Health Heterogeneity and the Preferences for Consumption Growth

Jay H. Hong  Josep Pijoan-Mas  José-Víctor Ríos-Rull

Seoul National University  CEMFI, CEPR  Minnesota, Mpls Fed, CAERP

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Introduction

- A big question in Macroeconomics is what determines savings.
  - The old are special (DeNardi, French, Jones (2015), Ameriks, Briggs, Caplin, Shapiro Tonetti (2015))
  - There is an increasing number of them.

- Two fundamental characteristics of the old
  - Their health worsens with age
  - It does so at different rate for people in different socio-economic groups
    Pijoan-Mas, Ríos-Rull (2014)

▷ How do age and health shape preferences and consumption decisions?
  - Surprisingly, little work exploring effects of health on consumption
We estimate the effect of health on the marginal utility of consumption

- We use a model where the evolution of health is itself endogenous
- But we use only the consumption Euler equation to estimate structural parameters
  - We exploit differences in consumption growth by age, education, wealth, and health groups
  - We use estimates of health transitions by age, education, and wealth.
  - We interpret them as the outcome of optimal behavior.

▷ Hence, *we do not need to know the whole health production technology.*
Conventional wisdom

The marginal utility of consumption falls when health declines

- Domeij, Johannesson (2006) and Scholz, Seshadri (2012)
  - Exploit the average joint decline of health and consumption with age
  - But age-consumption decline may be due to other reasons
    *Gourinchas, Parker (2002); Aguiar, Hurst (2013)*

- Finkelstein, Luttmer, Notowidigdo (2012)
  - Subjective well-being increases with health, more so for individuals with larger permanent income
  - But not necessarily related to consumption expenditure

- Koijen, Van Nieuwerburgh, Yogo (2012)
  - Households own too little long-term care insurance, too many annuities
Main findings

1. At age 65, better health gives higher marginal utility of consumption
   - You need healthy time to enjoy life

2. However, as individuals age, this difference narrows down
   - Consumption expenditure also substitutes for healthy time
   - Hence, low health may give high marginal utility of consumption

3. We provide some direct evidence of the age effect of health on consumption composition
Model: main elements

- Individuals differ in:
  - age \((i)\), education \((e)\), health \((h)\), wealth \((a)\), income \((s)\)

- They choose
  - nonmedical expend \((c)\), medical expend \((x)\), health-related behaviour \((y)\)

- Education \(e \in E = \{c, h, d\}\) is predetermined.
  - (potentially) different patience \(\beta^e\)
  - (potentially) different income process \(\pi^e,i(s' | s, h)\)
  - (potentially) maybe different health technologies \(\Gamma^e,i\)

- Health stock \(h \in H\) evolves stochastically \(\Gamma^e,i(h' | h, x, y)\)
  - different survival probability \(\gamma^i(h)\)
  - different income process \(\pi^e,i(s' | s, h)\)
  - different value of medical expenditure \(\varepsilon^i(h)\)
  - different value of non-medical expenditure \(\chi^i(h)\)
Preferences

Within period utility function:

\[ u^i(h, c, x, y) = \chi^i(h) \frac{c^{1-\sigma_c}}{1-\sigma_c} - \nu_0 y^{\nu_1} - \frac{\varepsilon^i(h)}{x^{\sigma_x}} \]

\[ \sigma_c, \sigma_x, \nu_0, \nu_1 > 0 \]

- \( \chi^i(h) \) regulates the health-dependence of \( u_c \)
  - It is the object of interest.

- We choose not to make \( \nu_0 \) health-dependent: we think of \( y \) as preventive health-behavior

- \( \varepsilon^i(h) \) regulates the health-dependence of \( u_x \)
  - In the main exercise we will ignore this part.
  - But extension: \( \varepsilon^i(h) \) stochastic to address the role of medical expenditure uncertainty in consumption growth.
The Optimization Problem

- The Bellman equation:

\[
v^{e,i}(a, h, s) = \max_{c,x,y} \left\{ u^i(h, c, x, y) \right. \\
+ \beta^e \psi^i(h) \sum_{s',h'} \Gamma^i(h' | h, x, y) \pi^{e,i}(s' | s, h) \mathbb{E}_{\varepsilon'}|h' v^{e,i+1}(a', h', s') \left. \right\}
\]

\[
\text{s.t.} \quad c + x + a' = a (1 + r) + s
\]

- The model can be solved to deliver decision rules

\[
c^{e,i}(a, h, s), \quad x^{e,i}(a, h, s), \quad y^{e,i}(a, h, s)
\]
The FOC

▷ Consumption Euler equation,

\[ \chi^i(h) c^{-\sigma_c} = \beta^e \psi^i(h) (1 + r) \sum_{s',h'} \Gamma^i(h' \mid h, x, y) \pi^{e,i}(s' \mid s, h) \chi^{i+1}(h')(c')^{-\sigma_c} \]

▷ Optimal health expenditure

\[ \chi^i(h) c^{-\sigma_c} = \beta^e \psi^i(h) \sum_{s',h'} \Gamma^i_x(h' \mid h, x, y) \pi^{e,i}(s' \mid s, h) v^{e,i+1}(s', h', a') \]

\[ - \varepsilon^i(h) - \sigma_x x^{-\sigma_x - 1} \quad \text{in extension} \]

▷ Optimal health behavior

\[ u_y = \beta^e \psi^i(h) \sum_{s',h'} \Gamma^i_y(h' \mid h, x, y) \pi^{e,i}(s' \mid s, h) v^{e,i+1}(s', h', a') \]
Problem: Estimating the Law of Motion for Health

Need to measure *effects of health investments* on health evolution

\[ \Gamma_i^{x}(h' \mid h, x, y) \quad \text{and} \quad \Gamma_i^{y}(h' \mid h, x, y) \quad \text{and} \quad \Gamma_i^{y}(h' \mid h, x, y) \]

- Very hard to measure directly due to endogeneity bias
  (typically one finds \( \Gamma_i^{x} < 0 \) and \( \Gamma_i^{y} < 0 \))
- In addition, a substantial part of \( x \) is not strictly health care
Our Solution

1) Use only the Euler equation of consumption
   - No need to solve the full dynamic problem
   - No need to measure $\Gamma^i_x (h' | h, x, y)$ and $\Gamma^i_y (h' | h, x, y)$

2) Replace health investments by their optimal policies
   - Take the law of motion for health
     \[ \Gamma^i (h' | h, x, y) \]
   - replace the $x$ and $y$ by their optimal policies
     \[ x^{e,i} (a, h, s) \text{ and } y^{e,i} (a, h, s) \]
   - Then, the law of motion of health is function of the state variables:
     \[ \Gamma^{e,i} (h' | a, h, s) \]
     which is easy to estimate
Consumption growth and information about $\chi(h)$

$$\beta^e \psi^i(h) (1 + r) \sum_{h'} \Gamma^{e,i}(h' | h,a) \frac{\chi^{i+1}(h')}{\chi^i(h)} \left( \frac{c^{e,i+1}(h', a')}{c^{e,i}(h,a)} \right)^{-\sigma} = 1$$

1/ If health was constant ($\Gamma^{e,i}$ diagonal), *higher consumption growth for high health* due to $\psi^i(h)$

2/ With changing health
   - Changes in health affect consumption growth through $\chi^{i+1}(h')/\chi^i(h)$
   - If health and consumption are complements ($\chi(h_g) > \chi(h_b)$)
     *Consumption growth higher for low health*
   - If health and consumption are substitutes ($\chi(h_g) < \chi(h_b)$)
     *Consumption growth higher for high health*

3/ If health expenditure uncertainty differs across health types, a further reason for consumption growth differences
The model moment conditions

- For each agent of type \((e, i, a, h)\):
  
  - The realised value of the Euler eqn. depends on the shock \(h'\)
    
    \[
    f(e, i, a, h; h') = \beta^e (1 + r) \frac{\chi(h')}{\chi(h)} \left( \frac{c^{e,i+1}(h', a^{e,i+1}(h, a))}{c^{e,i}(h, a)} \right)^{-\sigma} - 1
    \]

  - So we can rewrite the Euler equation in expectation as:
    
    \[
    \mathbb{E}_{h' \mid e, i, a, h} \left[ f(e, i, a, h; h') \right] = \psi^i(h) \sum_{h'} \Gamma^{e,i}(h' \mid h, a) f(e, i, a, h; h') = 0
    \]

  - Which give one moment condition for every type
The Empirical Analog

- We have a discretized state space \( \Omega \equiv E \times I \times A \times H \)

  \( \Omega \text{ is a discrete set with } M \text{ elements indexed by } m. \)

- For each individual \( j \) we observe
  - current state \( \omega_j \in \Omega \)
  - realized shocks tomorrow \( h'_j \)
  - consumption chosen tomorrow

- Hence, the empirical analog of our orthogonality conditions requires to compute the average consumption growth for each type \( \omega_j, h'_j \)
The Empirical Analog

- In particular:
  - For each individual type $\omega_j, h'_j$,
    \[
    \tilde{f}(\omega_j, h'_j; \theta) = \beta^{e_j} (1 + r) \frac{\chi(h'_j)}{\chi(h_j)} \sum_1^{\omega_j, h'_j} \left( \frac{c'_j}{c_j} \right)^{-\sigma} - 1
    \]
  - Hence, the empirical moment condition for every type $\omega_m \in \Omega$ is
    \[
    \tilde{g}_m(data; \theta) = \sum_j \mathbf{1}_{(\omega_j = \omega_m)} \psi^{i_j}(h_j) \sum_{h'_j \in H} \mathbf{1}_{(h'_j = h'_l)} \Gamma^{e_j, i_j}(h'_j | h_j, a_j) \tilde{f}(\omega_j, h'_j; \theta)
    \]
- Minimize the weighted quadratic loss function
  \[
  \tilde{Q}_J(data; \theta) = \frac{1}{2} \tilde{g}(data; \theta)' W \tilde{g}(data; \theta)
  \]
Data

- PSID 1999-2013

- Why: it has good data on
  
  a) non-durable consumption and services
  
  b) oop med expenditures (drugs, doctors, hospital, nursing homes, insurance)
  
  c) Wealth (household total net worth) and health (self-rated)

- Use HRS estimates of

  - Survival probabilities, $\psi^i(h)$
  
  - Health transitions, $\Gamma^{e,i}(h' \mid h, a)$

  Pijoan-Mas, Rios-Rull (2014)
Preliminary Estimations

- Sample selection:
  - Households aged 65-85 → No need to deal with earnings uncertainty
  - Headed by males
  - We lump together married and non-married

- (equivalized) consumption growth observations: 2,809

- Moment conditions
  - age group $i$ (4) $\in \{65-69, 70-74, 75-79, 80+\}$
  - education $e$ (3) $\in \{c, h, d\}$
  - health $h$ (2) $\in \{\text{good, bad}\}$
  - wealth $a$ (5): wealth quintiles
  - $120 (= 4 \times 3 \times 2 \times 5)$ moment conditions
Preliminary Estimations

- We pose a simple parametric structure for the age-dependence of the health modifier
  \[ \chi^i(h) = \chi_a(h) + \chi_b(h) \times i \]
  where
  - \( \chi_a(h) \): health modifier by health status at age 50
  - \( \chi_b(h) \): change of health modifier with age

- We pose two identifying restrictions
  - \( \chi_a(h_g) = 1 \)
  - \( \chi_b(h_g) = 0 \)

- Hence, we have a maximum of 6 parameters to identify
  - \( \chi_a(h_g), \chi_a(h_g) \)
  - \( \beta_c, \beta_h, \beta_d \)
  - \( \sigma_c \)
Results – Men, 65+ only, time-varying \( \chi \)

- **common \( \beta \)**

Results across different \( \sigma \), (with \( r = 2\% \), Consumption (ndc_s1_v1))

<table>
<thead>
<tr>
<th></th>
<th>( \sigma = 0.8 )</th>
<th>( \sigma = 1 )</th>
<th>( \sigma = 1.5 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \beta )</td>
<td>0.9953 (0.0037)</td>
<td>0.9832 (0.0045)</td>
<td>0.9455 (0.0064)</td>
</tr>
<tr>
<td>( \chi_a(b) )</td>
<td>0.7816 (0.0402)</td>
<td>0.7869 (0.0491)</td>
<td>0.7854 (0.0733)</td>
</tr>
<tr>
<td>( \chi_b(b) )</td>
<td>0.0024 (0.0044)</td>
<td>0.0023 (0.0053)</td>
<td>0.0038 (0.0076)</td>
</tr>
<tr>
<td>J stat (p-value)</td>
<td>124.25 (0.2211)</td>
<td>113.72 (0.4632)</td>
<td>108.15 (0.6115)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>( \sigma = 2 )</th>
<th>( \sigma = 2.5 )</th>
<th>( \sigma = 3 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \beta )</td>
<td>0.8989 (0.0084)</td>
<td>0.8447 (0.0102)</td>
<td>0.8447 (0.0116)</td>
</tr>
<tr>
<td>( \chi_a(b) )</td>
<td>0.7776 (0.1007)</td>
<td>0.7694 (0.1314)</td>
<td>0.7694 (0.1674)</td>
</tr>
<tr>
<td>( \chi_b(b) )</td>
<td>0.0063 (0.0100)</td>
<td>0.0094 (0.0124)</td>
<td>0.0094 (0.0150)</td>
</tr>
<tr>
<td>J stat (p-value)</td>
<td>113.42 (0.4712)</td>
<td>121.41 (0.2776)</td>
<td>129.88 (0.1324)</td>
</tr>
</tbody>
</table>
Picking the right $\sigma$

- Men, 65+ only, $\chi$ age dependent

![Graph showing the relationship between risk aversion ($\sigma$) and J-stat](image-url)
### Results – Men, 65+ only, time-varying $\chi$

- **education-specific $\beta$**

**Results across different $\sigma$, (with $r = 2\%$, Consumption (ndc_s1_v1))**

<table>
<thead>
<tr>
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<th>$\sigma = 1$</th>
<th>$\sigma = 1.5$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta^d$</td>
<td>1.0143 (.0078)</td>
<td>1.0023 (.0094)</td>
<td>0.9642 (.0133)</td>
</tr>
<tr>
<td>$\beta^h$</td>
<td>0.9940 (.0050)</td>
<td>0.9815 (.0061)</td>
<td>0.9416 (.0089)</td>
</tr>
<tr>
<td>$\beta^c$</td>
<td>0.9859 (.0057)</td>
<td>0.9743 (.0071)</td>
<td>0.9396 (.0108)</td>
</tr>
<tr>
<td>$\chi_a(b)$</td>
<td>0.7918 (.0407)</td>
<td>0.7979 (.0499)</td>
<td>0.7992 (.0747)</td>
</tr>
<tr>
<td>$\chi_b(b)$</td>
<td>0.0006 (.0044)</td>
<td>0.0004 (.0053)</td>
<td>0.0018 (.0076)</td>
</tr>
<tr>
<td>J stat ($p$-value)</td>
<td>116.13 (.3507)</td>
<td>107.93 (.5647)</td>
<td>105.50 (.6294)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
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<th>$\sigma = 2$</th>
<th>$\sigma = 2.5$</th>
<th>$\sigma = 3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta^d$</td>
<td>0.9173 (.0166)</td>
<td>0.8639 (.0194)</td>
<td>0.8056 (.0216)</td>
</tr>
<tr>
<td>$\beta^h$</td>
<td>0.8910 (.0116)</td>
<td>0.8321 (.0141)</td>
<td>0.7672 (.0161)</td>
</tr>
<tr>
<td>$\beta^c$</td>
<td>0.8988 (.0147)</td>
<td>0.8537 (.0186)</td>
<td>0.8053 (.0221)</td>
</tr>
<tr>
<td>$\chi_a(b)$</td>
<td>0.7921 (.1021)</td>
<td>0.7835 (.1324)</td>
<td>0.7846 (.1674)</td>
</tr>
<tr>
<td>$\chi_b(b)$</td>
<td>0.0044 (.0100)</td>
<td>0.0079 (.0124)</td>
<td>0.0114 (.0150)</td>
</tr>
<tr>
<td>J stat ($p$-value)</td>
<td>111.84 (.4597)</td>
<td>119.61 (.2716)</td>
<td>126.98 (.1425)</td>
</tr>
</tbody>
</table>
Picking the right $\sigma$

- Men, 65+ only, $\chi$ age dependent
with the right $\sigma$ (Men, 65+ only)

<table>
<thead>
<tr>
<th>Results, (with $r = 2%$, Consumption $(ndc_{s1_v1})$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta$ common $\quad$ $\beta$ edu specific</td>
</tr>
<tr>
<td>$\sigma=1.405$ $\quad$ $\sigma=1.303$</td>
</tr>
<tr>
<td>$\beta^d$ $\quad$ 0.9534 $\quad$ – $\quad$ 0.9804 $\quad$ (0.0118)</td>
</tr>
<tr>
<td>$\beta^h$ $\quad$ 0.9534 $\quad$ (0.0060) $\quad$ 0.9587 $\quad$ (0.0078)</td>
</tr>
<tr>
<td>$\beta^c$ $\quad$ 0.9534 $\quad$ – $\quad$ 0.9542 $\quad$ (0.0093)</td>
</tr>
<tr>
<td>$\chi_a(g)$ (good) $\quad$ 1. $\quad$ – $\quad$ 1. $\quad$ –</td>
</tr>
<tr>
<td>$\chi_a(b)$ (bad) $\quad$ 0.7864 $\quad$ (0.0685) $\quad$ 0.8002 $\quad$ (0.0646)</td>
</tr>
<tr>
<td>$\chi_b(g)$ (good) $\quad$ 0. $\quad$ – $\quad$ 0. $\quad$ –</td>
</tr>
<tr>
<td>$\chi_b(b)$ (bad) $\quad$ 0.0034 $\quad$ (0.0072) $\quad$ 0.0011 $\quad$ (0.0067)</td>
</tr>
<tr>
<td>$J$ stat ($p$-value) $\quad$ 107.94 $\quad$ (0.6168) $\quad$ 104.65 $\quad$ (0.6517)</td>
</tr>
</tbody>
</table>
Health modifier across age

- Men, 65+ only

Men (65+): $\beta$ common

<table>
<thead>
<tr>
<th>Age</th>
<th>Health Modifier ($\chi$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>65</td>
<td>1.0</td>
</tr>
<tr>
<td>70</td>
<td>1.0</td>
</tr>
<tr>
<td>75</td>
<td>1.0</td>
</tr>
<tr>
<td>80</td>
<td>1.0</td>
</tr>
<tr>
<td>85</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Men (65+): $\beta$ edu specific

<table>
<thead>
<tr>
<th>Age</th>
<th>Health Modifier ($\chi$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>65</td>
<td>0.8</td>
</tr>
<tr>
<td>70</td>
<td>0.85</td>
</tr>
<tr>
<td>75</td>
<td>0.9</td>
</tr>
<tr>
<td>80</td>
<td>0.95</td>
</tr>
<tr>
<td>85</td>
<td>1.0</td>
</tr>
</tbody>
</table>
Uncertainty in health expenditure (Extension)

- Consumption growth differences between health types can be different because they face different uncertainty in health expenditures.

- Two different strategies to account for this possibility:
  1. $\varepsilon_i(h)$ is zero and $x$ is stochastic and dependent on $e, i, a, h$.
  2. $\varepsilon_i(h)$ is stochastic, independent of $e, a \rightarrow$ endogeneous choices make $x$ to be related to $a$, and $e$.

- We extend the estimation strategy and distinguish the average consumption growth for individuals $(e, i, a, h; h)$ that differ in $\varepsilon'$.

- We consider two equal probability levels for $\varepsilon'$: high and low.

- We identify an individual’s $\varepsilon'$ differently depending on the model:
  1. Whether $x'$ is above or below the median conditional on $(e, i, a, h; h')$.
  2. Whether $x'/c'$ is above or below the median conditional on $(e, i, a, h; h')$. 

Results – Men, 65+ only, time-varying $\chi$

• **common $\beta$**

Results across different $\sigma$, (with $r = 2\%$, $\sigma = 1.405$, Consumption $(ndc\_s1\_v1)$)

<table>
<thead>
<tr>
<th></th>
<th>No exp shock</th>
<th>xp shock</th>
<th>ratio shock</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta$</td>
<td>0.9534 (.0060)</td>
<td>0.9554 (.0060)</td>
<td>0.9558 (.0061)</td>
</tr>
<tr>
<td>$\chi_a(b)$</td>
<td>0.7864 (.0685)</td>
<td>0.8272 (.0699)</td>
<td>0.8426 (.0725)</td>
</tr>
<tr>
<td>$\chi_b(b)$</td>
<td>0.0034 (.0072)</td>
<td>-0.0010 (.0072)</td>
<td>-0.0018 (.0072)</td>
</tr>
<tr>
<td>J stat ($p$-value)</td>
<td>104.65 (.6517)</td>
<td>110.33 (.5536)</td>
<td>114.74 (.4366)</td>
</tr>
</tbody>
</table>
Consumption Composition

Idea

  - Richer data on consumption items than years 1999+
    
    \( \text{It aggregates to 70\% of NIPA, better than CEX, Attanasio, Pistaferri (2013)} \)

- We build three consumption series

  - \( c \), non-durable consumption and services
  - \( c_s \), consumption expenditures that substitutes healthy time
    
    (food home, food delivered, household repairs, bus, taxis, other transport)
  - \( c_c \), consumption expenditures that complement healthy time
    
    (food out, trips, recreation)

- Explore effects of health at different ages on the budget shares
  
  - \( c_s/c \)
  - \( c_c/c \)
## Consumption Composition

### Results

<table>
<thead>
<tr>
<th></th>
<th>$c_s/c$ (%)</th>
<th></th>
<th>$c_c/c$ (%)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimates</td>
<td>S.E.</td>
<td>Estimates</td>
<td>S.E.</td>
</tr>
<tr>
<td>50 ≤ age ≤ 59</td>
<td>31.3</td>
<td>(0.67)</td>
<td>11.6</td>
<td>(0.56)</td>
</tr>
<tr>
<td>60 ≤ age ≤ 69</td>
<td>33.8</td>
<td>(0.81)</td>
<td>12.3</td>
<td>(0.68)</td>
</tr>
<tr>
<td>70 ≤ age ≤ 85</td>
<td>34.7</td>
<td>(0.77)</td>
<td>12.6</td>
<td>(0.65)</td>
</tr>
<tr>
<td>$(50 \leq age \leq 59) \times h_{good}$</td>
<td>-0.10</td>
<td>(0.67)</td>
<td>2.63</td>
<td>(0.56)</td>
</tr>
<tr>
<td>$(60 \leq age \leq 69) \times h_{good}$</td>
<td>-1.58</td>
<td>(0.81)</td>
<td>2.81</td>
<td>(0.68)</td>
</tr>
<tr>
<td>$(70 \leq age \leq 85) \times h_{good}$</td>
<td>-1.99</td>
<td>(0.78)</td>
<td>4.59</td>
<td>(0.65)</td>
</tr>
<tr>
<td>$(50 \leq age \leq 59) \times h_{exc}, h_{vg}$</td>
<td>-1.39</td>
<td>(0.67)</td>
<td>4.56</td>
<td>(0.56)</td>
</tr>
<tr>
<td>$(60 \leq age \leq 69) \times h_{exc}, h_{vg}$</td>
<td>-3.73</td>
<td>(0.89)</td>
<td>5.83</td>
<td>(0.75)</td>
</tr>
<tr>
<td>$(70 \leq age \leq 85) \times h_{exc}, h_{vg}$</td>
<td>-3.60</td>
<td>(0.98)</td>
<td>6.20</td>
<td>(0.82)</td>
</tr>
<tr>
<td>working</td>
<td>-2.11</td>
<td>(0.46)</td>
<td>0.86</td>
<td>(0.39)</td>
</tr>
<tr>
<td>married</td>
<td>-2.26</td>
<td>(0.44)</td>
<td>-1.80</td>
<td>(0.37)</td>
</tr>
<tr>
<td>college</td>
<td>-1.29</td>
<td>(0.39)</td>
<td>5.54</td>
<td>(0.33)</td>
</tr>
<tr>
<td>wealth (milion $)$</td>
<td>-0.06</td>
<td>(0.17)</td>
<td>0.92</td>
<td>(0.15)</td>
</tr>
</tbody>
</table>

Note: Missing category: $h_{fair}, h_{poor}$; Number obs: 6,103
**Consumption Composition**

*Summary*

- Individuals in good health
  - Spend more in goods that complement healthy time
  - Spend less in goods that substitute for healthy time
  - The difference is bigger for older groups
- The difference between good and bad health implies different things at different ages
Conclusion

- We use consumption Euler equations to estimate the effect of health on the marginal utility of consumption

- We find that

  1. At age 65, **better health** gives **higher marginal utility** of consumption
     - You need healthy time to enjoy life

  2. At later ages, the difference narrows down: **lower health** gives **higher marginal utility** of consumption
     - Consumption expenditure substitutes for healthy time

  3. Health differences imply differences in consumption patterns that are different at different ages