Classification of environments of entrepreneurship: Factor analysis of Registration Sub-Districts (RSDs) in 1891

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1. Introduction.

This paper discusses how census data for 1851-1911 can be used to classify the *employment status* of the economically active population within Registration Sub-Districts (RSDs) for England and Wales using a factor analysis methodology. This first analysis is based on 1891 as a pilot for the other census years. Employment status in the 1891 census is given for (i) employers, (ii) those working on own account without employees, and (iii) workers. The paper uses the database for Entrepreneurs 1851-1911 referred to in this and other project Working Papers developed by ESRC project ES/M010953 *Drivers of Entrepreneurship and Small Businesses*. For this paper the I-CeM source for 1891 is used.

The original population census returns for individuals/householders in the 1891 census are used for this paper. These are derived from the original Census Enumerators Books (CEBs). Individuals are identified by their employment status from their response to the census instruction to put a cross against one of three columns (numbered 7, 8, and 9) headed: 'employer', 'employed', or 'neither employer or employed'. The specific instruction under general instruction 5 was:[1]

> 'A *cross* must be made in Column 7, headed "Employer", when a person is a master, employing under him workers in his trade or industry; in Column 8, headed "Employed", when the person is working in a trade or industry under a master; and in Column 9, headed "Neither Employer nor Employed", when the person neither employs other workmen in his trade or industry, nor works for a master, but works on his own account. Married women assisting their husbands in their trade or industry are to be returned as "Employed".'

[1] 'General Instruction', Census of England and Wales, Householder's Schedule, 1891.

For most purposes the 'own account' can be identified with the modern terminology of sole proprietors who were self-employed not employing others; whilst masters/employers are self-employed employing others.

This information provides the basis of the assessments in this paper which seek to identify occupations and locations in terms of their composition of entrepreneurs who were 'own account' and/or 'employer', as distinct from workers who were 'employed'. From the outset it is understood that the population census was not a business census. It was administered by the General Register Office (GRO) to count the population, with information on businesses of little importance. The census was also not perfect in the design of questions about occupations, or in the classification and processing of the householder's returns. As a result, the way in which the census gathered material constrains the data and the interpretations possible. A fuller discussion of the nature of the data, and their limitations, is given in the ESRC project working papers:

WP 2: *Employers and the self-employed in the censuses 1851-1911: The census as a source for identifying entrepreneurs, business numbers and size distribution*.
WP 4: *Extracting entrepreneurs from the later censuses, 1891-1911*.

This paper first discusses the methodology (Section 2). Section 3 applies the method to classification of all entrepreneurs (employers plus own account). Section 4 and 5 then, respectively, develop the method for employers and own account separately. A check is made by estimating employers and own account together but as separate factor loadings (Section 6). In each case the general classification of occupations is discussed first, then sample mapping. Section 7 then compares the entrepreneur classifications with those for the whole working population (see Working Paper 8 *Classification of all occupations for economically active: Factor analysis of RSDs in 1891*). The final spatial classification of entrepreneurs in each RSD is given in section 8. Section 9 develops the same approach for female entrepreneurs separately leading to a separate classification of RSDs for females.

2. Methodology.

2.1. Method of factor analysis used

Factor analysis uses the correlation coefficients between pair-wise variables to reduce a large set of explanatory variables (occupations in this case) to a more limited number of groups (factors) based on their shared variance. Common features can be identified by either the correlation or covariance matrices. The former is most commonly used because it is usually easier to interpret. There are two main factor analysis techniques, Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA), we apply the former. We do use the PCA (principal component analysis) approach. Although there is no consensus in the literature whether principle components analysis is preferred to factor analysis (Osborne and Costello, 2005), in most cases both procedures will produce similar results, especially when the number of variables per factor is large (Goldberg and Velicer, 2006), and in large datasets (Osborne and Costello, 2005), both of which are pertinent to our analysis.

An important decision in EFA is determining the optimal number of factors (Goldberg and Velicer, 2006; Osborne and Costello, 2005), where factors represent substantially independent (uncorrelated) patterns of relationships between variables (Rummel, 1967, 1970). The most commonly method is to retain those factors that have eigenvalues greater than one, although this is among the least accurate methods (Osborne and Costello, 2005). We opt to retain two different numbers of factors in the analysis here, 12 and 25, as well as using guidance in the automatic cut-offs in Stata. These selections help to examine various possibilities for possible explanatory factors. A final choice is made by noting that extracting too many factors may result in a large error variance deriving from spurious and small sample effects, while extracting too few factors may omit important valuable common variance (Yong and Pearce, 2013).

After a first stage of component-factor analysis is conducted, we apply the commonly used method of "orthogonal" factor rotation to achieve an outcome where each factor has a correlation of exactly zero with all the other factors. In addition, we applied the "varimax" algorithm (Kaiser, 1958), which is the most commonly used procedure for "orthogonal" factor rotation (Goldberg and Velicer, 2006; Osborne and Costello, 2005). The resulting factor loadings determine how much the variable has contributed to the corresponding factor, whereby a larger factor loading implies that the variable's contribution is larger and vice versa (Rummel, 1967, 1970; Yong and Pearce, 2013). All calculations were undertaken in Stata.

Some robustness testing of the results of the 12 and 25 factors was undertaken by comparing against earlier stages of the analysis. In these stages, an initial exploration of the factors using only those sectors with the main entrepreneur categories was used. This was 43 sectors, excluding Public admin, clergy; Clerks, weighers, telegraph, non-theological students and apprentices; Domestic and service staff, cooks; Labourers & transport staff (including family on farms). A further stage was to subdivide mining into coal and other mining, and subdividing public administration etc. by extracting military personnel. The resulting factor analysis of the intermediate stages of 43 and 48 occupational variables are very similar to those for the full 50 sectors reported here.

2.2. Spatial level and Census data used

The purpose of the analysis is to classify spatial areas to common entrepreneurial characteristics. The spatial basis chosen is census Registration Sub-Districts (SRDs) in England and Wales. There were 2110 of these in 1891. This base is used as it aggregates small units, thus smoothing potential errors and noise in the data. It also brings residential locations together with workplace for most of the population, which for employers can be quite dispersed. Some employers and workers will still be located a long way from their residence, but for most small businesses and their workers the location of business and residence will be in the same RSD; this would not be the case if parishes were used.

The Census data extracted had careful pre-screening and cleaning to ensure that the subsequent analysis used consistent definitions and was not distorted by spurious entries, or occupationally inactive population. Hence, although many younger people were engaged in occupations, this was often inconsistently recorded by enumerators and may not properly separate full and part-time activity. To ensure consistency, the data used excluded everyone under 15. Also excluded was anyone who was retired, listed only as ‘pensioner’ or ‘former’, living on own means, unemployed, and students, scholars, or pupils.

Because the aim is a classification of entrepreneurial locations it was important to focus on those that were permanent or longer-term residents. As a result boarders, visitors and lodgers were excluded, as were those in institutions or ships. Whilst some boarders and institutional inmates will have been long-term residents of that locality, these categories include many for whom the relationship to the locality was unclear. For employers, in particular, it rarely identifies people

who are long-term residents: most are in hotels as party of a business buying or selling activity, or are visitors to another household on census night. Given the small numbers of employers in total, the inclusion of boarders, lodgers and visitors would have a potentially severe distortion effect on spatial classification.

Because the focus of this analysis is on entrepreneurs anyone who gave no answer to the employment status question as to whether they were employer, own account, or worker was also excluded. This means that the population covered in this paper is only those who explicitly acknowledged their status as workers, employers, or own account. Similarly excluded were all with nil or illegible answers to the employment status and occupation questions.

For employers and own account there were additional exclusions to ensure consistency of these categories (but these individuals were included with workers in analysis of the full economically active in other analyses in this project). For the analysis of those who were fully occupied and definitely of employer or own account status, there were sometimes confused responses which had to be screened; e.g. someone might respond as 'apprentice master' with an employer or own account status; or 'assistant to'. All individuals with references to the following in their occupational descriptors were excluded from employer and own account: apprentice, journeyman, servant, clerk, assistant and attendant. Similarly, those with generic descriptors that were insufficient to be confident of their status were excluded, even where they had stated that they were employers or own account: labourer, mechanic, artisan and machinist. In addition employers and own account with occupational codes that were consider to be implausible as business proprietors were excluded. For this analysis we erred on the side of caution; some of these codes are used in later analyses (such as 45-47 the nursing codes). There were 119 of these categories, ranging from 'farmer's and grazier's son, daughter, or other relative assisting in the work of the farm' to railway guard, church chapel cemetery caretakers and keepers, technicians (unspecified), bricklayer's labourer, and foreign diplomats. Also excluded were those that were employees of government or quasi-state industries: e.g. municipal, parish, and other local or county officers; civil service officers and clerks; post office officers and clerks; prison officers; police; all military; hospital workers; and ministers, priests, or in other religious bodies. As stated, all these categories were included in analysis of the full economically active, but not in the employer or own account categories (unless exceptional from their descriptors). A full listing is given in the working paper on occupational status.

2.3. Aggregation of occupations into 50 occupational groups

The occupational categories used are based on aggregations to 50 occupational groups. These groups are described in detail in another working paper. Aggregation is essential for the factor analysis to converge. The original I-CeM coding offers two categories for c. 400 and c.750 occupational categories. Both of these levels contain many occupations with very small numbers of people. When disaggregated around the 2110 RSDs this results in many RSDs having zero entries or very small numbers than can distort the analysis, especially for employers. Aggregating to 50 occupational categories overcomes most of these difficulties, though it is accepted that this approach imposes an order and grouping on the occupations from the outset.

3. Classification of all entrepreneurs (all employers and own account).

The sum of all employers and own account as a percentage of the economically active provides an entrepreneurship density for each RSD. This is similar to the 'entrepreneurship rate' used in many modern analyses and is thus an important starting point to classify RSDs for entrepreneurial characteristics. Using this measure for each sector / occupational group for each RSD, this section uses factor analysis at 12 and 25 factor levels. It is likely that many groups do not have specific differences from the general occupational norm; i.e. there are similar shares of entrepreneurs in many occupations, and groups of occupations. In such cases the occupations reflect the general character of entrepreneurship in the whole economy. Hence an analysis of all economically active provides a base for our main concern here, to identify occupations and locations that differ significantly from that norm in terms of entrepreneurial location. This does not make the others non-entrepreneurial, merely not distinctive for specific occupations or sectors.

The analysis is undertaken with 12-factor and 25-factor analyses. As summarised above, this is for all census respondents who were household residents, with a stated occupation, aged 15 and over, and excluding institutions, the unemployed, retired, students, boarders, visitors and lodgers.

3.1 12-Factor study

The factor variances explained for groupings of all entrepreneurs is shown in Table 1. The first 4 factors explain similar levels to the analysis of all economically active (30%), and the total variance explained for 12 factors is also comparable, though slightly lower (WP*: Classification of all occupations for economically active*, Table 1; q.v.) .

Factor	Variance	Difference	Proportion	Cumulative
Factor1	5.66186	1.57229	0.1132	0.1132
Factor2	4.08957	1.35904	0.0818	0.1950
Factor3	2.73053	0.04117	0.0546	0.2496
Factor4	2.68935	0.77966	0.0538	0.3034
Factor5	1.90969	0.42474	0.0382	0.3416
Factor6	1.48496	0.01112	0.0297	0.3713
Factor7	1.47384	0.04587	0.0295	0.4008
Factor8	1.42796	0.18375	0.0286	0.4294
Factor9	1.24422	0.03391	0.0249	0.4542
Factor10	1.21031	0.05753	0.0242	0.4784
Factor11	1.15278	0.00972	0.0231	0.5015
Factor12	1.14306	-	0.0229	0.5244

Table 1: Factor analysis for all entrepreneurs (sum of all employers and OA), 12-factor variance.

Number of obs = 2,110
Method: principal-component factors Retained factors = 12
Rotation: orthogonal varimax (Kaiser off) Number of params = 534
LR test: independent vs. saturated: chi2 (1225)= 3.1e+04 Prob>chi2 = 0.0000

The factor loadings are shown in Table 2. In this and subsequent factor loading tables the potentially significant loadings above a value of 0.2 are identified (marked in yellow) and where they are the highest loading for all factors for that occupation they are marked brown. Negative loadings are highlighted in blue where their value is smaller than -0.5.

50 ID	50ID	factor1	factor2	factor3	factor4	factor5	factor6	factor7	factor8	factor9	factor10	factor11	factor12
1	farming, fishing, market gardeners, horse breeding and keeping	-0.2325	0.7371	-0.1946	-0.1807	-0.0495	0.0776	0.083	0.0097	-0.0487	0.0141	-0.1271	-0.0323
2	coal mining	-0.0682	-0.0463	-0.1361	-0.0157	0.0553	-0.5931	-0.1806	-0.1004	-0.0594	-0.0196	0.1811	-0.0142
3	other mining & quarrying, brickmaking, gravel, salt works	0.0204	0.1071	-0.1283	0.0484	0.0413	-0.4931	-0.0306	0.061	-0.0958	0.0176	-0.2155	-0.1837
4	construction operatives (masons, bricklayers, thatcher, plumbers etc.)	0.099	0.8007	0.0345	0.1496	-0.0295	-0.2246	-0.0213	0.0966	0.0315	-0.0113	0.0376	0.0028
5	machinery mf	0.1911	0.0322	0.009	0.101	0.4356	0.1511	0.0691	-0.1661	0.0092	-0.0289	0.31	-0.0706
6	tool & weapons mf	0.0412	-0.0876	0.0818	0.005	0.6428	0.0005	-0.103	0.0414	-0.0011	-0.0417	-0.0425	0.0276
7	iron & steel mf, bolts and nails	-0.0159	-0.1508	-0.1078	0.0986	0.6191	-0.1176	-0.0836	-0.1124	0.0029	-0.016	-0.0057	-0.0514
8	blacksmiths	-0.2116	0.8502	-0.1344	-0.1269	-0.0703	0.0807	-0.067	0.0247	0.0283	-0.0448	-0.0222	-0.0179
9	other metal mf (copper, tin, brass, whitesmiths, etc.)	0.2084	-0.1457	0.3176	0.104	0.582	-0.005	0.1161	-0.0198	-0.0148	0.0435	-0.0202	0.0347
10	ship, road & rail vehicle mf	0.0027	0.41	-0.0611	0.2443	-0.0208	0.4594	-0.1808	0.0387	0.0245	0.1791	0.0242	-0.0225
11	earthenware & glass mf	0.1445	-0.0832	0.0152	0.1053	0.0921	0.2234	-0.208	-0.1455	-0.0193	-0.0025	0.1643	-0.3636
12	gas, coke and chemical mf	0.5921	-0.2382	0.199	-0.1079	0.0499	-0.0354	0.1542	-0.0846	0.0652	0.075	0.0714	0.0043
13	leather, fur, hair & bone mf	0.32	-0.058	0.601	0.0292	0.1805	0.034	0.0293	-0.099	0.0359	-0.0958	0.0223	-0.0601
14	wood mf (sawyers, coopers, cane workers)	0.0266	0.2066	0.5165	0.0247	-0.0107	0.1055	-0.1401	-0.1008	0.2535	-0.0684	0.0767	-0.001
15	furnishing mf (cabinet makers, french polishers, undertakers)	0.2948	-0.1639	0.6067	0.182	0.0342	-0.0054	-0.0057	0.1492	-0.0076	-0.0464	0.0453	0.0859
16	printing & paper mf (paper, cardboard, printers, bookbinders)	0.5198	-0.1832	0.5062	0.1685	0.1193	-0.0346	0.06	-0.009	-0.0733	-0.0157	-0.044	0.0551
17	waterproof goods mf (floor & oil cloth, rubber etc.)	0.3455	-0.0854	0.1216	-0.0161	0.0164	0.0844	0.4435	0.0484	-0.0799	0.0443	0.14	0.0325
18	woollen mf (woollen goods, carpets, blanket, flannel)	-0.007	0.3163	0.1274	0.0466	-0.0025	-0.4229	0.3036	-0.1915	0.2174	0.0148	0.1064	-0.0137
19	cotton & silk mf (incl ribbon, weaving, dyeing, bleaching etc.)	0.0835	-0.1896	-0.0882	0.0249	-0.071	0.0304	0.6992	-0.1133	-0.0501	-0.03	0.0123	-0.0367
20	other textile mf (flax, hemp, rope, jute, lace, tape, thread)	-0.0176	0.0377	0.0207	0.1366	-0.0546	-0.0275	0.084	0.1306	-0.116	-0.2766	0.585	-0.0143
21	clothing mf (tailors, milliners, hosiery, hats, gloves, umbrellas, buttons, leather)	-0.0584	-0.025	0.0068	0.0097	-0.0242	-0.083	0.039	0.0137	0.7519	0.03	-0.0473	0.0657
22	shoe, boot, clog mf	-0.0482	0.7132	0.122	0.2523	-0.0556	-0.0002	-0.0831	0.0494	0.021	0.0089	0.0711	0.0759
23	agric produce mf (millers, refiners, bakers, confectioners)	-0.1322	0.7316	-0.1148	-0.0893	-0.0255	0.1526	-0.0862	-0.0995	-0.0593	-0.0297	-0.0342	0.0068
24	drink & tobacco mf (maltsters, brewers, distillers, tobacco & pipes)	0.3074	-0.1841	0.2047	0.2997	0.1069	0.0948	-0.0835	0.1731	0.0123	-0.0572	0.1607	0.2105
25	watch & instrument mf	0.3596	-0.0496	0.4126	0.221	0.1724	-0.0147	0.0151	0.1531	-0.0954	-0.0844	-0.0793	0.1143
26	general mf (manufacturers, mechanic, artisan, machinist)	0.2321	-0.0304	0.0477	-0.1084	0.3041	0.0322	0.1074	0.108	0.0864	0.4935	-0.0049	-0.12
27	ocean, inland and dock transport	0.0662	0.0003	-0.0261	0.2462	-0.0797	0.0223	-0.0358	0.0839	-0.0648	0.6981	-0.007	0.096
28	road & rail transport	0.1454	0.1526	-0.0495	0.0164	-0.0481	0.072	-0.1402	0.66	-0.0205	0.0753	0.1161	-0.1346
29	coal dealing	0.0303	-0.1204	-0.1086	0.6002	0.1023	0.1845	0.1965	-0.0069	0.0537	0.0303	0.0727	-0.1785
30	timber, hay, corn and agric produce dealing	0.2497	0.083	-0.0037	0.1985	0.0187	0.2197	-0.1791	0.0003	0.6032	-0.0971	0.0497	-0.1173
31	clothing and dress dealing (drapers, hosiers, haberdashers)	0.2043	0.5757	0.1724	0.4209	0.0005	-0.3657	-0.0057	0.0646	0.091	0.1042	0.0434	0.0809
32	food sales (butchers, fishmongers, cheesemongers, milksellers, grocers)	0.1781	0.1252	0.2964	0.6943	-0.0252	-0.057	-0.1013	0.06	0.1243	0.16	0.0874	-0.0427
33	lodging & drink sales (wine & spirits, hotels, inns, coffee ho)	0.2313	0.0451	0.1888	0.3642	-0.0296	-0.0016	-0.0839	0.5038	0.013	0.2265	-0.1045	0.0954
34	stationery dealing (stationers, publishers, newsagents)	0.6892	-0.2492	0.3844	0.1197	-0.0035	-0.0674	0.0007	0.1225	-0.0446	0.049	-0.0471	0.0769
35	h/h & personal goods dealer (earthenware, glass, jewellers)	0.2918	-0.057	0.3181	-0.0005	0.441	-0.0179	0.0128	0.1789	-0.0765	0.073	-0.0578	0.115
36	ironmongers	0.4168	0.0208	0.0374	0.5409	0.2331	0.0138	-0.035	-0.1077	-0.0404	-0.0514	-0.1259	0.1209
37	other retail (general shopkeeper, huckster, hawker)	-0.0798	-0.1691	0.5966	0.1526	0.0015	0.0476	-0.0571	-0.0135	-0.0426	0.228	0.0315	-0.1241
38	chemists, druggists	0.4274	0.0012	0.1687	0.5547	0.103	-0.0345	0.0518	0.1062	-0.0361	0.0291	-0.0749	0.0712
39	merchants, banks, insurers and brokers	0.8124	-0.0724	-0.0667	-0.043	0.0427	0.0126	0.1504	-0.0517	0.0762	0.0681	0.0458	-0.0523
40	other commerce (accountants, salesmen, travellers, officers of cos.)	0.7087	-0.039	0.1474	0.1067	0.1844	0.0617	0.1429	-0.0107	0.0087	-0.0027	0.0662	-0.0164
41	construction management (builders and contractors)	0.5523	0.1513	-0.1129	0.2322	-0.1012	0.1262	-0.3527	0.1408	0.005	-0.0239	0.0528	0.0243
42	professions (barristers, solicitors, scientific pursuits)	0.7988	0.0044	-0.0668	0.0605	0.0242	-0.0096	-0.0817	-0.0352	0.0252	0.0015	-0.0569	-0.031
43	professions (doctors, dentists, artists, performers,education)	0.788	-0.084	0.1748	0.23	0.032	-0.0087	-0.0548	0.209	-0.0184	0.0374	-0.0106	0.0566
44	personal services (washing & bathing, hairdressing, chimney sweeps)	0.4688	-0.0258	0.1385	0.3494	-0.1166	0.0816	-0.2855	0.267	0.1283	0.0084	0.0354	0.081
45	Public admin, clergy	0.0237	0.1142	-0.0486	0.0755	0.0053	0.0999	0.0213	0.0158	-0.0742	-0.2796	-0.5746	-0.0944
46	Military	0.0164	0.0602	-0.0332	0.0576	-0.0293	0.072	-0.0475	-0.2497	-0.0944	0.086	-0.1052	0.569
47	Clerks, weighers, telegraph, non-theological students and apprentices	0.3276	-0.0259	0.1944	-0.2117	-0.1298	-0.0508	-0.1622	-0.1856	-0.1268	0.2027	-0.0109	-0.1605
48	Domestic and service staff, cooks	0.1157	0.0165	0.0126	-0.0493	0.0627	0.0454	-0.0499	0.0395	0.0933	0.0245	0.2152	0.5877
49	Labourers & transport staff (including family on farms)	-0.0206	0.0882	-0.0603	-0.049	0.0508	0.0515	0.2054	0.3622	0.1378	-0.1164	-0.0628	-0.0199
50	Persons of property and unoccupied	-0.0147	0.0166	-0.0219	-0.0305	0.0069	0.0623	-0.0249	0.0097	-0.0753	0.1073	0.1579	-0.06

Table 2 12-Factor loadings for all entrepreneurs for each of the 50 aggregated occupational variables.

In the discussion below the significant loadings are identified and the RSDs mapped in quartile ranges for each of the first 7 factors. In all the maps the scales are chosen to indicate the four quartiles for positive loadings (red to yellow), and the 50% point for negative loadings, those above 50%, and additionally all those with the largest negatives of less than -0.5 shown separately (shades of blue).

A summary of the factors with their highest loadings is:

Factor 1 (Commerce, professions and urban sectors)

Gas, coke and chemical mf

Printing & paper mf (paper, cardboard, printers, bookbinders)

Drink & tobacco mf (maltsters, brewers, distillers, tobacco & pipes)

Stationery dealing (stationers, publishers, newsagents)

Merchants, banks, insurers and brokers

Other commerce (accountants, salesmen, travellers, officers of cos.)

Construction management (builders and contractors)

Professions (barristers, solicitors, scientific pursuits)

Professions (doctors, dentists, artists, performers, education)

Personal services (washing & bathing, hairdressing, chimney sweeps)

Clerks, weighers, telegraph, non-theological students and apprentices

The main commercial, professional and gas production areas, together with clerks. This is a similar but more complex set of variables than for the factor for all economically active. Figure 1 shows it to be heavily concentrated in the main urban centres and the major resorts which are also commercial centres, though some large rural areas (e.g. in Northumberland, Mid wales and mid Devon) appear spurious; this is part of a small sample problem for some of these areas, as well as possible under-recording by enumerators (q.v. below).

Factor 2 (Farming, rural trades, shoes and clothing)

Farming, fishing, market gardeners, horse breeding and keeping

Construction operatives (masons, bricklayers, thatcher, plumbers etc.)

Blacksmiths

Shoe, boot, clog mf

Agric produce mf (millers, refiners, bakers, confectioners)

Clothing and dress dealing (drapers, hosiers, haberdashers)

Also included in this factor as the highest loading are:

Woollen mf (woollen goods, carpets, blanket, flannel)

But woollens also have a similar (slightly smaller) loading on Factor 7 and may be better grouped there (q.v.). However, the association of this factor with wider rural trades (such as building, shoe, retail clothing) shows the division of woollen mf. at an entrepreneurial level between more rural and more urban areas, with many entrepreneurs resident in rural areas either as small household producers, or as major employers preferring a rural residence but with their premises in urban centres (q.v. below for further analysis of textile employers). The factor is strongly loaded on farming and rural trades, but as shown in Figure 2 other factors become more significant in the fringe urban areas of the conurbations in NE, NW, Midlands, and especially the SE.

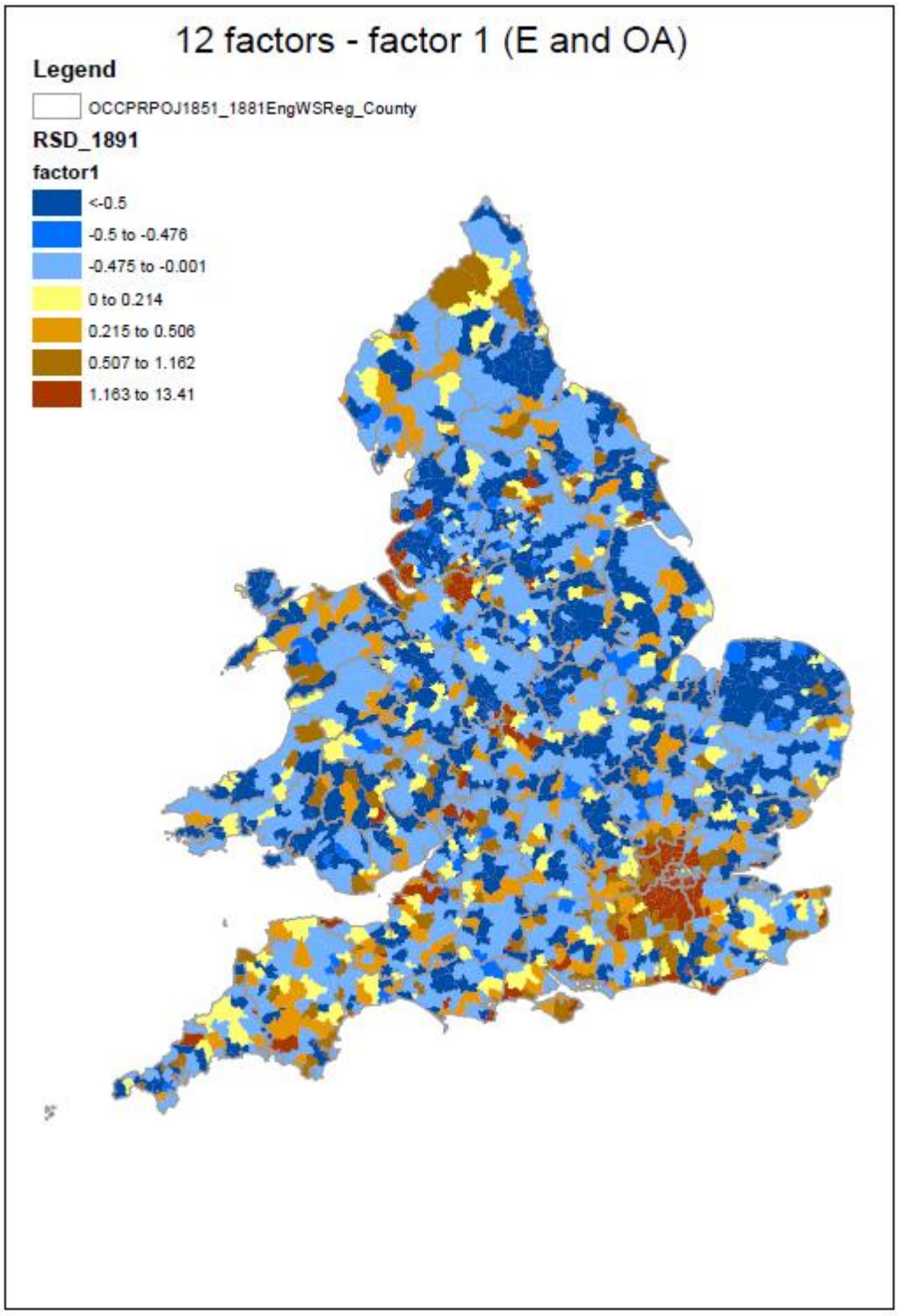
12 factors - factor 1 (E and OA)
Legend
OCCPRPOJ1851_1881EngWSReg_County
RSD_1891
factor1
<-0.5
-0.5 to -0.476
-0.475 to -0.001
0 to 0.214
0.215 to 0.506
0.507 to 1.162
1.163 to 13.41

Fig 1.

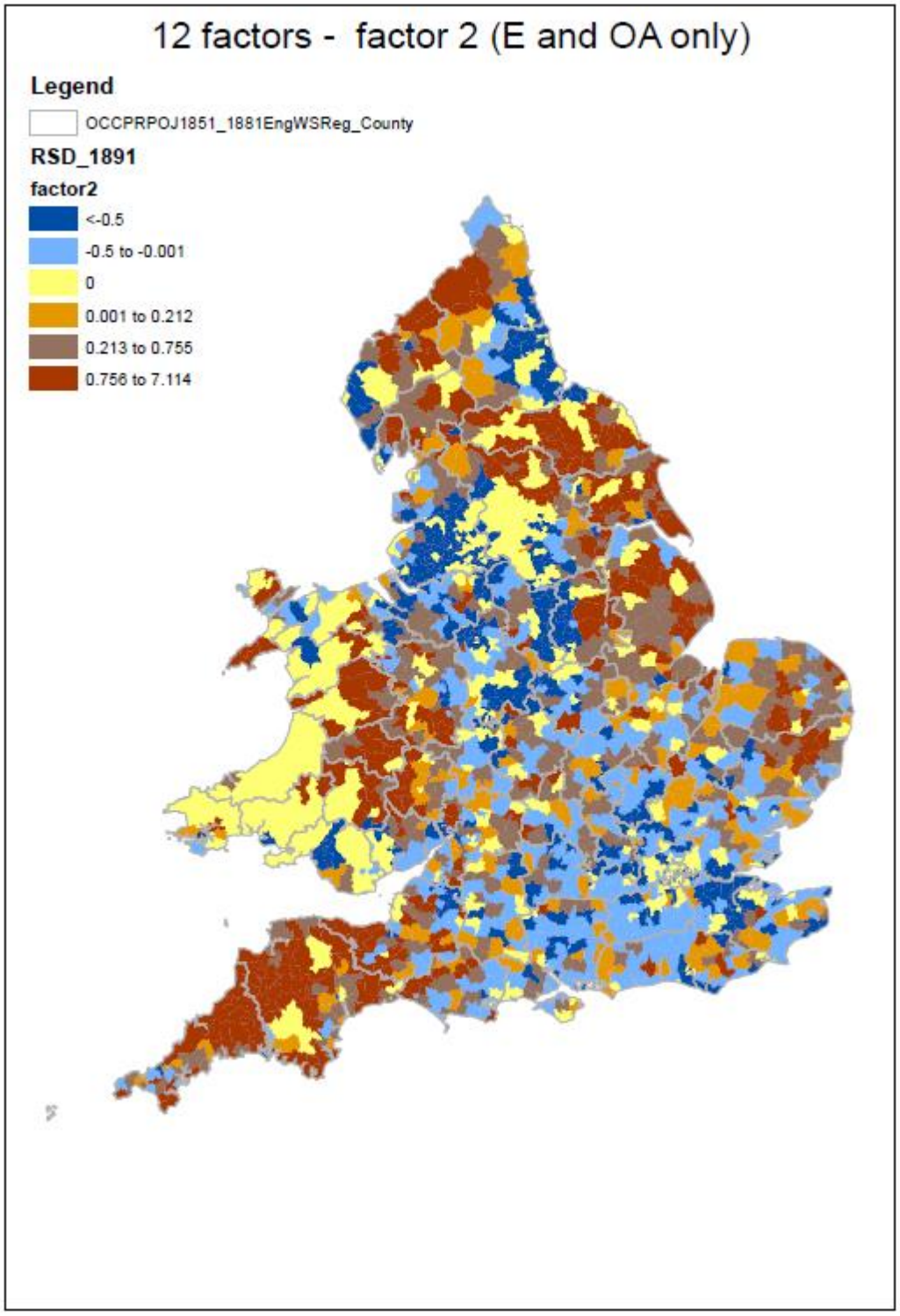

Fig 2

Factor 3 (Wood products, printing, instruments and other retail)

Leather, fur, hair & bone mf

Wood mf (sawyers, coopers, cane workers)

Furnishing mf (cabinet makers, french polishers, undertakers)

Watch & instrument mf

Other retail (general shopkeeper, huckster, hawker)

There is also an almost identical level of loading as for Factor 1 for:

Printing & paper mf (paper, cardboard, printers, bookbinders)

This is a grouping that appears to group some unlike occupations, though with a general emphasis on skilled crafts that have a low level of mechanisation. Figure 3 shows it to be widely spread in small mainly market towns that are centres for mainly rural areas (e.g. Lincoln, Norwich, Salisbury, Bedford and Buckinghamshire).

Factor 4 (Dealers and retailers)

Coal dealing

Food sales (butchers, fishmongers, cheesemongers, milksellers, grocers)

Ironmongers

Chemists, druggists

Dealers in household necessities for food, ironmongery, and heating (coal), as well as chemists. Figure 4 shows a spread across many small towns and fringe urban areas, but not the main urban centres which are captured by Factor 1.

Factor 5 (Tool and machinery manufacture and household goods dealers)

Machinery mf

Tool & weapons mf

Iron & steel mf, bolts and nails

Other metal mf (copper, tin, brass, whitesmiths, etc.)

H/h & personal goods dealer (earthenware, glass, jewellers)

The skilled metal working and metal manufacturing trades, also including household goods dealers (though probably mainly their manufacture as coded in the census). As shown in Figure 5, this brings out the W. Midlands Black Country and Sheffield, as well as some other centres, some of which probably reflect small sample sizes (q.v. below).

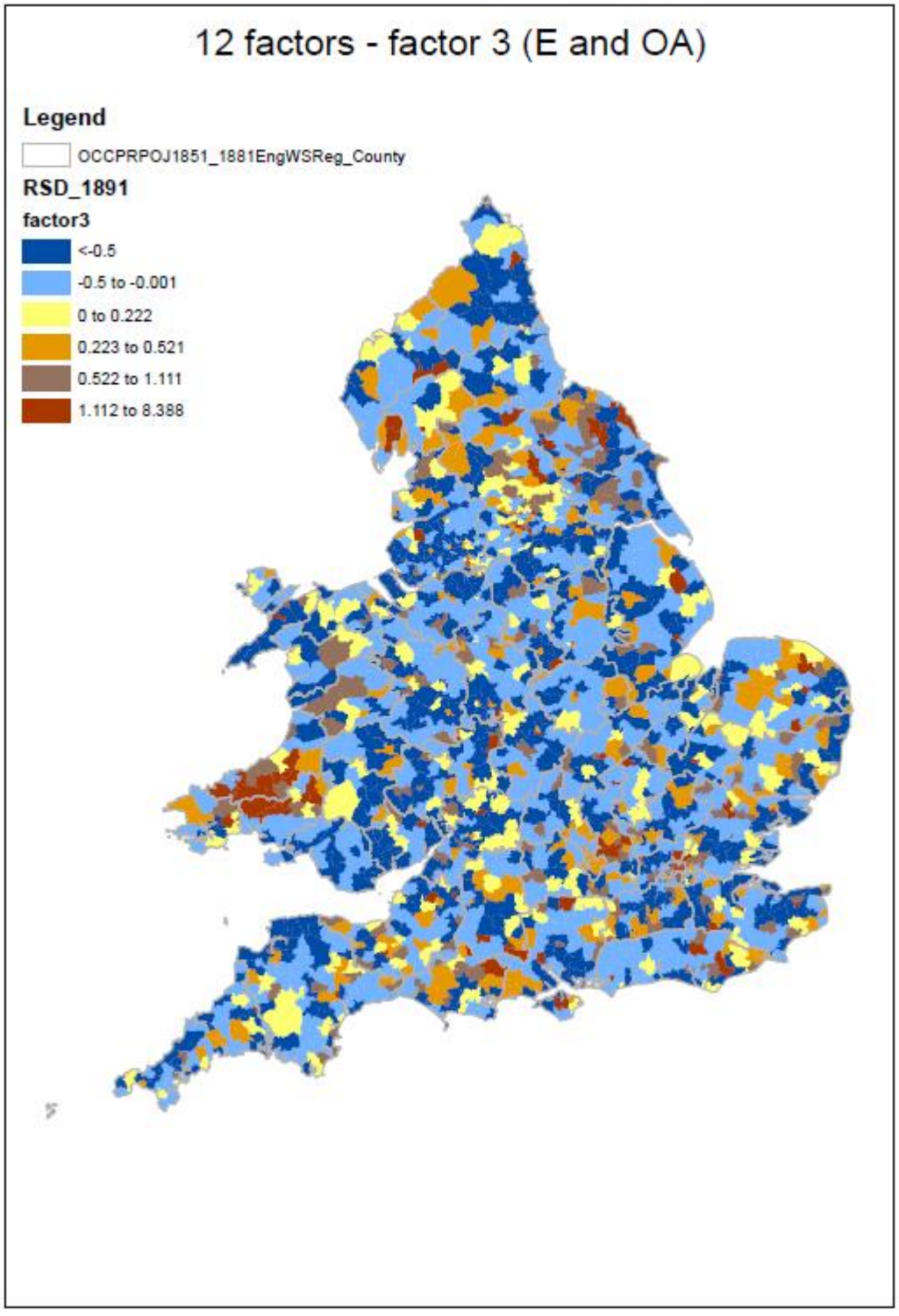
12 factors - factor 3 (E and OA)
Legend
OCCPRPOJ1851_1881EngWSReg_County
RSD_1891
factor3
<-0.5
-0.5 to -0.001
0 to 0.222
0.223 to 0.521
0.522 to 1.111
1.112 to 8.388

Fig. 3

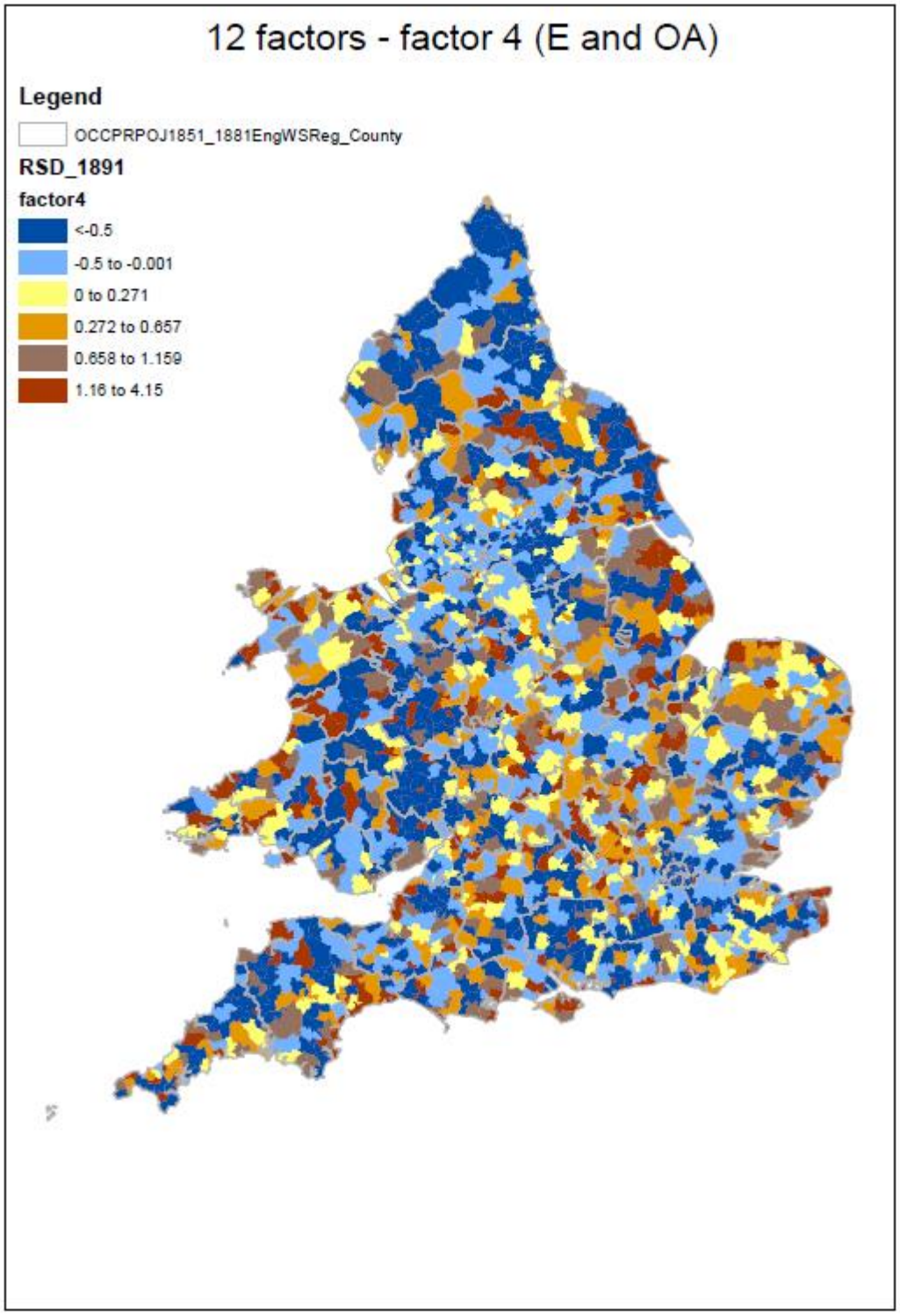
12 factors - factor 4 (E and OA)
Legend
OCCPRPOJ1851_1881EngWSReg_County
RSD_1891
factor4
<-0.5
-0.5 to -0.001
0 to 0.271
0.272 to 0.657
0.658 to 1.159
1.16 to 4.15

Fig 4.

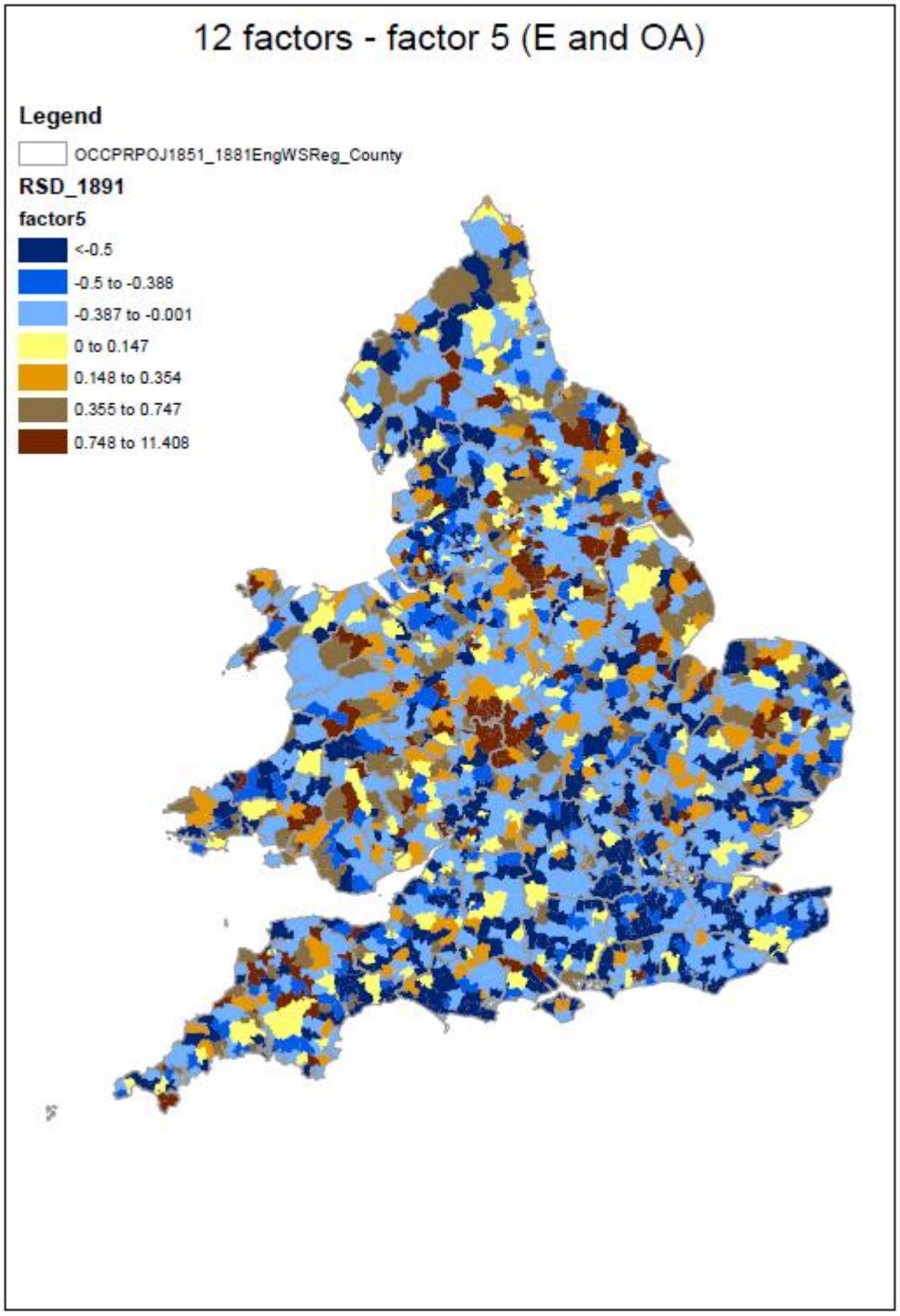

Fig 5.

Factor 6 (transport, earthenware and glass manufacture)

Ship, road & rail vehicle mf

Earthenware & glass mf

A diverse factor which groups rather unlike sectors, not easy to interpret for the positive loadings; though it may be identifying transport and small manufacturing centres in urban fringes and rural centres. It may be most effective for identifying a strongly negative loading on coal mining (-0.59), one of only two high negative loadings in the analysis. This negative influence of coal on entrepreneurship is a continuing pattern in all the subsequent results. There is also a high negative loading for other mining and quarrying (-0.49); as shown in the following results, this is a combination of a high negative loading for employers and a high positive loading for own account. As shown in Figure 6, whilst the negatives identify some of the coal areas well, there are also high negative loadings for some rural areas where there is no coal and little quarrying which reflect small sample sizes (q.v. below).

Factor 7 (Textiles)

Waterproof goods mf (floor & oil cloth, rubber etc.)

Cotton & silk mf (incl ribbon, weaving, dyeing, bleaching etc.)

As shown in Figure 7, this closely identifies the main textile areas in Lancs. (cotton), Yorks. (mixed textiles, not wool for this factor), Cheshire (silk), and also some rural concentrations especially in S. and Mid Wales. There is also a relatively high loading on woollen manufactures (see Table 1), and as noted under Factor 2, woollens may be more appropriately combined under this Factor 7.

Factor 8 (Carriers, lodgings and agricultural labourers)

Road & rail transport

Lodging & drink sales (wine & spirits, hotels, inns, coffee ho)

Labourers & transport staff (including family on farms)

Factor 9 (Clothing and agricultural produce manufacture and dealing)

Clothing mf (tailors, milliners, hosiery, hats, gloves, umbrellas, buttons, leather)

Timber, hay, corn and agric. produce dealing

Factor 10 (General manufacture and ports)

General mf (manufacturers, mechanic, artisan, machinist)

Ocean, inland and dock transport

Factor 11 (Other textiles)

Other textile mf (flax, hemp, rope, jute, lace, tape, thread)

This also has a high negative loading (-0.57) on Public admin, clergy.

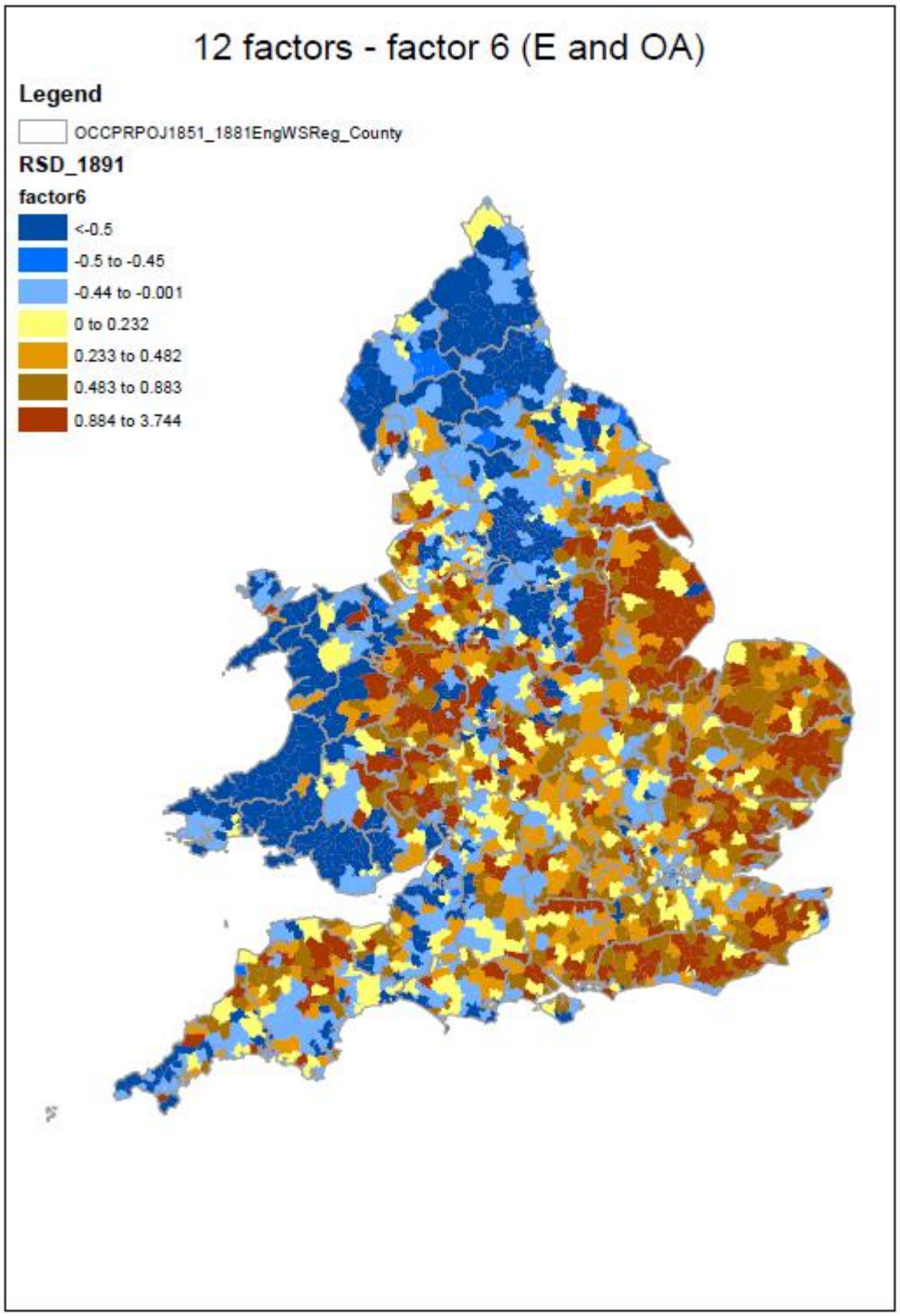

Fig 6

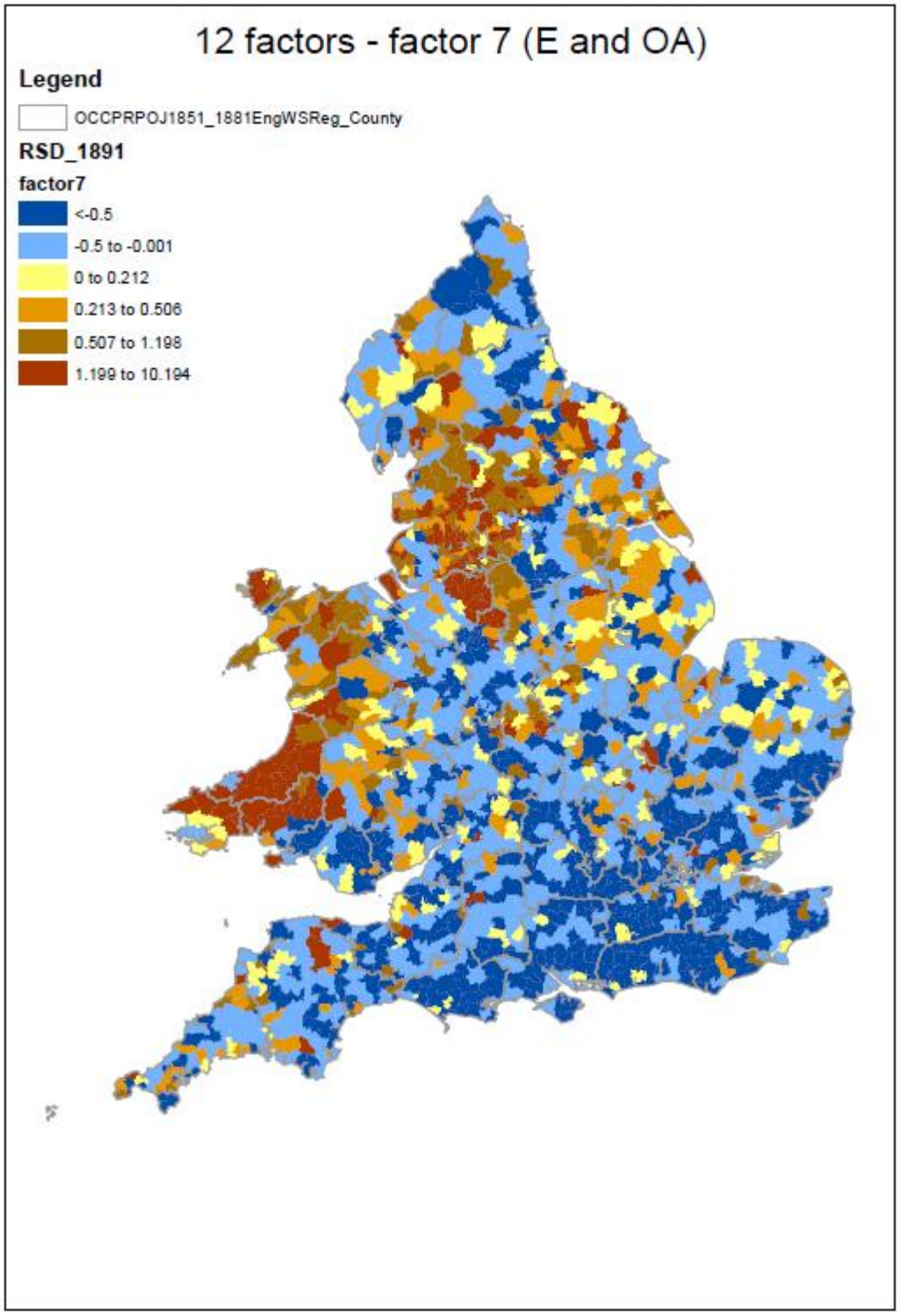

Fig 7.

Factor 12 (Military and domestic)

Military

Domestic and service staff, cooks

Because of their generally small variance explained and somewhat ambiguous loadings, no mapping is undertaken for factors 8-12.

The results of the 12-factor analysis show similarities to elements of the full economically active with some distinct entrepreneur differences: see WP 5: *Classification of all occupations for economically active: Factor analysis of RSDs in 189.* The first entrepreneur factor brings out the heavy concentration of most employers and own account in the main commercial, professional and gas production fields, together with clerks. These are the main urban locations. As with the economically active as a whole, the main environment of entrepreneurship is the commercial and urban field. The second entrepreneur factor brings out the strong focus of entrepreneurship on farming (almost all farmers are either employers or own account), as well as a range of associated rural, building, shoe, retail clothing and craft trades. These were pre-eminent field of own account or small employer activity and this factor seems to bring this out. The other entrepreneur factors range across other groupings of sectors, though for factors 5 and 6, and after factors 9 or 10 the interpretation becomes more difficult. In several cases the combination of employers and own account appears to be combining unlike characteristics when compared against the separate analyses for employers and own account (q.v. below).

3.2 25-Factor study

The variance pattern for the 25-factor analysis, shown in Table 3, is comparable with that for all the economically active (WP: *Classification of all occupations for economically active*, Table 3; q.v.). The first 3 factors are most significant, with small steps after 8 and 12 factors.

Factor	Variance	Difference	Proportion	Cumulative
Factor1	4.33981	0.34163	0.0868	0.0868
Factor2	3.99818	0.15444	0.0800	0.1668
Factor3	3.84374	2.40831	0.0769	0.2436
Factor4	1.43543	0.03352	0.0287	0.2723

Factor5	1.40192	0.03475	0.0280	0.3004
Factor6	1.36717	0.03065	0.0273	0.3277
Factor7	1.33652	0.00497	0.0267	0.3545
Factor8	1.33155	0.02247	0.0266	0.3811
Factor9	1.30908	0.02494	0.0262	0.4073
Factor10	1.28414	0.02033	0.0257	0.4330
Factor11	1.26381	0.03492	0.0253	0.4582
Factor12	1.22889	0.02954	0.0246	0.4828
Factor13	1.19935	0.05216	0.0240	0.5068
Factor14	1.14719	0.04210	0.0229	0.5297
Factor15	1.10508	0.01263	0.0221	0.5518
Factor16	1.09245	0.00832	0.0218	0.5737
Factor17	1.08414	0.01409	0.0217	0.5954
Factor18	1.07004	0.01225	0.0214	0.6168
Factor19	1.05780	0.01707	0.0212	0.6379
Factor20	1.04073	0.00937	0.0208	0.6587
Factor21	1.03136	0.00585	0.0206	0.6794
Factor22	1.02551	0.00620	0.0205	0.6999
Factor23	1.01931	0.00252	0.0204	0.7203
Factor24	1.01679	0.01041	0.0203	0.7406
Factor25	1.00637	-	0.0201	0.7607

Table 3: Factor analysis for all entrepreneurs (sum of all employers and OA), 25-factor variance.

Number of obs = 2,110
Method: principal-component factors Retained factors = 25
Rotation: orthogonal varimax (Kaiser off) Number of params = 950
LR test: independent vs. saturated: chi2(1225)= 3.1e+04 Prob>chi2 = 0.0000

The factor loadings in Table 4 are very comparable to the 12-factor study, but are more diffused across different factors.

50ID	50ID	factor1	factor2	factor3	factor4	factor5	factor6	factor7	factor8	factor9	factor10	factor11	factor12	factor13
1	farming, fishing, market gardeners, horse breeding and keeping	-0.6066	-0.5472	-0.0689	-0.0733	0.1417	0.0306	0.0407	0.1057	0.0938	0.0801	0.149	0.0182	0.034
2	coal mining	-0.1652	0.459	0.1072	-0.2268	0.0603	-0.2366	-0.3219	-0.3634	-0.1192	-0.118	-0.012	-0.0302	0.0614
3	other mining & quarrying, brickmaking, gravel, salt works	-0.1488	0.1187	0.0094	-0.1501	-0.0265	-0.1589	-0.2938	-0.1363	0.3391	0.1484	0.1004	0.2958	0.0763
4	construction operatives (masons, bricklayers, thatcher, plumbers etc.)	0.3026	-0.4677	0.2537	-0.0207	-0.1228	0.311	-0.0149	-0.1581	0.0135	0.1948	-0.3496	0.0485	0.0502
5	machinery mf	0.3555	0.4954	0.4925	0.0615	-0.0139	0.1816	0.2262	-0.0276	0.1626	0.0303	0.0008	-0.056	-0.0504
6	tool & weapons mf	0.1138	0.1987	-0.0152	0.0168	0.4739	0.233	-0.1705	0.4602	-0.0464	0.0579	-0.0994	0.0333	0.1501
7	iron & steel mf, bolts and nails	0.0541	0.462	0.3775	-0.0761	0.1199	0.2246	-0.1195	-0.0916	-0.081	0.0946	0.0344	-0.3028	-0.0352
8	blacksmiths	-0.4191	-0.0238	0.6267	-0.0096	0.1986	0.2177	-0.0256	-0.1576	0.1384	0.188	0.0821	-0.0098	-0.0504
9	other metal mf (copper, tin, brass, whitesmiths, etc.)	0.1546	0.3771	0.1299	-0.0368	0.2483	0.0792	-0.1458	0.0106	-0.0175	0.1313	0.0416	-0.3449	0.0926
10	ship, road & rail vehicle mf	0.2023	0.0328	0.6185	0.2045	0.0086	-0.0162	0.1632	0.2865	0.1575	-0.0622	0.0365	0.0406	-0.185
11	earthenware & glass mf	-0.001	0.1872	0.0581	-0.0032	0.2132	-0.0038	-0.189	-0.0937	-0.3724	-0.2438	-0.2656	0.5435	-0.1436
12	gas, coke and chemical mf	0.1698	0.2245	0.16	0.013	0.0129	0.0037	0.1909	-0.2468	-0.0827	-0.1508	-0.0337	0.0797	0.3146
13	leather, fur, hair & bone mf	0.3169	0.2087	-0.2297	0.3543	0.0896	0.1216	0.117	-0.0676	0.1843	0.0047	0.0592	-0.0101	0.0047
14	wood mf (sawyers, coopers, cane workers)	0.3089	0.1087	-0.0889	0.5537	0.165	0.1522	0.1592	-0.2428	-0.0384	-0.1104	0.0637	0.122	0.0852
15	furnishing mf (cabinet makers, french polishers, undertakers)	0.478	0.083	-0.1724	0.3383	0.1441	0.0464	-0.0785	-0.0809	0.0664	0.1032	0.021	-0.0007	0.0237
16	printing & paper mf (paper, cardboard, printers, bookbinders)	0.508	0.2013	-0.2997	0.2933	0.1788	-0.0789	0.1534	-0.0594	0.0226	0.0967	0.0674	-0.113	-0.0201
17	waterproof goods mf (floor & oil cloth, rubber etc.)	0.1028	0.1462	-0.0654	0.0261	-0.0504	0.0867	0.0727	0.0575	0.2741	-0.2198	-0.1585	-0.0664	-0.1073
18	woollen mf (woollen goods, carpets, blanket, flannel)	-0.0324	0.3338	-0.1895	-0.0594	-0.3717	0.0774	0.1007	0.1083	-0.0391	0.4684	-0.0399	0.2687	0.0933
19	cotton & silk mf (incl ribbon, weaving, dyeing, bleaching etc.)	-0.0695	0.4161	-0.305	-0.1219	-0.3164	-0.0225	0.1513	0.2104	-0.1823	-0.0905	0.0113	-0.2084	-0.1103
20	other textile mf (flax, hemp, rope, jute, lace, tape, thread)	0.0429	0.3702	-0.2602	0.0368	-0.4582	0.1586	0.1371	0.1549	-0.0068	0.2497	-0.0443	0.1373	-0.0082
21	clothing mf (tailors, milliners, hosiery, hats, gloves, umbrellas, buttons, leather)	-0.0266	0.1163	-0.163	0.0582	-0.2209	0.1586	-0.0945	0.0461	0.1796	-0.493	-0.2226	-0.0966	0.1836
22	shoe, boot, clog mf	0.025	0.0379	-0.163	0.1947	-0.1089	0.1077	-0.1754	-0.0604	0.4967	-0.2709	-0.063	-0.0387	-0.0697
23	agric produce mf (millers, refiners, bakers, confectioners)	-0.2323	-0.2821	0.1075	0.2694	0.0207	0.2212	0.1716	-0.0265	-0.0754	0.0258	0.4311	0.1441	0.0069
24	drink & tobacco mf (maltsters, brewers, distillers, tobacco & pipes)	0.3124	-0.0174	-0.0339	0.3449	-0.0654	0.0836	-0.1029	-0.1831	-0.1332	-0.0374	0.1235	0.006	-0.1803
25	watch & instrument mf	0.4155	0.1313	-0.0387	0.0392	0.2895	0.1238	-0.0006	0.3227	0.0942	0.0407	-0.0701	-0.0091	-0.017
26	general mf (manufacturers, mechanic, artisan, machinist)	0.2346	0.6608	0.3779	-0.1059	-0.0533	-0.262	0.0244	-0.0986	-0.093	0.0388	0.0043	-0.0233	0.0626
27	ocean, inland and dock transport	0.3935	0.0716	0.3477	0.3349	-0.07	-0.4673	0.2053	0.1424	-0.0514	-0.1485	0.1208	0.0518	-0.0277
28	road & rail transport	0.5719	-0.051	-0.15	0.1739	0.1213	-0.13	0.211	-0.2062	-0.1677	0.0861	-0.273	-0.1542	-0.0551
29	coal dealing	0.2081	0.0251	0.183	0.0323	-0.3417	0.2905	-0.1039	0.3343	-0.2992	-0.1866	0.0445	-0.0927	0.0012
30	timber, hay, corn and agric produce dealing	0.3117	-0.2867	0.1357	0.097	-0.0826	0.268	0.0429	-0.1015	-0.2308	-0.261	0.2309	0.0776	0.1733
31	clothing and dress dealing (drapers, hosiers, haberdashers)	0.5895	-0.1306	0.0205	0.2018	-0.1138	-0.063	-0.3469	-0.0059	0.3241	0.089	0.1049	0.0634	-0.0162
32	food sales (butchers, fishmongers, cheesemongers, milksellers, grocers)	0.7143	-0.2668	0.1127	0.1932	-0.2192	0.0995	-0.1536	-0.0148	-0.1116	0.0169	-0.0602	0.0201	0.0014
33	lodging & drink sales (wine & spirits, hotels, inns, coffee ho)	0.4586	-0.3268	0.069	0.1757	-0.1146	-0.2479	-0.3097	0.0916	-0.2118	0.0346	-0.0185	-0.1922	-0.0337
34	stationary dealing (stationers, publishers, newsagents)	0.8457	-0.0297	-0.2057	-0.0349	0.0951	-0.1324	0.0219	-0.0558	0.0569	0.0406	0.0689	-0.0492	-0.0557
35	h/h & personal goods dealer (earthenware, glass, jewellers)	0.3737	0.2021	-0.1422	0.0906	0.5496	0.073	-0.2099	0.2883	-0.0937	0.0241	-0.096	0.1873	0.0079
36	ironmongers	0.5948	-0.1958	0.1791	-0.0482	-0.2125	0.1759	-0.3392	0.037	-0.0312	0.0335	0.1248	0.0141	0.0188
37	other retail (general shopkeeper, huckster, hawker)	0.2629	0.1799	-0.0917	0.3616	-0.0929	-0.1315	-0.0279	-0.0344	-0.1192	0.2583	0.0723	0.0202	0.0408
38	chemists, druggists	0.6865	-0.1203	0.0319	-0.0359	-0.1612	0.0068	-0.3246	0.0895	-0.0315	0.0088	0.2238	-0.0291	0.0043
39	merchants, banks, insurers and brokers	0.7268	0.2004	-0.1738	-0.3612	0.0558	0.0374	0.177	0.0958	-0.0209	-0.079	0.1874	0.0734	-0.0133
40	other commerce (accountants, salesmen, travellers, officers of cos.)	0.7419	0.0512	-0.1435	-0.3663	0.059	0.0906	0.1219	-0.0069	0.078	-0.0993	0.1897	0.0739	-0.0063
41	construction management (builders and contractors)	0.5702	-0.0653	0.1858	-0.198	-0.0636	0.31	0.2172	-0.1016	0.0466	0.1101	-0.298	-0.0073	0.0512
42	professions (barristers, solicitors, scientific pursuits)	0.5718	-0.1556	0.0501	-0.4979	0.025	0.0173	0.0445	-0.0837	0.0165	-0.0131	0.0998	0.0316	0.0338
43	professions (doctors, dentists, artists, performers,education)	0.7091	-0.4037	0.019	-0.3031	0.04	0.0217	-0.0084	-0.0139	0.0049	0.001	-0.0374	0.0263	-0.0153
44	personal services (washing & bathing, hairdressing, chimney sweeps)	0.5777	-0.4436	-0.0265	0.1355	-0.0281	-0.0335	0.0134	-0.0643	-0.0332	0.0901	-0.3113	-0.0921	0.0073
45	Public admin, clergy	0.6696	-0.3402	0.0992	-0.1384	0.0496	-0.1506	0.1836	-0.0275	0.1119	0.0138	-0.0532	0.0888	-0.0134
46	Military	0.1483	-0.0596	0.4313	0.1106	-0.1293	-0.4503	0.1246	0.3071	0.1355	-0.0606	-0.1624	0.177	0.0393
47	Clerks, weighers, telegraph, non-theological students and apprentices	0.8214	0.1114	-0.0717	-0.3103	0.1033	0.0061	0.1929	-0.0373	0.0368	-0.1083	0.167	0.0642	-0.0185
48	Domestic and service staff, cooks	0.0673	-0.5176	-0.0578	-0.1539	0.1839	-0.3147	0.0534	0.043	-0.056	0.0505	0.0094	-0.1982	-0.0786
49	Labourers & transport staff (including family on farms)	-0.6325	-0.5351	0.0251	0.0821	0.1555	0.1444	0.2429	0.0456	-0.0867	-0.0417	0.0377	-0.0312	-0.0338
50	Persons of property and unoccupied	0.0237	-0.1399	0.024	0.0816	0.01	-0.144	0.0377	0.1114	0.0307	0.0119	0.0176	-0.0638	0.7995

50ID	50ID	factor14	factor15	factor16	factor17	factor18	factor19	factor20	factor21	factor22	factor23	factor24	factor25
1	farming, fishing, market gardeners, horse breeding and keeping	0.0051	0.0141	-0.0217	0.0396	0.0461	0.0727	-0.064	-0.0105	0.0337	-0.0311	-0.0548	-0.121
2	coal mining	0.0445	0.0186	-0.2299	-0.2218	-0.1482	-0.1269	0.0352	-0.2018	-0.2849	0.0105	0.0409	0.0542
3	other mining & quarrying, brickmaking, gravel, salt works	-0.487	0.0662	0.4053	0.2241	-0.0377	-0.0948	0.1066	0.1996	0.0246	0.0043	0.1116	-0.0167
4	construction operatives (masons, bricklayers, thatcher, plumbers etc.)	-0.12	-0.0115	0.0328	0.0131	0.0405	-0.0317	0.0143	-0.1489	-0.0056	-0.0489	0.0024	0.0292
5	machinery mf	0.0678	-0.0679	-0.078	0.0751	0.0253	-0.0226	-0.0866	0.1389	0.0453	0.0332	0.0047	0.0175
6	tool & weapons mf	-0.0739	0.03	0.1428	-0.3051	-0.094	-0.1366	0.1081	0.0737	-0.0576	0.2168	-0.2277	0.0656
7	iron & steel mf, bolts and nails	0.1527	-0.0059	0.1078	0.1988	0.0635	0.0203	0.009	0.2854	-0.0004	0.112	-0.1035	0.0875
8	blacksmiths	0.023	0.0534	-0.0801	0.1076	0.0097	-0.0508	-0.106	0.0403	-0.0201	0.0819	-0.0323	-0.0409
9	other metal mf (copper, tin, brass, whitesmiths, etc.)	0.0027	0.1332	0.1189	0.0447	-0.0807	0.3032	0.117	-0.4081	0.3392	-0.2356	0.1367	-0.11
10	ship, road & rail vehicle mf	-0.0193	-0.0889	-0.1535	0.0318	-0.0592	-0.0188	-0.1007	0.0142	-0.1426	-0.1272	0.1931	-0.1249
11	earthenware & glass mf	0.2131	0.003	-0.0875	0.2819	0.2047	0.0503	-0.018	0.0426	0.0712	-0.0262	0.1643	-0.0202
12	gas, coke and chemical mf	-0.2331	-0.0051	0.071	-0.4735	0.4426	0.0622	-0.2756	0.0712	0.1763	-0.0648	-0.0344	-0.1492
13	leather, fur, hair & bone mf	0.1623	-0.0534	0.1829	-0.0846	0.0413	-0.004	0.0284	-0.1145	-0.066	0.4747	0.3437	-0.2032
14	wood mf (sawyers, coopers, cane workers)	-0.1959	-0.1007	-0.0322	0.0453	-0.0925	0.2849	0.0334	0.0857	-0.0508	-0.0396	-0.1401	0.0124
15	furnishing mf (cabinet makers, french polishers, undertakers)	-0.1353	-0.1607	-0.1702	0.1392	-0.0408	0.3347	-0.0822	0.0242	-0.2141	-0.119	-0.2675	0.1
16	printing & paper mf (paper, cardboard, printers, bookbinders)	-0.0431	-0.0435	-0.0385	0.1806	0.0303	-0.1327	-0.1776	-0.0339	-0.0087	0.0304	0.1621	-0.0132
17	waterproof goods mf (floor & oil cloth, rubber etc.)	-0.1343	0.7137	-0.2117	0.0822	0.2738	0.0735	0.2099	-0.0318	-0.1701	0.0735	-0.1187	-0.0698
18	woollen mf (woollen goods, carpets, blanket, flannel)	0.2232	0.1183	0.0454	-0.1492	-0.0882	0.2043	-0.0197	0.0417	-0.0403	-0.1053	0.0753	0.1651
19	cotton & silk mf (incl ribbon, weaving, dyeing, bleaching etc.)	-0.3101	-0.3241	-0.1277	0.1809	0.1652	-0.1553	0.1031	-0.0677	0.0938	0.1028	-0.1309	-0.0019
20	other textile mf (flax, hemp, rope, jute, lace, tape, thread)	0.0237	0.0804	-0.1508	-0.0557	-0.0361	0.1805	0.0024	0.0521	0.0082	0.1317	0.0612	-0.0685
21	clothing mf (tailors, milliners, hosiery, hats, gloves, umbrellas, buttons, leather)	0.0086	0.1746	-0.0123	0.0678	-0.4463	-0.0506	-0.3954	0.1114	0.2362	0.0281	0.0524	0.1303
22	shoe, boot, clog mf	0.4188	-0.258	0.2657	-0.1247	0.2511	-0.0027	0.1641	-0.0198	-0.0937	-0.1657	-0.1006	0.1193
23	agric produce mf (millers, refiners, bakers, confectioners)	-0.0071	0.187	-0.026	-0.0047	0.1158	-0.1999	0.0115	-0.1822	0.1518	0.05	0.0256	0.5027
24	drink & tobacco mf (maltsters, brewers, distillers, tobacco & pipes)	0.0517	0.0468	-0.1695	-0.204	-0.1768	-0.1103	0.4438	0.3479	0.3675	-0.1046	0.0096	-0.1527
25	watch & instrument mf	-0.193	-0.0439	-0.1888	-0.2337	-0.0433	-0.1771	0.0465	0.1101	-0.1867	-0.3059	0.3049	0.0763
26	general mf (manufacturers, mechanic, artisan, machinist)	0.0262	0.0745	0.0668	-0.0618	-0.0581	0.0473	0.0859	-0.0153	-0.0308	0.0616	-0.0047	0.1259
27	ocean, inland and dock transport	-0.0096	0.0978	0.1869	-0.0307	0.0039	0.0293	0.0186	-0.041	0.0141	-0.0378	0.0027	0.122
28	road & rail transport	-0.0592	0.0498	0.1708	0.0918	-0.0203	-0.0934	0.1185	-0.0086	-0.0656	0.0033	0.0709	0.0929
29	coal dealing	-0.0493	0.0375	0.3518	0.1093	0.1259	0.0753	-0.0009	0.0634	-0.1354	-0.204	0.106	-0.0408
30	timber, hay, corn and agric produce dealing	-0.0492	0.0033	0.111	-0.0122	-0.2836	0.132	0.1324	-0.0703	-0.2807	0.1095	0.0048	-0.0839
31	clothing and dress dealing (drapers, hosiers, haberdashers)	-0.011	-0.0028	-0.1319	-0.0018	0.0286	0.0471	-0.055	-0.034	0.132	-0.0069	-0.0117	0.0346
32	food sales (butchers, fishmongers, cheesemongers, milksellers, grocers)	-0.0434	0.0294	0.0215	-0.0065	0.0156	-0.142	0.0192	-0.1018	-0.0149	0.0584	-0.0175	-0.0058
33	lodging & drink sales (wine & spirits, hotels, inns, coffee ho)	0.0231	0.0641	-0.0126	-0.0699	0.1343	0.053	-0.0932	0.1184	0.0247	0.1316	-0.0164	0.1327
34	stationary dealing (stationers, publishers, newsagents)	0.0119	0.0098	-0.0688	0.0534	0.0423	-0.0531	-0.1146	0.0123	-0.0021	-0.0022	0.0506	0.0592
35	h/h & personal goods dealer (earthenware, glass, jewellers)	0.0466	0.0212	0.0251	0.0824	0.0397	0.0453	-0.0738	-0.0829	0.1493	0.0782	-0.0807	-0.0005
36	ironmongers	-0.0426	-0.0561	-0.0896	0.0115	0.0435	0.0096	-0.0126	-0.1361	0.0233	0.1172	0.0281	-0.1375
37	other retail (general shopkeeper, huckster, hawker)	0.2183	0.2311	0.1517	0.0557	-0.0698	-0.3739	-0.2342	0.0098	-0.1056	-0.1859	-0.2877	-0.3063
38	chemists, druggists	0.002	-0.0127	-0.1626	-0.0547	0.1407	0.0482	-0.1274	0.0464	-0.0043	0.0864	0.0334	-0.0171
39	merchants, banks, insurers and brokers	0.0812	0.0486	0.073	0.0538	-0.0074	0.001	0.0113	-0.0156	0.0324	-0.0156	-0.0739	-0.004
40	other commerce (accountants, salesmen, travellers, officers of cos.)	0.0795	0.0501	0.0199	0.0601	-0.0142	-0.0133	0.0088	-0.0455	0.0253	-0.0877	-0.0719	-0.0492
41	construction management (builders and contractors)	0.0325	-0.0849	-0.0201	-0.0031	-0.0028	-0.0626	0.0334	0.0517	0.082	0.0882	-0.0631	0.0833
42	professions (barristers, solicitors, scientific pursuits)	0.0371	-0.026	0.019	-0.0021	-0.0593	-0.0133	0.005	0.0799	-0.0569	0.033	-0.0363	-0.0268
43	professions (doctors, dentists, artists, performers,education)	0.0655	0.0021	-0.026	-0.0078	-0.0209	0.015	0.0065	0.0074	-0.0028	-0.0358	-0.0254	0.0113
44	personal services (washing & bathing, hairdressing, chimney sweeps)	-0.0261	0.0477	0.0755	0.0012	-0.01	-0.0551	0.0361	-0.0765	-0.0054	-0.0499	0.0342	0.0642
45	Public admin, clergy	-0.0313	-0.0439	0.0161	-0.019	-0.0798	-0.0146	0.0289	-0.0225	0.0841	0.0213	-0.029	-0.0594
46	Military	0.0355	-0.1113	-0.0193	-0.0005	-0.1256	0.0744	0.124	-0.1403	0.1184	0.135	-0.1973	-0.0576
47	Clerks, weighers, telegraph, non-theological students and apprentices	0.0622	0.0373	0.007	0.0043	-0.0117	-0.0244	0.0223	0.0017	0.017	-0.0698	-0.0242	0.0082
48	Domestic and service staff, cooks	0.0806	0.1193	0.0747	-0.0708	0.0188	0.3005	-0.0682	0.3173	-0.0477	0.0961	0.1235	0.0381
49	Labourers & transport staff (including family on farms)	0.0977	0.0491	-0.0088	-0.0185	-0.0186	-0.0207	-0.0212	-0.0075	0.0265	-0.0217	-0.0323	-0.1216
50	Persons of property and unoccupied	0.1867	-0.03	-0.2252	0.2846	0.1379	-0.0985	0.2293	0.1275	-0.0193	-0.041	0.111	-0.0159

Table 4. 25-Factor loadings for all entrepreneurs for each of the 50 aggregated occupational variables.

The main interpretations of the first three factors is similar:

Factor 1. The main commercial and professional centres;

Factor 2. Farming and rural industries, but also combining some aspects of the 12-factor Factor 2 (maker-dealers in clothes, shoes and apparel);

Factor 3. Furniture, printing, drink and tobacco, watch & instruments, food sales, lodging, ironmongers chemists and personal services (combining elements of Factors 3, 4 and 9).

Factor 4 is now entirely wood manufacture,

Factor 5 other metal and household goods manufacture.

Factor 6 tool & weapons and iron & steel manufacture.

After this almost all factors relate to single aggregated occupational categories.

A notable feature is that for Factor 14 there is a very high negative loading for coal mining (-0.91), which is the only major potentially significant occupation for this factor, again showing the high negative relationship of coal mining with entrepreneurship. This is a strong contrast to the factor loadings for all economically active. The coal sector is one of very high employment, but is concentred under a few employers, almost all of whom live outside the immediate mining areas, usually in more rural areas or in the south of England. Despite its large workforces, this is not correlated with other forms of entrepreneurship. This is a pattern found in modern studies of historic coal mining areas, and is a contrast with many metals mining and quarrying industries which have relatively high entrepreneurship rates.

Overall the 25-fcator study confirms the concentration on the same major factors, up to factor 3 or on similar industries (factors 4-6), but for higher order factors the variance is being divided between such a large number of potentially orthogonal dimensions that the results are confused and difficult to interpret. The rest of the analysis here proceeds with 12-factor approaches.

4. Classification of employers.

The 12-factor study for employers as a separate category is shown in Tables 5 and 6. The factor variance is highly concentrated in the first 4 factors, which account for 30% of the variance, after which there is a steady decline in significance.

Factor	Variance	Difference	Proportion	Cumulative
Factor1	5.53504	2.28594	0.1153	0.1153
Factor2	3.24911	0.02241	0.0677	0.1830
Factor3	3.22670	0.80714	0.0672	0.2502
Factor4	2.41956	0.73939	0.0504	0.3006
Factor5	1.68017	0.06199	0.0350	0.3356
Factor6	1.61818	0.25835	0.0337	0.3693
Factor7	1.35983	0.06009	0.0283	0.3977
Factor8	1.29974	0.07137	0.0271	0.4248
Factor9	1.22837	0.01884	0.0256	0.4503

Factor10	1.20953	0.13597	0.0252	0.4755
Factor11	1.07355	0.01742	0.0224	0.4979
Factor12	1.05613	-	0.0220	0.5199

Table 5: Factor analysis for all employer entrepreneurs, 12-factor variance.

Number of obs = 2,110

Rotation: orthogonal varimax (Kaiser off) Number of params = 510

LR test: independent vs. saturated: chi2(1128) = 2.6e+04 Prob>chi2 = 0.0000

The factor loadings are shown in Table 6. Note in this case that two groups (coal mining) and (persons of property) are not calculated by the factor analysis as they have too small a sample size.

50ID	50ID	factor1	factor2	factor3	factor4	factor5	factor6	factor7	factor8	factor9	factor10	factor11	factor12
1	farming, fishing, market gardeners, horse breeding and keeping	-0.1901	0.7724	-0.0885	-0.0951	-0.1786	-0.0605	0.004	-0.0001	0.053	0.0199	-0.0535	-0.0373
3	other mining & quarrying, brickmaking, gravel, salt works	-0.0725	-0.073	0.0871	0.0589	-0.0091	0.0194	-0.0672	-0.1482	0.6661	0.0185	-0.1278	0.0218
4	construction operatives (masons, bricklayers, thatcher, plumbers etc.)	0.308	0.6281	0.028	-0.0325	0.0113	0.2029	0.058	0.0162	0.2433	0.0016	0.0454	0.0263
5	machinery mf	-0.0199	0.0231	0.2063	0.354	0.3143	0.3315	0.0162	0.0322	-0.0362	-0.0638	0.087	-0.0381
6	tool & weapons mf	-0.0047	-0.0332	0.0061	0.6455	0.0239	-0.0648	-0.0912	-0.0371	-0.0096	-0.056	0.0156	-0.0205
7	iron & steel mf, bolts and nails	-0.0683	-0.1232	-0.0023	0.6403	0.1718	0.0186	-0.0592	-0.0218	0.2295	-0.0745	0.0081	0.0261
8	blacksmiths	-0.0824	0.8226	-0.0687	-0.1095	0.0424	-0.0842	-0.0776	-0.0082	-0.0663	-0.0376	0.0142	-0.0116
9	other metal mf (copper, tin, brass, whitesmiths, etc.)	0.1421	-0.141	0.1405	0.7083	-0.0145	0.082	0.123	0.0843	-0.008	0.0437	-0.0119	0.0474
10	ship, road & rail vehicle mf	0.1838	0.3987	-0.0014	0.0064	0.3712	-0.1207	-0.1113	0.0076	-0.3366	0.1918	0.0066	0.0109
11	earthenware & glass mf	-0.0425	-0.0423	0.1632	0.1142	0.1737	-0.1029	-0.0941	0.0369	-0.0418	-0.1037	0.2078	-0.4628
12	gas, coke and chemical mf	0.158	-0.2589	0.5685	0.1114	-0.092	0.1089	0.0809	0.2038	0.015	0.0503	0.0607	-0.0002
13	leather, fur, hair & bone mf	0.3304	-0.1186	0.2575	0.2464	-0.0751	0.2139	-0.021	0.3708	0.0466	-0.0887	-0.0564	0.0124
14	wood mf (sawyers, coopers, cane workers)	0.0676	-0.0027	0.0467	0.0476	0.007	-0.007	-0.0259	0.7618	-0.093	-0.046	0.0242	-0.0152
15	furnishing mf (cabinet makers, french polishers, undertakers)	0.4817	-0.2353	-0.0152	0.0922	-0.1015	0.1218	-0.0294	0.301	-0.0919	-0.0205	0.0579	-0.0428
16	printing & paper mf (paper, cardboard, printers, bookbinders)	0.5154	-0.2724	0.2773	0.1991	-0.0362	0.155	0.1231	0.0984	-0.0998	-0.0528	-0.076	0.0058
17	waterproof goods mf (floor & oil cloth, rubber etc.)	0.1157	-0.0889	0.2832	0.1023	-0.0639	0.0303	0.4848	-0.0182	-0.1672	0.0658	-0.0255	0.0807
18	woollen mf (woollen goods, carpets, blanket, flannel)	0.0618	0.0779	-0.0563	-0.0234	-0.1451	0.5654	0.0654	0.1098	0.3504	0.0274	-0.007	-0.0589
19	cotton & silk mf (incl ribbon, weaving, dyeing, bleaching etc.)	-0.1095	-0.1395	0.1586	-0.008	0.002	0.1135	0.7113	-0.0777	-0.0175	-0.0219	-0.0202	0.0388
20	other textile mf (flax, hemp, rope, jute, lace, tape, thread)	0.0562	-0.0877	0.0968	-0.0451	0.1105	0.638	0.1859	-0.0059	-0.0443	-0.023	0.0154	0.0079
21	clothing mf (tailors, milliners, hosiery, hats, gloves, umbrellas, buttons, leather)	0.0341	-0.137	-0.0137	-0.0486	0.0326	0.1321	0.1398	0.1723	-0.2776	-0.0391	-0.3471	0.0438
22	shoe, boot, clog mf	0.3179	0.481	-0.0938	-0.0115	-0.1805	0.1033	0.0504	0.109	0.0481	-0.0221	-0.0688	0.0625
23	agric produce mf (millers, refiners, bakers, confectioners)	-0.0861	0.7305	-0.018	-0.0453	0.0957	-0.0321	-0.1023	-0.0483	-0.1552	-0.044	-0.0235	0.0971
24	drink & tobacco mf (maltsters, brewers, distillers, tobacco & pipes)	0.4012	-0.1509	0.0815	0.058	0.3848	0.0249	-0.0531	0.0077	-0.0791	-0.1719	-0.013	0.0679
25	watch & instrument mf	0.5338	-0.1894	0.1158	0.2983	-0.0941	-0.0409	0.0189	0.0693	-0.1836	-0.0159	-0.0597	-0.0152
26	general mf (manufacturers, mechanic, artisan, machinist)	0.1052	-0.0669	0.2349	0.3658	-0.0589	0.0309	0.0708	-0.0163	-0.0854	0.4611	0.0702	-0.1702
27	ocean, inland and dock transport	0.0814	-0.0191	0.075	-0.0532	0.1287	0.0057	-0.0404	-0.0451	0.015	0.7619	-0.0064	-0.0601
28	road & rail transport	0.4519	-0.0943	0.1925	-0.0818	0.0276	-0.1822	-0.0014	-0.022	0.0428	0.0911	0.2946	0.0385
29	coal dealing	0.2558	-0.1139	0.0314	0.0622	0.5961	0.0377	0.1159	-0.0043	-0.0043	0.2363	-0.0479	0.0678
30	timber, hay, corn and agric produce dealing	0.1154	0.0801	0.3067	-0.0473	0.3898	0.009	-0.1673	0.4445	-0.0087	0.0682	-0.0133	-0.0608
31	clothing and dress dealing (drapers, hosiers, haberdashers)	0.7562	0.1891	0.0528	0.0757	-0.061	0.2305	0.0467	0.0969	0.0905	0.0469	-0.0546	-0.0211
32	food sales (butchers, fishmongers, cheesemongers, milksellers, grocers)	0.6822	0.0363	0.161	-0.0784	0.3399	-0.0684	-0.1721	0.0498	-0.1078	0.111	0.0494	0.0121
33	lodging & drink sales (wine & spirits, hotels, inns, coffee ho)	0.6125	0.0103	0.0649	-0.0008	-0.1196	-0.1841	-0.0796	0.0367	-0.085	0.1396	0.1105	0.0375
34	stationery dealing (stationers, publishers, newsagents)	0.6313	-0.2568	0.4788	0.0546	-0.1022	0.008	-0.0039	0.0263	-0.0671	-0.0188	-0.0228	0.0229
35	h/h & personal goods dealer (earthenware, glass, jewellers)	0.3636	-0.1287	0.1617	0.6039	-0.1085	-0.0634	0.0181	0.0709	-0.1083	0.0703	-0.0059	-0.0001
36	ironmongers	0.5597	-0.0326	0.1958	0.2228	0.3334	0.0581	-0.0249	0.0145	0.0964	0.0206	-0.1294	0.0892
37	other retail (general shopkeeper, huckster, hawker)	0.0491	-0.2332	0.0174	0.1178	-0.0202	0.5197	-0.1753	-0.0889	-0.1473	0.0414	0.2217	0.0105
38	chemists, druggists	0.6789	-0.0991	0.1347	0.0949	0.1954	0.0628	0.0791	-0.0007	0.0459	-0.0017	-0.0154	-0.0255
39	merchants, banks, insurers and brokers	0.2239	-0.066	0.7555	0.0469	0.0134	0.0324	0.1393	0.0482	0.0307	0.1474	-0.0001	-0.0295
40	other commerce (accountants, salesmen, travellers, officers of cos.)	0.2744	-0.0152	0.6438	0.1996	0.1301	0.0291	0.1014	0.0182	-0.029	0.0137	-0.0019	-0.0046
41	construction management (builders and contractors)	0.4197	0.1122	0.4026	-0.1178	0.2989	-0.1514	-0.2076	-0.0287	0.0123	0.002	0.0481	-0.0332
42	professions (barristers, solicitors, scientific pursuits)	0.3577	0.0023	0.6502	0.1	0.1281	-0.0254	0.0184	0.0163	0.1188	-0.0271	-0.0362	-0.011
43	professions (doctors, dentists, artists, performers,education)	0.6709	0.0001	0.334	0.0374	0.1378	-0.0404	0.0399	-0.0564	-0.0079	0.0339	0.025	-0.0681
44	personal services (washing & bathing, hairdressing, chimney sweeps)	0.4413	-0.1684	0.3484	-0.1462	0.1325	-0.1854	-0.1876	0.0139	-0.0361	-0.013	0.1116	0.0765
45	Public admin, clergy	0.0347	0.0674	0.0083	-0.0087	0.0379	-0.1302	0.0043	-0.0412	0.1246	-0.0282	-0.7078	-0.1109
46	Military	-0.0085	0.0579	0.0119	0.0532	0.0825	-0.0381	0.0072	-0.0277	-0.0117	-0.1292	0.1114	0.7415
47	Clerks, weighers, telegraph, non-theological students and apprentices	0.0037	0.0492	0.3943	-0.0109	-0.2629	0.0867	-0.2687	-0.1544	-0.1765	-0.0486	-0.0255	0.0891
48	Domestic and service staff, cooks	0.008	-0.0618	-0.0029	-0.0001	-0.0692	-0.1313	0.0382	0.2743	0.2437	0.3236	0.1212	0.3289
49	Labourers & transport staff (including family on farms)	0.104	0.0813	-0.0621	-0.0214	0.1058	-0.1939	0.3878	0.0561	0.1175	-0.1943	0.3598	-0.2366

Table 6. Factor loadings for all employer entrepreneurs, 12-factor variance

The factors when mapped are shown, and their highest loadings can be summarised as follows:

Factor 1 (Retail, lodging, transport and small craft trades)

Furnishing mf (cabinet makers, french polishers, undertakers)
Printing & paper mf (paper, cardboard, printers, bookbinders)
Drink & tobacco mf (maltsters, brewers, distillers, tobacco & pipes)
Watch & instrument mf
Road & rail transport
Clothing and dress dealing (drapers, hosiers, haberdashers)
Food sales (butchers, fishmongers, cheesemongers, milksellers, grocers)
Lodging & drink sales (wine & spirits, hotels, inns, coffee ho)
Stationary dealing (stationers, publishers, newsagents)
Ironmongers
Chemists, druggists
Construction management (builders and contractors)
Professions (doctors, dentists, artists, performers, education)
Personal services (washing & bathing, hairdressing, chimney sweeps)

This factor absorbs almost all the retail sector as well as smaller-scale manufactures in furniture, drink, and printing, and carriers and lodgings. It appears to capture one of the key realms of the small employer tradesman. It is similar to Factors 3 and 4 for the total entrepreneur estimates.

Figure 8 shows this factor to be much more concentrated than for all entrepreneurs (which resemble Factors 3 & 4: Figs. 3 and 4) in a few RSDs. This figure all indicates a stron feature of the employer throughout the discussion in this section, that often employers are located away from their business locations. However, in some cases the analysis here also reflects some instabilities and small number issues (q.v. below).

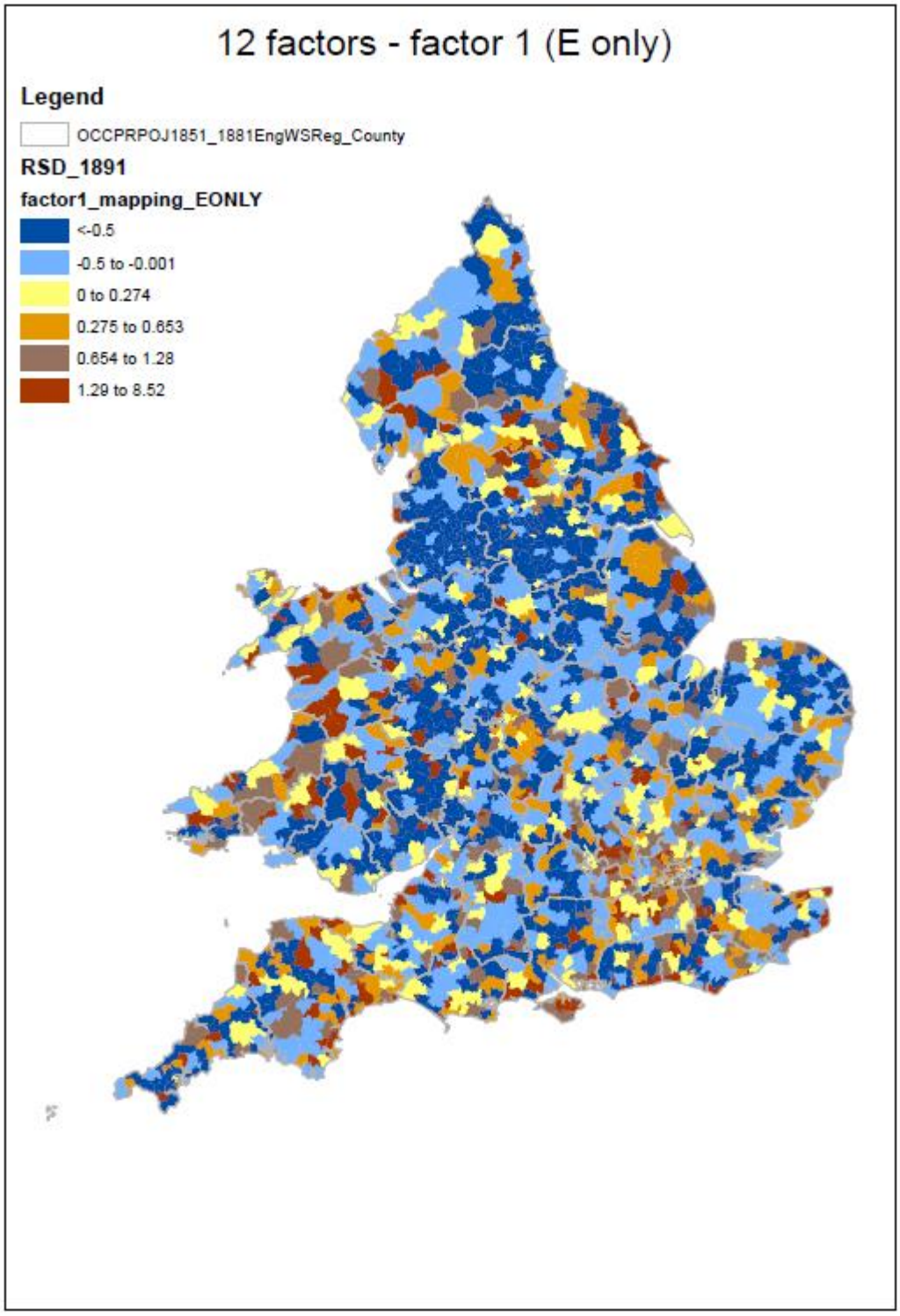

Fig. 8.

Factor 2 (Farming, rural trades, shoes and construction operatives)

Farming, fishing, market gardeners, horse breeding and keeping

Construction operatives (masons, bricklayers, thatcher, plumbers etc.)

Blacksmiths

Ship, road & rail vehicle mf

Shoe, boot, clog mf

Agricultural produce mf (millers, refiners, bakers, confectioners)

This factor is very similar to that for all entrepreneurs, with the only differences being the inclusion of ship, road and rail manufacture (though the loading is relatively low; 0.40), instead of clothing. Ship, road and rail manufacture includes many small rural trades such as wheelwrights and saddler and harness makers as well as port-related shipwrights and boat builders, and urban-based bicycle and carriage manufacture. This group is somewhat problematically assigned to this factor, but in other regards the separate extraction of employers appears to better separate the more rural form the more urban character for these two cases than employers and own account combined.

The mapping (Figure 9) reflects broadly similar patterns to all entrepreneurs (Fig. 2) and has a higher number of RSDs with sample size being a lesser problem.

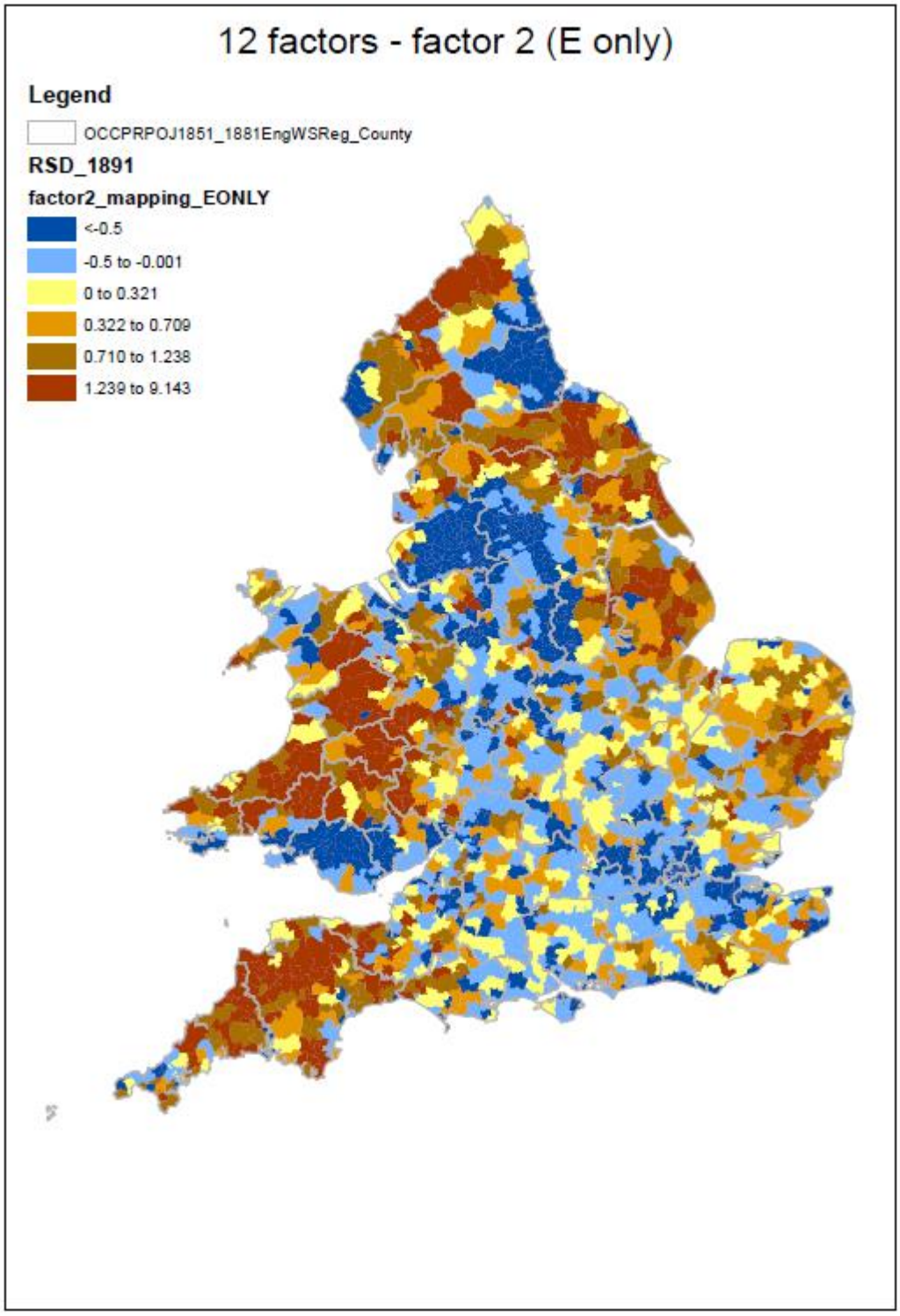

Figure 9.

Factor 3 (Commercial and professional centres)

Gas, coke and chemical mf

Merchants, banks, insurers and brokers

Other commerce (accountants, salesmen, travellers, officers of cos.)

Professions (barristers, solicitors, scientific pursuits)

Clerks, weighers, telegraph, non-theological students and apprentices

This factor closely resembles Factor 1 for all entrepreneurs, but with 5 compared to 11 variables. Four that are highly loaded clearly draw out the merchant and chemicals entrepreneurs; the fifth variable for clerks includes a few that are also employers.

The mapping in Figure 10 closely resembles factor 1 (Fig. 1) for all entrepreneurs, but with some more dispersed locations reflecting residence rather than business location.

Factor 4 (Tool and heavy manufactures and household goods dealers)

Machinery mf

Tool & weapons mf

Iron & steel mf, bolts and nails

Other metal mf (copper, tin, brass, whitesmiths, etc.)

H/h & personal goods dealer (earthenware, glass, jewellers)

This is identical to the variables in Factor 5 for the total entrepreneurs. The mapping (Figure 11) is also similar to factor 5 for all employers (Fig. 5).

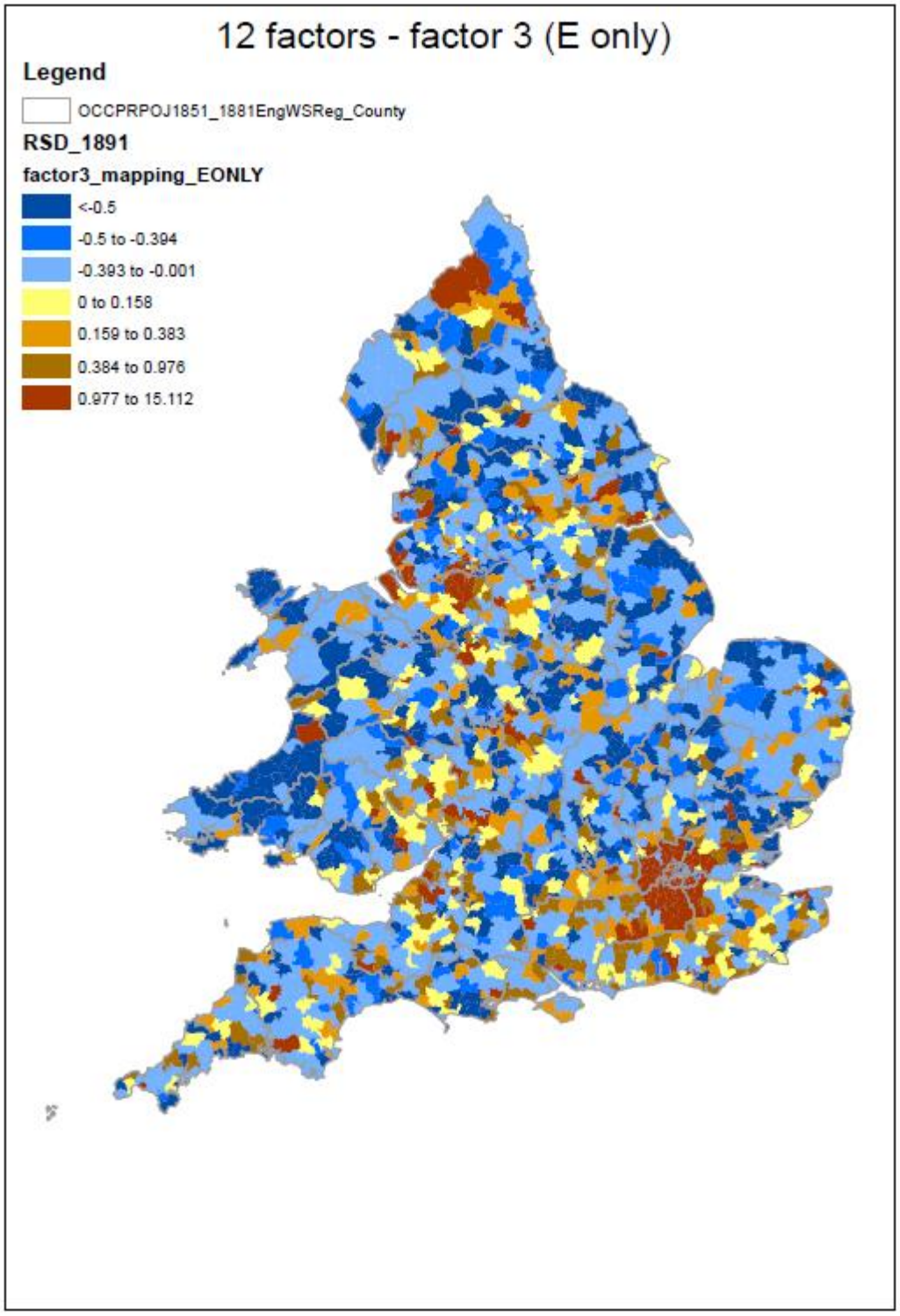
12 factors - factor 3 (E only)
Legend
OCCPRPOJ1851_1881EngWSReg_County
RSD_1891
factor3_mapping_EONLY
<-0.5
-0.5 to -0.394
-0.393 to -0.001
0 to 0.158
0.159 to 0.383
0.384 to 0.976
0.977 to 15.112

Figure 10.

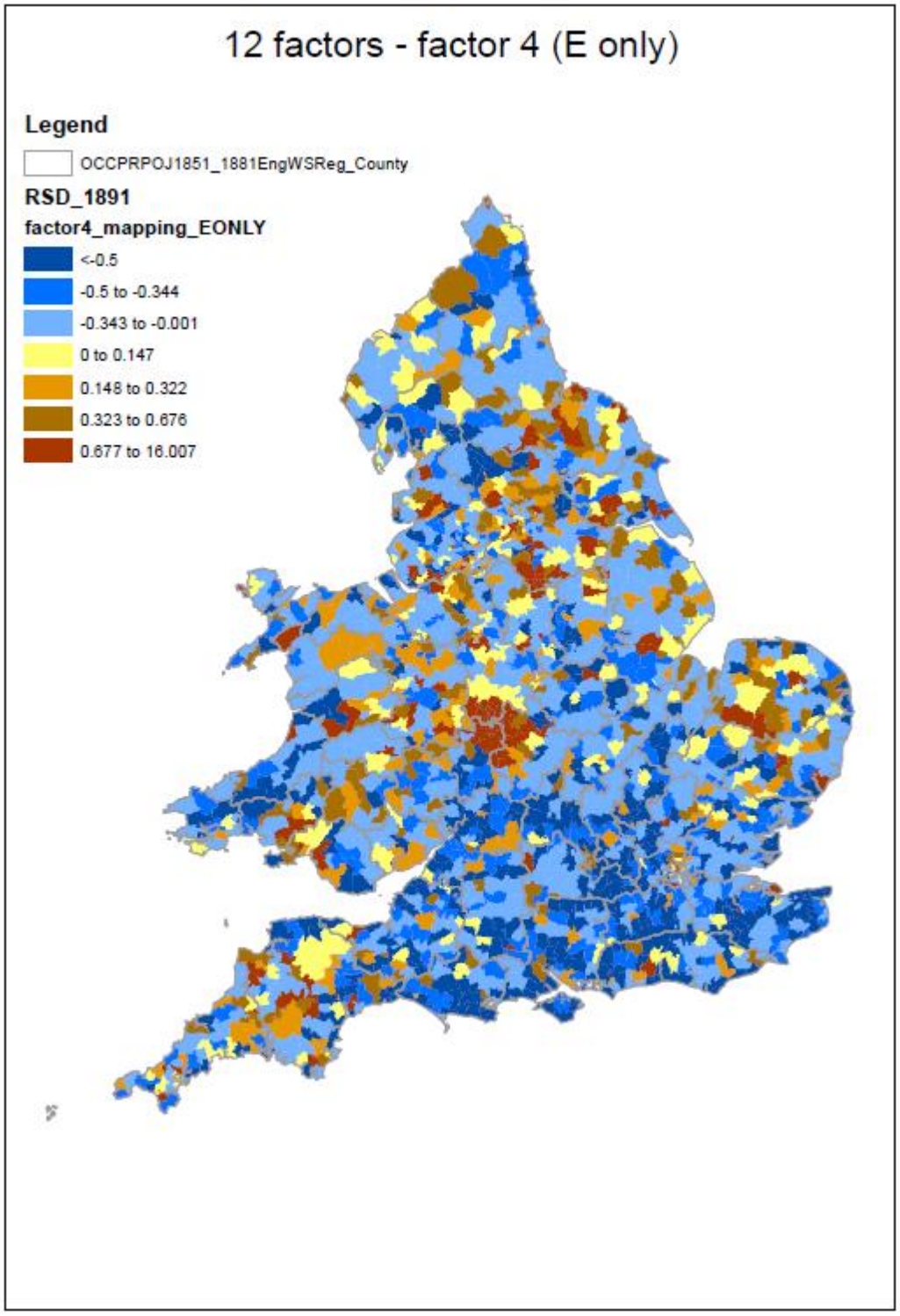

Figure 11.

Factor 5 (Coal and timber dealers)

Coal dealing

Timber, hay, corn and agricultural produce dealing

This is similar to Factors 4 and 9 for total entrepreneurs. It is a more focused dealing factor for a mix of retail and wholesale heavier goods. Mapping is not continued for this and the later factors.

Factor 6 (Wool and 'other' textiles)

Woollen mf (woollen goods, carpets, blanket, flannel)

Other textile mf (flax, hemp, rope, jute, lace, tape, thread)

Other retail (general shopkeeper, huckster, hawker)

This splits these textiles sectors from those in Factor 7 (q.v.). The addition of other retail is somewhat anomalous. This is by far its highest loading, which otherwise is only loaded at 0.22 on Factor 10 which is associated with General manufacture and ports.

Factor 7 (Cotton and silk textiles, and waterproof goods)

Waterproof goods mf (floor & oil cloth, rubber etc.)

Cotton & silk mf (incl ribbon, weaving, dyeing, bleaching etc.)

This is identical to Factor 7 for all entrepreneurs. As in that case it splits woollen textiles from cotton but it is possible that a combined textiles group might be more appropriately grouped as a joint Factors 6 and 7 for employers. However, the factor loadings on the alternative factors is very low so that for employers as for all entrepreneurs; i.e. as to be expected, different types of textiles are split between RSDs, and hence locations.

Factor 8 (Leather and wood manufacture)

Leather, fur, hair & bone mf

Wood mf (sawyers, coopers, cane workers)

Two occupational groups, of which wood is the major loading. These are grouped with other related leather and organic products in Factor 3 for all entrepreneurs.

Factor 9 (Mining and quarrying (non-coal))

Other mining & quarrying, brickmaking, gravel, salt works

One occupational group for non-coal mining and quarrying

Factor 10 (General manufacture and ports)

General mf (manufacturers, mechanic, artisan, machinist)

Ocean, inland and dock transport

These are the same occupational groups as Factor 10 for the total entrepreneurs.

Factor 11 (Other textiles)

There is no significant high positive loading for any occupational group on this factor, but a high negative loading for Public admin, clergy (-0.71). This indicates that RSDs with high public administrative staff have low employer numbers.

Factor 12 (Military and domestic)

Military

Domestic and service staff, cooks

This is identical to Factor 12 for all entrepreneurs; but additionally there is a high negative loading for earthenware & glass manufacture (-0.46) which otherwise has no high loadings throughout the analysis.

The results of the analysis for employers are similar in many respects for the analysis of all entrepreneurs, which is perhaps a little surprising since employers are outnumbered about 4:1 by own account. The main differences (apart from ordering of the factors), is for Factor 1 which more finely splits retail and small crafts, and Factor 3 which splits commercial centres slightly differently. For the other 10 factors the loadings are broadly similar.

For employers the first factor brings out the heavy concentration of most employers in retail and small craft trades. Second is farming and rural industries. Third is the main commercial, professional and gas production fields, together with clerks in the main urban locations. For employers there is, therefore, a distinction from the economically active as a whole and all entrepreneurs (including own account), in the sequencing of the main environments of entrepreneurship but the general patterns captured by the first three factors are similar.

5. Classification of own account.

The classification of own account entrepreneurs for the 12-factor analysis is shown in Tables 7 and 8. The variance is more highly concentrated than in any other analysis, in this case into the first 3 factors (20% of variance), after which there is step and then slow decline. Because of the large sample size all occupational groups are calculated for own account entrepreneurs.

Factor	Variance	Difference	Proportion	Cumulative
Factor1	3.67380	0.29869	0.0735	0.0735
Factor2	3.37511	0.35219	0.0675	0.1410
Factor3	3.02292	1.27721	0.0605	0.2014
Factor4	1.74571	0.30289	0.0349	0.2364
Factor5	1.44282	0.01487	0.0289	0.2652
Factor6	1.42795	0.07390	0.0286	0.2938
Factor7	1.35404	0.01015	0.0271	0.3208
Factor8	1.34389	0.06598	0.0269	0.3477
Factor9	1.27792	0.00961	0.0256	0.3733
Factor10	1.26830	0.02646	0.0254	0.3986
Factor11	1.24184	0.08368	0.0248	0.4235
Factor12	1.15817	-	0.0232	0.4466

Table 7: Factor analysis for own account entrepreneurs, 12-factor variance.

Number of obs = 2,110

Method: principal-component factors Retained factors = 12

Rotation: orthogonal varimax (Kaiser off) Number of params = 534

LR test: independent vs. saturated: chi2(1225) = 1.8e+04 Prob>chi2 = 0.0000

50ID	50ID	factor1	factor2	factor3	factor4	factor5	factor6	factor7	factor8	factor9	factor10	factor11	factor12
1	farming, fishing, market gardeners, horse breedir	0.5084	-0.1866	-0.157	-0.1001	-0.0027	0.1635	0.1883	-0.0508	0.0994	0.4052	0.0334	0.0524
2	coal mining	0.1353	-0.0158	-0.0795	-0.0543	-0.0608	0.0398	-0.6169	-0.0469	-0.0487	0.0016	-0.0985	-0.0619
3	other mining & quarrying, brickmaking, gravel, sa	0.2716	0.056	0.0305	0.0602	-0.0926	0.0213	-0.0738	0.0218	-0.0128	0.5448	-0.0565	0.0378
4	construction operatives (masons, bricklayers, tha	0.8399	0.0526	-0.0107	0.055	-0.0155	-0.0345	-0.0279	0.0039	-0.0214	-0.0087	-0.0089	-0.0015
5	machinery mf	0.0787	0.0291	0.0324	-0.1017	0.6798	0.0238	0.043	0.0483	0.1975	-0.0247	0.0305	0.1494
6	tool & weapons mf	-0.0545	0.0824	0.3172	0.0833	0.0841	0.0768	-0.1373	-0.0656	-0.0374	-0.1863	-0.1646	0.1954
7	iron & steel mf, bolts and nails	-0.076	-0.0123	0.0681	-0.0277	0.0542	0.2715	-0.2055	-0.1564	-0.0693	-0.0322	-0.2422	0.2055
8	blacksmiths	0.7142	-0.21	-0.1206	-0.1087	-0.007	-0.0977	0.0531	-0.018	0.0089	0.167	-0.0062	0.083
9	other metal mf (copper, tin, brass, whitesmiths, e	-0.045	0.0423	0.469	0.0995	0.1216	0.1893	-0.1145	-0.0369	0.1176	-0.1028	-0.1891	-0.0353
10	ship, road & rail vehicle mf	0.3535	-0.1015	-0.0079	0.0971	-0.0234	0.0588	0.4408	0.0019	-0.0565	-0.1022	-0.0547	-0.0155
11	earthenware & glass mf	-0.0194	0.1942	0.2274	-0.1856	-0.0817	0.2064	0.1886	0.18	0.1132	-0.1054	-0.1934	0.0503
12	gas, coke and chemical mf	-0.1271	0.2955	0.2936	-0.0707	0.0259	-0.0338	0.0697	0.02	-0.009	0.0681	0.2419	-0.1663
13	leather, fur, hair & bone mf	-0.0188	0.1017	0.6728	-0.1126	0.0358	-0.0761	0.0932	-0.0056	-0.0466	0.0301	0.0552	0.0672
14	wood mf (sawyers, coopers, cane workers)	0.3754	-0.0495	0.4056	-0.0131	-0.0296	-0.1013	0.0032	0.1303	-0.1408	-0.313	0.0332	-0.0622
15	furnishing mf (cabinet makers, french polishers, u	-0.0876	0.3414	0.58	0.2426	0.1263	-0.0362	-0.0181	0.0272	-0.0087	-0.1514	0.0608	0.0323
16	printing & paper mf (paper, cardboard, printers, b	-0.0536	0.3425	0.5783	0.0128	0.0828	-0.0774	0.0556	0.0457	0.1434	-0.0117	0.033	0.0767
17	waterproof goods mf (floor & oil cloth, rubber etc	-0.0094	0.1753	0.1256	0.0514	0.0688	-0.0735	0.1412	-0.0948	-0.1155	-0.0771	0.3752	-0.1257
18	woollen mf (woollen goods, carpets, blanket, flar	0.4326	0.0087	-0.0128	-0.0435	-0.0054	-0.1087	-0.3175	0.0301	-0.0065	-0.1511	0.2419	-0.0508
19	cotton & silk mf (incl ribbon, weaving, dyeing, ble	-0.118	-0.0032	0.0079	-0.0672	-0.0166	0.2043	-0.006	-0.0514	0.0272	0.0056	0.6872	0.0493
20	other textile mf (flax, hemp, rope, jute, lace, tape	0.0568	-0.0333	-0.0714	0.0216	0.3619	0.1646	0.0795	0.0327	-0.2336	-0.12	0.0163	-0.0391
21	clothing mf (tailors, milliners, hosiery, hats, glove	0.039	-0.0402	-0.0337	0.0128	0.0493	-0.0413	-0.1334	0.7354	0.0041	-0.0133	0.0661	0.0022
22	shoe, boot, clog mf	0.6565	-0.1371	0.0461	0.1372	0.0265	0.1131	0.2654	0.0903	-0.0575	-0.0021	-0.1297	-0.0294
23	agric produce mf (millers, refiners, bakers, confec	0.5715	-0.0722	-0.0732	-0.2089	-0.0398	-0.0109	-0.1001	-0.0443	0.0049	0.0289	-0.0464	0.1544
24	drink & tobacco mf (maltsters, brewers, distillers,	-0.0803	0.1993	0.174	0.1544	0.6883	-0.01	-0.021	0.0099	-0.0359	0.0107	-0.0013	-0.0655
25	watch & instrument mf	0.118	0.2673	0.3707	0.2634	0.0268	0.0388	-0.0191	-0.0456	0.0224	-0.1715	0.2326	0.2683
26	general mf (manufacturers, mechanic, artisan, ma	-0.0049	-0.0076	0.1307	0.1599	0.1137	-0.2876	-0.1164	-0.0118	0.0989	0.2037	0.038	0.0721
27	ocean, inland and dock transport	0.0501	0.021	0.0518	0.4625	0.0071	0.0241	0.0693	-0.1819	0.1366	0.039	-0.0103	-0.4213
28	road & rail transport	0.1641	-0.0252	-0.1158	0.3473	0.026	0.0545	0.306	0.0206	-0.2509	0.2064	-0.1944	0.1669
29	coal dealing	-0.0097	0.0082	-0.0217	0.0659	-0.0133	0.6971	0.0424	0.0167	0.0014	0.0092	0.1667	0.022
30	timber, hay, corn and agric produce dealing	0.0416	0.0278	0.0477	0.0433	0.0015	0.1036	0.1666	0.7305	0.0099	0.0059	-0.1206	0.0101
31	clothing and dress dealing (drapers, hosiers, habe	0.74	0.0967	0.0065	0.2385	0.0507	0.1218	-0.1451	0.0632	0.1074	-0.0518	-0.0274	-0.1043
32	food sales (butchers, fishmongers, cheesemonge	0.3126	-0.0263	0.3366	0.2025	0.0962	0.5131	-0.1051	0.1772	0.138	0.1615	0.0413	-0.1783
33	lodging & drink sales (wine & spirits, hotels, inns,	0.0994	0.1422	0.0615	0.7119	0.0097	0.1154	0.0122	0.0507	0.0456	0.0427	-0.0131	0.0583
34	stationary dealing (stationers, publishers, newsag	-0.2	0.4535	0.4276	0.1414	0.0741	0.0038	-0.1286	-0.0258	0.0662	-0.034	0.1224	-0.0303
35	h/h & personal goods dealer (earthenware, glass,	0.0009	0.2108	0.2926	0.1261	0.0938	0.0199	-0.1012	-0.0826	0.1327	0.0654	-0.0299	0.237
36	ironmongers	0.0307	0.1198	-0.0258	-0.0562	0.0289	0.2913	0.0226	-0.0722	0.5439	-0.1232	-0.0088	0.101
37	other retail (general shopkeeper, huckster, hawk	-0.0705	-0.0355	0.6507	0.0643	0.0078	0.224	0.0212	-0.0186	-0.0246	0.1002	-0.0851	-0.188
38	chemists, druggists	0.0909	0.1057	0.0439	0.2177	0.1366	-0.0054	-0.0347	0.112	0.5715	0.0778	0.0133	-0.0661
39	merchants, banks, insurers and brokers	-0.0573	0.784	0.0362	-0.0358	0.0554	0.068	-0.0729	-0.0144	0.0266	-0.0238	0.1202	0.0111
40	other commerce (accountants, salesmen, travelle	-0.0205	0.5869	0.2576	-0.0104	0.1088	0.0933	-0.0293	-0.0298	0.1003	-0.0586	0.1259	-0.0064
41	construction management (builders and contracte	0.1884	0.3113	-0.0337	0.0481	-0.0037	-0.0205	0.3046	-0.1108	0.1262	-0.2602	-0.1596	-0.2413
42	professions (barristers, solicitors, scientific pursu	-0.0179	0.715	-0.0639	-0.0465	-0.0113	-0.0811	0.0358	-0.0013	-0.0269	0.159	-0.1523	-0.0288
43	professions (doctors, dentists, artists, performers	-0.0428	0.7949	0.1657	0.251	0.0701	-0.021	0.0467	0.0146	0.0257	-0.0689	-0.0452	0.0114
44	personal services (washing & bathing, hairdressir	0.1442	0.3405	0.1726	0.4847	0.0226	-0.0374	0.1424	0.1693	-0.0013	-0.3093	-0.1083	-0.031
45	Public admin, clergy	0.0316	-0.0187	-0.0293	0.0696	0.0184	-0.0809	0.1627	-0.0333	-0.0014	0.1124	0.0081	0.5442
46	Military	0.0133	-0.0473	0.0479	-0.0086	-0.0139	-0.2099	0.1408	-0.0148	0.4511	0.0963	0.0252	-0.1311
47	Clerks, weighers, telegraph, non-theological stud	-0.068	0.3075	0.2084	-0.1513	-0.0507	-0.093	0.0488	-0.0442	-0.0731	0.2357	-0.1245	-0.2404
48	Domestic and service staff, cooks	0.049	0.0817	0.0229	-0.0529	0.4567	-0.0286	0.0241	0.0027	-0.1324	-0.0477	-0.142	-0.2671
49	Labourers & transport staff (including family on fa	0.0496	0.014	-0.0424	0.006	0.0588	0.0311	0.0616	0.0964	-0.2184	0.2834	0.1058	-0.0551
50	Persons of property and unoccupied	-0.0073	-0.0387	-0.0076	0.0643	-0.0121	-0.0802	0.0383	-0.0237	-0.0461	0.008	0.0135	0.0157

Table 8. Factor loadings for own account entrepreneurs, 12-factor variance.

The main interpretation of the factor loadings in Table 8 for the 12 factors is:

Factor 1 (Farming and rural trades, shoes, wool)

Farming, fishing, market gardeners, horse breeding and keeping

Construction operatives (masons, bricklayers, thatcher, plumbers etc.)

Blacksmiths

Woollen mf (woollen goods, carpets, blanket, flannel)

Shoe, boot, clog mf

Agric produce mf (millers, refiners, bakers, confectioners)

Clothing and dress dealing (drapers, hosiers, haberdashers)

This factor, for farming and rural industries, is very close to the loadings on Factor 2 for employers, and is closer than employers to the total for all entrepreneurs (by including construction and clothing). However, it also includes woollens. For own account the textile sectors are spread across three factors (1, 5 and 11). The mapping is also very similar (compare Figs 9 and 12), though more concentrated in fewer areas.

Factor 2 (Main commercial centres and resorts)

Gas, coke and chemical mf

Merchants, banks, insurers and brokers

Other commerce (accountants, salesmen, travellers, officers of cos.)

Construction management (builders and contractors)

Professions (barristers, solicitors, scientific pursuits)

Professions (doctors, dentists, artists, performers, education)

Clerks, weighers, telegraph, non-theological students and apprentices

This is similar to Factor 3 of the employer analysis, but more focused on commerce with more retailers, as also reflected in the mapping (Figure 13), and is thus closer to the Factor 1 for all entrepreneurs. In general terms, however, Factors 1 and 2 reverse between the employer and own account results.

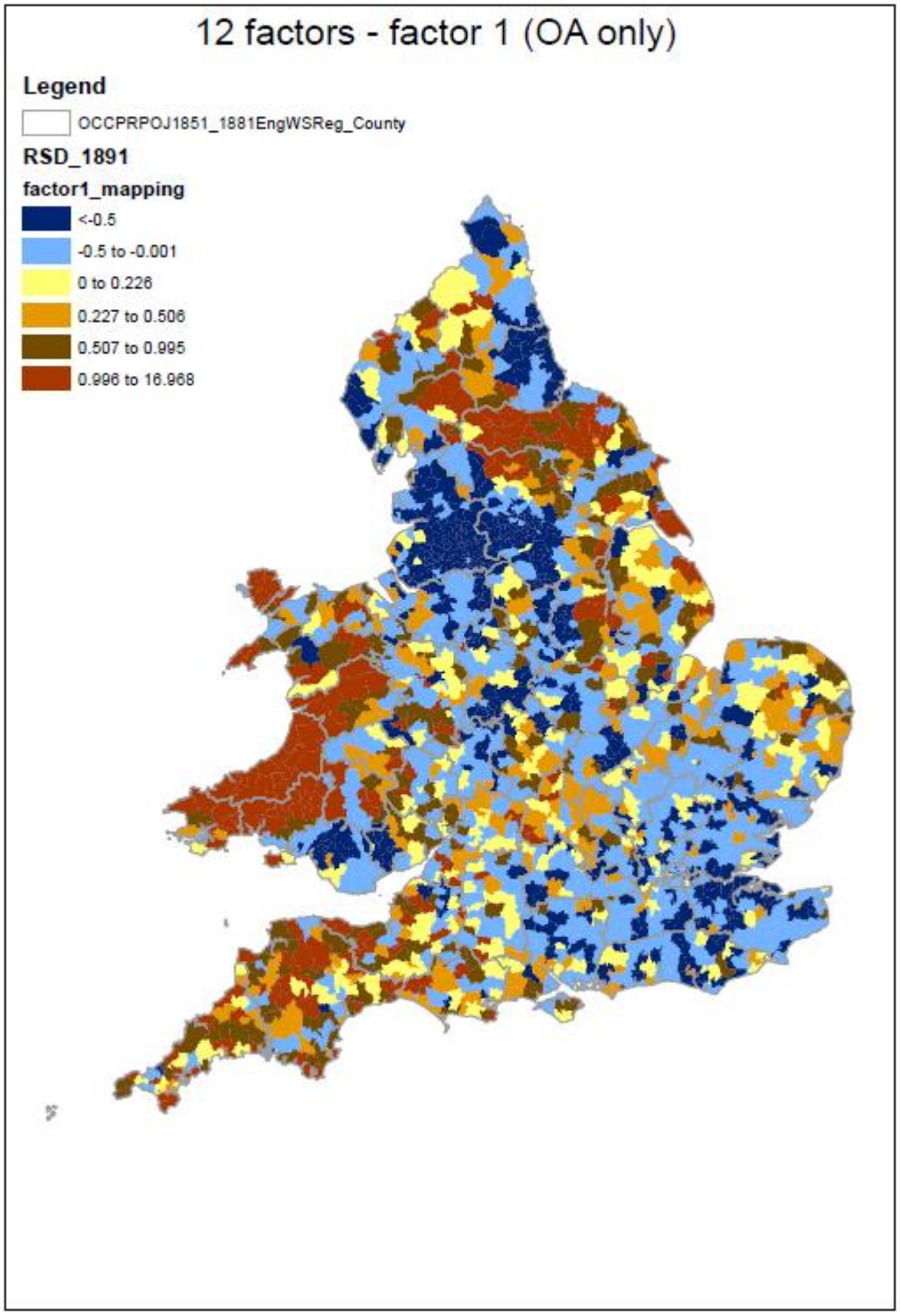
12 factors - factor 1 (OA only)
Legend
OCCPRPOJ1851_1881EngWSReg_County
RSD_1891
factor1_mapping
<-0.5
-0.5 to -0.001
0 to 0.226
0.227 to 0.506
0.507 to 0.995
0.996 to 16.968

Figure 12.

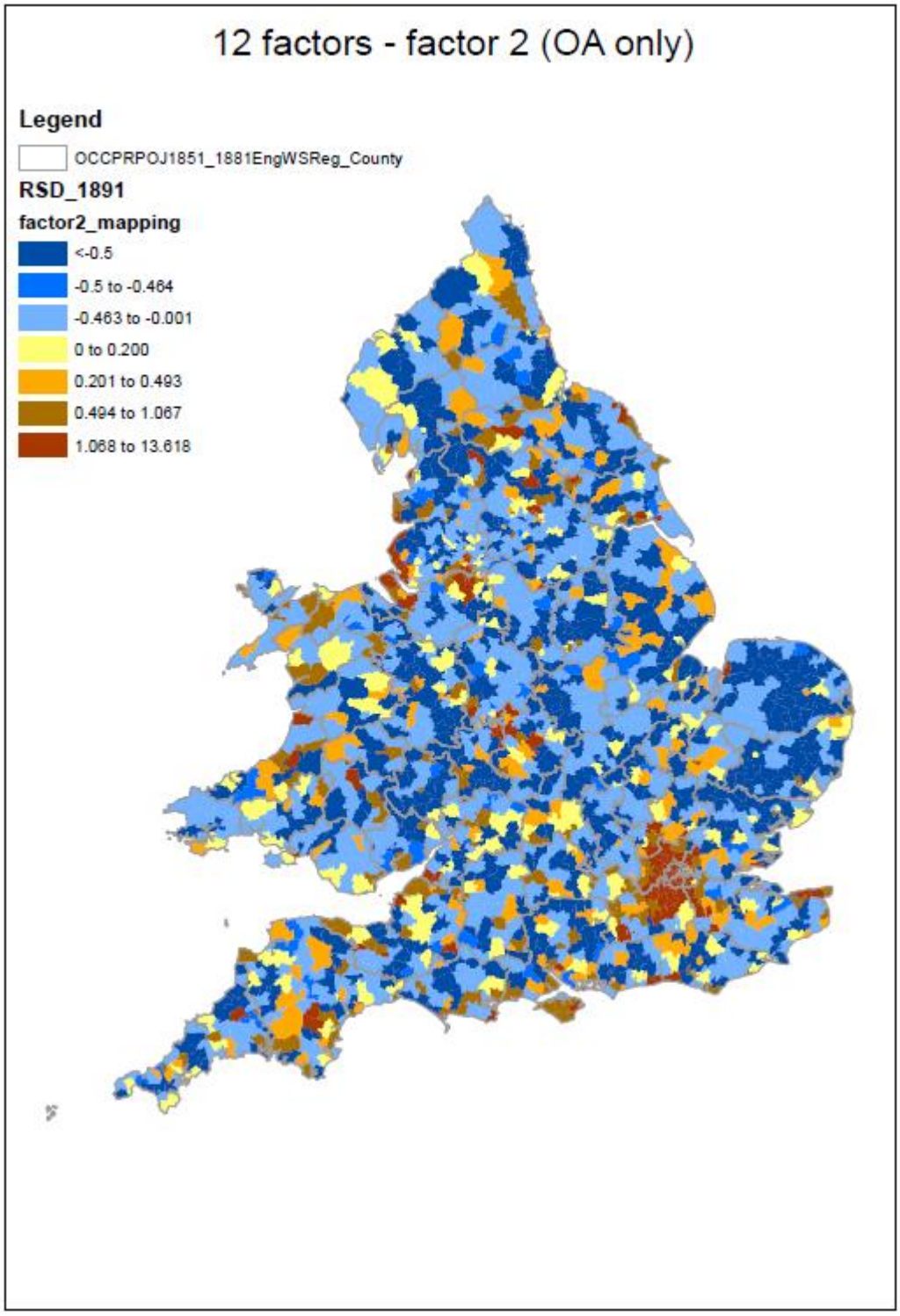

Figure 13.

Factor 3 (Tools, metal, wood, furniture, printing, household goods and 'other' retail)

Tool & weapons mf

Other metal mf (copper, tin, brass, whitesmiths, etc.)

Earthenware & glass mf

Leather, fur, hair & bone mf

Wood mf (sawyers, coopers, cane workers)

Furnishing mf (cabinet makers, french polishers, undertakers)

Printing & paper mf (paper, cardboard, printers, bookbinders)

Stationary dealing (stationers, publishers, newsagents)

H/h & personal goods dealer (earthenware, glass, jewellers)

Other retail (general shopkeeper, huckster, hawker)

This factor is a mix of manufactures together with dealing in stationary, household goods and 'other' retail. It overlaps mainly with Factors 1 and 8 for the employers. Earthenware is only loaded at a very low level on this factor (0.23) indicating that this sector has few own account members but these are most related to other small manufactures industries. The mapping is complex and reflects some small samples (q.v. below).

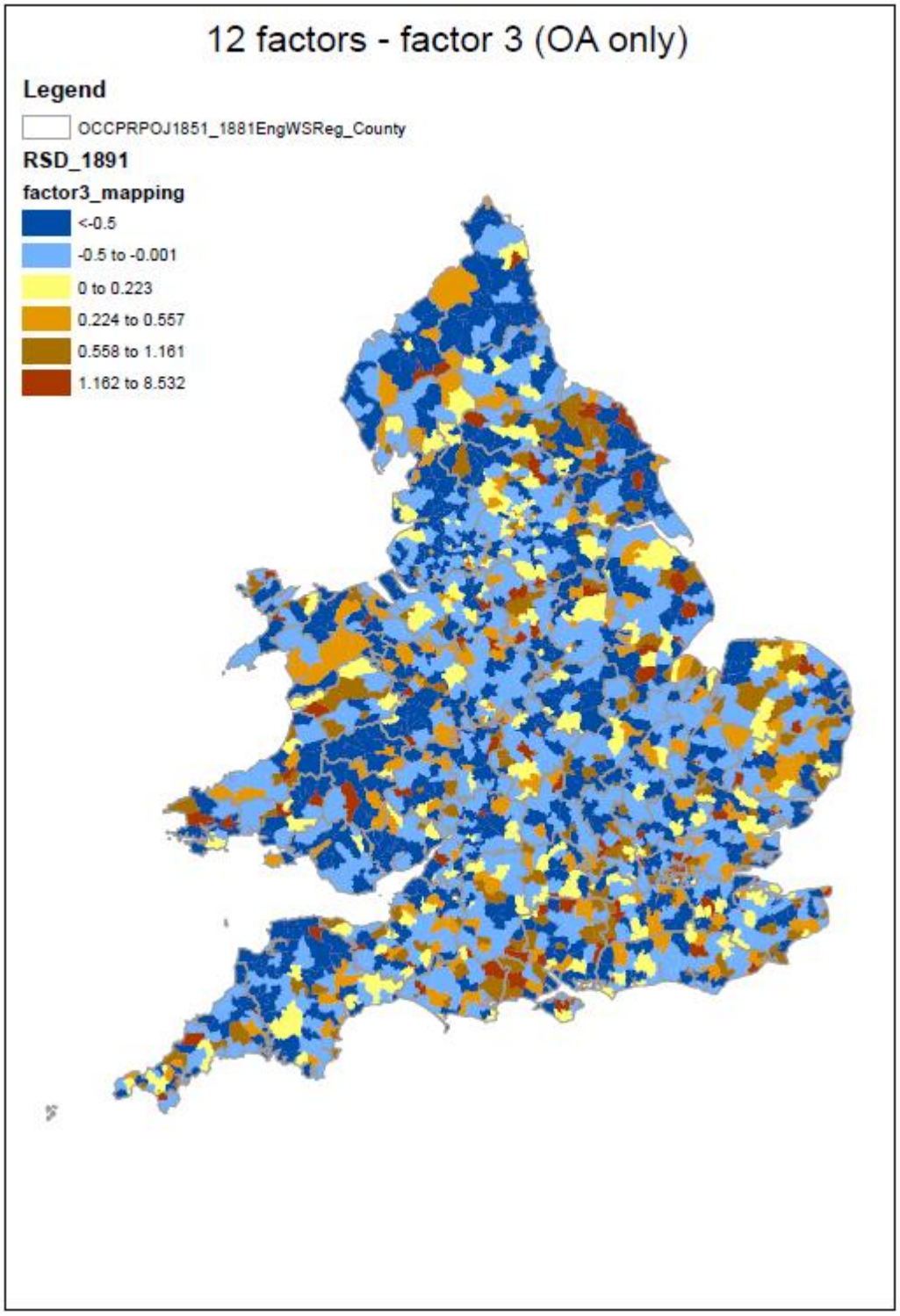

Figure 14.

Factor 4 (Ports, transport and lodgings)

Ocean, inland and dock transport

Road & rail transport

Lodging & drink sales (wine & spirits, hotels, inns, coffee ho)

Personal services (washing & bathing, hairdressing, chimney sweeps)

This factor is similar to the total entrepreneur Factors 8 and 10. It distinguishes transport and ports more clearly than the employer results. The Figure 15 mapping is similar in many ways to factor 2 for resort areas but lacks the main commercial centres.

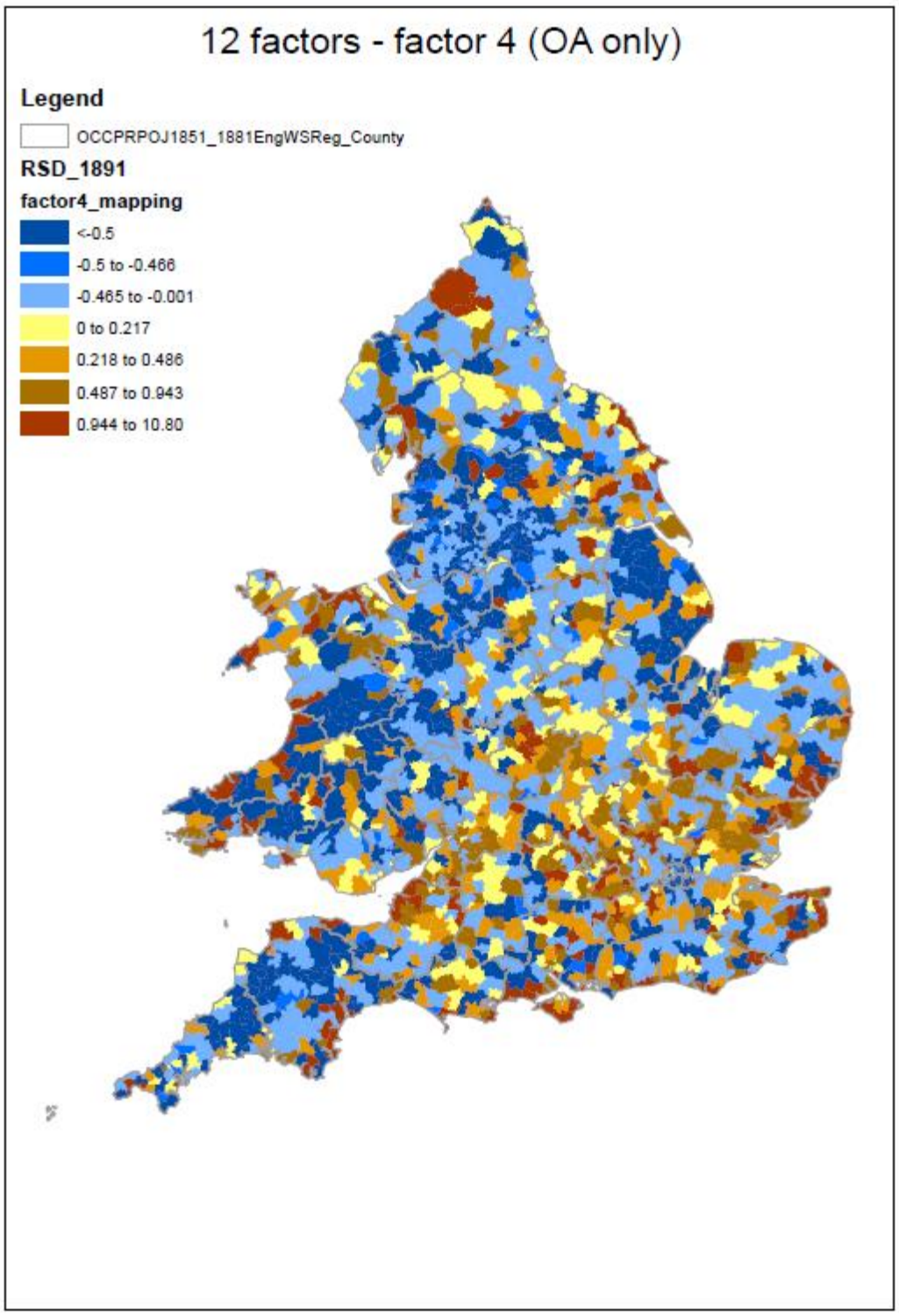

Figure 15.

Factor 5 (Medium scale manufacturers)

Machinery mf

Other textile mf (flax, hemp, rope, jute, lace, tape, thread)

Drink & tobacco mf (maltsters, brewers, distillers, tobacco & pipes)

Domestic and service staff, cooks

This factor combines a number of medium-scale manufactures. By implication this group of manufactures interrelates with a wider use of own account domestic staff than other sectors. Mapping is not continued for this and higher factors.

Factor 6 (Coal and food retail)

Coal dealing

Food sales (butchers, fishmongers, cheesemongers, milksellers, grocers)

This factor combines two occupational sectors of the main retailers and coal dealing. Both are the main household necessities and reflect a key retail factor.

Factor 7 (Vehicle manufacture)

Ship, road & rail vehicle mf

A single occupational group reflecting transport manufacturers, within which small scale wheelwrights and saddlers reflect the strong own account presence which is linked with farming and rural for employers (Factor 2). This factor has the only strong negative loading, for coal mining (-0.62). Whilst the loading is explicable as in early results, its negative link with the vehicles sector on this factor is unclear.

Factor 8 (Clothing maker-dealers)

Clothing mf (tailors, milliners, hosiery, hats, gloves, umbrellas, buttons, leather)

A single factor occupational group of the clothing maker dealers, a very numerous own account sector, especially among women. These are in Factor 1 for employers.

Factor 9 (Specialist retail)

Ironmongers

Chemists, druggist

Military

A factor reflecting two more specialist retail than factor 6 or 3, with local military presence.

Factor 10 (Mining and quarrying (non-coal))

Other mining & quarrying, brickmaking, gravel, salt works

Labourers & transport staff (including family on farms)

This factor combines mining and quarrying with the main labour category reflecting the close kink of quarrying and other mining with farming and use of labour from the land.

Factor 11 (Cotton textiles and waterproof goods)

Waterproof goods mf (floor & oil cloth, rubber etc.)

Cotton & silk mf (including ribbon, weaving, dyeing, bleaching etc.)

The third factor with a textile component, reflecting RSDs with concentrations in cotton, which are closely linked to those with waterproof goods.

Factor 12 (Heavy manufacturing)

Iron & steel mf, bolts and nails

Public admin, clergy

A confused factor reflecting heavy metal manufacturer in smaller own account businesses (though with only a very low loading: 0.2), and public administration.

The result of the analysis of own account is similar for the main factors to the analysis for employers and for all entrepreneurs. However, it is more concentrated in explained variance on the first three factors, and there is more confusion of characteristics for the higher factors which suggest that use of the own account factors for classification should probably be concentrated on the lower groups of Factors 1 to 3, or 7, 8, 9 or 10.

For own account the first factor brings out farming and rural industries (similar to Factor 2 for employers); Factor 2 is the main commercial and professional classes of self-employed. Factor 3 is a wide range of medium scale manufacturing industries in tools, metal, wood, furniture, printing, household goods and ‘other’ retail. Factor 4 is the ports. For own account there is thus a different ordering of main fields of activity, and some different groupings of activity, compared to both employers and to the economically active as a whole; but the overall sectoral focuses are similar.

6. Joint estimates of employers and own account

To test the robustness of the separate estimation processes discussed in Sections 5 and 6, employers and own account were also estimated jointly within one factor analysis allowing each occupational category to have separate loadings on each factor. This differs from the total entrepreneurship estimates in Section 4 since it allows the different employer and own account elements to show through. Compared to the separate estimation in Sections 5 and 6, however, intercorrelation between the two sets of occupational variables prevents some occupational categories being estimated in the joint analysis (E2 coal mining, and E50 person of property).

These results are not discussed in detail as they essentially confirm the previous analysis, as to be expected sitting somewhere between the results for all entrepreneurs (Tables 1-4) and the separate employers (Tables 5 and 6) and own account (Tables 7 and 8).

Tables 9 and 10 report the joint estimates of employers and own account for the 12 factor model. The factor variance is more dispersed across the first 7 or 8 factors, compared to the total and to the separate estimates where in both cases the variance explained is highly concentrated in the first 3 or 4 factors. This indicates the way in which the joint estimation is spreading the variance in the data between occupations and RSDs, as well as between the two groups of employers and own account. There is a disappointingly low level of explained variance from the first 3 factors compared to the previous estimates, indicating less clear cut results.

Factor	Variance	Difference	Proportion	Cumulative
Factor1	6.47493	0.60737	0.0661	0.0661
Factor2	5.86757	0.30589	0.0599	0.1259
Factor3	5.56167	1.25937	0.0568	0.1827
Factor4	4.30230	1.56122	0.0439	0.2266
Factor5	2.74108	0.52363	0.0280	0.2546
Factor6	2.21745	0.03284	0.0226	0.2772
Factor7	2.18462	0.21128	0.0223	0.2995
Factor8	1.97334	0.16666	0.0201	0.3196

Factor9	1.80668	0.02941	0.0184	0.3381
Factor10	1.77727	0.13346	0.0181	0.3562
Factor11	1.64381	0.03296	0.0168	0.3730
Factor12	1.61085	-	0.0164	0.3894

Table 9: Factor analysis for employers and own account entrepreneurs jointly estimated, 12-factor variance.

Number of obs = 2,110
Method: principal-component factors Retained factors = 12
Rotation: orthogonal varimax (Kaiser off) Number of params = 1,110
LR test: independent vs. saturated: chi2 (4753) = 6.3e+04 Prob>chi2 = 0.0000

The factor loadings (Table 10) are also less clear cut. They are most similar to the patterns for the separate estimates in Tables 6 and 8, but are less clear and interpretable. Key elements to note are the general similarities of factors identified and the similar pattern of loadings, but more mixed spread of occupations between sectors. There are generally lower levels of loading overall. There are only two high negative loadings, both for 'other mining': -0.59 for employers and -0.52 for own account. Coal mining is eliminated from the analysis of employers and for own account has a small loading (0.21) for Factor 7 which is otherwise mainly a textiles factor. In this analysis therefore coal mining is less clearly a negative factor, but the special case of mining industries in general is potentially brought out in the loadings for other mining. The high positive loading for other mining in all the previous analyses, however, reinforces the view that the results of joint estimation is not very robust and the separate estimates for sections 5 and 6 are to be preferred.

50ID	50ID	factor1	factor2	factor3	factor4	factor5	factor6	factor7	factor8	factor9	factor10	factor11	factor12
E1	farming, fishing, market gardeners, horse breeding and keeping	-0.1567	-0.1967	0.7802	-0.1865	-0.0521	-0.1375	-0.0355	0.0258	-0.0528	-0.0472	0.0609	0.0548
E3	other mining & quarrying, brickmaking, gravel, salt works	0.0473	-0.0536	-0.029	-0.1209	0.0926	0.1011	0.0514	-0.0198	-0.0081	-0.1208	-0.5913	-0.0118
E4	construction operatives (masons, bricklayers, thatcher, plumbe	0.0629	0.2851	0.5727	-0.0501	0.0052	0.0247	0.2046	0.0714	-0.0375	-0.0879	-0.037	0.0103
E5	machinery mf	0.193	0.0609	-0.0497	-0.0423	0.3585	0.0241	0.0508	0.0923	0.0361	0.1095	0.1674	-0.1863
E6	tool & weapons mf	0.0258	-0.0056	-0.0472	0.0312	0.6524	0.0044	-0.0566	-0.0911	-0.063	-0.0149	0.0463	0.0317
E7	iron & steel mf, bolts and nails	0.0328	-0.0111	-0.1654	-0.1045	0.6635	0.1229	0.0354	-0.1005	-0.0294	0.0115	-0.1219	-0.0878
E8	blacksmiths	-0.1885	0.0293	0.6952	-0.1784	-0.0932	-0.2463	-0.0333	-0.1001	-0.0332	0.0865	0.1379	-0.1227
E9	other metal mf (copper, tin, brass, whitesmiths, etc.)	0.2419	0.0424	-0.1306	0.1661	0.6082	-0.0602	0.0722	0.1585	0.022	0.0334	0.0044	-0.0106
E10	ship, road & rail vehicle mf	-0.0714	0.3608	0.2868	-0.0521	0.0123	-0.1806	-0.152	-0.0466	0.2348	0.184	0.2368	-0.204
E11	earthenware & glass mf	0.1108	0.0242	-0.0373	-0.0433	0.1166	0.076	-0.2034	-0.0035	-0.0454	0.226	0.0085	-0.034
E12	gas, coke and chemical mf	0.6032	0.0085	-0.2099	0.1756	0.0682	-0.044	0.0884	0.0969	0.06	0.0875	-0.0284	-0.0147
E13	leather, fur, hair & bone mf	0.3503	0.1572	-0.0535	0.3469	0.218	-0.0161	0.1591	0.0461	-0.1344	0.106	0.0206	-0.0657
E14	wood mf (sawyers, coopers, cane workers)	0.0413	0.0451	0.0209	0.3139	0.0701	-0.1157	0.0704	0.0463	-0.076	0.3804	0.0077	-0.0058
E15	furnishing mf (cabinet makers, french polishers, undertakers)	0.1393	0.278	-0.1465	0.5175	0.0346	-0.0415	0.1432	0.0393	-0.04	0.0827	0.03	0.073
E16	printing & paper mf (paper, cardboard, printers, bookbinders)	0.4377	0.316	-0.1898	0.3748	0.1333	0.0452	0.0666	0.1135	-0.0305	-0.0962	0.032	-0.0673
E17	waterproof goods mf (floor & oil cloth, rubber etc.)	0.3087	0.0278	-0.0732	0.1089	0.0417	-0.0366	0.0027	0.3544	0.0439	0.0175	-0.0077	-0.048
E18	woollen mf (woollen goods, carpets, blanket, flannel)	0.0433	-0.0683	0.0852	-0.0223	0.0201	0.0756	0.71	0.0729	-0.0489	0.0119	-0.0418	0.0115
E19	cotton & silk mf (incl ribbon, weaving, dyeing, bleaching etc.)	0.1457	-0.11	-0.1475	-0.0755	-0.0485	0.0309	0.0282	0.6898	-0.06	-0.0521	0.0094	0.0024
E20	other textile mf (flax, hemp, rope, jute, lace, tape, thread)	0.1642	0.0195	-0.0846	-0.0195	-0.001	0.204	0.3272	0.2461	-0.0583	0.0006	0.1589	-0.0491
E21	clothing mf (tailors, milliners, hosiery, hats, gloves, umbrellas, b	0.0453	0.0243	-0.1133	-0.0021	-0.0195	0.1086	0.0957	0.0869	-0.1108	0.059	0.128	0.0374
E22	shoe, boot, clog mf	-0.024	0.215	0.3694	0.0893	-0.0251	-0.1372	0.2138	0.0119	-0.0439	-0.2163	0.1328	-0.1066
E23	agric produce mf (millers, refiners, bakers, confectioners)	-0.1254	0.0215	0.6374	-0.1197	-0.0478	-0.1626	-0.1131	-0.0676	-0.009	0.0245	0.1541	-0.1829
E24	drink & tobacco mf (maltsters, brewers, distillers, tobacco & p	0.1237	0.4881	-0.1608	0.0639	0.0681	0.0323	-0.0333	-0.0058	-0.0566	0.0472	0.0578	-0.1076
E25	watch & instrument mf	0.267	0.3629	-0.0834	0.3878	0.2397	-0.071	-0.053	0.1115	-0.075	-0.1251	0.0441	0.0605
E26	general mf (manufacturers, mechanic, artisan, machinist)	0.3008	0.0063	-0.0734	0.0131	0.3254	-0.0867	0.0563	0.0929	0.2903	0.1408	0.0463	0.1341
E27	ocean, inland and dock transport	0.1281	0.0855	0.0129	-0.0711	-0.0007	0.0758	0.0017	-0.0047	0.7211	0.0094	-0.024	0.033
E28	road & rail transport	0.2419	0.3755	-0.059	0.072	-0.048	-0.138	-0.0538	-0.0166	0.076	0.0715	-0.0496	0.4785
E29	coal dealing	0.0435	0.4614	-0.1373	-0.0947	0.1168	0.0637	-0.0171	0.1977	0.1459	0.2438	-0.0071	-0.0419
E30	timber, hay, corn and agric produce dealing	0.2207	0.2699	0.0512	-0.0527	0.0382	0.0525	0.0664	-0.0742	-0.0513	0.489	0.1127	-0.0502
E31	clothing and dress dealing (drapers, hosiers, haberdashers)	0.2697	0.5462	0.2384	0.2752	0.0789	0.0732	0.4206	0.0023	-0.0128	-0.1443	0.0438	0.0425
E32	food sales (butchers, fishmongers, cheesemongers, milksellers,	0.2064	0.7362	0.0236	0.1355	-0.0499	0.0341	-0.0305	-0.1317	0.1311	0.1486	0.0743	-0.0052
E33	lodging & drink sales (wine & spirits, hotels, inns, coffee ho)	0.159	0.4595	0.0404	0.2186	0.0123	-0.1633	-0.0232	-0.0927	0.0771	-0.0748	0.0796	0.3926
E34	stationary dealing (stationers, publishers, newsagents)	0.6468	0.4036	-0.1695	0.2621	-0.0059	-0.0334	0.0142	-0.0549	-0.0419	-0.111	0.0325	0.1207
E35	h/h & personal goods dealer (earthenware, glass, jewellers)	0.3198	0.168	-0.0559	0.3039	0.5251	-0.1231	-0.0274	0.0329	0.054	-0.0498	0.0132	0.1456
E36	ironmongers	0.2868	0.5956	-0.0246	0.052	0.2308	0.1152	0.0392	0.011	0.0061	-0.0486	0.0166	-0.1593
E37	other retail (general shopkeeper, huckster, hawker)	0.0769	-0.0325	-0.2525	0.1402	0.1087	0.0688	0.1872	0.0078	0.046	-0.0265	0.1526	-0.0698
E38	chemists, druggists	0.2688	0.636	-0.0587	0.1218	0.1212	0.135	0.0229	0.0859	-0.0661	-0.1212	0.039	0.0319
E39	merchants, banks, insurers and brokers	0.7947	0.1228	-0.0511	-0.0879	0.0289	-0.0691	0.0217	0.0734	0.0597	0.0798	0.011	-0.0058
E40	other commerce (accountants, salesmen, travellers, officers of	0.6216	0.2492	-0.0048	-0.0113	0.175	-0.0239	-0.0358	0.1039	-0.0046	0.1057	0.0307	-0.0224
E41	construction management (builders and contractors)	0.3456	0.5356	0.0817	-0.063	-0.0953	-0.1278	-0.1061	-0.1927	0.0588	0.1784	-0.0936	-0.0818
E42	professions (barristers, solicitors, scientific pursuits)	0.6619	0.3339	0.0127	-0.0764	0.0817	0.0148	-0.0338	-0.0305	-0.0616	0.0595	-0.0591	-0.0556
E43	professions (doctors, dentists, artists, performers,education)	0.4466	0.599	0.0292	0.0735	0.0504	-0.0188	-0.0481	0.0161	-0.0045	-0.0687	0.0474	0.1362
E44	personal services (washing & bathing, hairdressing, chimney s	0.3337	0.4565	-0.1455	0.0904	-0.1461	-0.1494	-0.0476	-0.1939	0.025	0.1717	-0.0647	0.0953
E45	Public admin, clergy	0.0016	0.0451	0.1006	-0.0138	0.0004	-0.0421	-0.0594	0.0197	-0.012	-0.0561	-0.1593	-0.1438
E46	Military	-0.0318	0.0509	0.0363	0.0327	0.0011	-0.0493	0.0038	-0.0256	-0.0282	-0.0507	0.0073	-0.1053
E47	Clerks, weighers, telegraph, non-theological students and appre	0.3001	-0.0861	0.0505	0.0438	-0.064	0.0356	-0.0757	-0.1939	-0.0489	-0.1187	0.1208	-0.0366
E48	Domestic and service staff, cooks	0.0241	0.0127	-0.0324	0.0359	0.0118	-0.0671	0.0441	0.0029	0.0734	0.0308	-0.0659	0.1152
E49	Labourers & transport staff (including family on farms)	0.0066	0.082	0.055	0.0225	-0.0349	-0.006	-0.0696	0.1034	-0.0239	0.031	-0.0577	0.0054
OA1	farming, fishing, market gardeners, horse breeding and keeping	-0.0653	-0.183	0.6144	-0.1132	-0.0503	0.2226	-0.1112	0.141	0.0305	-0.0949	-0.1398	0.115
OA2	coal mining	-0.0413	-0.1016	-0.0678	-0.0925	0.0182	0.1455	0.2081	-0.1665	-0.0637	-0.1762	-0.2539	-0.0455
OA3	other mining & quarrying, brickmaking, gravel, salt works	0.0541	-0.0722	0.2095	0.0198	-0.0237	0.1924	0.0173	-0.0549	0.0012	-0.0245	-0.5294	0.1187
OA4	construction operatives (masons, bricklayers, thatcher, plumbe	0.038	0.0902	0.6905	0.0807	-0.0844	0.1794	0.2639	-0.1377	0.0566	0.0671	-0.1786	0.0169
OA5	machinery mf	0.1002	-0.019	0.0561	0.0375	0.1001	0.3229	0.0534	-0.0613	-0.0253	-0.1152	0.4212	0.0309
OA6	tool & weapons mf	-0.0173	0.1472	-0.0877	0.228	0.4823	0.0497	-0.0559	-0.1239	-0.0445	-0.0425	0.0868	0.0161
OA7	iron & steel mf, bolts and nails	-0.0379	-0.0441	-0.1118	-0.0519	0.3881	0.147	-0.0119	-0.1501	-0.0365	0.0128	-0.1074	-0.0692
OA8	blacksmiths	-0.1167	-0.1398	0.705	-0.0526	-0.036	0.0819	0.1627	-0.0519	-0.0205	0.0273	-0.0822	0.1009
OA9	other metal mf (copper, tin, brass, whitesmiths, etc.)	0.0015	0.1409	-0.1041	0.3661	0.1941	0.2027	-0.0232	-0.0315	0.04	-0.0166	0.0102	-0.0537
OA10	ship, road & rail vehicle mf	-0.0859	0.1221	0.3747	-0.023	-0.0199	0.065	-0.152	-0.077	0.2194	0.1786	0.1181	-0.0334
OA11	earthenware & glass mf	0.1283	0.0388	-0.0292	0.2132	-0.0042	0.1537	-0.1633	-0.0214	-0.0534	0.1504	0.0249	-0.0646
OA12	gas, coke and chemical mf	0.2622	-0.079	-0.2033	0.3065	-0.0587	0.0548	-0.0028	0.0235	0.1324	0.027	0.0095	-0.0721
OA13	leather, fur, hair & bone mf	0.0704	-0.0234	-0.0847	0.6125	0.0653	0.0344	-0.0105	-0.0398	-0.0426	0.1164	0.0203	-0.048
OA14	wood mf (sawyers, coopers, cane workers)	-0.0586	0.0465	0.2279	0.4364	-0.0431	0.0015	0.1082	-0.1154	0.0043	0.3974	-0.0772	-0.0998
OA15	furnishing mf (cabinet makers, french polishers, undertakers)	0.1557	0.3252	-0.2318	0.6424	0.0111	0.051	0.0506	0.0052	0.0081	0.0228	0.048	0.113
OA16	printing & paper mf (paper, cardboard, printers, bookbinders)	0.2383	0.1294	-0.133	0.5921	0.0435	0.105	-0.053	-0.0417	-0.0195	-0.0668	0.0239	0.0137
OA17	waterproof goods mf (floor & oil cloth, rubber etc.)	0.1368	0.0064	-0.0773	0.1933	-0.0409	-0.0681	0.0441	0.1089	0.1559	0.0795	0.0011	0.0316
OA18	woollen mf (woollen goods, carpets, blanket, flannel)	-0.0307	-0.0074	0.2092	0.0254	-0.0196	-0.0123	0.6988	-0.0362	0.0172	0.0427	0.0147	-0.0406
OA19	cotton & silk mf (incl ribbon, weaving, dyeing, bleaching etc.)	0.0076	-0.1193	-0.1021	0.0808	-0.067	0.0432	0.0032	0.6655	-0.0294	-0.0291	0.0046	-0.0159
OA20	other textile mf (flax, hemp, rope, jute, lace, tape, thread)	-0.0272	0.0462	0.0183	-0.0384	-0.0631	0.1763	0.0255	-0.0264	-0.0821	0.0247	0.2123	0.0879
OA21	clothing mf (tailors, milliners, hosiery, hats, gloves, umbrellas, b	-0.0094	-0.0437	-0.0007	-0.0585	-0.0547	0.2272	0.114	-0.0759	-0.1173	0.2555	0.1632	0.1435
OA22	shoe, boot, clog mf	-0.127	0.1999	0.5932	0.0384	-0.0596	0.2738	0.0192	-0.1068	0.0512	0.1639	-0.0087	0.0107
OA23	agric produce mf (millers, refiners, bakers, confectioners)	-0.0407	-0.1199	0.5364	-0.0098	-0.0007	0.0605	0.1359	-0.01	-0.0262	-0.0526	-0.0371	-0.0053
OA24	drink & tobacco mf (maltsters, brewers, distillers, tobacco & p	0.1815	0.0946	-0.1603	0.194	0.0436	0.2346	0.054	-0.0953	0.0929	-0.0952	0.3254	0.2571
OA25	watch & instrument mf	0.1012	0.3457	0.0121	0.4453	0.0851	0.0974	-0.02	0.1556	-0.0351	-0.0903	-0.0673	0.0133
OA26	general mf (manufacturers, mechanic, artisan, machinist)	0.0487	-0.0474	0.0138	0.1029	0.0932	-0.1162	0.0905	0.0008	0.1074	0.0113	0.0209	0.3966
OA27	ocean, inland and dock transport	0.0014	0.1151	-0.0173	0.0581	-0.0467	0.082	-0.0227	-0.0712	0.6981	-0.0797	0.0263	0.051
OA28	road & rail transport	-0.025	0.0968	0.2451	-0.1141	-0.0724	0.1034	-0.2033	-0.0659	0.0153	0.1286	-0.0754	0.3802
OA29	coal dealing	-0.0539	0.0627	-0.05	-0.0756	0.0905	0.4421	-0.1053	0.2545	0.0357	0.1059	-0.0232	-0.0571
OA30	timber, hay, corn and agric produce dealing	0.0529	0.0734	0.0673	-0.011	-0.0297	0.2752	-0.1035	-0.0784	-0.1321	0.4764	0.135	0.1478
OA31	clothing and dress dealing (drapers, hosiers, haberdashers)	0.019	0.2754	0.5164	0.0647	-0.0391	0.3536	0.36	-0.1265	0.1658	-0.0431	-0.162	-0.0097
OA32	food sales (butchers, fishmongers, cheesemongers, milksellers,	-0.084	0.1275	0.0862	0.2257	0.0235	0.6987	0.1222	0.0524	0.138	0.0687	-0.0811	-0.0394
OA33	lodging & drink sales (wine & spirits, hotels, inns, coffee ho)	-0.0165	0.5113	0.0285	0.0551	-0.0211	0.1925	-0.0287	0.0549	0.1513	-0.044	-0.069	0.4158
OA34	stationary dealing (stationers, publishers, newsagents)	0.2958	0.1333	-0.3155	0.4694	0.0094	0.0652	0.0506	0.0134	0.0799	-0.1287	0.0198	0.0752
OA35	h/h & personal goods dealer (earthenware, glass, jewellers)	0.1211	0.0618	0.001	0.3308	0.2433	0.031	-0.0344	0.0458	0.1137	-0.1137	-0.0281	0.1648
OA36	ironmongers	0.0589	0.133	0.0165	0.0236	0.1061	0.2001	-0.0325	0.1578	0.0708	-0.1205	-0.0994	-0.2051
OA37	other retail (general shopkeeper, huckster, hawker)	-0.0648	0.0335	-0.1274	0.5015	-0.0152	0.2543	-0.1038	-0.0796	0.0983	-0.0126	0.0895	0.001
OA38	chemists, druggists	0.0998	0.1097	0.0408	0.071	0.0413	0.2558	0.079	0.0556	0.2218	-0.0514	0.0576	0.0304
OA39	merchants, banks, insurers and brokers	0.7561	0.0409	-0.1397	0.1272	0.0763	0.045	0.0749	0.1372	0.1147	0.0468	0.003	0.0003
OA40	other commerce (accountants, salesmen, travellers, officers of	0.4799	0.1769	-0.0975	0.3302	0.1278	0.0887	0.0918	0.1436	0.0281	-0.0385	0.0523	-0.0755
OA41	construction management (builders and contractors)	0.2495	0.1895	0.1384	0.0493	-0.06	0.0295	-0.1176	-0.1002	0.2413	0.0309	-0.0042	-0.2382
OA42	professions (barristers, solicitors, scientific pursuits)	0.6809	0.0782	-0.0153	0.0254	-0.0495	-0.0174	-0.0724	-0.1732	-0.0494	-0.1233	-0.0061	0.0519
OA43	professions (doctors, dentists, artists, performers,education)	0.6565	0.4001	-0.1582	0.2442	0.0208	0.0513	0.008	-0.0472	0.0629	-0.0243	-0.0381	0.1062
OA44	personal services (washing & bathing, hairdressing, chimney s	0.2051	0.5601	-0.0467	0.1628	-0.0995	0.1024	-0.0037	-0.1865	0.1272	0.2567	-0.0657	0.0743
OA45	Public admin, clergy	-0.0018	0.0314	0.1029	-0.0322	0.0209	0.0215	-0.1338	0.0261	-0.1508	-0.0497	-0.006	0.0743
OA46	Military	0.0249	-0.0136	0.0458	0.0239	-0.0189	-0.0219	-0.0134	-0.0087	0.2197	-0.0921	0.0113	-0.0619
OA47	Clerks, weighers, telegraph, non-theological students and appre	0.2816	-0.0789	-0.0761	0.2055	-0.1117	0.0437	-0.0967	-0.1982	-0.038	-0.2276	0.0859	-0.026
OA48	Domestic and service staff, cooks	0.1067	0.0339	0.0273	0.0651	-0.0008	0.0559	0.0162	-0.096	0.023	0.0232	0.1854	0.0556
OA49	Labourers & transport staff (including family on farms)	0.0149	-0.0501	0.0808	-0.0585	-0.0045	0.0574	-0.0291	-0.0055	-0.0105	0.0071	0.0805	0.094
OA50	Persons of property and unoccupied	-0.0239	0.0036	0.0034	-0.0199	0.0034	-0.0494	-0.0034	0.0026	0.0393	0.0295	0.0173	0.001

Table 10: Factor loadings for employers and own account entrepreneurs jointly estimated, 12-factor study.

7. Factor loadings and final classification of entrepreneur environments

The successive factor analyses make clear that there is a consistency in the results obtained, though the ordering of the factors may differ in relative ranking and level of variance explained, and the details of the occupational groups may vary on otherwise similar factors. However, despite understandable levels of variation, there is a very high level of consistency across most of the factor structures, at least for the lower order factors. This indicates, first, that it is possible to identify fairly clear different environments of entrepreneurship through use of factor loadings; and second, that whilst there are some important distinctive environments where entrepreneurship differs from all economically active, there are also many general patterns across occupations for the whole country. This section uses these findings to compare the RSD spatial groups. The main focus is on the 12-factor results. Although some use will be made of the 25-factor results, these are mainly important for demonstrating consistency of estimation, and confirming that the 12-factor analysis is sufficient for most purposes.

The variance for each 12-factor analysis is shown in Table 11. The greatest variance explained is for the analysis of all economically active, as to be expected since this has by far the largest variance in the population, and the number of individuals included is far larger (employers and own account together numbering only about 10% of the total occupied population) **Harry please give no**. **and %).** The results for the three entrepreneur studies have similar patterns of cutting off at 3-4 factors for the main variance explained, but having important further contributions to explanation up to about 7-8 factors; although as discussed above the factors up to 12, and in the 25-factor studies up to some higher orders, also pick up important concentrations of loadings for small groups of RSDs, usually covering single occupational groups. It is notable that the own account analysis has the lowest concentration of explained variance for all 12 factors, and especially for the first 4-5. This is despite having about four times the population numbers as employers. This suggests the own account are more dispersed across occupational groups and less spatially concentred than employers. This is to be expected given their generally low entry costs to business start-up, and their frequent willingness to operate at more marginal levels of income (as ‘survival’ or ‘necessity’ entrepreneurs).

Factor	All economically active	All entrepreneurs	Employers	Own account
1	6.30	5.66	5.53	3.67
2	3.36	4.08	3.24	3.37
3	3.09	2.73	3.22	3.02
4	2.73	2.68	2.41	1.74
5	2.33	1.90	1.68	1.44
6	2.03	1.48	1.61	1.42
7	1.90	1.47	1.35	1.35
8	1.78	1.42	1.29	1.34
9	1.77	1.24	1.22	1.27
10	1.39	1.21	1.20	1.26
11	1.38	1.15	1.07	1.24
12	1.17	1.14	1.05	1.15
Chi-squared	***6.2e+04***	***3.1e+04***	***2.6e+04***	***1.8e+04***

Table 11: Factor variance for each of the 12-factor studies.

Table 12 summarises the occupational groups that are loaded most highly on each factor, and also compares this with the first 8 factors for all economically active (workers, employers and own account: see Working Paper on *Classification of all occupations for economically active: Factor analysis of RSDs in 1891*). As before, these are the *highest* loadings for any occupational group on any of the 12 factors. This is a strong discriminator between the different groups helping us to understand the different factors, but this method tends to supress some of the contribution that some occupational groups may make to other factors where they are more spread across other types of RSD areas.

Table 12 illustrates the general consistency of the factor analyses. The first 3 factors always include 3 groups for: Commerce and professions; Retail; Farming and rural trades. The first 5 factors always include these 3 groups, plus heavy and medium manufacturers. As discussed above, the employer analysis appears clearer and more directly interpretable than either all entrepreneurs together or own account as a separate analysis. The employer analysis also has the advantage of explaining greater variance than own account separately, and does not fall far short of the all entrepreneurs variance explained, becoming very similar to it at Factor 6 and greater.

This is despite having a smaller sample size and more frequent separation of business and residential location. However, the employer-only analysis does have the disadvantage of excluding coal mining (mainly as a result of the divorce of residence from business location). This can be overcome be entering coal separately from one of the other analyses.

Factor	All economically active	All entrepreneurs	Employers	Own account
1	**Commerce & professions**	**Commerce & professions, urban**	**Retail, lodging, transport & professions**	**Farming, rural trades, shoes, wool**
	Merchants etc.	Gas and chemical mf	Furnishing mf	Farming etc.
	Other commerce	Printing & paper mf	Printing & paper mf	Construction operatives
	Construction mangmnt	Drink & tobacco mf	Drink & tobacco mf	Blacksmiths
	Professions (law etc.)	Stationary dealing	Watch & instrument mf	Woollen mf
	Professions (doctors etc.)	Merchants etc.	Road & rail transport	Shoe mf
	Stationary dealing	Other commerce	Clothing & dress dealing	Agric produce mf
	Public admin, clergy	Construction mangmnt	Food sales	Clothing &dress dealing
	Clerks etc.	Professions (law etc.)	Lodging & drink sales	
		Professions (doctors etc.)	Stationary dealing	
		Personal services	Ironmongers	
		Clerks etc.	Chemists, druggists	
			Construction mangmnt	
			Professions (doctors etc.)	
			Personal services	
2	**Mining & heavy metals**	**Farming, rural trades, shoes, wool**	**Farming & produce mf., smiths, shoes & building trades**	**Commerce & professions, urban**
	Coal mining	Farming etc.	Farming etc.	Gas and chemical mf
	Machinery mf	Construction operatives	Construction operatives	Merchants etc.
	Iron & steel mf	Blacksmiths	Blacksmiths	Other commerce
	Other metal mf	Woollen mf	Ship, road, rail vehicle mf	Construction mangmnt
	Gas and chemical mf	Shoe mf	Shoe mf	Professions (law etc.)
	General mf	Agric produce mf	Agricultural produce mf	Professions (doctors etc.)
		Clothing &dress dealing		Clerks etc.
3	**Retail**	**Small mfs.**	**Commerce & professions, urban**	**Tools, metal, wood mf, household goods**
	Clothing & dress dealing	Leather mf	Gas and chemical mf	Tool & weapons mf
	Food sales	Wood mf	Merchants etc.	Other metal mf
	Lodging & drink sales	Furnishing mf	Other commerce	Leather mf
	Ironmongers	Printing & paper mf	Professions (law etc.)	Wood mf
	Chemists, druggists	Watch & instrument mf	Clerks etc.	Furnishing mf
		Other retail		Printing & paper mf
				Stationary dealing

				H/h goods dealer Other retail
4	**Small mf & transport** Leather mf Wood mf Furnishing mf Printing & paper mf Drink & tobacco mf Road & rail transport Other retail	**Dealing & retail** Coal dealing Food sales Ironmongers Chemists, druggists	**Tools, heavy mf & household goods dealers** Machinery mf Tool & weapons mf Iron & steel mf, Other metal mf H/h goods dealer	**Ports, transport and lodgings** Ocean & inland transport Road & rail transport Lodging & drink sales Personal services
5	**Building and washing** Construction operatives Personal services	**Medium & heavy mf** Machinery mf Tool & weapons mf Iron & steel mf Other metal mf H/h goods dealer	**Agric. produce, coal and timber dealers** Coal dealing Timber & agric dealers	**Medium scale manufacturers** Machinery mf Other textile mf Drink & tobacco mf Domestic
6	**Transport & military** Ship, road, rail vehicle mf Ocean & inland transport Military	**Transport & earthenware** Ship, road, rail vehicle mf Earthenware & glass mf	**Wool and other textiles** Woollen mf Other textile mf Other retail	**Coal and food retail** Coal dealing Food sales
7	**Textiles manufacture** Woollen mf Cotton & silk mf Other textile mf	**Cotton & waterproof goods** Waterproof goods mf Cotton & silk mf	**Cotton & waterproof goods** Waterproof goods mf Cotton & silk mf	**Vehicle manufacture** Ship, road, rail vehicle mf
8	**Tools, instruments & Hhd goods** Tool & weapons mf Watch & instrument mf Hhd goods dealer	**Clothing & agric produce** Clothing mf Timber and agric dealers	**Leather and wood mf** Leather mf Wood mf	**Clothing maker-dealers** Clothing mf
Large Negative	Farming; other mining; labourers	Coal mining; other mining; public admin	Public admin; earthenware & glass; *coal mining excluded*	Coal mining (factor 7)
Total	37 (plus 3 negative)	39 (plus 3 negative)	39 (plus 3 negative)	36 (plus 1 negative)

Table 12: Summary of the first 8 Factors for each 12-factor analysis, with the loadings that are the highest for that occupation category.

8. Factor scores

The mapping discussed above shows many RSDs to have high scores on several factors. This means that whilst the different factors are orthogonal to each other, it is quite possible for a given RSD to have attributes that relate strongly to quite different factors. To obtain a more general classification of RSDs it is necessary to assess how far any RSD is primarily loaded on one factor rather than others. Although it is also possible to have a classification that combines factors, this is followed as an approach only in a few cases under 'direction', as discussed below. The first classification is achieved by choosing the factor on which it most highly loaded. This classification can be largely automated, and there is advantage in using an objective statistical approach throughout.

Initially the first eight factors are used from the results above, plus a ninth for those RSDs that load highly negatively on coal mining within factor 6. This produces a mapping of 10 factors, plus coal, plus no strong loadings. No strong loadings are RSDs which have no high concentrations on any of the factors: they are close to the general average employer distribution across the country, or have no strong spatial concentrations.

The following discussion develops a final classification of RSDs first for all entrepreneurs, and then for employers. A two-stage process is followed: first the original mapping is shown taking a purely automatic scoring of RSDs to their highest factor; second, this score is then adjusted to produce a final classification. For the final mapping, a number of potential confusions or ambiguities that make the original map difficult to interpret are removed using a 'directed' approach. This uses a scrutiny of each RSD for each factor. This combines aspects of the standard approaches of 'exploratory' and 'confirmatory' factor analysis; where the exploratory approach has been used to inspect the first factor allocations, and the confirmatory approach is used to ensure interpretation meets criteria of interpretability against known patterns: a 'reality check'. The starting point is the automatic 'original' classification, but this was tensioned against alternatives taking account of sample size in each RSD, and against the known patterns of different locations derived from secondary literature.

The judgement on the groupings of RSDs for each factor was made by reference to the factor scores in 6 stages:

1. Each RSD was classified to the factor on which it had the highest score. This gave a first classification of each RSD which were then scrutinised:
2. Those where the highest score on any factor was below 0.5 were re-allocated to a separate group with 'no strong loadings'.
3. Those RSDs which had scores over 0.5 were scrutinised to check that none had a strong alternative classification to different factor(s) for which their scores were close to that on the highest factor to which they had been classified. These were candidates for possible re-allocation.
4. A control was made for small sample sizes. The RSDs were ranked on the number of census entries for all the occupations on the relevant factor. These were then scrutinised individually to remove those with very small census numbers but with high loadings that distorted the allocation. Where RSDs with very small numbers had an alternative high factor loading that would allocate them to a different factor for which they had a substantial number of census respondents, they were re-allocated to that factor. This was undertaken for all RSDs below a given respondent size for that factor (defined below).
5. If in step 4 there was no alternative factors with high loadings, those with small census numbers were allocated to the separate group with 'no strong loadings'.
6. A final check was made of all those RSDs with small census numbers (but above the specified respondent size) to check for matches against known spatial patterns. This resulted in a few being reallocated to high ranking alterative factors.

These tests put all RSDs against a 'reality check' that the final coding accorded with known or likely patterns; mainly as a negative test where there was a strong indication of a mis-coding.

In addition, RSDs that did not score highly on any of the factors were allocated to a separate group, termed 'no strong loadings'. These are RSDs which have no high concentrations on any of the employer variables: they are close to the general average employer distribution across the country, or have no spatial concentrations high enough on any occupation to give them a high factor loading.

The approach followed has to be carefully tailored to each analysis: all entrepreneurs, or employers only.

8.1 All entrepreneurs (employers and own account)

The initial mapping of RSD allocated to their highest factor loadings is shown in Figure 16. This uses the first 10 factors as listed in Table 2, but also adds a separate mapping for those areas that clear patterns that relate to now spatial variations in the total economically active, as well as some distinctions. The coal, textile, tools & machinery, and main commercial centres most obviously fit with expected patterns for all occupied. Rural areas are mixed in categorisation between farming with rural trades (factor 2), dealers and retail (factor 4), transport etc. (factor 6), and carriers and lodgings (factor 9). The rural groups are complex and probably influenced by small sample sizes (q.v.). Wood products (factor 3), clothing (factor 9) and general manufacturing/ports (factor 10) all appear to require some further interrogation.

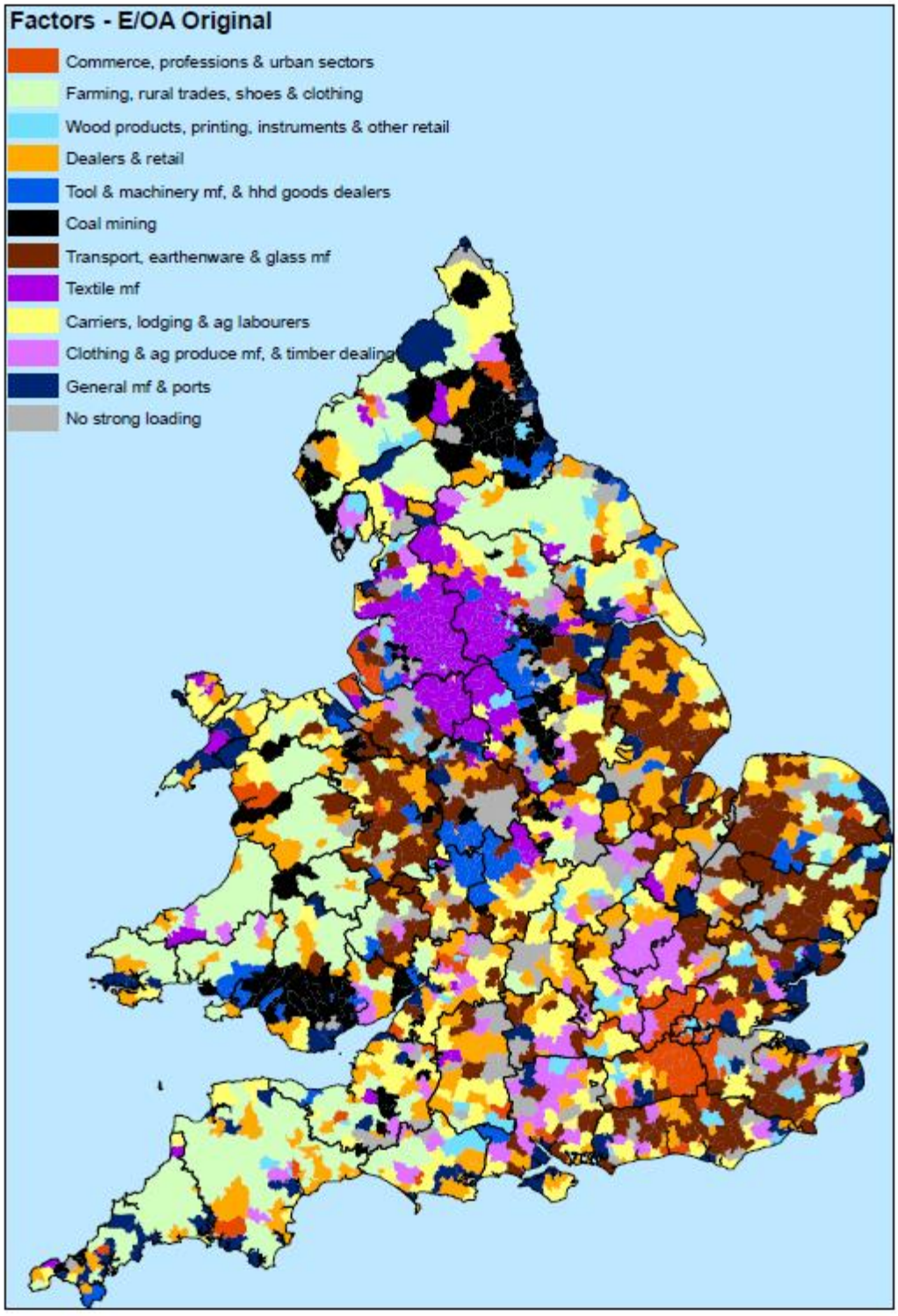

Figure 16. 'Original' mapping of RSD factor scores for all entrepreneurs.

The next stage of analysis is to check each RSD in the original mapping to test how far its allocation is robust to small samples in each location. The primary change made was to simplify

the original factor 6. This had positive loadings on transport, earthenware and glass manufacture, but high negative loadings on cola mining. The high negative loaded RSDs are retained, but those with positive loadings are reassigned to their second highest factor, or to no strong loading if they have no good alternative. This is mainly either to factors 2 (farming etc.) and 8 (carriers etc.), but most become no strong loading. For other factors, only a small number of other RSDs are reassigned based on small sample sizes. This mainly affects a few RSDs in Factor 9 (carriers etc.) which are mainly related to agricultural industries, and for Factor 11 (general manufacturing & ports) which includes the occupation category 'General mf (manufacturers, mechanic, artisan, machinist)' mostly in urban centres and small towns. Factor 10 (clothing etc.) appears to be identifying an important type of area where second occupations to agriculture are important. Many of these in the south of England appear to be those with high levels of outworking in apparel manufacture.

The resulting classification is complex, as to be expected from combing employers and own account for all entrepreneurs. But it appears to identify most of the areas of different types of industry and entrepreneur.

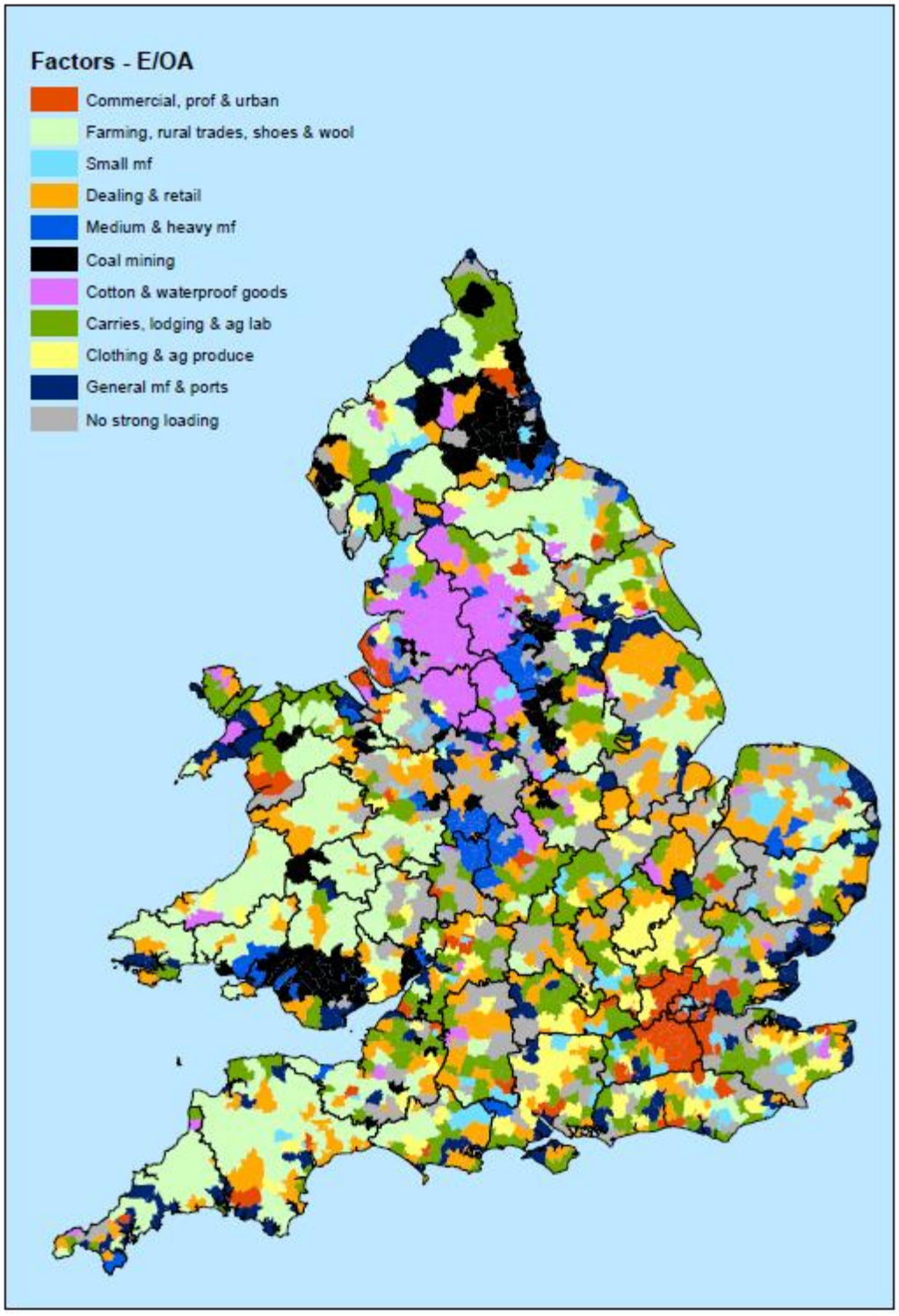

Figure 17. Final mapping of RSD factor scores for all entrepreneurs.

8.2 Employers only

For employers only the results of the factor analysis shown in Table 6 are mapped on their original factor scores in Figure 18 for the first 8 factors. In the mapping, to the first 8 factors in Table 6 is added a ninth for those areas which have high negative loadings on coal mining in the 12-factor analysis of own account (Factor 7), and which also had low loadings on any other factor and had at least three employers or own account. A total of 61 coal RSDs met these criteria and had no factor scores above 0.5 on the other 8 factors. No re-allocations were involved in using this approach since all would have been classified as no strong loading otherwise. This approach allows the separate employer factor analysis to be sued as the main source for classification (covering the first eight factors), and then using the own account to allocate a group of those with no strong loading. Figure 18 is the first attempt at a classification of all RSDs using a direct mapping of the RSD with their highest scores following the above methodology ('original' map).

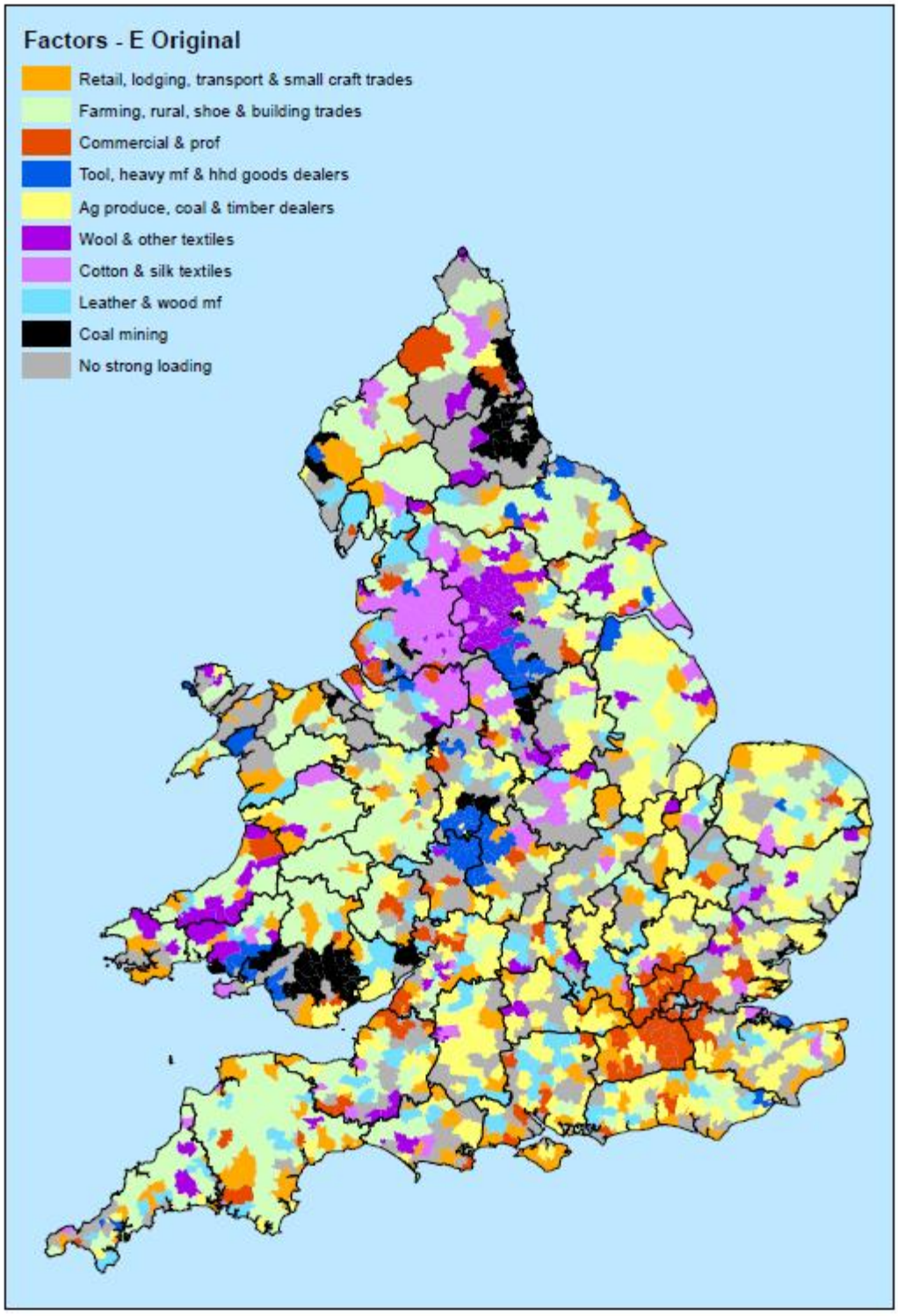

Figure 18. 'Original' mapping of RSD factor scores for employers only.

For the final mapping, a number of potential confusions or ambiguities that make the map difficult to interpret are removed using the 'directed' approach. Following the 6 stages outlined earlier. In these stages 182 RSDs were re-allocated at stages 4 and 5, to take account of small

sample sizes, most were reallocated to no strong loading. This involved 117 of the 182 re-allocated RSDs. At stage 6 the final 'reality check' against known spatial patterns resulted in 6 being reallocated to high ranking alterative factors

The specified threshold for each factor chosen as a cut-off for the employer allocation, where respondent numbers in an RSD were at or below the following sizes, are shown in Table 13. Some of these are at very small levels indicating the small number of employers present in many areas which are used as an indicator, and hence the sensitivities to small samples in the employer analysis.

Factor	Factor description	Respondent size threshold ≤	Total re-allocated	Of which, re-allocated to no strong loading
1	Retail, lodging, transport & professions	all are large	-	-
2	Farming & produce mf., smiths, shoes & building trades	all are large	-	-
3	Commerce & professions, urban	10	38	23
4	Tools, heavy manufactures & household goods dealers	5	18	13
5	Agricultural produce dealing, coal and timber dealers	all are large	-	-
6	Wool and other textiles	6	44	22
7	Cotton & waterproof goods	4	33	26
8	Agricultural produce, leather and wood manufactures	8	49	33
9	Coal mining	3	-	-
Total			**182**	**117**

Table 13: The size thresholds used and number RSDs reallocated for each factor based on small census numbers of employers in any RSD.

The reality checks can be illustrated by some examples. The first five cases all have small numbers of employers and small differences between the factor scores (less than 0.3 difference) and St. Olave has a difference between factor scores of only 0.01 and for Stowmarket only 0.03.

For Oldbury in the Black Country, originally coded as Factor 5 (score 1.275) with second Factor 4 (score 0.8708), the actual numbers of employers are 15 in Factor 5 and 24 in Factor 4, but there is a very stark difference is in total numbers (employers, OA & workers) where there were 52 people in Factor 5 and 1,157 in Factor 4. Similarly one Cardiff RSD has 90 employers in Factor 5, but 223 employers in Factor 3 which is also reflected in a much larger number of total people in Factor 3 (3,445) than Factor 5 (378).

The resulting final classification of RSDs for all employers is shown in Figure 19.

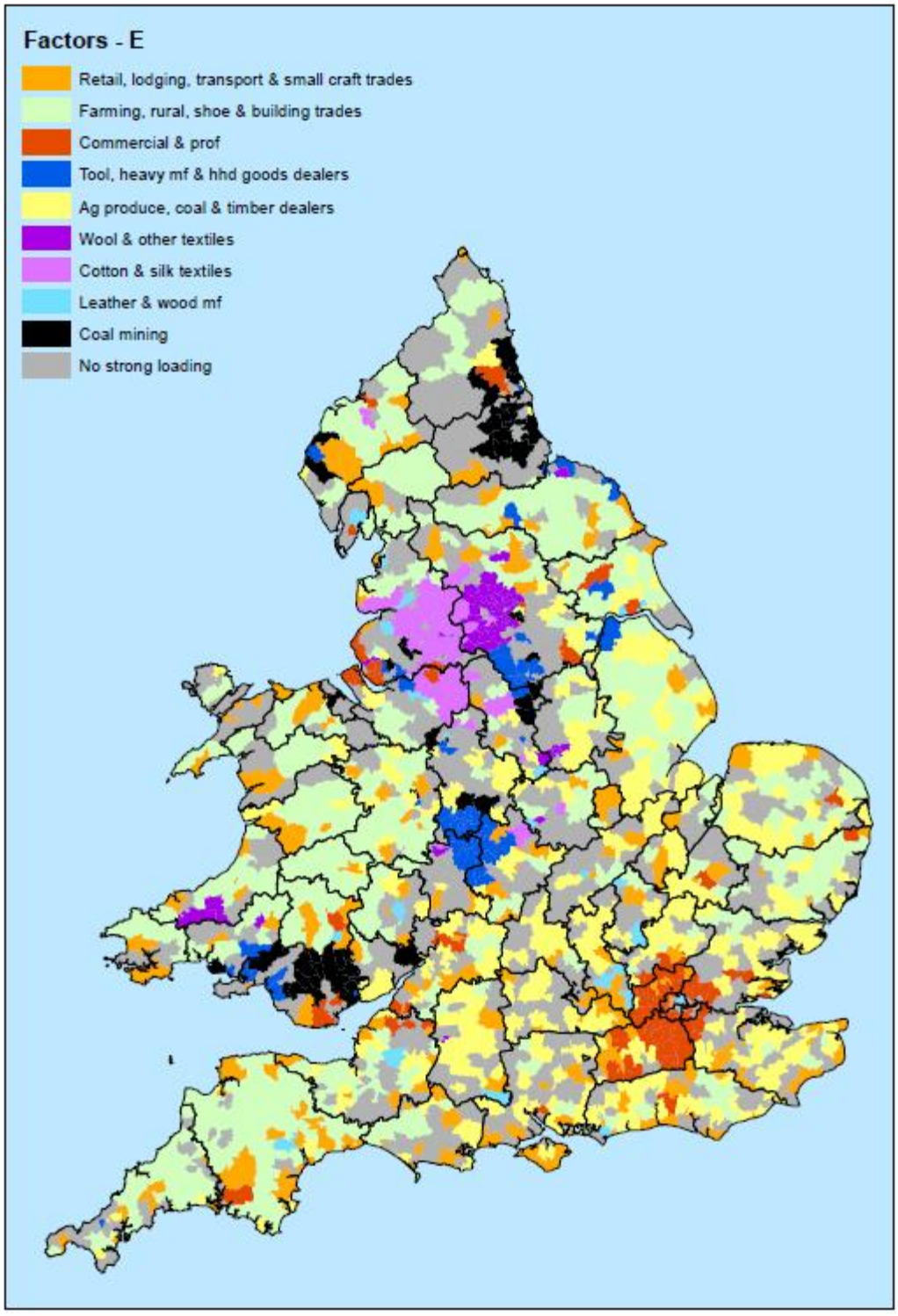

Figure 19. Final mapping of RSD factor scores of employers only.

9. Females entrepreneurs (all employers and own account)

The number of female employers is very low, only 85,000, and the number of own account also low: 310,000. This makes classification by factor analysis challenging. Preliminary analysis in this cases showed that although small samples were an important constraint, some very significant features were identified by some of the high order factors. In this case, therefore, a 13-factor study was undertaken, which was the automatic cut-off indicated by the Stata software. However, only 33 of the 50 occupational groups are significant in this 13-factor analysis, the rest are eliminated automatically mainly because of very small or zero entries. This includes the last five sectors. Because of the small population of females identified in the census as entrepreneurs analysis is restricted here to all entrepreneur categories together (all employers and own account).

The 13-factor variance (Table 14) has a rapid decline from the first to Factors 2 and 3 and then levels off markedly showing only small increments in explanation for Factors 4 and greater. This generally flat distribution reflects the small sample size, and also indicates the small number of RSDs and occupations loading strongly on the higher factors, with even the first three factors having small levels of explained variance. The female patterns are therefore highly concentrated on the first 3-4 factors, are otherwise more complex, less clear-cut, and have smaller overall explanatory power than the for both genders together with small sample sizes severely affecting estimation for high order factors.

Factor	Variance	Difference	Proportion	Cumulative
Factor 1	2.21329	0.28298	0.0671	0.0671
Factor 2	1.93030	0.47929	0.0585	0.1256
Factor 3	1.45101	0.07312	0.0440	0.1695
Factor 4	1.37789	0.19198	0.0418	0.2113
Factor 5	1.18591	0.03558	0.0359	0.2472
Factor 6	1.15034	0.00138	0.0349	0.2821
Factor 7	1.14896	0.01419	0.0348	0.3169
Factor 8	1.13477	0.00478	0.0344	0.3513
Factor 9	1.13000	0.03163	0.0342	0.3855
Factor 10	1.09837	0.04658	0.0333	0.4188

Factor 11	1.05179	0.00313	0.0319	0.4507
Factor 12	1.04866	0.02498	0.0318	0.4825
Factor 13	1.02368		0.0310	0.5135

Table 14. Factor analysis for all female entrepreneurs (sum of all employers and OA), 12-factor variance

Number of obs = 2,110

Method: principal-component factors Retained factors = 13

Rotation: orthogonal varimax (Kaiser off) Number of params = 351

LR test: independent vs. saturated: chi2 (528) = 4075.80 Prob > chi2 = 0.0000

The factor loadings are shown in Table 15. There are no negative loadings less than -0.5, but there are three near -0.5, respectively: for earthenware and glass at -0.3 and -0.4; and for farming at -0.3. Earthenware and glass has only high loadings for negatives; its highest positives are 0.16 and 0.15 on Factors 2 and 3.

50ID	50ID	factor1	factor2	factor3	factor4	factor5	factor6	factor7	factor8	factor9	factor10	factor11	factor12	factor13
1	farming, fishing, market gardeners, horse breeding and keeping	-0.3821	0.5093	-0.1683	0.0874	0.0322	-0.0882	0.0304	-0.0855	0.33	-0.0526	-0.1309	-0.0662	-0.0132
2	coal mining	-0.0041	0.003	0.0237	-0.0373	-0.0671	0.0135	0.0259	0.0544	-0.0611	0.0205	-0.0662	0.0308	0.7959
5	machinery mf	0.0283	-0.0165	0.0652	-0.0657	-0.1934	0.0705	-0.0874	-0.0724	0.0062	0.6425	0.1065	-0.1404	-0.2183
6	tool & weapons mf	0.0265	-0.018	-0.0356	0.0006	0.0461	0.0953	0.0181	0.7097	-0.0048	0.0236	-0.015	-0.0003	0.0854
7	iron & steel mf, bolts and nails	-0.0259	-0.0011	-0.0493	0.0125	0.0109	-0.0359	0.058	0.0155	-0.055	-0.0186	0.7396	0.0209	-0.1108
9	other metal mf (copper, tin, brass, whitesmiths, etc.)	-0.0957	-0.0095	0.3589	0.0205	-0.154	-0.0198	-0.0593	0.5231	0.1419	-0.0758	0.1015	-0.1063	0.0203
10	ship, road & rail vehicle mf	0.1299	0.1233	-0.2062	0.0279	0.2171	-0.2009	-0.0962	0.4023	-0.2957	0.1014	-0.0479	0.0074	-0.0636
11	earthenware & glass mf	-0.002	0.1642	0.1525	-0.0128	-0.0999	0.008	0.0976	0.0081	-0.4263	-0.0592	-0.3898	0.1102	-0.3207
12	gas, coke and chemical mf	-0.0252	0.0231	-0.1212	-0.0045	0.6937	-0.089	0.0512	0.0503	0.0391	-0.059	-0.0566	-0.0035	-0.09
13	leather, fur, hair & bone mf	0.0934	-0.1958	0.4561	0.124	0.2934	0.0265	-0.0822	0.0229	0.1341	0.1258	0.0464	0.1263	-0.0332
14	wood mf (sawyers, coopers, cane workers)	-0.0215	-0.1087	0.0832	0.7524	0.0104	-0.0096	0.1469	0.0319	0.0243	0.0298	0.0318	-0.0185	-0.0295
15	furnishing mf (cabinet makers, french polishers, undertakers)	0.5295	-0.1508	0.2372	0.0075	0.1078	0.0288	0.1408	0.0517	0.112	-0.0178	-0.0451	-0.0017	-0.0347
16	printing & paper mf (paper, cardboard, printers, bookbinders)	0.0866	-0.0283	0.5497	0.0223	0.069	-0.0334	0.0406	0.1047	-0.037	-0.0474	-0.1133	0.0051	0.0961
17	waterproof goods mf (floor & oil cloth, rubber etc.)	-0.0007	-0.0812	-0.0688	-0.0856	0.035	0.6092	0.2351	0.0797	0.0084	0.0652	-0.1371	0.0538	-0.1656
18	woollen mf (woollen goods, carpets, blanket, flannel)	-0.0119	0.1611	0.0093	-0.031	-0.0261	-0.0293	-0.003	0.0285	0.7375	0.0252	-0.0816	0.0541	-0.1072
19	cotton & silk mf (incl ribbon, weaving, dyeing, bleaching etc.)	-0.1407	-0.2567	-0.098	-0.103	0.1128	-0.0002	0.4267	-0.0697	0.1188	-0.0947	-0.2247	-0.2392	0.0265
20	other textile mf (flax, hemp, rope, jute, lace, tape, thread)	-0.0192	-0.0565	0.0093	-0.0529	0.0189	0.0047	0.088	-0.0625	-0.0246	-0.008	0.02	0.7504	0.0869
21	clothing mf (tailors, milliners, hosiery, hats, gloves, umbrellas, buttons, leather)	-0.0191	0.0155	-0.0255	0.0215	-0.0661	0.0193	-0.1355	0.072	0.1475	-0.0694	-0.019	0.5464	-0.1496
22	shoe, boot, clog mf	0.0713	0.1991	0.1132	-0.0473	-0.002	0.0244	0.5612	-0.0215	-0.1767	-0.07	0.3666	0.0706	0.0745
24	drink & tobacco mf (maltsters, brewers, distillers, tobacco & pipes)	0.469	-0.136	0.2235	-0.017	0.0203	0.1223	0.1279	0.1948	0.0706	-0.0257	0.0661	-0.1046	-0.1657
25	watch & instrument mf	0.1078	0.075	0.0435	0.4028	0.0107	-0.0867	0.5408	0.003	0.0874	0.2391	-0.0326	0.1021	-0.0045
26	general mf (manufacturers, mechanic, artisan, machinist)	0.0631	0.014	-0.0341	0.7456	-0.0103	0.0855	-0.1188	-0.0218	-0.0597	-0.0876	-0.0176	-0.0381	-0.0103
27	ocean, inland and dock transport	-0.0098	0.0426	-0.0479	0.0117	0.1362	-0.0312	0.1021	0.0654	0.0227	0.6972	-0.1015	0.0613	0.2041
31	clothing and dress dealing (drapers, hosiers, haberdashers)	0.1381	0.8021	-0.0271	-0.0353	-0.0303	-0.079	-0.0115	-0.008	0.0779	0.0244	-0.0104	0.0254	0.0097
32	food sales (butchers, fishmongers, cheesemongers, milksellers, grocers)	-0.0023	0.7338	0.0984	-0.0827	0.0842	0.1411	0.0736	0.0443	-0.0394	0.0245	0.0502	-0.0604	-0.0236
33	lodging & drink sales (wine & spirits, hotels, inns, coffee ho)	0.4197	0.3422	-0.0472	0.0809	0.0619	0.1599	0.0621	-0.1793	0.1087	-0.129	0.0057	-0.0899	0.175
34	stationary dealing (stationers, publishers, newsagents)	0.5634	-0.0586	0.1261	0.0031	0.0331	0.0866	0.0709	-0.0053	0.0107	-0.1435	-0.0231	-0.0554	-0.0041
35	h/h & personal goods dealer (earthenware, glass, jewellers)	0.084	0.1779	0.5575	0.0569	-0.1128	-0.0659	0.1509	-0.0561	-0.1142	-0.0081	-0.1036	-0.0213	-0.0475
37	other retail (general shopkeeper, huckster, hawker)	0.0382	0.0776	0.3137	-0.0038	0.5882	0.2487	-0.022	-0.056	-0.1017	0.0622	0.1407	-0.0271	0.0034
39	merchants, banks, insurers and brokers	0.0086	0.0625	0.0075	0.116	0.0086	0.7328	-0.1437	0.0118	-0.0334	-0.0205	0.0357	-0.0157	0.1029
40	other commerce (accountants, salesmen, travellers, officers of cos.)	-0.0023	-0.0301	0.3191	-0.0135	0.2532	-0.0348	-0.2408	-0.2384	-0.0081	0.0865	0.0537	-0.0528	0.0769
43	professions (doctors, dentists, artists, performers,education)	0.7536	0.1097	-0.0182	0.0177	-0.0364	-0.0475	0.0384	-0.0167	-0.0227	0.035	0.0546	-0.0179	0.0024
44	personal services (washing & bathing, hairdressing, chimney sweeps)	0.6252	0.171	-0.091	0.0782	-0.0195	-0.0765	-0.1783	-0.0146	-0.1339	0.1115	-0.1337	0.0844	0.0248

Table 15. 13-Factor loadings for all female entrepreneurs for each of the 50 aggregated occupational variables.

A summary of the factors for female entrepreneurs with their highest loadings is:

Factor 1 (Professions, lodging etc.; resorts)

Furnishing mf (cabinet makers, french polishers, undertakers)

Drink & tobacco mf (maltsters, brewers, distillers, tobacco & pipes)

Lodging & drink sales (wine & spirits, hotels, inns, coffee ho.)

Stationary dealing (stationers, publishers, newsagents)

Professions (doctors, dentists, artists, performers, education)

Personal services (washing & bathing, hairdressing, chimney sweeps)

Negative loading on farming (-0.38)

Factor 2 (Farming and small retail)

Farming, fishing, market gardeners, horse breeding and keeping

Clothing and dress dealing (drapers, hosiers, haberdashers)

Food sales (butchers, fishmongers, cheesemongers, milksellers, grocers)

Factor 3 (Leather, Hhd goods etc.)

Leather, fur, hair & bone mf

Printing & paper mf (paper, cardboard, printers, bookbinders)

H/h & personal goods dealer (earthenware, glass, jewellers)

Other commerce (accountants, salesmen, travellers, officers of cos.)

Factor 4 (wood and general mf.)

Wood mf (sawyers, coopers, cane workers)

General mf (manufacturers, mechanic, artisan, machinist)

Factor 5 (Gas, chemical etc.)

Gas, coke and chemical mf

Other retail (general shopkeeper, huckster, hawker)

Factor 6 (Waterproof goods etc.)

Waterproof goods mf (floor & oil cloth, rubber etc.)

Merchants, banks, insurers and brokers

Factor 7 (Cotton, silk, shoe and watch mf)

Cotton & silk mf (incl ribbon, weaving, dyeing, bleaching etc.)

Shoe, boot, clog mf

Watch & instrument mf

Factor 8 (Tools, metal and vehicles)

Tool & weapons mf

Other metal mf (copper, tin, brass, whitesmiths, etc.)

Ship, road & rail vehicle mf

Factor 9 (woollen mf)

Woollen mf (woollen goods, carpets, blanket, flannel)

High *negative* loading (the highest of all negatives, and the only less than -0.4) on:

Earthenware & glass mf (-0.43)

Factor 10 (machinery and ports)

Machinery mf

Ocean, inland and dock transport

Factor 11 (small metal mf)

Iron & steel mf, bolts and nails

Negative loading on earthenware and glass (-0.39)

Factor 12 (clothing and small wares mf.)

Other textile mf (flax, hemp, rope, jute, lace, tape, thread)

Clothing mf (tailors, milliners, hosiery, hats, gloves, umbrellas, buttons, leather)

Factor 13 (Coal) surprisingly highly loaded exhibiting the potentially major impact of coal mining workforces on female entrepreneur opportunities, perhaps through developing laundry and other services (q.v. below).

Coal mining

Negative loading on earthenware and glass (-0.32)

The 'original' mapping of all 13 of these factors (Figure 20) has the most striking feature of a wide range of areas with no strong loading. This reflects the small sample sizes for female entrepreneurs. The map also shows a varied and complex structure, but with some notable high

concentrations that match known patterns: in major commercial centres and resorts for Factor 1, and in clothing and small textiles for Factor 12. The concentration on Factor 12 illustrates one of the useful characteristics of the factor study, that spatial concentration in relatively small occupational groups are identified that may explain small proportions of the total variance, but are very significant groups for those few areas having this concentration. A notable feature of many of the areas for Factor 1 is, that apart from a high frequency in large commercial centres and most resorts, this factor is highly concentrated in the south of England. Because of the negative loading of Factor 1 on farming this may reflect a greater development in the south of alternatives to farming than generally occurs in the north and Wales (especially washing and lodgings); whereas in the north and Wales farming remains the main potential female occupation. This probably reflects two features: one lower income levels in many of the more peripheral rural areas that restrict economic development to farming, and where there are alternatives this is often in mining which takes in a lesser proportion of females at this date, whilst agriculture remains the main alternative available. Despite these strong patterns, many of the factors need careful checking for sample sizes to achieve a robust final classification. This particularly affects Factors 3, 4, 5 and 13.

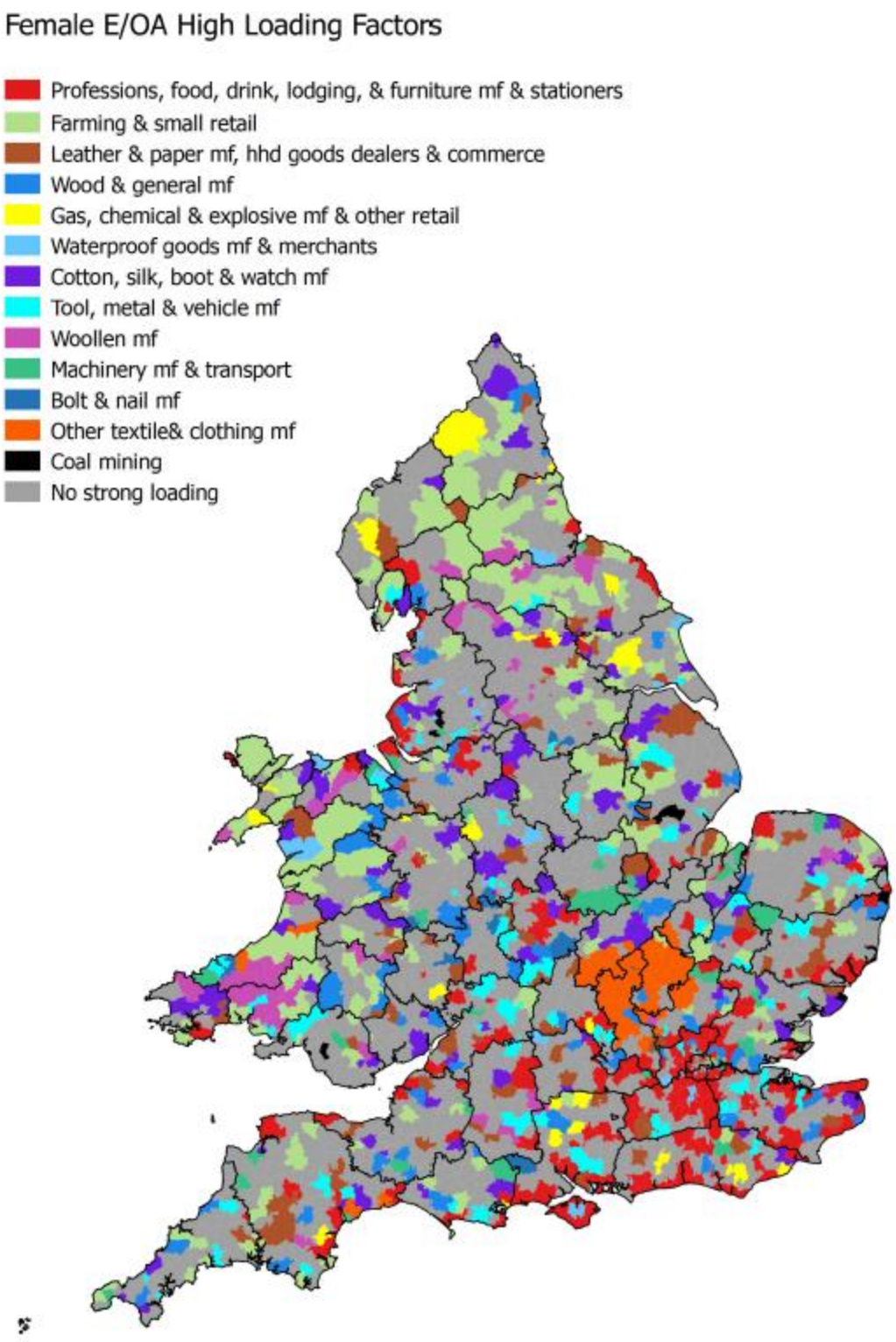

Figure 20. Mapping of RSDs for their highest factor scoring, all female entrepreneurs, 13-factor study: 'Original' mapping.

Although the 13-factor study identifies some important spatial concentrations for the high order factors, the pattern is confused for many of the factors which mainly reflect small sample sizes. The final mapped classification makes a number of adjustments, following the same 6-stage procedure used earlier. In this case adjustments for small sample size are more frequent because of the small numbers of females involved.

In the final mapping (Figure 21) the imposition of a sample size threshold leads to no strong loading becoming an even larger group of RSDs, reflecting the small numbers of female entrepreneurs that are distinctive in the sector concentrations. Factor 5, which often has small numbers and is mainly 'other retail', is merged with Factor 2 to make a combined factor; and Factor 13 (coal) which has only 6 RSDs all with very small numbers of entrepreneurs is reassigned to the highest second factor (which in almost all cases is Factor 1) or to no strong loading. This reduces the final factor list to 11 factors:

Factor 1 (Professions, lodging etc.; resorts)
Furnishing mf (cabinet makers, french polishers, undertakers)
Drink & tobacco mf (maltsters, brewers, distillers, tobacco & pipes)
Lodging & drink sales (wine & spirits, hotels, inns, coffee ho.)
Stationary dealing (stationers, publishers, newsagents)
Professions (doctors, dentists, artists, performers, education)
Personal services (washing & bathing, hairdressing, chimney sweeps)

Factor 2 (Farming and small retail)
Farming, fishing, market gardeners, horse breeding and keeping
Clothing and dress dealing (drapers, hosiers, haberdashers)
Food sales (butchers, fishmongers, cheesemongers, milksellers, grocers)
Other retail (general shopkeeper, huckster, hawker)

Factor 3 (Leather, Hhd goods etc.)
Leather, fur, hair & bone mf
Printing & paper mf (paper, cardboard, printers, bookbinders)
H/h & personal goods dealer (earthenware, glass, jewellers)
Other commerce (accountants, salesmen, travellers, officers of cos.)

Factor 4 (wood and general mf.)

Wood mf (sawyers, coopers, cane workers)

General mf (manufacturers, mechanic, artisan, machinist)

Factor 5 (Waterproof goods etc.)

Waterproof goods mf (floor & oil cloth, rubber etc.)

Merchants, banks, insurers and brokers

Factor 6 (Cotton, silk, shoe and watch mf)

Cotton & silk mf (incl ribbon, weaving, dyeing, bleaching etc.)

Shoe, boot, clog mf

Watch & instrument mf

Factor 7 (Tools, metal and vehicles)

Tool & weapons mf

Other metal mf (copper, tin, brass, whitesmiths, etc.)

Ship, road & rail vehicle mf

Factor 8 (woollen mf)

Woollen mf (woollen goods, carpets, blanket, flannel)

Factor 9 (machinery and ports)

Machinery mf

Ocean, inland and dock transport

Factor 10 (small metal mf)

Iron & steel mf, bolts and nails

Factor 11 (clothing and small wares mf.)

Other textile mf (flax, hemp, rope, jute, lace, tape, thread)

Clothing mf (tailors, milliners, hosiery, hats, gloves, umbrellas, buttons, leather)

As well as amalgamating two factors the final classification also imposes size cut-offs to all factors. This results in an increase in the number of RSDs with no strong loading. Now Factors 1 and 2 are even more by the most numerous (after no strong loading). In Figure 21, the notable feature of Factor 1 is retained of having high frequency in large commercial centres and most resorts, and a high concentration in the south of England. The imposition of the cut-off of small sample size to all factors, reduces factors other than 1 and 2 to very small numbers of RSDs that are truly distinctive and have high enough sample sizes to merit identification. Factors 6 (cotton, silk, boots and watches) and 11 (clothing and other textiles) remain significant. Factor 6 identifies the strong concentrations in a few areas in NW England (such as Preston & Chorley, Oldham, Ashton under Lyne & Bury) and dispersed settlements. Factor 11 very neatly picks up the straw plait industry Beds., Bucks., Northants. and Herts., as well as more dispersed hosiery and gloves especially in Devon. These female industries are generally associated with outworking. But the census does not usually record outworking so that these are areas that the outworking stature is associated with a significant number of female proprietresses who are important to this industry

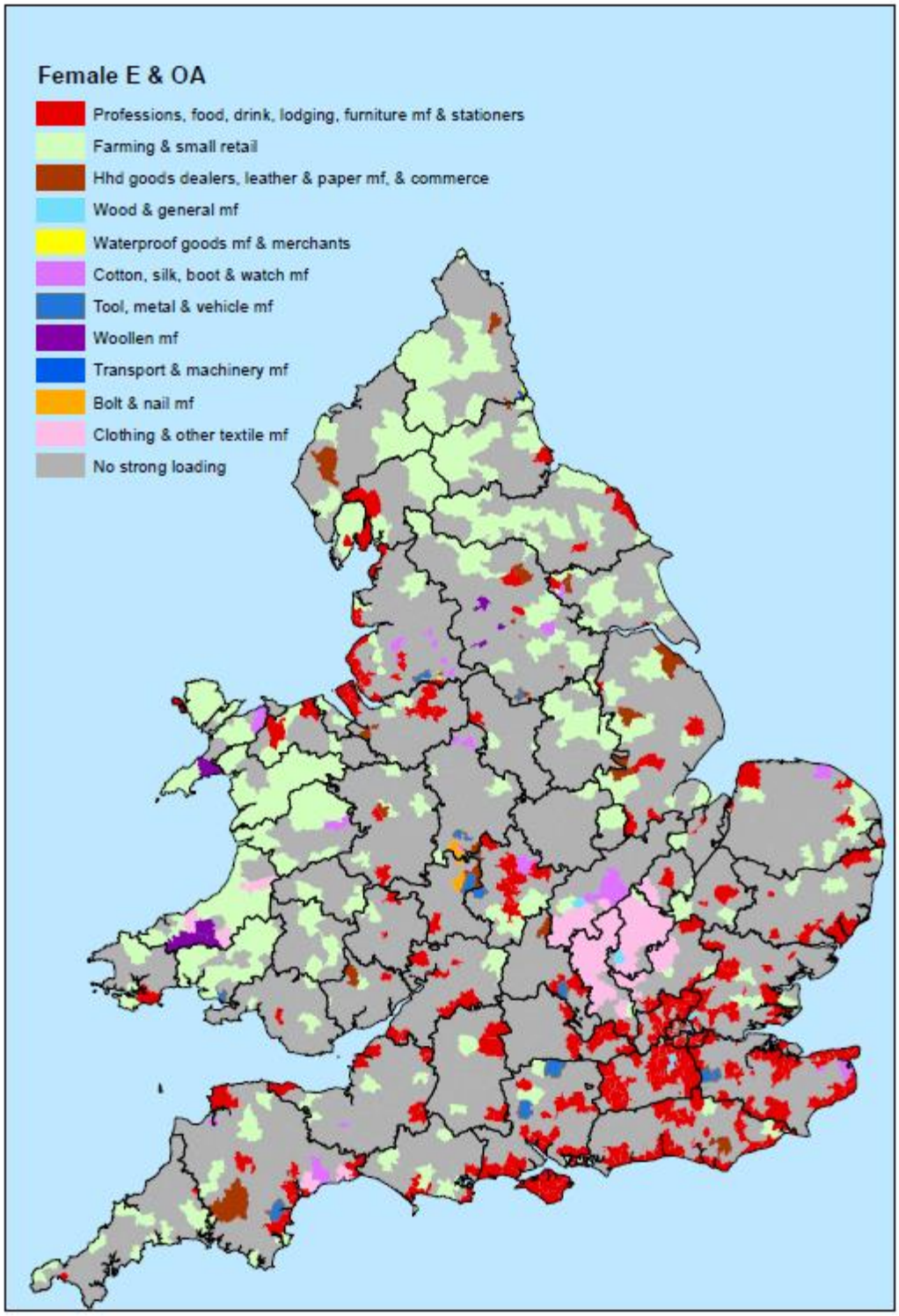

Figure 21. Mapping of RSDs for their highest factor scoring, all female entrepreneurs, 13-factor study: Final mapping.

9. Conclusion.

This working paper has developed a classification of RSDs for 1891 based on their level of local entrepreneurship using an aggregation of occupational categories into 50 groups. The final results for male and female entrepreneurs together (Figure 19) and female entrepreneurs separately (Figure 21) mostly fit closely to patterns that are well understood from the literature for occupations, but are a new departure for entrepreneurship since data at this spatial level have not previously been available. In most cases the RSDs fall into spatial groups even though there has been no use of contiguity controls, such as could be used for urban areas. These results are a pilot for the application of similar methods to understanding entrepreneurship in other census years and for the development of the classification for a range of analytical purposes. These developments are summarised in subsequent working papers.

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The database used for 1891 and 1901-11 derives from K. Schürer, E. Higgs, A.M. Reid, E.M Garrett, *Integrated Census Microdata, 1851-1911, version V. 2 (I-CeM.2),* (2016) [data collection]. UK Data Service, SN: 7481, http://dx.doi.org/10.5255/UKDA-SN-7481-1; enhanced; E. Higgs, C. Jones, K. Schürer and A. Wilkinson, *Integrated Census Microdata (I-CeM) Guide, 2nd ed*. (Colchester: Department of History, University of Essex, 2015).

The GIS boundary files for RSDs were constructed by Joe Day for the ESRC fertility project directed by Alice Reid:

http://www.geog.cam.ac.uk/research/projects/victorianfertilitydecline/publications.html

These used as a starting point the GIS parish files of Satchell, A.E.M., Kitson, P.M.K., Newton, G.H., Shaw-Taylor, L., Wrigley E.A. (2006) *1851 England and Wales census parishes, townships and places*, 2006, ESRC RES-000-23-1579, supported by Leverhulme Trust and the British Academy; Satchell, A.E.M. (2015) *England and Wales census parishes, townships and places*; which is an enhanced and corrected version of Burton, N, Westwood J., and Carter P. (2014) *GIS*

of the ancient parishes of England and Wales, 1500-1850, UKDA, SN 4828; which is a GIS version of Kain, R.J.P., and Oliver, R.R. (2001) *Historic parishes of England and Wales: An electronic map of boundaries before 1850 with a gazetteer and metadata*, UKDA, SN 4348.

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References

Goldberg, L. R. and Velicer, W. F. (2006) Principles of Exploratory Factor Analysis, in Strack, Stephen (ed). *Differentiating normal and abnormal personality*, 2nd ed. New York: Springer Publishing Co.

Kaiser, H. F. (1958) The varimax criterion for analytic rotation in factor analysis, *Psychometrika*, 23, 187-200.

Osborne, J. W. and Costello, A. B. (2005) Best Practices in Exploratory Factor Analysis: Four Recommendations for Getting the Most from Your Analysis, *Practical Assessment, Research & Evaluation*, 10(7), 1-9.

Rummel, R. J. (1967) Understanding factor analysis, *Journal of Conflict Resolution*, XI (4), 444-480.

Rummel, R. J. (1970) *Applied factor analysis*, Evanston: Northwestern University Press.

Yong, A.G. and Pearce, S. (2013). A Beginner's Guide to Factor Analysis: Focusing on Exploratory Factor Analysis, *Tutorials in Quantitative Methods for Psychology*, 9(2), 79-94.

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