In Sickness and in Health?
Dynamics of Health and Cohabitation among older people
(Work in Progress)

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Outline

• Brief overview of past LTC research
• Purpose of current research
• Theoretical Background: The Grossman Model
• Empirical Approach
• Preliminary Results
• Conclusion and Outlook
Previous LTC Research

The Rickayzen/Walsh disability projection model has been applied in various contexts:

- Projecting implications for public finances of various health scenarios (*Health Policy*, 2005).
- Projecting the balance between supply of and demand for informal care.
- Comparing financial consequences of different systems, from the point of view of the individual as well as the public sector in general.
Purpose of research

*The project:* estimate the potential market for ‘topup’ LTC insurance, in which individuals get benefits tailor made to their individual needs.

The Rickayzen/Walsh model cannot be used for this purpose as

- It only differentiates according to *gender* and *cohort*
- Other covariates such as *marital status*, *education* etc are not taken into account
- We also need information on variance and covariance of the relevant variables

To develop a model that overcomes these problems has been the purpose of this research.
Problems in LTC insurance markets

- Adverse selection (aggravated by dynamic perspective)
- Too much coverage?
- Is part of the problem lack of distinction between ‘disability’ (i.e. health) and ‘need’ (i.e. circumstances)?
- Cohabitation status and socioeconomic variables are of particular interest as they
  - Have strong impact on health
  - Determine financial needs in case of disability
- Increasing our knowledge of these factors allows for
  - More accurate pricing
  - Tailor-made products
Theoretical Background: The Grossman Model

The Grossman (1972) model has two main pillars:

- **The household production model of consumption:** health is a commodity produced in the household
- **The human capital perspective:** health is at the same time a commodity and a capital stock, from which a stream of earnings is derived

Grossman’s twist: good health increases the amount of time available for consumption and production

The main empirical interest has been in the role of *schooling/education* in the production of health. The effect of *cohabitation* has not been analysed so far.
Empirical Strategy

Decompose the observed variation in health (and cohabitation) into different components:

<table>
<thead>
<tr>
<th>Component</th>
<th>Health</th>
<th>Cohab</th>
<th>Cov</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unobserved structural differences</td>
<td>$\omega^H$</td>
<td>$\omega^C$</td>
<td>$\omega^{HC}$</td>
</tr>
<tr>
<td>Transitory shocks</td>
<td>$\sigma^H$</td>
<td>$\sigma^C$</td>
<td>$\sigma^{HC}$</td>
</tr>
<tr>
<td>Persistence in transitory shocks</td>
<td>$\rho^H$</td>
<td>$\rho^C$</td>
<td>-</td>
</tr>
<tr>
<td>State dependence</td>
<td>$H_{t-1}$</td>
<td>$C_{t-1}$</td>
<td>-</td>
</tr>
<tr>
<td>Exogenous factors</td>
<td>$A_t, E_t, Y_t$</td>
<td>$A_t, E_t, Y_t$</td>
<td>-</td>
</tr>
<tr>
<td>Causal links</td>
<td>$C_{t-1}$</td>
<td>$H_{t-1}$</td>
<td></td>
</tr>
</tbody>
</table>
Estimating equations

Estimating *cohabitation*: a *probit* model

\[ C_{it}^* = c + \beta_1 E_{it} + \beta_2 A_{it}^1 + \beta_3 A_{it}^2 + \beta_4 A_{it}^3 + \beta_5 Y_{it} + \beta_6 \hat{C}_{it-1} + \beta_7 \hat{H}_{it-1} + \beta_8 \hat{H}_{it-1} + \varepsilon_{it}^C \]

Exogenous Variables State Dependence

\[ \hat{C}_{it} = \begin{cases} 
  \text{cohabiting} & \text{if } C_{it}^* \geq 0 \\
  \text{single} & \text{otherwise}
\end{cases} \]
Estimating equations II

Estimating *health*: an ordered probit model

\[ H_{it}^* = \delta_1 E_{it} + \delta_2 A_{it}^1 + \delta_3 A_{it}^2 + \delta_4 A_{it}^3 + \delta_5 Y_{it} + \delta_6 \hat{C}_{it-1} + \delta_7 \hat{H}_{it-1}^1 + \delta_8 \hat{H}_{it-1}^2 + \varepsilon_{it}^H \]

**Exogenous Variables**

- healthy \[ \text{if } H_{it}^* \leq \alpha_1 \]
- moderate \[ \text{if } \alpha_1 \leq H_{it}^* \leq \alpha_2 \]
- severe \[ \text{if } \alpha_2 \leq H_{it}^* \leq \alpha_3 \]
- dead \[ \text{if } \alpha_3 \leq H_{it}^* \]

**State Dependence**

- \( \hat{H}_{it} \)

The \( \alpha \)'s are cutoffs for the latent health variable \( H_{it}^* \)
Estimating equations III

The error terms: correlation patterns

\[ \varepsilon_{it}^j = \mu_i^j + \eta_{it}^j, \quad \eta_{it}^j = \rho^j \eta_{it-1}^j + \nu_{it}^j, \quad j = C, H \]

- Fixed effect
- Auto-correlation
- Random Disturbance

\[
\text{Corr}(\nu_{it}^H, \nu_{it}^C) = \sigma_{HC} \quad \text{allowing for correlation between health shocks and cohabitation shocks}
\]

\[
\text{Cov} (\mu_i^H, \mu_i^C) = \omega_{HC} \quad \text{allowing for correlation between fixed health effects and fixed cohabitation effects}
\]
Dataset

We make use of the **British Household Panel Survey**:
- All 12 waves of the panel
- All permanent members of the panel
- Definition of Disability: ADL
  - Healthy: <2 ADLs
  - Moderate: 2 ADLs
  - Severe: >2 ADLs
- Problem: excluding individuals with missing information would bias mortality rates. Hence, information has to be imputed.
- A total of 6,000 individuals are divided into four groups:
  - Males & females
  - Pre- and post retirement (1991)
# Results: Older Men

<table>
<thead>
<tr>
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<th>Cohab</th>
<th>Cov</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unobserved struct. differences</td>
<td>0.648**</td>
<td>0.794**</td>
<td>-0.236**</td>
</tr>
<tr>
<td>Transitory shocks</td>
<td>1</td>
<td>1</td>
<td>-0.285**</td>
</tr>
<tr>
<td>Persistence in transitory shocks</td>
<td>0.185**</td>
<td>0.911**</td>
<td>-</td>
</tr>
<tr>
<td>State dependence</td>
<td>0.166**</td>
<td>0.937**</td>
<td>-</td>
</tr>
<tr>
<td>Exogenous factors</td>
<td>Y_t: 0.0785*</td>
<td>Y_t:-0.0717*</td>
<td>-</td>
</tr>
<tr>
<td>Causal links</td>
<td>0.0785**</td>
<td>-0.0311**</td>
<td>0.0233</td>
</tr>
</tbody>
</table>
Results: Implications

- Individuals are systematically different even after age, gender and education has been controlled for.
- There is a strong positive correlation in unobservables for health and marital status (i.e. self-selection).
- This implies an adverse selection problem, that can be mitigated by conditioning on more than health, e.g. marital status, education.
- Cohabitation is potentially more important for health (and vice versa) than education.
Results: Men, Disability
Results: Men, Disability

Disability of Males, no FE

Disability of Males, university degree
Results: Men, Cohabitation

Cohabitation Males, no FE

Cohabitation Males, university degree
Results: Men, Cohabitation

Cohabitation of Males, no FE

Cohabitation of Males, university degree
Results, Implications

- People with higher education have higher life expectancy at all ages
- There is less of a difference in Healthy Life Expectancy
- Males with higher education seem to spend more time in disability, especially at older ages
- For cohabitation, no great education differences
Conclusions and outlook

- Some interesting and some surprising findings
  - E.g. Marriage is **bad** for health – is it really?
  - The time effect is **negative** – are people becoming less healthy?
- Robustness checks need to be done
  - Extending to the other subgroups
  - Hypothesis testing

Future research topics:
- Assess whether demand would rise if *premiums* were conditioned on marital and socioeconomic status (i.e. increased accuracy)
- Assess whether demand would rise if *benefits* were conditioned on marital and socioeconomic status (i.e. new definition of ‘need’)