 2]
     519       x    [NEWWARD = 25]*[C4ECACT = 1]*[TENURE3 = 3]
     520            [NEWWARD = 25]*[C4ECACT = 2]*[TENURE3 = 1]
     521            [NEWWARD = 25]*[C4ECACT = 2]*[TENURE3 = 2]
     522       x    [NEWWARD = 25]*[C4ECACT = 2]*[TENURE3 = 3]
     523            [NEWWARD = 25]*[C4ECACT = 3]*[TENURE3 = 1]
     524            [NEWWARD = 25]*[C4ECACT = 3]*[TENURE3 = 2]
     525       x    [NEWWARD = 25]*[C4ECACT = 3]*[TENURE3 = 3]
     526       x    [NEWWARD = 25]*[C4ECACT = 4]*[TENURE3 = 1]
     527       x    [NEWWARD = 25]*[C4ECACT = 4]*[TENURE3 = 2]
     528       x    [NEWWARD = 25]*[C4ECACT = 4]*[TENURE3 = 3]
     529       x    [NEWWARD = 26]*[C4ECACT = 1]*[TENURE3 = 1]
     530       x    [NEWWARD = 26]*[C4ECACT = 1]*[TENURE3 = 2]
     531       x    [NEWWARD = 26]*[C4ECACT = 1]*[TENURE3 = 3]
     532       x    [NEWWARD = 26]*[C4ECACT = 2]*[TENURE3 = 1]
     533       x    [NEWWARD = 26]*[C4ECACT = 2]*[TENURE3 = 2]
     534       x    [NEWWARD = 26]*[C4ECACT = 2]*[TENURE3 = 3]
     535       x    [NEWWARD = 26]*[C4ECACT = 3]*[TENURE3 = 1]
     536       x    [NEWWARD = 26]*[C4ECACT = 3]*[TENURE3 = 2]
     537       x    [NEWWARD = 26]*[C4ECACT = 3]*[TENURE3 = 3]
     538       x    [NEWWARD = 26]*[C4ECACT = 4]*[TENURE3 = 1]
     539       x    [NEWWARD = 26]*[C4ECACT = 4]*[TENURE3 = 2]
     540       x    [NEWWARD = 26]*[C4ECACT = 4]*[TENURE3 = 3]
```

3.2 A Saturated 3-Dimensional Model of Newcastle

Note that the SPSS procedure adds 0.5 to each entry which must be subtracted.

Table Information

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                                Observed            Expected
Factor                    Value     Count       %        Count       %

NEWWARD              benwell
 C4ECACT high student low wor
  TENURE3 high council renting        .50 (   .05)        .50 (   .05)
  TENURE3 high ownership and m        .50 (   .05)        .50 (   .05)
  TENURE3 high rental HA & pri        .50 (   .05)        .50 (   .05)
 C4ECACT      highest working
  TENURE3 high council renting        .50 (   .05)        .50 (   .05)
  TENURE3 high ownership and m       6.50 (   .62)       6.50 (   .62)
  TENURE3 high rental HA & pri       1.50 (   .14)       1.50 (   .14)
 C4ECACT high-retired and wor
  TENURE3 high council renting       1.50 (   .14)       1.50 (   .14)
  TENURE3 high ownership and m       1.50 (   .14)       1.50 (   .14)
  TENURE3 high rental HA & pri       2.50 (   .24)       2.50 (   .24)
 C4ECACT  higher unemployment
  TENURE3 high council renting       6.50 (   .62)       6.50 (   .62)
  TENURE3 high ownership and m        .50 (   .05)        .50 (   .05)
  TENURE3 high rental HA & pri       8.50 (   .81)       8.50 (   .81)

NEWWARD             blakelaw
 C4ECACT high student low wor
  TENURE3 high council renting        .50 (   .05)        .50 (   .05)
  TENURE3 high ownership and m        .50 (   .05)        .50 (   .05)
  TENURE3 high rental HA & pri        .50 (   .05)        .50 (   .05)
 C4ECACT      highest working
  TENURE3 high council renting        .50 (   .05)        .50 (   .05)
  TENURE3 high ownership and m      15.50 (  1.48)      15.50 (  1.48)
  TENURE3 high rental HA & pri        .50 (   .05)        .50 (   .05)
 C4ECACT high-retired and wor
  TENURE3 high council renting       5.50 (   .53)       5.50 (   .53)
  TENURE3 high ownership and m       2.50 (   .24)       2.50 (   .24)
  TENURE3 high rental HA & pri       2.50 (   .24)       2.50 (   .24)
 C4ECACT  higher unemployment
  TENURE3 high council renting      16.50 (  1.58)      16.50 (  1.58)
  TENURE3 high ownership and m        .50 (   .05)        .50 (   .05)
  TENURE3 high rental HA & pri        .50 (   .05)        .50 (   .05)


NEWWARD                byker
 C4ECACT high student low wor
  TENURE3 high council renting       1.50 (   .14)       1.50 (   .14)
  TENURE3 high ownership and m        .50 (   .05)        .50 (   .05)
  TENURE3 high rental HA & pri        .50 (   .05)        .50 (   .05)
 C4ECACT      highest working
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  TENURE3 high council renting      1.50 (   .14)       1.50 (   .14)
  TENURE3 high ownership and m      5.50 (   .53)       5.50 (   .53)
  TENURE3 high rental HA & pri       .50 (   .05)        .50 (   .05)
 C4ECACT high-retired and wor
  TENURE3 high council renting      3.50 (   .33)       3.50 (   .33)
  TENURE3 high ownership and m       .50 (   .05)        .50 (   .05)
  TENURE3 high rental HA & pri       .50 (   .05)        .50 (   .05)
 C4ECACT  higher unemployment
  TENURE3 high council renting     21.50 (  2.06)      21.50 (  2.06)
  TENURE3 high ownership and m       .50 (   .05)        .50 (   .05)
  TENURE3 high rental HA & pri      2.50 (   .24)       2.50 (   .24)

NEWWARD              castle
 C4ECACT high student low wor
  TENURE3 high council renting       .50 (   .05)        .50 (   .05)
  TENURE3 high ownership and m       .50 (   .05)        .50 (   .05)
  TENURE3 high rental HA & pri       .50 (   .05)        .50 (   .05)
 C4ECACT      highest working
  TENURE3 high council renting       .50 (   .05)        .50 (   .05)
  TENURE3 high ownership and m     21.50 (  2.06)      21.50 (  2.06)
  TENURE3 high rental HA & pri      2.50 (   .24)       2.50 (   .24)
 C4ECACT high-retired and wor
  TENURE3 high council renting      2.50 (   .24)       2.50 (   .24)
  TENURE3 high ownership and m      9.50 (   .91)       9.50 (   .91)
  TENURE3 high rental HA & pri      1.50 (   .14)       1.50 (   .14)
 C4ECACT  higher unemployment
  TENURE3 high council renting      4.50 (   .43)       4.50 (   .43)
  TENURE3 high ownership and m       .50 (   .05)        .50 (   .05)
  TENURE3 high rental HA & pri       .50 (   .05)        .50 (   .05)

NEWWARD                dene
 C4ECACT high student low wor
  TENURE3 high council renting       .50 (   .05)        .50 (   .05)
  TENURE3 high ownership and m      2.50 (   .24)       2.50 (   .24)
  TENURE3 high rental HA & pri       .50 (   .05)        .50 (   .05)
 C4ECACT      highest working
  TENURE3 high council renting       .50 (   .05)        .50 (   .05)
  TENURE3 high ownership and m     33.50 (  3.21)      33.50 (  3.21)
  TENURE3 high rental HA & pri       .50 (   .05)        .50 (   .05)
 C4ECACT high-retired and wor
  TENURE3 high council renting      2.50 (   .24)       2.50 (   .24)
  TENURE3 high ownership and m      7.50 (   .72)       7.50 (   .72)
  TENURE3 high rental HA & pri      1.50 (   .14)       1.50 (   .14)
 C4ECACT  higher unemployment
  TENURE3 high council renting      4.50 (   .43)       4.50 (   .43)
  TENURE3 high ownership and m       .50 (   .05)        .50 (   .05)
  TENURE3 high rental HA & pri       .50 (   .05)        .50 (   .05)

NEWWARD              denton
 C4ECACT high student low wor
  TENURE3 high council renting       .50 (   .05)        .50 (   .05)
  TENURE3 high ownership and m       .50 (   .05)        .50 (   .05)
  TENURE3 high rental HA & pri       .50 (   .05)        .50 (   .05)
 C4ECACT      highest working
  TENURE3 high council renting      1.50 (   .14)       1.50 (   .14)
  TENURE3 high ownership and m      6.50 (   .62)       6.50 (   .62)
  TENURE3 high rental HA & pri       .50 (   .05)        .50 (   .05)
 C4ECACT high-retired and wor
  TENURE3 high council renting      7.50 (   .72)       7.50 (   .72)
  TENURE3 high ownership and m      8.50 (   .81)       8.50 (   .81)
  TENURE3 high rental HA & pri      1.50 (   .14)       1.50 (   .14)
 C4ECACT  higher unemployment
  TENURE3 high council renting     11.50 (  1.10)      11.50 (  1.10)
  TENURE3 high ownership and m       .50 (   .05)        .50 (   .05)
  TENURE3 high rental HA & pri       .50 (   .05)        .50 (   .05)

NEWWARD             elswick
 C4ECACT high student low wor
  TENURE3 high council renting       .50 (   .05)        .50 (   .05)
  TENURE3 high ownership and m       .50 (   .05)        .50 (   .05)
  TENURE3 high rental HA & pri      1.50 (   .14)       1.50 (   .14)
 C4ECACT      highest working
  TENURE3 high council renting       .50 (   .05)        .50 (   .05)
  TENURE3 high ownership and m      2.50 (   .24)       2.50 (   .24)
  TENURE3 high rental HA & pri       .50 (   .05)        .50 (   .05)
 C4ECACT high-retired and wor
  TENURE3 high council renting      2.50 (   .24)       2.50 (   .24)
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  TENURE3 high ownership and m       1.50 (   .14)       1.50 (   .14)
  TENURE3 high rental HA & pri        .50 (   .05)        .50 (   .05)
 C4ECACT  higher unemployment
  TENURE3 high council renting       5.50 (   .53)       5.50 (   .53)
  TENURE3 high ownership and m       1.50 (   .14)       1.50 (   .14)
  TENURE3 high rental HA & pri      14.50 (  1.39)      14.50 (  1.39)

NEWWARD                fawdon
 C4ECACT high student low wor
  TENURE3 high council renting        .50 (   .05)        .50 (   .05)
  TENURE3 high ownership and m        .50 (   .05)        .50 (   .05)
  TENURE3 high rental HA & pri        .50 (   .05)        .50 (   .05)
 C4ECACT      highest working
  TENURE3 high council renting       1.50 (   .14)       1.50 (   .14)
  TENURE3 high ownership and m       4.50 (   .43)       4.50 (   .43)
  TENURE3 high rental HA & pri       1.50 (   .14)       1.50 (   .14)
 C4ECACT high-retired and wor
  TENURE3 high council renting       3.50 (   .33)       3.50 (   .33)
  TENURE3 high ownership and m       7.50 (   .72)       7.50 (   .72)
  TENURE3 high rental HA & pri       2.50 (   .24)       2.50 (   .24)
 C4ECACT  higher unemployment
  TENURE3 high council renting      16.50 (  1.58)      16.50 (  1.58)
  TENURE3 high ownership and m       1.50 (   .14)       1.50 (   .14)
  TENURE3 high rental HA & pri        .50 (   .05)        .50 (   .05)

NEWWARD                fenham
 C4ECACT high student low wor
  TENURE3 high council renting       1.50 (   .14)       1.50 (   .14)
  TENURE3 high ownership and m        .50 (   .05)        .50 (   .05)
  TENURE3 high rental HA & pri        .50 (   .05)        .50 (   .05)
 C4ECACT      highest working
  TENURE3 high council renting       1.50 (   .14)       1.50 (   .14)
  TENURE3 high ownership and m       8.50 (   .81)       8.50 (   .81)
  TENURE3 high rental HA & pri        .50 (   .05)        .50 (   .05)
 C4ECACT high-retired and wor
  TENURE3 high council renting       3.50 (   .33)       3.50 (   .33)
  TENURE3 high ownership and m       6.50 (   .62)       6.50 (   .62)
  TENURE3 high rental HA & pri       3.50 (   .33)       3.50 (   .33)
 C4ECACT  higher unemployment
  TENURE3 high council renting      11.50 (  1.10)      11.50 (  1.10)
  TENURE3 high ownership and m       4.50 (   .43)       4.50 (   .43)
  TENURE3 high rental HA & pri        .50 (   .05)        .50 (   .05)

NEWWARD                grange
 C4ECACT high student low wor
  TENURE3 high council renting        .50 (   .05)        .50 (   .05)
  TENURE3 high ownership and m        .50 (   .05)        .50 (   .05)
  TENURE3 high rental HA & pri        .50 (   .05)        .50 (   .05)
 C4ECACT      highest working
  TENURE3 high council renting       1.50 (   .14)       1.50 (   .14)
  TENURE3 high ownership and m      15.50 (  1.48)      15.50 (  1.48)
  TENURE3 high rental HA & pri       3.50 (   .33)       3.50 (   .33)
 C4ECACT high-retired and wor
  TENURE3 high council renting       3.50 (   .33)       3.50 (   .33)
  TENURE3 high ownership and m      10.50 (  1.00)      10.50 (  1.00)
  TENURE3 high rental HA & pri       3.50 (   .33)       3.50 (   .33)
 C4ECACT  higher unemployment
  TENURE3 high council renting       5.50 (   .53)       5.50 (   .53)
  TENURE3 high ownership and m       1.50 (   .14)       1.50 (   .14)
  TENURE3 high rental HA & pri       1.50 (   .14)       1.50 (   .14)

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NEWWARD                heaton
 C4ECACT high student low wor
  TENURE3 high council renting       1.50 (   .14)       1.50 (   .14)
  TENURE3 high ownership and m       1.50 (   .14)       1.50 (   .14)
  TENURE3 high rental HA & pri      18.50 (  1.77)      18.50 (  1.77)
 C4ECACT      highest working
  TENURE3 high council renting        .50 (   .05)        .50 (   .05)
  TENURE3 high ownership and m       8.50 (   .81)       8.50 (   .81)
  TENURE3 high rental HA & pri       6.50 (   .62)       6.50 (   .62)
 C4ECACT high-retired and wor
  TENURE3 high council renting        .50 (   .05)        .50 (   .05)
  TENURE3 high ownership and m       3.50 (   .33)       3.50 (   .33)
  TENURE3 high rental HA & pri        .50 (   .05)        .50 (   .05)
 C4ECACT  higher unemployment
  TENURE3 high council renting        .50 (   .05)        .50 (   .05)
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TENURE3 high ownership and m	.50 (.05)	.50 (.05)
TENURE3 high rental HA & pri	.50 (.05)	.50 (.05)
NEWWARD jesmond		
C4ECACT high student low wor		
TENURE3 high council renting	.50 (.05)	.50 (.05)
TENURE3 high ownership and m	1.50 (.14)	1.50 (.14)
TENURE3 high rental HA & pri	21.50 (2.06)	21.50 (2.06)
C4ECACT highest working		
TENURE3 high council renting	.50 (.05)	.50 (.05)
TENURE3 high ownership and m	4.50 (.43)	4.50 (.43)
TENURE3 high rental HA & pri	7.50 (.72)	7.50 (.72)
C4ECACT high-retired and wor		
TENURE3 high council renting	.50 (.05)	.50 (.05)
TENURE3 high ownership and m	4.50 (.43)	4.50 (.43)
TENURE3 high rental HA & pri	1.50 (.14)	1.50 (.14)
C4ECACT higher unemployment		
TENURE3 high council renting	.50 (.05)	.50 (.05)
TENURE3 high ownership and m	.50 (.05)	.50 (.05)
TENURE3 high rental HA & pri	1.50 (.14)	1.50 (.14)
NEWWARD kenton		
C4ECACT high student low wor		
TENURE3 high council renting	.50 (.05)	.50 (.05)
TENURE3 high ownership and m	.50 (.05)	.50 (.05)
TENURE3 high rental HA & pri	.50 (.05)	.50 (.05)
C4ECACT highest working		
TENURE3 high council renting	2.50 (.24)	2.50 (.24)
TENURE3 high ownership and m	9.50 (.91)	9.50 (.91)
TENURE3 high rental HA & pri	.50 (.05)	.50 (.05)
C4ECACT high-retired and wor		
TENURE3 high council renting	4.50 (.43)	4.50 (.43)
TENURE3 high ownership and m	7.50 (.72)	7.50 (.72)
TENURE3 high rental HA & pri	1.50 (.14)	1.50 (.14)
C4ECACT higher unemployment		
TENURE3 high council renting	11.50 (1.10)	11.50 (1.10)
TENURE3 high ownership and m	.50 (.05)	.50 (.05)
TENURE3 high rental HA & pri	1.50 (.14)	1.50 (.14)
NEWWARD lemington		
C4ECACT high student low wor		
TENURE3 high council renting	.50 (.05)	.50 (.05)
TENURE3 high ownership and m	.50 (.05)	.50 (.05)
TENURE3 high rental HA & pri	.50 (.05)	.50 (.05)
C4ECACT highest working		
TENURE3 high council renting	.50 (.05)	.50 (.05)
TENURE3 high ownership and m	17.50 (1.67)	17.50 (1.67)
TENURE3 high rental HA & pri	.50 (.05)	.50 (.05)
C4ECACT high-retired and wor		
TENURE3 high council renting	3.50 (.33)	3.50 (.33)
TENURE3 high ownership and m	5.50 (.53)	5.50 (.53)
TENURE3 high rental HA & pri	.50 (.05)	.50 (.05)
C4ECACT higher unemployment		
TENURE3 high council renting	7.50 (.72)	7.50 (.72)
TENURE3 high ownership and m	.50 (.05)	.50 (.05)
TENURE3 high rental HA & pri	2.50 (.24)	2.50 (.24)
NEWWARD monkchester		
C4ECACT high student low wor		
TENURE3 high council renting	.50 (.05)	.50 (.05)
TENURE3 high ownership and m	.50 (.05)	.50 (.05)
TENURE3 high rental HA & pri	.50 (.05)	.50 (.05)
C4ECACT highest working		
TENURE3 high council renting	.50 (.05)	.50 (.05)
TENURE3 high ownership and m	1.50 (.14)	1.50 (.14)
TENURE3 high rental HA & pri	1.50 (.14)	1.50 (.14)
C4ECACT high-retired and wor		
TENURE3 high council renting	1.50 (.14)	1.50 (.14)
TENURE3 high ownership and m	.50 (.05)	.50 (.05)
TENURE3 high rental HA & pri	.50 (.05)	.50 (.05)
C4ECACT higher unemployment		
TENURE3 high council renting	23.50 (2.25)	23.50 (2.25)
TENURE3 high ownership and m	.50 (.05)	.50 (.05)
TENURE3 high rental HA & pri	3.50 (.33)	3.50 (.33)
NEWWARD moorside		
C4ECACT high student low wor		

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   TENURE3 high council renting       1.50 (    .14)       1.50 (    .14)
   TENURE3 high ownership and m        .50 (    .05)        .50 (    .05)
   TENURE3 high rental HA & pri      11.50 (   1.10)      11.50 (   1.10)
  C4ECACT      highest working
   TENURE3 high council renting        .50 (    .05)        .50 (    .05)
   TENURE3 high ownership and m        .50 (    .05)        .50 (    .05)
   TENURE3 high rental HA & pri       1.50 (    .14)       1.50 (    .14)
  C4ECACT high-retired and wor
   TENURE3 high council renting       2.50 (    .24)       2.50 (    .24)
   TENURE3 high ownership and m        .50 (    .05)        .50 (    .05)
   TENURE3 high rental HA & pri        .50 (    .05)        .50 (    .05)
  C4ECACT  higher unemployment
   TENURE3 high council renting       8.50 (    .81)       8.50 (    .81)
   TENURE3 high ownership and m        .50 (    .05)        .50 (    .05)
   TENURE3 high rental HA & pri      11.50 (   1.10)      11.50 (   1.10)


 NEWWARD              newburn
  C4ECACT high student low wor
   TENURE3 high council renting        .50 (    .05)        .50 (    .05)
   TENURE3 high ownership and m        .50 (    .05)        .50 (    .05)
   TENURE3 high rental HA & pri        .50 (    .05)        .50 (    .05)
  C4ECACT      highest working
   TENURE3 high council renting       3.50 (    .33)       3.50 (    .33)
   TENURE3 high ownership and m       5.50 (    .53)       5.50 (    .53)
   TENURE3 high rental HA & pri        .50 (    .05)        .50 (    .05)
  C4ECACT high-retired and wor
   TENURE3 high council renting       5.50 (    .53)       5.50 (    .53)
   TENURE3 high ownership and m       7.50 (    .72)       7.50 (    .72)
   TENURE3 high rental HA & pri       2.50 (    .24)       2.50 (    .24)
  C4ECACT  higher unemployment
   TENURE3 high council renting       8.50 (    .81)       8.50 (    .81)
   TENURE3 high ownership and m        .50 (    .05)        .50 (    .05)
   TENURE3 high rental HA & pri       1.50 (    .14)       1.50 (    .14)

 NEWWARD            sandyford
  C4ECACT high student low wor
   TENURE3 high council renting       2.50 (    .24)       2.50 (    .24)
   TENURE3 high ownership and m       2.50 (    .24)       2.50 (    .24)
   TENURE3 high rental HA & pri      23.50 (   2.25)      23.50 (   2.25)
  C4ECACT      highest working
   TENURE3 high council renting        .50 (    .05)        .50 (    .05)
   TENURE3 high ownership and m       2.50 (    .24)       2.50 (    .24)
   TENURE3 high rental HA & pri       3.50 (    .33)       3.50 (    .33)
  C4ECACT high-retired and wor
   TENURE3 high council renting       3.50 (    .33)       3.50 (    .33)
   TENURE3 high ownership and m        .50 (    .05)        .50 (    .05)
   TENURE3 high rental HA & pri        .50 (    .05)        .50 (    .05)
  C4ECACT  higher unemployment
   TENURE3 high council renting       8.50 (    .81)       8.50 (    .81)
   TENURE3 high ownership and m        .50 (    .05)        .50 (    .05)
   TENURE3 high rental HA & pri        .50 (    .05)        .50 (    .05)

 NEWWARD            scotswood
  C4ECACT high student low wor
   TENURE3 high council renting        .50 (    .05)        .50 (    .05)
   TENURE3 high ownership and m        .50 (    .05)        .50 (    .05)
   TENURE3 high rental HA & pri        .50 (    .05)        .50 (    .05)
  C4ECACT      highest working
   TENURE3 high council renting        .50 (    .05)        .50 (    .05)
   TENURE3 high ownership and m       6.50 (    .62)       6.50 (    .62)
   TENURE3 high rental HA & pri        .50 (    .05)        .50 (    .05)
  C4ECACT high-retired and wor
   TENURE3 high council renting        .50 (    .05)        .50 (    .05)
   TENURE3 high ownership and m       2.50 (    .24)       2.50 (    .24)
   TENURE3 high rental HA & pri       1.50 (    .14)       1.50 (    .14)
  C4ECACT  higher unemployment
   TENURE3 high council renting      10.50 (   1.00)      10.50 (   1.00)
   TENURE3 high ownership and m        .50 (    .05)        .50 (    .05)
   TENURE3 high rental HA & pri       3.50 (    .33)       3.50 (    .33)

 NEWWARD        south gosforth
  C4ECACT high student low wor
   TENURE3 high council renting        .50 (    .05)        .50 (    .05)
   TENURE3 high ownership and m        .50 (    .05)        .50 (    .05)
   TENURE3 high rental HA & pri       1.50 (    .14)       1.50 (    .14)
  C4ECACT      highest working
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TENURE3 high council renting	.50 (.05)	.50 (.05)
TENURE3 high ownership and m	21.50 (2.06)	21.50 (2.06)
TENURE3 high rental HA & pri	5.50 (.53)	5.50 (.53)
C4ECACT high-retired and wor		
TENURE3 high council renting	.50 (.05)	.50 (.05)
TENURE3 high ownership and m	7.50 (.72)	7.50 (.72)
TENURE3 high rental HA & pri	.50 (.05)	.50 (.05)
C4ECACT higher unemployment		
TENURE3 high council renting	.50 (.05)	.50 (.05)
TENURE3 high ownership and m	.50 (.05)	.50 (.05)
TENURE3 high rental HA & pri	.50 (.05)	.50 (.05)
NEWWARD walker		
C4ECACT high student low wor		
TENURE3 high council renting	.50 (.05)	.50 (.05)
TENURE3 high ownership and m	.50 (.05)	.50 (.05)
TENURE3 high rental HA & pri	.50 (.05)	.50 (.05)
C4ECACT highest working		
TENURE3 high council renting	.50 (.05)	.50 (.05)
TENURE3 high ownership and m	1.50 (.14)	1.50 (.14)
TENURE3 high rental HA & pri	.50 (.05)	.50 (.05)
C4ECACT high-retired and wor		
TENURE3 high council renting	2.50 (.24)	2.50 (.24)
TENURE3 high ownership and m	1.50 (.14)	1.50 (.14)
TENURE3 high rental HA & pri	.50 (.05)	.50 (.05)
C4ECACT higher unemployment		
TENURE3 high council renting	24.50 (2.34)	24.50 (2.34)
TENURE3 high ownership and m	.50 (.05)	.50 (.05)
TENURE3 high rental HA & pri	.50 (.05)	.50 (.05)
NEWWARD walkergate		
C4ECACT high student low wor		
TENURE3 high council renting	.50 (.05)	.50 (.05)
TENURE3 high ownership and m	.50 (.05)	.50 (.05)
TENURE3 high rental HA & pri	.50 (.05)	.50 (.05)
C4ECACT highest working		
TENURE3 high council renting	2.50 (.24)	2.50 (.24)
TENURE3 high ownership and m	10.50 (1.00)	10.50 (1.00)
TENURE3 high rental HA & pri	1.50 (.14)	1.50 (.14)
C4ECACT high-retired and wor		
TENURE3 high council renting	1.50 (.14)	1.50 (.14)
TENURE3 high ownership and m	9.50 (.91)	9.50 (.91)
TENURE3 high rental HA & pri	2.50 (.24)	2.50 (.24)
C4ECACT higher unemployment		
TENURE3 high council renting	9.50 (.91)	9.50 (.91)
TENURE3 high ownership and m	.50 (.05)	.50 (.05)
TENURE3 high rental HA & pri	1.50 (.14)	1.50 (.14)
NEWWARD west city		
C4ECACT high student low wor		
TENURE3 high council renting	3.50 (.33)	3.50 (.33)
TENURE3 high ownership and m	.50 (.05)	.50 (.05)
TENURE3 high rental HA & pri	3.50 (.33)	3.50 (.33)
C4ECACT highest working		
TENURE3 high council renting	.50 (.05)	.50 (.05)
TENURE3 high ownership and m	.50 (.05)	.50 (.05)
TENURE3 high rental HA & pri	2.50 (.24)	2.50 (.24)
C4ECACT high-retired and wor		
TENURE3 high council renting	.50 (.05)	.50 (.05)
TENURE3 high ownership and m	.50 (.05)	.50 (.05)
TENURE3 high rental HA & pri	.50 (.05)	.50 (.05)
C4ECACT higher unemployment		
TENURE3 high council renting	16.50 (1.58)	16.50 (1.58)
TENURE3 high ownership and m	.50 (.05)	.50 (.05)
TENURE3 high rental HA & pri	4.50 (.43)	4.50 (.43)
NEWWARD westerhope		
C4ECACT high student low wor		
TENURE3 high council renting	.50 (.05)	.50 (.05)
TENURE3 high ownership and m	.50 (.05)	.50 (.05)
TENURE3 high rental HA & pri	.50 (.05)	.50 (.05)
C4ECACT highest working		
TENURE3 high council renting	.50 (.05)	.50 (.05)
TENURE3 high ownership and m	15.50 (1.48)	15.50 (1.48)
TENURE3 high rental HA & pri	.50 (.05)	.50 (.05)
C4ECACT high-retired and wor		
TENURE3 high council renting	6.50 (.62)	6.50 (.62)

TENURE3 high ownership and m	20.50 (1.96)	20.50 (1.96)
TENURE3 high rental HA & pri	1.50 (.14)	1.50 (.14)
C4ECACT higher unemployment		
TENURE3 high council renting	.50 (.05)	.50 (.05)
TENURE3 high ownership and m	.50 (.05)	.50 (.05)
TENURE3 high rental HA & pri	.50 (.05)	.50 (.05)
NEWWARD wingrove		
C4ECACT high student low wor		
TENURE3 high council renting	.50 (.05)	.50 (.05)
TENURE3 high ownership and m	1.50 (.14)	1.50 (.14)
TENURE3 high rental HA & pri	6.50 (.62)	6.50 (.62)
C4ECACT highest working		
TENURE3 high council renting	.50 (.05)	.50 (.05)
TENURE3 high ownership and m	5.50 (.53)	5.50 (.53)
TENURE3 high rental HA & pri	3.50 (.33)	3.50 (.33)
C4ECACT high-retired and wor		
TENURE3 high council renting	.50 (.05)	.50 (.05)
TENURE3 high ownership and m	5.50 (.53)	5.50 (.53)
TENURE3 high rental HA & pri	1.50 (.14)	1.50 (.14)
C4ECACT higher unemployment		
TENURE3 high council renting	4.50 (.43)	4.50 (.43)
TENURE3 high ownership and m	2.50 (.24)	2.50 (.24)
TENURE3 high rental HA & pri	4.50 (.43)	4.50 (.43)
NEWWARD woolsington		
C4ECACT high student low wor		
TENURE3 high council renting	.50 (.05)	.50 (.05)
TENURE3 high ownership and m	.50 (.05)	.50 (.05)
TENURE3 high rental HA & pri	.50 (.05)	.50 (.05)
C4ECACT highest working		
TENURE3 high council renting	1.50 (.14)	1.50 (.14)
TENURE3 high ownership and m	1.50 (.14)	1.50 (.14)
TENURE3 high rental HA & pri	2.50 (.24)	2.50 (.24)
C4ECACT high-retired and wor		
TENURE3 high council renting	6.50 (.62)	6.50 (.62)
TENURE3 high ownership and m	6.50 (.62)	6.50 (
TENURE3 high rental HA & pri	.50 (.05)	.50 (
C4ECACT higher unemployment		
TENURE3 high council renting	11.50 (1.10)	11.50 (
TENURE3 high ownership and m	.50 (.05)	.50 (
TENURE3 high rental HA & pri	.50 (.05)	.50 (

3.3 A Loglinear 2-Interaction Model on 5 Variables

```
Data Information

      8599 cases are accepted.
         0 cases are rejected because of missing data.
      8599 weighted cases will be used in the analysis.
       432 cells are defined.
         0 structural zeros are imposed by design.
       213 sampling zeros are encountered.


Variable Information

Factor     Levels    Value

C4ECACT        4           Economic Activity 4-cluster
                         1 high student low work
                         2 highest working
                         3 high-retired and working
                         4 higher unemployment sick and at home

C3MARCOH       3           Couple Status 3-cluster
                         1 mostly married
                         2 mostly unmarried
                         3 mixed&intermediate

AREAAGE4       4           area age 4 cluster
                         1 young adults lowest children mixed
                         2 most 30-44 and most children mixed
                         3 most 44-59 mixed
                         4 most over 59 mixed

EDQUAL3        3           qualification 3 cluster
                         1 highest qualified
                         2 intermediate qualification
                         3 lowest qualification

TENURE3        3           tenure 3-cluster
                         1 high council renting
                         2 high ownership and mortgages
                         3 high rental HA & private
```

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Model and Design Information

Model: Poisson

**Design: Constant + C3MARCOH*AREAAGE4 + C4ECACT*AREAAGE4 +
AREAAGE4*EDQUAL3 +
AREAAGE4*TENURE3 + C4ECACT*C3MARCOH + C3MARCOH*EDQUAL3 +
C3MARCOH*TENURE3
+ C4ECACT*EDQUAL3 + C4ECACT*TENURE3 + EDQUAL3*TENURE3**

```
Parameter   Aliased  Term
```

1		Constant
2		[C3MARCOH = 1]*[AREAAGE4 = 1]
3		[C3MARCOH = 1]*[AREAAGE4 = 2]
4		[C3MARCOH = 1]*[AREAAGE4 = 3]
5		[C3MARCOH = 1]*[AREAAGE4 = 4]
6		[C3MARCOH = 2]*[AREAAGE4 = 1]
7		[C3MARCOH = 2]*[AREAAGE4 = 2]
8		[C3MARCOH = 2]*[AREAAGE4 = 3]
9		[C3MARCOH = 2]*[AREAAGE4 = 4]
10		[C3MARCOH = 3]*[AREAAGE4 = 1]
11		[C3MARCOH = 3]*[AREAAGE4 = 2]
12		[C3MARCOH = 3]*[AREAAGE4 = 3]
13	x	[C3MARCOH = 3]*[AREAAGE4 = 4]
14		[C4ECACT = 1]*[AREAAGE4 = 1]
15		[C4ECACT = 1]*[AREAAGE4 = 2]
16		[C4ECACT = 1]*[AREAAGE4 = 3]
17		[C4ECACT = 1]*[AREAAGE4 = 4]
18		[C4ECACT = 2]*[AREAAGE4 = 1]
19		[C4ECACT = 2]*[AREAAGE4 = 2]
20		[C4ECACT = 2]*[AREAAGE4 = 3]
21		[C4ECACT = 2]*[AREAAGE4 = 4]
22		[C4ECACT = 3]*[AREAAGE4 = 1]
23		[C4ECACT = 3]*[AREAAGE4 = 2]
24		[C4ECACT = 3]*[AREAAGE4 = 3]
25		[C4ECACT = 3]*[AREAAGE4 = 4]
26	x	[C4ECACT = 4]*[AREAAGE4 = 1]
27	x	[C4ECACT = 4]*[AREAAGE4 = 2]
28	x	[C4ECACT = 4]*[AREAAGE4 = 3]
29	x	[C4ECACT = 4]*[AREAAGE4 = 4]
30		[AREAAGE4 = 1]*[EDQUAL3 = 1]
31		[AREAAGE4 = 1]*[EDQUAL3 = 2]
32	x	[AREAAGE4 = 1]*[EDQUAL3 = 3]
33		[AREAAGE4 = 2]*[EDQUAL3 = 1]
34		[AREAAGE4 = 2]*[EDQUAL3 = 2]
35	x	[AREAAGE4 = 2]*[EDQUAL3 = 3]
36		[AREAAGE4 = 3]*[EDQUAL3 = 1]
37		[AREAAGE4 = 3]*[EDQUAL3 = 2]
38	x	[AREAAGE4 = 3]*[EDQUAL3 = 3]
39		[AREAAGE4 = 4]*[EDQUAL3 = 1]
40		[AREAAGE4 = 4]*[EDQUAL3 = 2]
41	x	[AREAAGE4 = 4]*[EDQUAL3 = 3]
42		[AREAAGE4 = 1]*[TENURE3 = 1]
43		[AREAAGE4 = 1]*[TENURE3 = 2]
44	x	[AREAAGE4 = 1]*[TENURE3 = 3]
45		[AREAAGE4 = 2]*[TENURE3 = 1]
46		[AREAAGE4 = 2]*[TENURE3 = 2]
47	x	[AREAAGE4 = 2]*[TENURE3 = 3]
48		[AREAAGE4 = 3]*[TENURE3 = 1]
49		[AREAAGE4 = 3]*[TENURE3 = 2]
50	x	[AREAAGE4 = 3]*[TENURE3 = 3]
51		[AREAAGE4 = 4]*[TENURE3 = 1]
52		[AREAAGE4 = 4]*[TENURE3 = 2]
53	x	[AREAAGE4 = 4]*[TENURE3 = 3]
54		[C4ECACT = 1]*[C3MARCOH = 1]
55		[C4ECACT = 1]*[C3MARCOH = 2]
56	x	[C4ECACT = 1]*[C3MARCOH = 3]
57		[C4ECACT = 2]*[C3MARCOH = 1]
58		[C4ECACT = 2]*[C3MARCOH = 2]
59	x	[C4ECACT = 2]*[C3MARCOH = 3]
60		[C4ECACT = 3]*[C3MARCOH = 1]

61		[C4ECACT = 3]*[C3MARCOH = 2]
62	x	[C4ECACT = 3]*[C3MARCOH = 3]
63	x	[C4ECACT = 4]*[C3MARCOH = 1]
64	x	[C4ECACT = 4]*[C3MARCOH = 2]
65	x	[C4ECACT = 4]*[C3MARCOH = 3]
66		[C3MARCOH = 1]*[EDQUAL3 = 1]
67		[C3MARCOH = 1]*[EDQUAL3 = 2]
68	x	[C3MARCOH = 1]*[EDQUAL3 = 3]
69		[C3MARCOH = 2]*[EDQUAL3 = 1]
70		[C3MARCOH = 2]*[EDQUAL3 = 2]
71	x	[C3MARCOH = 2]*[EDQUAL3 = 3]
72	x	[C3MARCOH = 3]*[EDQUAL3 = 1]
73	x	[C3MARCOH = 3]*[EDQUAL3 = 2]
74	x	[C3MARCOH = 3]*[EDQUAL3 = 3]
75		[C3MARCOH = 1]*[TENURE3 = 1]
76		[C3MARCOH = 1]*[TENURE3 = 2]
77	x	[C3MARCOH = 1]*[TENURE3 = 3]
78		[C3MARCOH = 2]*[TENURE3 = 1]
79		[C3MARCOH = 2]*[TENURE3 = 2]
80	x	[C3MARCOH = 2]*[TENURE3 = 3]
81	x	[C3MARCOH = 3]*[TENURE3 = 1]
82	x	[C3MARCOH = 3]*[TENURE3 = 2]
83	x	[C3MARCOH = 3]*[TENURE3 = 3]
84		[C4ECACT = 1]*[EDQUAL3 = 1]
85		[C4ECACT = 1]*[EDQUAL3 = 2]
86	x	[C4ECACT = 1]*[EDQUAL3 = 3]
87		[C4ECACT = 2]*[EDQUAL3 = 1]
88		[C4ECACT = 2]*[EDQUAL3 = 2]
89	x	[C4ECACT = 2]*[EDQUAL3 = 3]
90		[C4ECACT = 3]*[EDQUAL3 = 1]
91		[C4ECACT = 3]*[EDQUAL3 = 2]
92	x	[C4ECACT = 3]*[EDQUAL3 = 3]
93	x	[C4ECACT = 4]*[EDQUAL3 = 1]
94	x	[C4ECACT = 4]*[EDQUAL3 = 2]
95	x	[C4ECACT = 4]*[EDQUAL3 = 3]
96		[C4ECACT = 1]*[TENURE3 = 1]
97		[C4ECACT = 1]*[TENURE3 = 2]
98	x	[C4ECACT = 1]*[TENURE3 = 3]
99		[C4ECACT = 2]*[TENURE3 = 1]
100		[C4ECACT = 2]*[TENURE3 = 2]
101	x	[C4ECACT = 2]*[TENURE3 = 3]
102		[C4ECACT = 3]*[TENURE3 = 1]
103		[C4ECACT = 3]*[TENURE3 = 2]
104	x	[C4ECACT = 3]*[TENURE3 = 3]
105	x	[C4ECACT = 4]*[TENURE3 = 1]
106	x	[C4ECACT = 4]*[TENURE3 = 2]
107	x	[C4ECACT = 4]*[TENURE3 = 3]
108		[EDQUAL3 = 1]*[TENURE3 = 1]
109		[EDQUAL3 = 1]*[TENURE3 = 2]
110	x	[EDQUAL3 = 1]*[TENURE3 = 3]
111		[EDQUAL3 = 2]*[TENURE3 = 1]
112		[EDQUAL3 = 2]*[TENURE3 = 2]
113	x	[EDQUAL3 = 2]*[TENURE3 = 3]
114	x	[EDQUAL3 = 3]*[TENURE3 = 1]
115	x	[EDQUAL3 = 3]*[TENURE3 = 2]
116	x	[EDQUAL3 = 3]*[TENURE3 = 3]

Note: 'x' indicates an aliased (or a redundant) parameter.
These parameters are set to zero.

Table Information

```
                                      Observed              Expected
Factor                       Value      Count       %         Count       %

C4ECACT  high student low wor
 C3MARCOH     mostly unmarried
  AREAAGE4  young adults lowest
   EDQUAL3     highest qualified
    TENURE3  high rental HA & pri      101.00 (  1.17)      105.33 (  1.22)



C4ECACT       highest working
 C3MARCOH       mostly married
  AREAAGE4  young adults lowest
   EDQUAL3     highest qualified
    TENURE3  high ownership and m      315.00 (  3.66)      282.44 (  3.28)
    TENURE3  high ownership and m      497.00 (  5.78)      489.35 (  5.69)

  AREAAGE4     most 44-59 mixed
   EDQUAL3     highest qualified
    TENURE3  high ownership and m      279.00 (  3.24)      305.66 (  3.55)
   EDQUAL3  intermediate qualifi
     TENURE3  high ownership and m      497.00 (  5.78)      486.67 (  5.66)


_
 C3MARCOH   mixed&intermediate
  AREAAGE4  young adults lowest
   EDQUAL3     highest qualified
    TENURE3  high ownership and m       81.00 (   .94)       88.22 (  1.03)
    TENURE3  high ownership and m      415.00 (  4.83)      421.04 (  4.90)

  AREAAGE4     most 44-59 mixed
   EDQUAL3     highest qualified
    TENURE3  high ownership and m      239.00 (  2.78)      244.61 (  2.84)
%


C4ECACT  high-retired and wor
 C3MARCOH       mostly married

  AREAAGE4     most 44-59 mixed
   EDQUAL3     highest qualified
     TENURE3  high ownership and m      317.00 (  3.69)      295.24 (  3.43)
     TENURE3  high ownership and m      443.00 (  5.15)      449.84 (  5.23)


EDQUAL3  lowest qualification
    TENURE3  high ownership and m      100.00 (  1.16)      119.65 (  1.39)

  AREAAGE4   most over 59 mixed
   EDQUAL3     highest qualified
    TENURE3  high ownership and m      116.00 (  1.35)      132.70 (  1.54)
    TENURE3  high ownership and m      254.00 (  2.95)      221.50 (  2.58)
     TENURE3  high ownership and m       80.00 (   .93)       63.97 (   .74)

 C3MARCOH   mixed&intermediate
  AREAAGE4  young adults lowest
   EDQUAL3  lowest qualification

    TENURE3  high ownership and m      123.00 (  1.43)      115.63 (  1.34)

   EDQUAL3  lowest qualification
    TENURE3  high council renting      253.00 (  2.94)      257.58 (  3.00)
    TENURE3  high ownership and m      119.00 (  1.38)       96.33 (  1.12)

  AREAAGE4   most over 59 mixed
   EDQUAL3  lowest qualification
    TENURE3  high council renting      242.00 (  2.81)      249.29 (  2.90)

C4ECACT   higher unemployment
 C3MARCOH       mostly married
  AREAAGE4  young adults lowest
   EDQUAL3     highest qualified
```

```
 C3MARCOH     mostly unmarried
  AREAAGE4  young adults lowest

   EDQUAL3  lowest qualification
    TENURE3  high council renting      379.00 (  4.41)      374.96 (  4.36)
    TENURE3  high rental HA & pri      128.00 (  1.49)      118.56 (  1.38)

AREAAGE4     most 44-59 mixed
   EDQUAL3  lowest qualification
    TENURE3  high council renting      196.00 (  2.28)      194.34 (  2.26)


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```

Goodness-of-fit Statistics

	Chi-Square	DF	Sig.
Likelihood Ratio	**500.5506**	**362**	**2.E-06**
Pearson	**1450.9899**	**362**	**5.-130**

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3.4 Selected GIS Maps of Cluster Variables for Newcastle

The following pages give GIS maps of the output areas in Newcastle. These can be used to:

- portray the cluster variables
- visualise the approximate spatial model noted
- aid validation of the methods and resulting cluster data
- help search for visual associations between cluster variables