Morale in Old Age: Accounting for Heterogeneity

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Background to the study: The Social Survey

The Rural North Wales Elderly Project

- Health
- formal & informal care support
- access to services
- social mobility
- loneliness & isolation
- networking
- neighbourhood
- life events
- life satisfaction
- etc

Background to the study: Data Structure

The structure of the longitudinal data.

1979	1983	1987
534 respondents (65+) were interviewed	First follow up of the sample; 108 old elderly re-interviewed; 117 deceased 17 in residential care.	Second follow up of the sample; all survivors re- interviewed; 107 deceased since 1983; 29 in residential care.

Morale in old age

Morale was measured using the Anglicised version of the Philadelphia Geriatric Centre Morale Scale Lawton (1975)

See Wenger (1984).

For a comprehensive lit. review see Wenger (1992) and Wenger et al (1995)

List of explanatory variables

OBJECTIVE		SUBJECTIVE
Age	Has close living relatives	Self-assessed health
Gender	Household composition	Health limiting activities
Income	5 pfeiffer dependency	People available to do favours
Social class	Cumulative pfeiffer score	Presence of real friends
Home tenure	Frequency see family	Wish for more friends
Ethnicity	Relative seen most often	Confidant
Marital status	Who cares when ill	Self-assess loneliness
Hours spend alone	Isolation measure	
Change in marital status	Number of years widowed	
Has telephone	Nearest neighbour	
Loneliness measure	Visits relatives	
Housebound	network type	

Some definitions

• omitted variables: variables difficult or potentially unmeasurable (e.g frailty)

• heterogeneity: systematic effect on the response variable due to omitted variables

• past behaviour : probability of experiencing an outcome being influenced by the outcome's past performance e.g state dependence, duration dependence

A good reference is:

Gibbons, R. D., D. R. Hedeker, et al. (1993). "Some conceptual and statistal issues in analysis of longitudinal psychiatric data: Application to the NIMH Treatment of Depression Collaborative Research Program dataset." Archives of General Psychiatry **50**(9): 739-750.

Method

- traditional methods do not fully utilize the properties of the longitudinal nature of data
- an adequate statistical model must handle
  - multicollinearity
  - heterogeneity (due to omitted variables)
  - past behaviour (state dependence)
- conventional regression model leads to a well-known specification error
- must express heterogeneity explicitly in the model (frailty or mixture models)
- algorithms have been developed to fit such models (Davies 1987)
- advantage of our method is the statistic (R^2) for **intra**-individual variation

Data

- Morale is a process
- X-sectional vs longitudinal analysis →
- Issues:
    - subjective & objective variables
    - models that fully utilize data
    - large number of variables as correlates of morale

- **longitudinal** allows:
    - increased control
    - past behaviour
    - heterogeneity
    - omitted variables
    - change over time
    - intra- as well as inter

- **X-sectional** allows:
    - none of the above
    - inter individual

Statistical modelling

time t $y_{it} = \beta x_{it} + \theta_i + \varepsilon_{it}$

And to include past behaviour/Markov effect

time t $y_{it} = \{\alpha y_{it-1}\} + \beta x_{it} + \theta_i + \varepsilon_{it}$

For this exercise we used conditional likelihood method of estimation

time t $y_{it} = \{\alpha y_{it-1}\} + \beta x_{it} + \theta_i + \varepsilon_{it}$

time t+1 $y_{it+1} = \{\alpha y_{it}\} + \beta x_{it+1} + \theta_i + \varepsilon_{it+1}$

Statistical modelling

- This method also known as the difference method:

$$y_{it+1} - y_{it} = \gamma(y_{it} - y_{it-1}) + \beta(x_{it+1} - \underline{x}_{it}) + (\varepsilon_{it+1} - \varepsilon_{it})$$

- The nuisance parameter θ and all time constants will be eliminated.

Problem with the model…

- Consider the model once more:

$$y_{it+1} - y_{it} = \gamma(y_{it} - y_{it-1}) + \beta(x_{it+1} - \underline{\beta x}_{it}) + (\varepsilon_{it+1} - \varepsilon_{it})$$

- This model leads to a well-known specification error…
- The solution is ‘instrumental variables’ : we can replace the offending variable with another which is highly correlated with it but not with the error.

Consequences of assumption violation…

1. To demonstrate this specification error and its consequences we fitted the model as is …
2. We re-fitted the model with the solution, by replacing past behaviour term with response at time 1

Results

Explanatory variables	Conditional p.e	Conditional s.e	With Instrumental Variables* p.e	With Instrumental Variables* s.e
Past Behaviour*	-0.30	0.1	-0.03	0.2
Hours spend alone				
up to 3 hours	0.07	0.13	0.11	0.18
3-9 hours	-0.38	0.13	-0.37	0.14
9+ hours	0.00		0.00	
Has close relatives				
yes	0.00		0.00	
no	-0.32	0.13	-0.32	0.13
Subjective variables				
Presence of friends**				
yes	0.00		0.00	
no	0.43	0.15	0.22	0.64

*Morale 1979 as instrument for past behaviour;

Consequences of assumption violation…

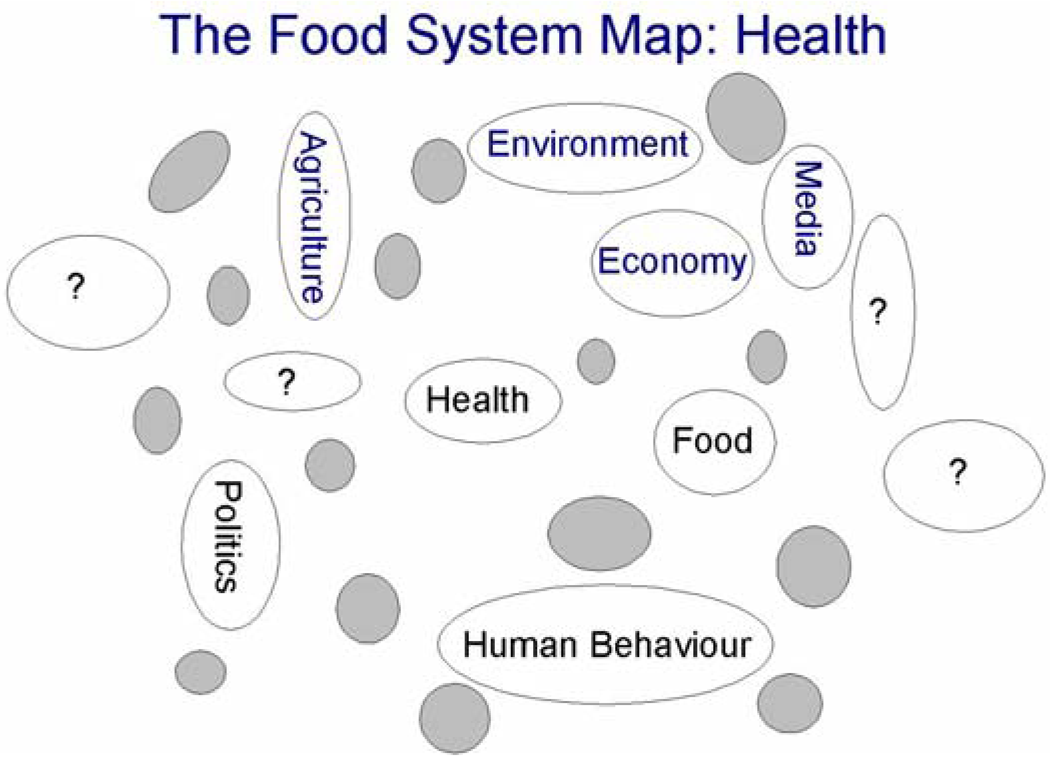
1. The results for ‘presence of friends’ is counter intuitive
2. Subjective variables carry measurement error leading to possible assumption violation
3. We re-fitted the model with objective variables as instruments for subjective variables

Results

Explanatory variables	Conditional p.e	Conditional s.e	With Instrumental Variables* p.e	With Instrumental Variables* s.e
Past Behaviour*	-0.30	0.1	-0.03	0.2
Hours spend alone				
up to 3 hours	0.07	0.13	0.11	0.18
3-9 hours	-0.38	0.13	-0.37	0.14
9+ hours	0.00		0.00	
Has close relatives				
yes	0.00		0.00	
no	-0.32	0.13	-0.32	0.13
<u>**Subjective variables**</u>				
Presence of friends**				
yes	0.00		0.00	
no	0.43	0.15	0.22	0.64

*Morale 1979 as instrument for past behaviour; ** Objective variables as instruments for subjective variables.

Theoretical implications:
Time varying omitted variables and the feel-good factor



Source: Shahtahmasebi, S. (2006) The good life: a holistic approach to the health of the population. *TSW Holistic Health & Medicine* ***1,*** 153–168. DOI 10.1100/tswhhm.2006.90.

Theoretical implications:
Time varying omitted variables and the feel-good factor

We would like to fit this model:

$$y_{it} = \underline{\beta x}_{it} + \theta_i + \varepsilon_{it} + \xi_{it}$$

But we fitted this model:

$$y_{it} = \underline{\beta x}_{it} + \theta_i + \varepsilon_{it}$$

Re-write and distinguish between subjective and objective variables

$$y_{it} = \beta O_{it} + \alpha S_{it} + \theta_i + \varepsilon_{it}$$

Theoretical implications:
Time varying omitted variables and the feel-good factor

But $S = S' + \zeta$

$$y_{it} = \beta O_{it} + \alpha(S'_{it} + \zeta_{it}) + \theta_i + \varepsilon_{it}$$

$$y_{it} = \beta O_{it} + \alpha S'_{it} + \theta_i + \varepsilon_{it} + \alpha\zeta_{it} \text{ .... A}$$

OR

$$y_{it+1} - y_{it} = \beta(O_{it+1} - O_{it}) + \alpha([S' + \zeta]_{it+1} - [S' + \zeta]_{it}) + (\varepsilon_{it+1} - \varepsilon_{it}) \text{ ..... B}$$

Can’t fit this model because S' is unknown

Theoretical implications:

Time varying omitted variables and the feel-good factor

But S in known – so we fit

$$y_{it} = \beta O_{it} + \alpha(S_{it} - \zeta_{it}) + \theta_i + \varepsilon_{it} \text{ .... C}$$

$$y_{it} = \beta O_{it} + \alpha S_{it} + \theta_i + [\varepsilon_{it} + \xi_{it}] \text{ .... D}$$

Where $\xi_{it} = - \alpha\zeta_{it}$

AKA $y_{it} = \underline{\beta x}_{it} + \theta_i + \varepsilon_{it}$

Which we fitted using a combination of Instrumental Variables and Conditional Likelihood methods.

Theoretical implications:
Time varying omitted variables and the feel-good factor

- So it is possible to fit models of type (at least pragmatically):

$$y_{it} = \underline{\beta x}_{it} + \theta_i + \varepsilon_{it} + \xi_{it}$$

Thank you

Results

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Appendix: Sample Size

Sample size calculations

To detect a difference of 0.1 on the morale scale at two time points

ρ is the Corr[$y_{i,t}$,$y_{i,t-1}$] and α is the probability of type I error

α		σ^2			
P=80 d=0.1	ρ	0.5	1.0	1.5	
5%	0.2	20	40	59	79
	0.4	15	30	45	59
	0.6	10	20	30	40
10%	0.2	16	31	47	62
	0.4	12	24	35	47
	0.6	8	16	24	31

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