

# **Portfolio Choice in Retirement: Health Risk and the Demand for Annuities, Housing, and Risky Assets**

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# Motivation

- *Success story*: Life-cycle theory during the working phase when households face *labor-income risk*.  
...but little work on life-cycle theory in retirement when households face *health risk*.

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- *Success story*: Life-cycle theory during the working phase when households face *labor-income risk*.  
  
...but little work on life-cycle theory in retirement when households face *health risk*.
- *Public policy*: Potential reform of health care and Social Security.
- *Financial industry*: Portfolio advice to ensure financial security in retirement.
- *Financial innovation*: Annuities (including deferred and variable), reverse mortgages, long-term care insurance, life insurance, etc.

## Financial Asset Holdings and Participation Rates by Age

Age	Stocks		Investment Funds		Retirement Accounts	
< 35	\$3.0	(13.7%)	\$18.0	(5.3%)	\$10.0	(41.6%)
35–44	\$15.0	(17.0%)	\$22.5	(11.6%)	\$36.0	(57.5%)
45–54	\$18.5	(18.6%)	\$50.0	(12.6%)	\$67.0	(64.7%)
55–64	\$24.0	(21.3%)	\$112.0	(14.3%)	\$98.0	(60.9%)
65–74	\$38.0	(19.1%)	\$86.0	(14.6%)	\$77.0	(51.7%)
≥ 75	\$40.0	(20.2%)	\$75.0	(13.2%)	\$35.0	(30.0%)

Source: 2007 Survey of Consumer Finances, thousands of dollars

# Contributions

1. Explain the entire portfolio composition: Bonds, stocks, annuities (DB pension plans and Social Security), and housing.
  - *Housing* is the most important tangible asset for retirees.
  - Positive (rather than normative) analysis.

# Contributions

1. Explain the entire portfolio composition: Bonds, stocks, annuities (DB pension plans and Social Security), and housing.
  - *Housing* is the most important tangible asset for retirees.
  - Positive (rather than normative) analysis.
2. Realistic model of health risk: Health expenditure is an *endogenous* response to health shocks (Grossman 1972).
  - Retirees can adjust health expenditure in response to changes in health and wealth.
  - Retirees may be able to change the distribution of future health outcomes through health investment.

## *Why is endogeneity of health expenditure important?*

- Reduces background risk arising from health.

Analogous to endogeneity of labor supply reducing background risk arising from labor income (Bodie et al. 1992).

- Models with exogenous health expenses overstate the degree of market incompleteness.

Makes liquid assets (bonds and stocks) too important relative to illiquid assets (annuities and housing).

- Necessary for policy experiments and welfare analysis.

Alternative market structure (e.g., new financial products or Social Security reform) can change the *endogenous* accumulation of health.

## Description of the Model

### *Housing:*

- Owns a home and consumes its service flow.
- Faces realistic housing-price risk.
- Can sell or upgrade.
- Mortgage or home equity line of credit: Can borrow up to 20% of home value.



*Health* is an accumulation process:

1. Exogenous shock in each period, whose distribution depends on previous health.
  
2. Endogenous health expenditure:
  - Improves health on the margin through a diminishing returns technology.
  
  - Cost of health care depends on health insurance (primarily Medicare).
  
  - Choice over health care depends on wealth and health.

# Financial Assets

1. *Riskless bond*: 2.5% real annual return.

*Mortgage* is a short position.

2. *Risky asset*: 6.5% average return, 18% standard deviation.

3. *Real annuity*: 1.5% average return, using Social Security life tables (Mitchell et al. 2008).

- Benchmark model: Endowment of annuities at age 65 (DB pension plans and Social Security).
- Model with an annuity market: Retirees can purchase annuities privately.

## Budget Constraint

$$\underbrace{\sum_{i=1}^N A_{it}}_{\text{savings}} = \underbrace{W_t}_{\text{financial wealth}} - \underbrace{C_t}_{\text{consumption}} - \underbrace{P_t E_t}_{\text{housing expenditure}} - \underbrace{Q_t I_t}_{\text{health expenditure}}$$
$$W_{t+1} = \sum_{i=1}^N A_{it} R_{i,t+1}$$

- $P_t$ : Relative price of housing.
- $Q_t$ : Relative price of health goods and services (accounts for health insurance).

## Description of the Retiree's Problem

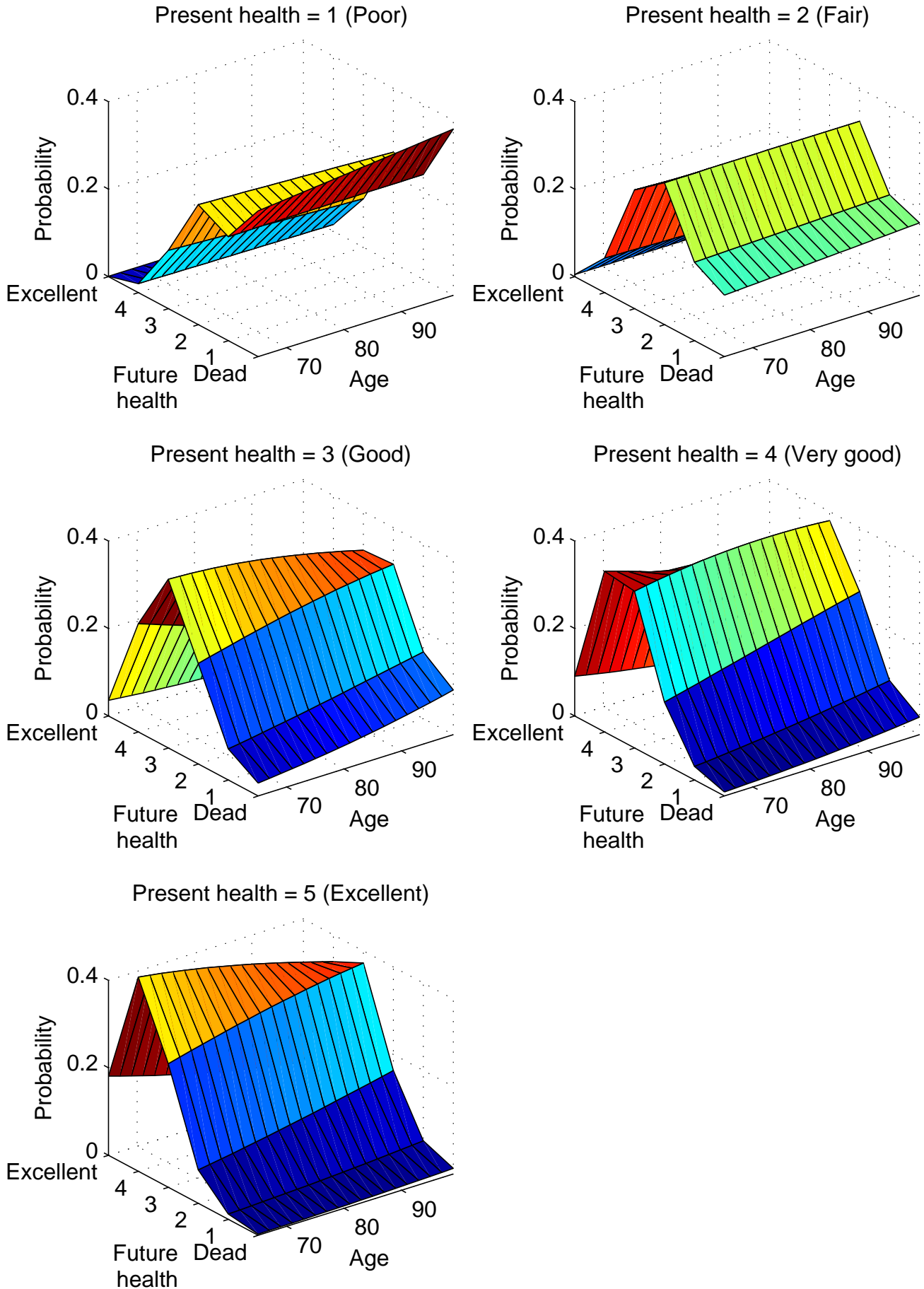
- Initial endowment of financial wealth and health at age 65.
- Maximize expected discounted utility over retirement, until death.
  - Alive: Utility flow over consumption, housing, and health.
  - Death: Bequest utility over financial wealth and housing.
- *Choice variables*: Consumption, health expenditure, and portfolio choice (bonds, stocks, annuities, and housing).
- *Homogeneity in wealth*: Health relative to wealth is the key state variable.

## Health and Retirement Study

- *Sample*: Retired single females, born 1891–1940 and aged 65 and older.
- Interviewed every 2 years.
- *Health expenditure*: Costs associated with hospitals, nursing homes, doctor visits, dentist visits, outpatient surgery, prescription drugs, home health care, and special facilities.
- *Health insurance*: Out-of-pocket health expenditure as a share of total health expenditure.

- Self-reported general *health status*: Excellent, Very good, Good, Fair, Poor, and Dead.
- Ordered probit model to estimate transition probabilities between health status, controlling for observables and health investment.

Figure 1: Health Transition Probabilities in the Absence of Health Investment



## Health Expenditure

Calibration: 1) Utility weight on health, 2) EIS, 3) Returns to health investment

Health Status	Age				
	65–66	71–72	77-78	83–84	89–90
Panel A: HRS Data (% of Annuity Income)					
Poor	16	20	25	31	39
Fair	12	16	20	25	31
Good	8	11	14	19	25
Very good	6	8	11	14	19
Excellent	5	6	8	10	13
Panel B: Benchmark Model (% of Annuity Income)					
Poor	21	22	26	31	35
Fair	16	18	21	25	27
Good	12	14	16	19	19
Very good	7	9	9	11	11
Excellent	6	6	5	7	7



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Calibration: 1) Utility weight on health, 2) **EIS**, 3) Returns to health investment

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Poor	16	20	25	31	39
Fair	12	16	20	25	31
Good	<b>8</b>	<b>11</b>	<b>14</b>	<b>19</b>	<b>25</b>
Very good	6	8	11	14	19
Excellent	5	6	8	10	13
Panel B: Benchmark Model (% of Annuity Income)					
Poor	21	22	26	31	35
Fair	16	18	21	25	27
Good	<b>12</b>	<b>14</b>	<b>16</b>	<b>19</b>	<b>19</b>
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Excellent	6	6	5	7	7

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Very good	7	9	9	11	11
Excellent	6	6	5	7	7

## Distribution of Health

Calibration: Initial endowment at age 65–66

Health Status	Age				
	65–66	71–72	77–78	83–84	89–90
Panel A: HRS Data (% of Retirees)					
Poor	10	11	12	13	14
Fair	24	25	26	26	27
Good	33	33	33	33	33
Very good	25	24	23	22	21
Excellent	8	7	7	6	5
Panel B: Benchmark Model (% of Retirees)					
Poor	10	8	8	9	11
Fair	24	15	17	20	23
Good	33	32	33	35	36
Very good	25	33	31	29	26
Excellent	8	13	10	7	5

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Fair	24	25	26	26	27
Good	33	33	33	33	33
Very good	25	24	23	22	21
Excellent	8	7	7	6	5
Panel B: Benchmark Model (% of Retirees)					
Poor	10	8	8	9	11
Fair	24	15	17	20	23
Good	33	32	33	35	36
Very good	25	33	31	29	26
Excellent	8	13	10	7	5

## Portfolio Share in Bonds

Calibration: Strength of bequest motive

Health Status	Age				
	65–66	71–72	77–78	83–84	89–90
Panel A: HRS Data (% of Tangible Wealth)					
Poor	3	7	12	17	22
Fair	3	8	13	17	21
Good	3	8	13	18	22
Very good	3	8	13	18	22
Excellent	3	7	12	16	20
Panel B: Benchmark Model (% of Tangible Wealth)					
Poor	8	9	13	18	21
Fair	5	8	12	17	21
Good	4	7	11	16	20
Very good	2	6	11	16	20
Excellent	3	5	11	17	20

# Portfolio Share in Risky Assets

Calibration: Risk aversion

Health Status	Age				
	65–66	71–72	77–78	83–84	89–90
Panel A: HRS Data (% of Tangible Wealth)					
Poor	3	3	4	5	6
Fair	3	4	5	7	9
Good	4	5	6	8	9
Very good	5	6	7	8	10
Excellent	5	6	7	8	10
Panel B: Benchmark Model (% of Tangible Wealth)					
Poor	3	7	8	9	9
Fair	5	7	8	9	9
Good	6	7	8	9	10
Very good	7	7	8	9	10
Excellent	7	8	8	9	9

## Portfolio Share in Annuities

Calibration: Initial endowment at age 65–66

Health Status	Age				
	65–66	71–72	77–78	83–84	89–90
Panel A: HRS Data (% of Tangible Wealth)					
Poor	73	66	60	53	46
Fair	73	66	58	51	43
Good	71	64	57	50	43
Very good	70	63	57	50	43
Excellent	66	60	54	48	43
Panel B: Benchmark Model (% of Tangible Wealth)					
Poor	73	62	54	47	43
Fair	73	62	54	47	42
Good	71	62	54	46	42
Very good	70	62	54	46	42
Excellent	66	62	54	47	42

## Portfolio Share in Annuities

Calibration: Initial endowment at age 65–66

Health Status	Age				
	65–66	71–72	77–78	83–84	89–90
Panel A: HRS Data (% of Tangible Wealth)					
Poor	73	66	60	53	46
Fair	73	66	58	51	43
Good	71	64	57	50	43
Very good	70	63	57	50	43
Excellent	66	60	54	48	43
Panel B: Benchmark Model (% of Tangible Wealth)					
Poor	73	62	54	47	43
Fair	73	62	54	47	42
Good	71	62	54	46	42
Very good	70	62	54	46	42
Excellent	66	62	54	47	42



## Portfolio Share in Housing

Calibration: 1) Utility weight on housing, 2) Elasticity of substitution between health and non-health consumption

Health Status	Age				
	65–66	71–72	77–78	83–84	89–90
Panel A: HRS Data (% of Tangible Wealth)					
Poor	22	23	24	25	26
Fair	21	22	24	25	26
Good	22	23	24	25	26
Very good	23	23	24	24	25
Excellent	27	27	27	27	28
Panel B: Benchmark Model (% of Tangible Wealth)					
Poor	16	22	25	27	26
Fair	18	23	26	27	27
Good	20	24	27	28	28
Very good	22	25	27	29	29
Excellent	25	25	27	28	28

## Portfolio Share in Housing

Calibration: 1) Utility weight on housing, 2) Elasticity of substitution between health and non-health consumption

Health Status	Age				
	65–66	71–72	77–78	83–84	89–90
Panel A: HRS Data (% of Tangible Wealth)					
Poor	22	23	24	25	26
Fair	21	22	24	25	26
Good	22	23	24	25	26
Very good	23	23	24	24	25
Excellent	27	27	27	27	28
Panel B: Benchmark Model (% of Tangible Wealth)					
Poor	16	22	25	27	26
Fair	18	23	26	27	27
Good	20	24	27	28	28
Very good	22	25	27	29	29
Excellent	25	25	27	28	28

## Welfare Gain from Private Annuitization

Health Status	% of Wealth
Poor	13.4%
Fair	13.8%
Good	14.8%
Very Good	15.8%
Excellent	18.0%

- Alternatively, size of market frictions and participation costs.
- Smaller than 40% welfare gain in a model without health expenses or a bequest motive (Mitchell et al. 1999).
- Annuity market reduces demand for health care.

*Intuition:* Health expenditure is “saving” in one’s own health.

# Summary

- Life-cycle model with health risk explains the cross-sectional distribution and the joint dynamics of health expenditure, health, and asset allocation in retirement.
- Realistic calibration with health risk and a bequest motive reduces the size of the “annuity puzzle” .
- Link between annuities and health care: Same frictions that prevent private annuitization increases the demand for health care.
- *Goal:* Use models like this for practical portfolio advice.

Table 1: Descriptive Statistics for Health Status and Health Care Utilization

	Health Status				
	Poor	Fair	Good	Very Good	Excellent
Panel A: Doctor-Diagnosed Health Problems (% of Retirees)					
High blood pressure	72	67	61	50	34
Diabetes	30	24	15	9	5
Cancer	19	16	14	13	9
Lung disease	21	14	8	5	3
Heart problems	56	41	28	18	12
Stroke	29	17	11	7	4
Psychiatric problems	31	21	13	9	5
Arthritis	81	74	65	55	38
Panel B: Some Difficulty with Activities of Daily Living (% of Retirees)					
Bathing	48	24	12	7	5
Dressing	46	24	12	6	4
Eating	24	10	4	3	2
Panel C: Health Care Utilization (% of Retirees)					
Doctor visit	97	97	95	93	88
Dentist visit	33	41	50	57	59
Home health care	35	20	12	7	5
Nursing home	23	12	8	6	5
Outpatient surgery	19	19	18	17	16
Prescription drugs	95	93	87	80	65
Cholesterol test	78	77	77	78	70
Mammogram	53	59	62	63	60
Vigorous physical activity	7	14	25	34	46
Smoking	10	11	10	9	8

Table 2: Estimation of the Health Transition Probabilities

Explanatory Variable	(1)		(2)	
Birth cohort:				
1891–1900	-67.44	(-3.36)	-80.35	(-3.99)
1901–1910	-26.26	(-3.24)	-36.18	(-4.38)
1911–1920	-4.98	(-1.02)	-13.41	(-2.68)
1921–1930	0.20	(0.06)	-4.81	(-1.48)
Health status:				
Poor	-150.39	(-5.40)	-120.26	(-4.31)
Fair	-87.35	(-5.34)	-77.28	(-4.58)
Very good	40.09	(2.74)	36.16	(2.42)
Excellent	118.38	(5.30)	110.93	(4.94)
(Age – 65)/10	-18.11	(-5.04)	-13.42	(-3.68)
× Poor	14.42	(3.42)	11.19	(2.62)
× Fair	15.03	(4.11)	13.75	(3.71)
× Very good	0.36	(0.09)	1.79	(0.43)
× Excellent	2.19	(0.29)	4.77	(0.63)
Tangible wealth	7.00	(3.24)	5.77	(2.63)
× Poor	-10.73	(-3.03)	-9.74	(-2.72)
× Fair	-7.35	(-2.42)	-6.97	(-2.27)
× Very good	5.44	(1.52)	5.53	(1.54)
× Excellent	5.63	(0.97)	5.42	(0.93)
Doctor visit	-1.63	(-0.15)	-0.88	(-0.08)
× Poor	-2.73	(-0.12)	-10.78	(-0.48)
× Fair	2.06	(0.13)	2.75	(0.16)
× Very good	3.14	(0.21)	2.76	(0.19)
× Excellent	-14.95	(-0.68)	-12.44	(-0.56)
Dentist visit	9.15	(2.55)	6.57	(1.82)
× Poor	2.47	(0.38)	2.38	(0.36)
× Fair	1.27	(0.24)	2.05	(0.39)
× Very good	11.24	(1.90)	11.48	(1.94)
× Excellent	13.31	(1.11)	12.73	(1.06)
Home health care	-29.92	(-4.88)	-19.44	(-3.13)
× Poor	3.97	(0.49)	7.88	(0.95)
× Fair	1.48	(0.19)	5.12	(0.65)
× Very good	-13.60	(-1.09)	-15.33	(-1.22)
× Excellent	-92.41	(-3.21)	-86.65	(-3.10)
Nursing home	1.54	(0.15)	0.69	(0.07)
× Poor	-16.11	(-1.18)	-9.03	(-0.66)
× Fair	-30.40	(-2.16)	-21.95	(-1.55)
× Very good	-24.87	(-1.25)	-17.43	(-0.87)
× Excellent	-86.20	(-1.60)	-84.47	(-1.54)

Explanatory Variable	(1)		(2)	
Outpatient surgery	0.00	(0.00)	1.52	(0.35)
× Poor	2.74	(0.38)	1.58	(0.21)
× Fair	0.18	(0.03)	-0.35	(-0.06)
× Very good	-1.83	(-0.26)	-1.78	(-0.25)
× Excellent	-0.84	(-0.06)	-0.13	(-0.01)
Prescription drugs	-20.77	(-3.92)	-3.70	(-0.68)
× Poor	20.06	(1.36)	26.10	(1.74)
× Fair	-3.17	(-0.32)	-2.61	(-0.27)
× Very good	-1.53	(-0.19)	-5.11	(-0.64)
× Excellent	-12.65	(-0.99)	-22.64	(-1.78)
Cholesterol test	4.25	(0.96)	8.25	(1.86)
× Poor	-3.71	(-0.48)	-6.12	(-0.80)
× Fair	5.69	(0.87)	4.25	(0.65)
× Very good	15.00	(2.01)	13.09	(1.74)
× Excellent	-13.19	(-0.95)	-14.09	(-1.02)
Mammogram	2.61	(0.66)	3.21	(0.81)
× Poor	0.57	(0.09)	-0.79	(-0.12)
× Fair	0.14	(0.02)	-0.85	(-0.15)
× Very good	-1.92	(-0.30)	-1.37	(-0.22)
× Excellent	32.52	(2.58)	31.95	(2.53)
Vigorous physical activity	15.10	(4.22)	10.49	(2.91)
× Poor	6.14	(0.68)	2.00	(0.22)
× Fair	10.06	(1.68)	9.50	(1.57)
× Very good	4.85	(0.85)	7.68	(1.35)
× Excellent	19.54	(1.82)	22.83	(2.13)
Smoking	-17.95	(-3.15)	-18.38	(-3.16)
× Poor	4.88	(0.54)	3.37	(0.36)
× Fair	6.45	(0.80)	2.90	(0.36)
× Very good	6.96	(0.77)	6.88	(0.76)
× Excellent	-29.06	(-1.50)	-28.96	(-1.52)
Doctor-diagnosed health problems:				
High blood pressure			-11.51	(-5.27)
Diabetes			-19.24	(-7.04)
Cancer			-15.66	(-5.40)
Lung disease			-26.41	(-7.93)
Heart problems			-16.49	(-7.14)
Stroke			-8.73	(-2.63)
Psychiatric problems			-11.99	(-4.28)
Arthritis			-12.10	(-5.17)
Some difficulty with activities of daily living:				
Bathing			-14.93	(-4.24)
Dressing			-12.25	(-3.79)
Eating			-28.51	(-5.68)
Cut points:				
Poor	-2.06	(-19.49)	-2.26	(-20.45)
Fair	-1.45	(-13.92)	-1.63	(-15.00)
Good	-0.62	(-5.94)	-0.77	(-7.13)
Very good	0.39	(3.79)	0.26	(2.41)
Excellent	1.63	(15.15)	1.51	(13.53)
Wald test on health care utilization	403.99	(0.00)	244.16	(0.00)
Observations	13,540		13,423	

Table 3: Estimation of the Portfolio Share in Risky Assets, Annuities, and Housing

Explanatory Variable	Risky Assets		Annuities		Housing	
Birth cohort:						
1891–1900	-3.46	(-18.13)	21.73	(10.56)	-15.41	(-8.42)
1901–1910	-3.27	(-15.95)	8.93	(8.31)	-4.62	(-3.86)
1911–1920	-2.37	(-8.43)	5.37	(6.93)	-1.33	(-1.61)
1921–1930	-0.34	(-1.49)	2.31	(3.81)	1.37	(2.19)
Health status:						
Poor	-1.40	(-2.43)	1.66	(1.37)	0.55	(0.37)
Fair	-1.66	(-4.77)	2.17	(2.20)	-0.38	(-0.38)
Very good	0.62	(1.66)	-1.53	(-1.55)	1.11	(1.11)
Excellent	0.67	(1.22)	-5.68	(-2.72)	5.08	(2.52)
(Age – 65)/10	1.32	(5.51)	-11.70	(-20.73)	1.70	(2.62)
× Poor	-0.13	(-0.28)	0.66	(0.83)	-0.19	(-0.18)
× Fair	0.74	(2.44)	-0.78	(-1.20)	0.42	(0.56)
× Very good	-0.11	(-0.43)	0.70	(1.04)	-0.81	(-1.08)
× Excellent	-0.17	(-0.47)	2.20	(1.93)	-1.31	(-1.10)
Tangible wealth	6.32	(33.42)	-23.36	(-35.26)	12.00	(26.29)
× Poor	0.88	(2.22)	-1.26	(-1.07)	3.83	(3.43)
× Fair	0.61	(2.14)	-0.95	(-0.92)	1.40	(1.71)
× Very good	-0.45	(-1.81)	1.01	(1.20)	-2.58	(-3.73)
× Excellent	-0.85	(-2.37)	4.50	(2.25)	-5.46	(-4.20)
Observations	20,635		20,635		20,635	



Table 4: Parameters in the Benchmark Model

Parameter	Symbol	Value
Preferences:		
Subjective discount factor	$\beta$	0.96
Elasticity of intertemporal substitution	$\sigma$	0.7
Relative risk aversion	$\gamma$	8
Utility weight on housing	$\phi$	0.4
Utility weight on health	$\alpha$	0.3
Elasticity of substitution between health and non-health consumption	$\rho$	0.7
Strength of the bequest motive	$\bar{u}$	0.2
Asset returns:		
Bond return	$\bar{R}_1 - 1$	2.5%
Average risky-asset return	$\bar{R}_2 - 1$	6.5%
Standard deviation of risky-asset return	$\sigma_2$	18%
Average annuity return	$\bar{R}_3 - 1$	1.5%
Housing:		
Depreciation rate	$\delta$	1.14%
Average housing return	$\bar{R}_D - 1$	0.4%
Standard deviation of housing return	$\sigma_D$	3.5%
Borrowing limit	$\lambda$	20%
Health:		
Growth rate of the relative price of health goods and services	$q$	1.9%
Average of log health	$\mu_H$	-12
Standard deviation of log health	$\sigma_H$	1
Returns to scale on health investment	$\psi$	0.12

Table 5: Health Expenditure by Age and Health Status

Health Status	Age				
	65–66	71–72	77–78	83–84	89–90
Panel A: HRS Data (% of Annuity Income)					
Poor	16	20	25	31	39
Fair	12	16	20	25	31
Good	8	11	14	19	25
Very good	6	8	11	14	19
Excellent	5	6	8	10	13
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Poor	21	22	26	31	35
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Good	12	14	16	19	19
Very good	7	9	9	11	11
Excellent	6	6	5	7	7

Table 6: Distribution of Health by Age

Health Status	Age				
	65–66	71–72	77–78	83–84	89–90
Panel A: HRS Data (% of Retirees)					
Poor	10	11	12	13	14
Fair	24	25	26	26	27
Good	33	33	33	33	33
Very good	25	24	23	22	21
Excellent	8	7	7	6	5
Panel B: Benchmark Model (% of Retirees)					
Poor	10	8	8	9	11
Fair	24	15	17	20	23
Good	33	32	33	35	36
Very good	25	33	31	29	26
Excellent	8	13	10	7	5

Table 7: Portfolio Share in Bonds by Age and Health Status

Health Status	Age				
	65–66	71–72	77–78	83–84	89–90
Panel A: HRS Data (% of Tangible Wealth)					
Poor	3	7	12	17	22
Fair	3	8	13	17	21
Good	3	8	13	18	22
Very good	3	8	13	18	22
Excellent	3	7	12	16	20
Panel B: Benchmark Model (% of Tangible Wealth)					
Poor	8	9	13	18	21
Fair	5	8	12	17	21
Good	4	7	11	16	20
Very good	2	6	11	16	20
Excellent	3	5	11	17	20

Table 8: Portfolio Share in Risky Assets by Age and Health Status

Health Status	Age				
	65–66	71–72	77–78	83–84	89–90
Panel A: HRS Data (% of Tangible Wealth)					
Poor	3	3	4	5	6
Fair	3	4	5	7	9
Good	4	5	6	8	9
Very good	5	6	7	8	10
Excellent	5	6	7	8	10
Panel B: Benchmark Model (% of Tangible Wealth)					
Poor	3	7	8	9	9
Fair	5	7	8	9	9
Good	6	7	8	9	10
Very good	7	7	8	9	10
Excellent	7	8	8	9	9

Table 9: Portfolio Share in Annuities by Age and Health Status

Health Status	Age				
	65–66	71–72	77–78	83–84	89–90
Panel A: HRS Data (% of Tangible Wealth)					
Poor	73	66	60	53	46
Fair	73	66	58	51	43
Good	71	64	57	50	43
Very good	70	63	57	50	43
Excellent	66	60	54	48	43
Panel B: Benchmark Model (% of Tangible Wealth)					
Poor	73	62	54	47	43
Fair	73	62	54	47	42
Good	71	62	54	46	42
Very good	70	62	54	46	42
Excellent	66	62	54	47	42

Table 10: Portfolio Share in Housing by Age and Health Status

Health Status	Age				
	65–66	71–72	77–78	83–84	89–90
Panel A: HRS Data (% of Tangible Wealth)					
Poor	22	23	24	25	26
Fair	21	22	24	25	26
Good	22	23	24	25	26
Very good	23	23	24	24	25
Excellent	27	27	27	27	28
Panel B: Benchmark Model (% of Tangible Wealth)					
Poor	16	22	25	27	26
Fair	18	23	26	27	27
Good	20	24	27	28	28
Very good	22	25	27	29	29
Excellent	25	25	27	28	28

Table 11: Health Expenditure and Asset Allocation in the Model with an Annuity Market

Health Status	Age				
	65–66	71–72	77–78	83–84	89–90
Panel A: Health Expenditure (% of Annuity Income)					
Poor	16	17	19	22	21
Fair	10	12	14	16	15
Good	6	8	9	12	12
Very good	4	5	6	7	9
Excellent	3	4	5	5	9
Panel B: Bonds (% of Tangible Wealth)					
Poor	0	0	0	-1	-1
Fair	0	0	0	-1	-1
Good	0	0	0	-1	-1
Very good	0	0	0	-1	-1
Excellent	0	0	-1	-1	-1
Panel C: Risky Assets (% of Tangible Wealth)					
Poor	0	0	0	0	0
Fair	0	0	0	0	0
Good	0	0	0	0	0
Very good	0	0	0	0	0
Excellent	0	0	0	0	0
Panel D: Annuities (% of Tangible Wealth)					
Poor	96	97	97	97	97
Fair	97	97	97	97	97
Good	97	97	97	97	97
Very good	96	97	97	97	97
Excellent	96	96	96	96	96
Panel E: Housing (% of Tangible Wealth)					
Poor	4	4	4	3	3
Fair	4	4	4	4	4
Good	4	3	3	3	3
Very good	4	4	4	4	4
Excellent	4	5	5	5	5



Table 12: Estimation of the Out-of-Pocket Health Expenditure Share

Explanatory Variable	Elasticity	
Birth cohort:		
1891–1900	-27.69	(-10.10)
1901–1910	-17.73	(-8.09)
1911–1920	-12.60	(-7.27)
1921–1930	-5.37	(-4.08)
Health status:		
Poor	-10.59	(-4.88)
Fair	-3.71	(-1.96)
Very good	3.92	(1.98)
Excellent	-3.34	(-1.23)
(Age – 65)/10	6.10	(4.90)
× Poor	4.09	(2.74)
× Fair	1.49	(1.17)
× Very good	-1.66	(-1.25)
× Excellent	-0.21	(-0.11)
Tangible wealth	5.59	(7.15)
× Poor	0.66	(0.50)
× Fair	3.70	(3.24)
× Very good	0.87	(0.74)
× Excellent	0.28	(0.18)
Observations	14,088	