EICC, Edinburgh

The finer points of postcode mortality modelling

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Plan of talk

1. Postcode anatomy
2. Geodemographics
3. Comparing geodemographic profilers
4. Enhancing geodemographic profilers
5. Conclusions

1. Postcode anatomy

1. Hierarchical structure of a UK postcode

1. Postcode modelling options — geographical

Postcode element	Example	Count
Region	EH	121
District	EH11	2,951
Sector	EH11 2	10,156

Source: Own calculations using 1,706,823 postcodes in Mosaic 2008 directory from Experian

1. Number of annuities in typical category

Postcode element	Annuities
Region	3,682
District	150
Sector	44

- Postal district and sector are *micro-regions*
- Micro-regions are swamped by random variation
- Micro-regions therefore unsuitable for own-portfolio modelling

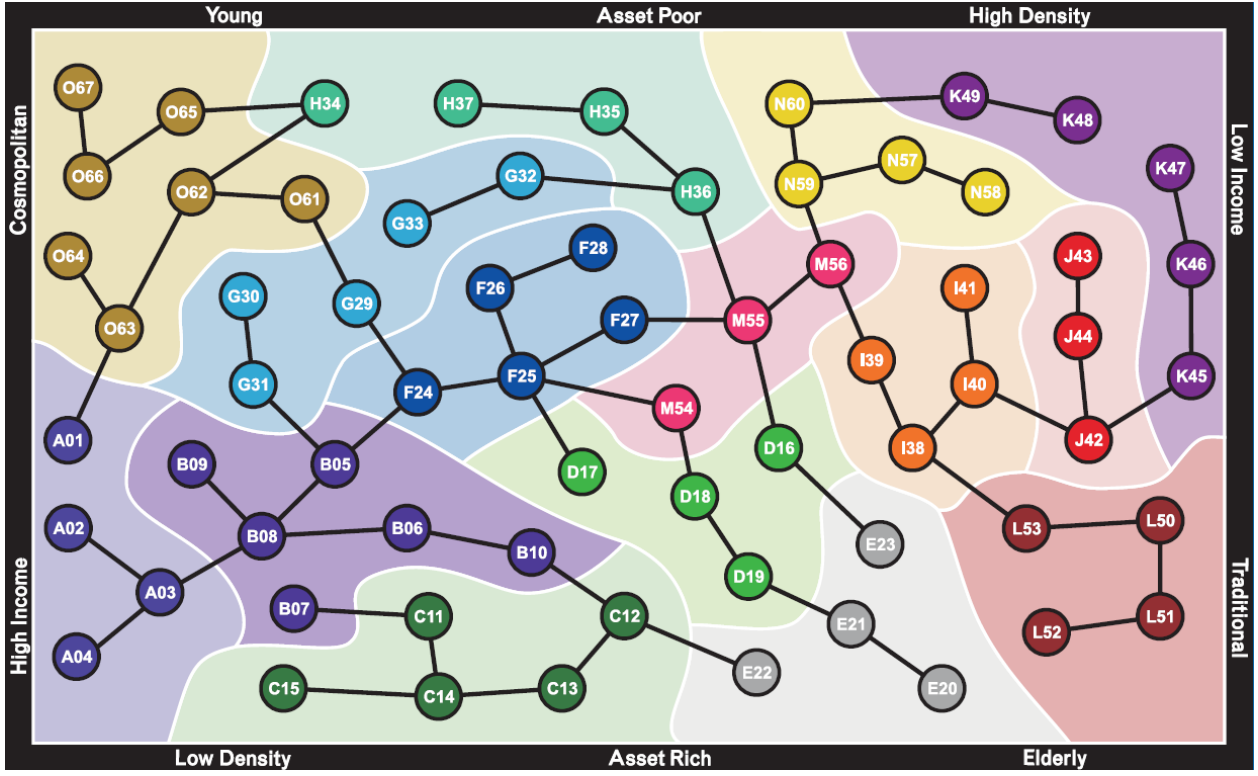
Source: Own calculations using large annuity portfolio

2. Geodemographics

2. Postcode modelling options — geodemographics

- 1.6 million residential postcodes
- Each maps to a *geodemographic group*

2. Geodemographic example — Mosaic



Source: Experian Ltd

2. Some postcode profilers in U.K.

- Mosaic (Experian)
- Acorn (CACI)
- P^2 (Beacon Dodsworth)
- Health Acorn (CACI)
- plus others such as FSS (Experian), Personicx (Acxiom) and CAMEO (Eurodirect)

2. Postcode modelling options

- Geodemographics proven in independent research:
  - → Richards (2008) used Mosaic with survival models
  - → Madrigal et al (2009) used Acorn with GLMs
- Little doubt remains as to usefulness of geodemographics

3. Comparing geodemographic profilers

3. How to compare profilers?

Profiler	Groups	Types
Mosaic	15	67
Acorn	17	56
P^2	13	40
Health Acorn	4	25

- More groups require more parameters
- Need to balance model fit against number of parameters

Source: Own calculations excluding groups or type codes representing unclassified, unmatched or crown dependencies

3. How to compare profilers?

- An *information criterion* balances fit against number of parameters
- A better model has a lower value
- Example: Akaike's Information Criterion — AIC — defined as:

$$\text{AIC} = -2\ell + 2n$$

where ℓ is the log-likelihood function and n is the number of parameters.

- Other examples include the BIC and GCV statistics

3. Comparing profilers for mortality modelling

- Explanatory power of given group:

Profiler	Explanatory power†
Mosaic	1,282
Acorn	1,118
P^2	909
Health Acorn	652

- Mosaic or Acorn group around twice as powerful as Health Acorn

Source: Own calculations using Perks survival model for ages 60–95 between 2000 and end-2006.

† "Explanatory power" is the drop in AIC for a model Age*Gender+Time+Group compared with a model for Age*Gender+Time.

3. Comparing profilers for mortality modelling

- Profilers have widely differing numbers of groups: from 4 to 17
- AIC perhaps too forgiving of larger number of parameters?

3. Comparing profilers for mortality modelling

- Map each type code into one of three lifestyle groups
- Number of parameters thus *same* for each profiler

3. Comparing profilers for mortality modelling

Profiler	Explanatory power†
Mosaic	1,588
Acorn	1,322
Health Acorn	1,163
P^2	1,052

- Lifestyles defined by Mosaic and Acorn still the best of the bunch
- Order above is unchanged using a five-level lifestyle (not shown)

Source: Own calculations using Perks survival model for ages 60–95 between 2000 and end-2006.

† "Explanatory power" is drop in AIC from Age*Gender+Time to Age*(Gender+Lifestyle)+Time, where Lifestyle is an optimised mapping of type code to a simpler three-level classification.

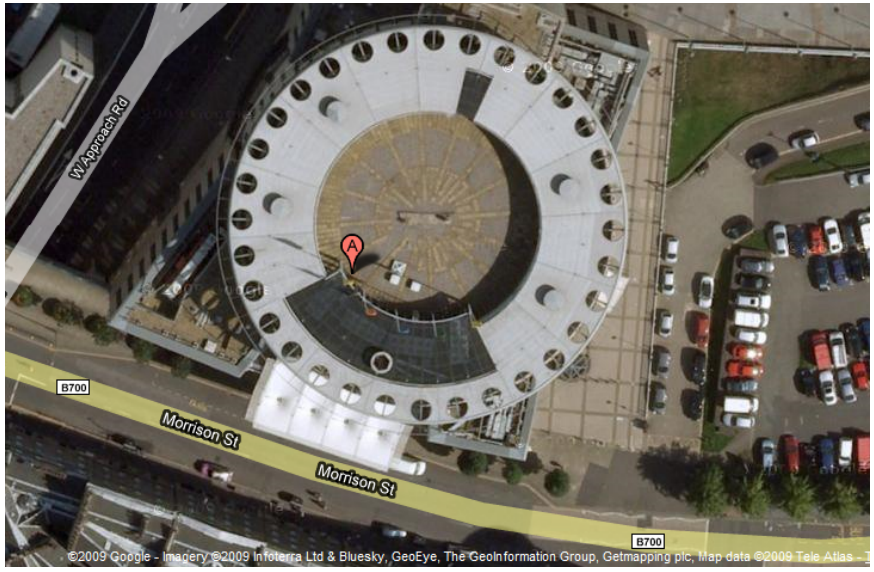
4. Enhancing geodemographic profilers

4. Enhancing profilers for mortality modelling

- Remove profiles for "large-user" postcodes
- Add discontinued postcodes
- Add postcodes for crown dependencies

4. Enhancements for mortality modelling — I

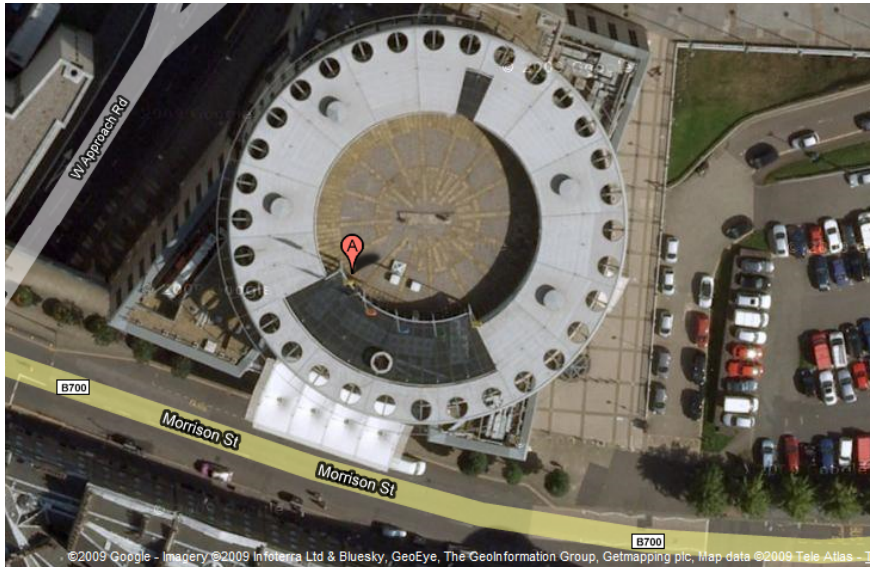
- Large-user postcodes assigned to non-residential buildings
- Sometimes spuriously assigned to a geodemographic type
- Example: EH3 8EE is EICC in Edinburgh



Source: Satellite image from Google Maps

4. Enhancements for mortality modelling — I

- Example: EH3 8EE is EICC in Edinburgh:



- EH3 8EE has Acorn type E18 "Multi-ethnic young, converted flats"
- EH3 8EE has P^2 type H22 "Students in the Community"

Source: Profiles for EH3 8EE from Acorn 07 directory and Beacon Dodsworth P^2 directory, satellite image from Google Maps

4. Enhancements for mortality modelling — II

- Around 1.7m current postcodes
- Around 2.4m postcodes including discontinued ones
- Standard marketing profilers often need old postcodes added back

4. Enhancements for mortality modelling — III

- Crown dependencies not part of United Kingdom
- No geodemographic data, so treated as unrecognised
- Add postcodes for Guernsey (GY), Jersey (JE) and Isle of Man (IM)

4. Enhancements for mortality modelling — III

- Surprising differences between crown dependencies:

Parameter	Estimate	Std. error	p-value	Significance
Age	0.122072	0.0006	0	***
Gender.M	0.465098	0.0117	0	***
Intercept	-13.1395	0.1229	0	***
Guernsey	0	n/a	n/a	n/a
Jersey	0.301669	0.1417	0.0333	*
Isle of Man	0.0699179	0.156	0.654	

Source: Longevitas Ltd. Selected parameters from a model of regional variation of U.K. and Crown Dependencies (Guernsey, Jersey and the Isle of Man). The baseline for the intercept is Guernsey, and a Perks survival model has been fitted for ages 60-95 over the years 2000-2006.

5. Conclusions

5. Conclusions

- Geodemographic profile powerful explanatory variable for mortality
- Not all geodemographic profilers are equal
- Health-based profilers not as good as marketing profilers
- Off-the-shelf systems can be (should be!) enhanced for mortality work

References

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