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The impact of health conditions on senior driving:

A national-level longitudinal study using the Health and Retirement Study (HRS)

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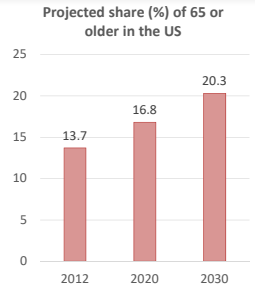
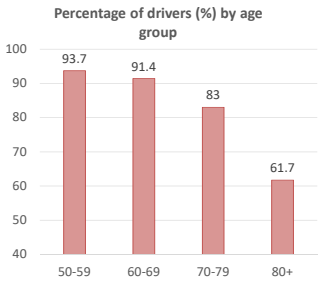
Motivation



http://www.census.gov/prod/2014pubs/p25-1140.pdf



Santos, A., N. McGuckin, H. Nakamoto, D. Gray, and S. Liss. Summary of Travel Trends: 2009 National Household Travel Survey. 2011.

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Motivation

- Is our transportation system ready to support the mobility needs of a more aged population in the future?

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Preview of results

- Researchers and practitioners need a better understanding of the determinants of senior driving:
  - The impact of health on senior driving has been neglected by the transportation planning literature;
- Major findings of this study:
  - Poor general health negatively impacts senior driving (65 or older), the magnitude of the impact is larger than that of poverty status, residential patterns or family structure;
  - Impact of general health on senior driving varies by race but not by gender or poverty status;
  - Poor physical, cognitive and vision conditions negatively impact senior driving.

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Literature

- Aging and driving (Giuliano, 2004; Rosenbloom, 2001):
  - Seniors drive considerably less after reaching age 70;
  - Seniors do not take public transportation to compensate for reduced driving.
- Insights from gerontologists:
  - Driving cessation: total discontinuation of operating a vehicle;
  - Health conditions impact driving cessation for the elderly (Anstey et al., 2006; Edwards et al., 2008);
  - Mostly from clinical trials.

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Contribution

- Examining health impacts on senior driving
  - Not widely studied in the transportation planning literature;
  - Controlling for socio-demographics, residential patterns, and policy factors;
- A panel (longitudinal) dataset
  - The same respondents are surveyed across multiple time points;
  - Controlling for individual-specific unobservable factors;
- A nationally representative sample

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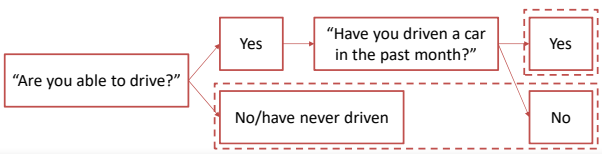
HRS

- Health and Retirement Study (HRS) public sample
  - Bi-annual survey for persons 50 & older (1992 - 2014);
  - Nationally representative panel data (~20,000 per wave).
- Questions about driving
  - In 2006, 2008, 2010, 2012 & 2014
  - For persons 65 & older:



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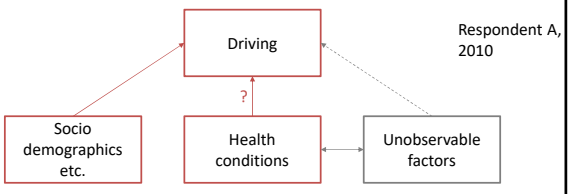
Research design

- Why panel data?



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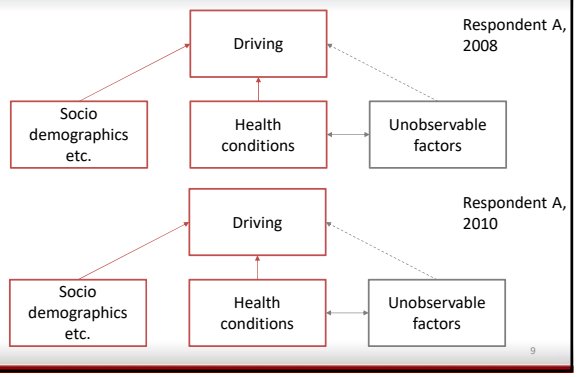
Research design



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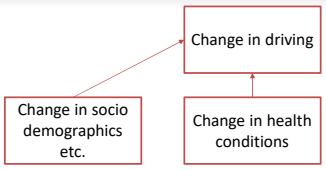
Research design



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Research design

- Fixed-effects logit model:

$$drive_{it} = \beta_0 + \beta_1 health_{it} + \mathbf{X_{it}'} \cdot \boldsymbol{\beta_2} + \boldsymbol{\mu_t} + \boldsymbol{\nu_i} + \varepsilon_{it}$$

$$\Delta drive_{it} = \beta_1 \Delta health_{it} + \Delta \mathbf{X_{it}'} \cdot \boldsymbol{\beta_2} + \Delta \boldsymbol{\mu_t} + \Delta \varepsilon_{it}$$

  - *i:* individual, *t:* survey year (2006, 08, 10, 12, 14);
  - $drive_{it}$: individual i has driven (1/0) in survey year *t*;
  - $health_{it}$: health conditions for individual *i* in survey year *t*;
  - $\mathbf{X_{it}}$: poverty, employment status, single-family residence, living alone, age, census divisions (proxy for senior citizen licensing policies);
    - » Gender and race: interaction models
  - μ_t: unobservable factors common to all persons in survey year *t*;
  - γ_i: unobservable factors for individual *i*

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Health conditions

- General health:
  - Sub-par self-rated health ("fair" or "poor");
- Physical conditions:
  - Underweight/overweight/obese, difficulties in activities of daily living, difficulties in using large muscles, high blood pressure, heart disease, arthritis;
- Cognitive or potentially related conditions:
  - Stroke, depression, memory problems, sleep problems, psychiatric diseases;
- Vision:
  - Problems with distant vision, problems with near vision.

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Sample

- Respondents 65+ yrs who have reported changes in their driving status across these five points.

Year	2006	2008	2010	2012	2014
Have driven in the past month	0.93	0.73	0.53	0.37	0.18
Age	76.2	77.6	79.0	80.1	81.3
Below poverty line	0.08	0.10	0.12	0.14	0.13
Non-Hispanic white	0.80	0.79	0.78	0.77	0.75
Non-Hispanic African-American	0.12	0.12	0.13	0.13	0.14
Hispanic	0.07	0.07	0.08	0.09	0.09
Female	0.62	0.62	0.63	0.63	0.66
N	2,328	2,440	2,328	2,097	1,706

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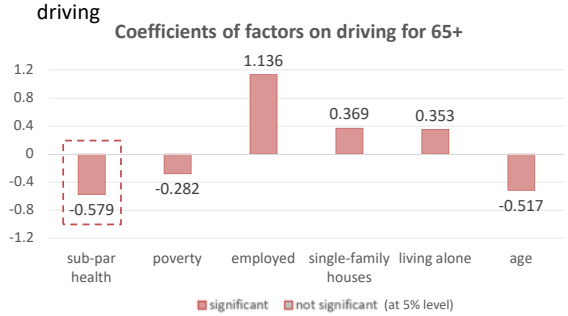
Results

- Sub-par self-rated health negatively impacts senior driving



(Appendix 1)

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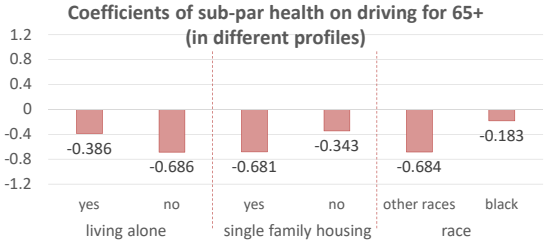
Results

- Sub-par health impact on driving varies by living status (alone/not), residence (single family housing) and race
  - No variation by gender, poverty and employment



(Appendix 1)

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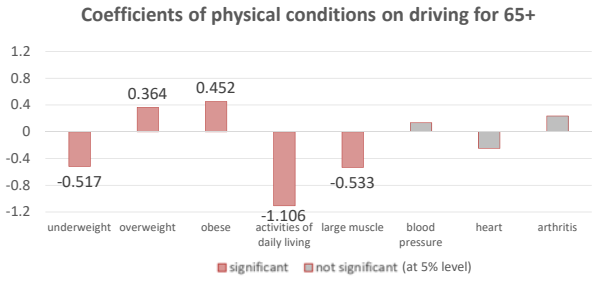
Results

- Poor physical conditions negatively impact senior driving



(Appendix 2)

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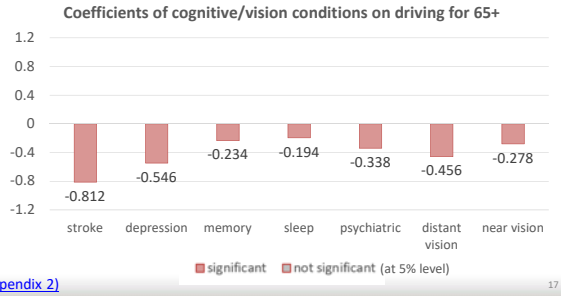
Results

- Poor cognitive and vision conditions negatively impact senior driving



(Appendix 2)

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Discussions

- Challenges ahead:
  - The elderly drive less when their health declines;
  - Currently, transit cannot compensate;
- Policy Directions
  - A more flexible, convenient and senior-friendly transit;
  - Work with health providers to identify mobility needs;
  - Self-driving automobiles?
- Future research: geo-coded HRS sample:
  - Neighborhood and metropolitan level built environment patterns;
  - Impact of health on driving with different levels of senior driving licensure policies.

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Odds ratio

- Odds ratio:

$$\widehat{odds\ ratio} = \frac{\hat{P}(y=1|x=1)\big/\hat{P}(y=0|x=1)}{\hat{P}(y=1|x=0)\big/\hat{P}(y=0|x=0)} = \exp(\hat{\beta}),$$

- For instance:
  - The odds ratio of sub-par self-rated health (*shlt45*): -0.579, exp(-0.579) = 0.561

$$0.561 = \frac{\hat{P}(drive=1|shlt45=1)\big/\hat{P}(drive=0|shlt45=1)}{\hat{P}(drive=1|shlt45=0)\big/\hat{P}(drive=0|shlt45=0)}$$

(Back)

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A general model

- Model with all health variables except general health
  - Physical conditions:
    - BMI (underweight, overweight, obese), difficulties in activities of daily living, difficulties in activities using large muscles, high blood pressure, heart disease, arthritis;
  - Cognitive conditions:
    - Stroke, depression, memory problems, sleep problems, psychiatric diseases;
  - Vision conditions:
    - Problems with distant vision, problems with near vision.

(Note: significant, not significant)

(Back)

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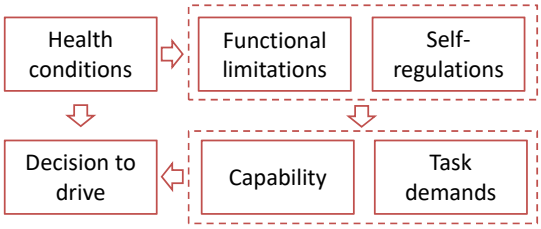
Theory

- Capability theory (Fuller, 2005)



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